CHAPTER 14

Core Firm Dominated Industrial Districts and The Japanese Auto Industry

This chapter focuses on core firm dominated industrial districts with particular reference to the Japanese automobile industry, in which Toyota City provides the leading geographic and organizational exemplar. The industry offers a significant illustration of the transition from the fordist to the ICT techno-economic paradigm and throughout the chapter comparative attention is drawn to the US industry. According to Womack, Jones and Roos (1990: 11), auto manufacture is the "industry of industries in transition" in the 20th century. During fordism, US auto firms pioneered the shift to mass production and established the US as the dominant global producer. More recently, as an expression of flexible specialization, Japanese auto firms have pioneered 'lean' production with its remarkably efficient use of materials, space, energy, supplier organizations and labour. Moreover, lean production and its reliance on close and dense subcontracting patterns is intimately related to geographic concentration and Toyota City, and environs, had emerged by the early 1980s as the most efficient industrial district in the global auto sector (Womack *et al* 1990: Williams *et al* 1993; see also Miyakawa 1981 and 1991). Lean production, especially as illustrated by Toyota City, had become the world 'benchmark' against which auto firms globally have been forced to adjust (Cusumano 1985, 1988).

For Freeman (1988), the emergence of Japan as a global technology leader (Table 2. 3; Figure 2. 4) is rooted in a distinctive 'national innovation system.' Freeman summarizes the main features of this system as: (a) a commitment to 'reverse engineering' to comprehensively learn best practice technology as a basis for further innovation; (b) a commitment by managers, engineers and workers to think in an integrated way about the entire production system including with respect to product and process design; (c) use of factories as laboratories which constantly bring together R&D professionals with production engineers and workers in a manner which facilitated collective learning processes; (d) an emphasis on increasing quality by constantly seeking to correct defects and up-grading products and processes; and (e) the involvement of suppliers and consumers in close and stable relationships at the core of which is the exchange of technological expertise. Each of these characteristics is notably evident in the auto industry.

The chapter is in three main parts. The first part provides an historical overview of production trends in the industry, particularly with respect to Japan and the US and some general differences in the auto industry of the two countries are noted. The second part examines the organizational structure of Japanese auto production systems as of the mid-1980s, paying special attention to the social division of labour and firm-supplier relationships (Asanuma 1987 and 1989; Sheard 1983). Finally, questions related to the nature and extent to which the principles and practices of lean production are transferred elsewhere, notably to the US are addressed (Rubenstein 1991; Williams *et al* 1993; Womack *et al* 1990). For related discussions of automobile manufacturing in Europe, see Hudson and Schamp (1995) while Law (1991) and Morales' (1994) studies are global in scope.

AUTOMOBILE PRODUCTION: US FORDISM CHALLENGED BY JAPANESE FLEXIBLE SPECIALIZATION

In 1900, the auto industry was still a craft industry and production relatively small (Table 14.1). At that time, the US accounted for about 44% of global production and Germany about 24%. With the introduction of mass production (Womack *et al* 1990; chapter 2) production levels exploded and the US quickly became the dominant national producer. Thus by 1925, production levels were over 400% of 1900 levels and the US accounted for fully 87% of global production, the UK then having emerged as the number two producer.

Table 14.1

Total motor vehicle production in selected countries, 1900-90

	1900	1925	1950	1975	1990
North America					
United States	4,192	4,265,830	8,005,859	8,986,513	9,888,036
Mexico	0	0	21,575	360,678	820,558
Western Europe					
(W) Germany	2,312	62,753	306,064	3,186,208	4,660,657
Italy	0	49,400	127,847	1,458,629	1,874,672
United Kingdom	0	167,000	783,672	1,648,399	1,295,611
Sweden	0	-	17,553	366,753	335,853
Asia-Pacific					
Japan	0	-	31,597	6,941,591	13,486,796
South Korea	0	0	0	36,264	1,321,630
Eastern Europe					
Yugoslavia	0	0	0	205,567	342,727
South America					
Brazil	0	0	0	930,235	914,576
World	9,504	4,900,730	10,577,426	32,998,363	44,165,033

Source: Morales 1994: 16

The US remained pre-eminent until well into the 1960s although after 1950 the share of global production accounted for by Europe and especially Japan increased rapidly. By 1980, Japan was the largest national producer of autos, and in 1990 Japan accounted for almost 31% of global output. If, in the transition from the fordist to the IC techno-economic paradigm, the geographic balance in auto production has become more equal among the US, Europe and Japan, "Japan is clearly the driving force" (Morales 1994: 15).

Historical perspective on Japan's auto industry

The Japanese and US auto industries developed independently around the beginning of the 20th century. In the US, led by the Ford Company, the predecessor companies of GM, Chrysler and others, the industry grew rapidly and by the 1920s and 1930s it had become the largest in the world with production increasingly concentrated in Michigan, especially the Detroit area (Boas 1961; Kroos 1974: 438-49; Table 2.4). In contrast, Japanese developments were sporadic and by the 1930s dependent on US know-how.

Origins - In Japan, the roots of the industry to the end of the 19th century. In 1897 the first imported vehicle arrived in Yokohama where the first importing agency was established in 1901 (Miyakawa 1991: 89). Around this time, motor vehicle manufacturing began, initially in Tokyo where Japan's machinery firms and related government owned firms were located and where "pioneering engineers gathered to copy modern western industrial products and technologies" (Miyakawa 1991: 89). According to Takeuchi (1990: 167), auto manufacturing began in Tokyo when several individuals, using techniques from rickshaw construction and ironworking, built autos for themselves by copying European models. Another early, perhaps the first model was financed by a bicycle shop owner in Tokyo who had visited the US in 1902 and had brought back two gasoline engines. He then hired an engineer, who had worked in a Russian factory where there was an auto which he had learnt how to operate, to develop a car. In 1911 the first auto factory was built in Japan and in these early years about 43 different models were manufactured by 13 firms in Tokyo. In the early 1900s, Osaka also became a vehicle manufacturing centre, particularly after 1911 and the growth in production of army trucks. In Kobe, Mitsubishi Shipbuilding began manufacturing autos based on Fiat models.

Local production remained relatively small scale, however, and was unable to compete with imports led by Ford's model T. Japan did not have a high quality machinery industry and its limited home market was increasingly served by imports, especially from the US (Table 14.2).

Table 14.2

Supply of Trucks and Cars in Japan 1916-35

	Local Production	CBU Imports	CKD Assembly
1916	294	218	
17	250	860	
18	195	1712	
19	60	1579	
20	45	1745	
21	4	1074	
22	-	752	
23	-	1938	
24	-	4063	
25	-	1765	3437
26	245	2381	8677
27	302	3895	12668
28	347	7883	24341
29	437	5018	29338
30	458	2591	19678
31	436	1887	20199
32	880	997	14087
33	1681	491	15082
34	2787	896	33458
35	5089	931	30787

Source: Odaka, ONO and Adachi 1988: 34
CBU: Completely built Units. CKD: Completely Knocked Down.
Note: Ford plant opened in 1925; Chevrolet plant opened in 1927 Import tariff raised in 1932.

By 1917 imports were greater than local production which by the early 1920s appears to have virtually disappeared. Meanwhile car, truck and bus imports satisfied local demand and were stimulated by the Kanto earthquake of 1923 which destroyed Tokyo's railway and streetcar network. In fact, Japan removed the tariff on auto imports for a time, and Ford and Chevrolet (GM) established branch plants in Yokohama and Osaka in 1925 and

1927 respectively (Miyakawa 1991: 91). Originally, these plants were 'complete knock down' assembly operations and only assembled the parts which were entirely imported. However, Ford (but not GM) made an effort to develop a local supply capability which ultimately provided the basis for Nissan's development in the early 1930s with the production of the Datsun in 1931 (Takeuchi 1990: 168). In fact, Toyota, then a large scale manufacturer of textile machinery, had begun to develop an interest in auto assembly at this time and it too sent engineers to work with Ford in Yokohama to learn production know-how (Miyakawa 1991: 94).

As reliance increased on US producers and imports, Japan's military, stimulated by the First World War and China campaigns, spearheaded a powerful lobby for a domestic auto industry. This lobbying culminated in the Automobile Industry Act of 1936 which "was enacted to assist automobile production,....This law was intended to prevent foreign enterprises from gaining control of Japanese industries and to encourage or aid new or ailing Japanese enterprises" (Takeuchi 1990: 169). Thus, this Act: required that Japanese gain majority control of the auto industry; provided local 'registered' firms with special incentives such as five year income tax holidays and tariff exemptions on special equipment; encouraged registered firms to buy locally by making such purchases a criterion for registration; and after 1936 Ford and GM were not allowed to expand and were more or less forced out. In addition, import tariffs on imported motor vehicles were increased from 50 to 70% and on engines from 35 to 60% while the Yen was devalued against the dollar. Within the context of such heavy protectionism, GM and Ford sought cooperative arrangements with Nissan but, "because of heavy pressure from the Army" (Miyakawa 1991: 94) these efforts failed. In 1939 a further Act required GM and Ford to close their factories. Indeed, GM left Japan while Ford did maintain a legal presence. By 1939 Nissan, Toyota and Isuzu were the dominant three companies in Japan. Nissan and Isuzu were located in Tokyo, close to Japan's established machinery manufacturers while

Toyota created its own company town, Toyota City near Nagoya, in 1938 where it had the task of developing a local supply network.

Post World War 2 trends - After World War 2, when the Japanese auto industry was largely destroyed, the industry remained depressed until the early 1950s. In the late 1940s, technological capability was poor, there was a severe economic depression and the Labour Union Law of 1945 encouraged the formation of unions which was soon followed by labour strife among Nissan, Isuzu and Toyota. Following considerable debate, however, in 1952 the Ministry of Industry and Trade (MITI) designated the industry as a high priority in its economic restructuring programme (along with synthetic fibres, petrochemicals and electronics). At that time, the debate within Japan was about whether industrial strategy should emphasize the principle of comparative advantage and focus on traditional industries such as textiles which would take advantage of Japan's large, hard working but low cost labour supplies, or seek to encourage diversification into the industries of the future which required more capital, quality components and labour skill. While such important institutions as the Bank of Japan favoured the former strategy the latter strategy, favoured by MITI and a minority of western advice, chose the latter.

Consequently, the auto industry was protected by high tariffs and a law passed that required supplier firms (part producers) to be officially registered; registrations were awarded to those firms who were considered the most likely to ensure quality of production. The domestication of the parts industry was further encouraged by gradual reductions in foreign exchange allocations to buy imported parts. In 1951, the Amended Law for Introduction of Foreign Capital allowed involvement by foreign auto firms in order for Japanese firms to acquire expertise. In practice, Toyota chose not to link itself with foreign firms while Nissan entered a joint venture with Austin (UK), Isuzu with Rootes (UK) and Hino with Renault (France). These agreements, however, did not involve US firms and were temporary. Isuzu canceled its technological cooperation agreement in 1965 and in 1969 Nissan stopped manufacturing Austin cars and started to develop its own models. In the meantime, Toyota had manufactured its own passengers since 1952. By the late 1950s, when the Japanese industry still emphasized buses and trucks, Japanese auto manufacturers had already established exports to other Asian countries and in 1957 and 1958 respectively Nissan and Toyota began exporting to the US. The core Japanese companies also engaged in direct competition with one another, initially largely for domestic markets and subsequently for export markets.

Thus, the growth of the Japanese auto industry has largely occurred since 1950 and in the 1960s that Japan began to produce cars that approached the quality of US and European models. Increases in the quantity and quality of output have been relentless (Table 14.3). In quantity terms, for example, Japan successively surpassed the output of France (1964), the UK (1966), West Germany (1967) and, benefiting from the increased demand for small cars, finally overtook the United States in 1980 to become the world's largest automobile producing country (Sheard 1983: 52). In the major markets regions of the world, Japanese firms have since gained important shares of all market segments, including large and luxury segments (Bloomfield 1991).

Table 14.3

Production of Autos, Trucks and Buses 1950-85

	Cars	Total 4-wheelers	Exports	Export Ratio (%)
	000 Units			
1950	2	32	-	
55	20	69	1	1.8
1960	165	482	39	8.1
65	696	1876	194	10.3
1970	3179	5289	1087	20.6
75	4568	6942	2677	38.6
1980	7038	11043	5967	54.0
85	7647	12271	6730	54.8

Source: Odaka, ONO and Adachi 1988: 41

In 1980, Japan produced over 11 million 4-wheelers, including over 7 million cars, and over half of the total production was exported. In fact, reflecting its growing global competitiveness, the export-sales of ratio of Japanese autos increased consistently until 1985. With respect to direct foreign investment (DFI), Japanese firms had established branch plants in developing countries. such as Pakistan, Thailand and Chile, in the early 1960s. Since 1980, Japanese auto firms have invested massively in North America (Table 9.X) and Europe, that is in their major overseas markets, a strategy stimulated by host governments seeking to reduce growing visible balance of payments deficits with Japan. While Japan's export sales ratio is unlikely to increase further, the global market share of Japanese based MNCs may well increase. It also might be noted that since the early 1970s, Japan liberalized its own policies to DFI and GM, Ford and Chrysler re-established themselves in Japan, although typically on a smaller scale than Japanese firms in the US.

Toyota City

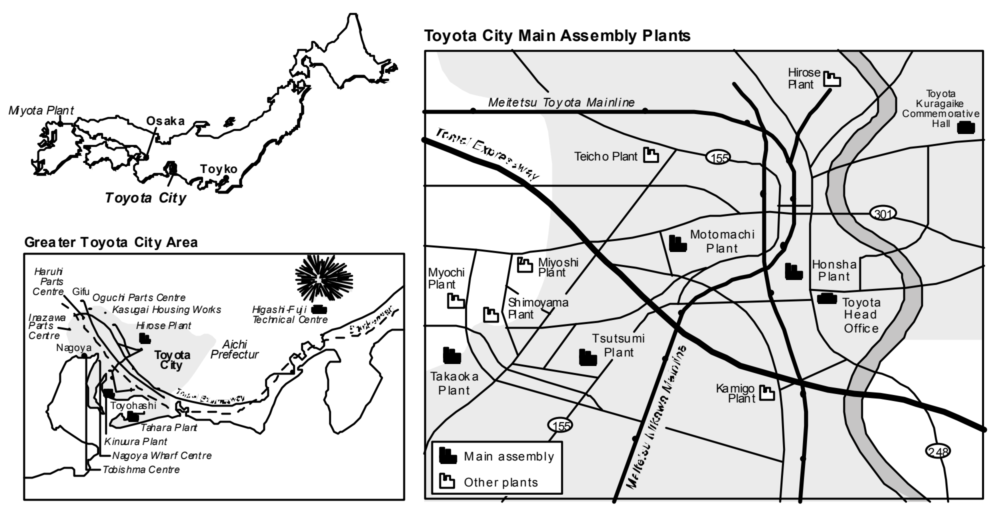
By the early 1980s, Japanese firms enjoyed an enormous cost advantage over US rivals, *even in North American markets* (Figure 5. 9). Among Japanese firms, both Womack, Roos and Jones (1990) and Williams *et al*. (1993) cite Toyota as the most efficient auto manufacturer which had achieved the greatest success in increasing labour productivity (Table 5. 4). For these authors, by the 1980s Toyota's factories, notably its Takaoka plant, had become the world's benchmark and had achieved the leading edge status of Ford's Highland Park facility in 1916. Indeed, the world's biggest manufacturing firm and biggest auto manufacturer, GM, felt it advisable in 1980 to enter into a joint venture with Toyota (NUMMI) in the US to gain insights into the latter's competitive strengths. Meanwhile, Toyota City has become a mecca for visitors from around the world who have interests in the auto industry.

Certainly, within the auto industry Toyota epitomizes the 'Japanese' approach to development, as summarized by Freeman (1988) (see page 1 of this chapter). Thus, Toyota's plan to become an auto manufacturer was rooted in a conviction to learn from best practices elsewhere, notably in the US, and to reverse engineer technology as a basis for further innovation. In this regard, Toyota did not even use joint ventures with foreign manufacturers to access expertise. Moreover, Toyota has strongly encouraged white and blue collar workers to think in an integrated way about design; R&D and production activities are conceived as loopy, constantly interrelated processes; it pioneered functionally flexible labour relations; and it has developed close, stable relationships with its suppliers based on a commitment to technological innovation. Moreover, to a greater degree than Nissan, Honda and other Japanese auto manufacturers, Toyota emphasized the geographic concentration of its activities and that of its suppliers. From its inception, Toyota planned to create a 'company' town and simultaneously an industrial district.

Geographically, from 1937 to 1980 Toyota chose to concentrate its auto activities in and around the old fortress town of Koromo which became Toyota City in 1959 (Miyakawa 1980; 1981; 1991). The idea for the Toyota Motor Company, which began operations in 1937, originated with Sakichi Toyoda who had visited the US in 1911 to investigate new industries, especially the auto industry (Miyakawa 1980: 41). While the family's existing business involved making textile machinery, he subsequently built a motor engine and provided funds for his son to develop the motor car business. In developing appropriate know-how, the Toyoda's were particularly helped by Ford who had operations in the Tokyo area. The Toyoda's chose Koromo, however, as the location for the Toyota Motor Company. As a small isolated town whose silk industry was in depression, Koromo provided cheap land, a supportive local government, a supply of workers and an opportunity for the firm to create "an ideal industrial community" (Miyakawa 1980: 42). Nearby Nagoya offered metropolitan services and manufacturing firms. Even so, to access technological know-how, Toyota established an R&D centre in Tokyo in the 1940s while its initial supplier association was also largely based there.

This area, in the 1930s remote from established centres of industry, including the fledgling auto industry in Tokyo and Osaka, now anchors the Nagoya-Hamamatsu metropolitan area, the largest centre of the Japanese auto industry which includes major Honda and Suzuki operations as well as those of Toyota (Figure 14. 1; Miyakawa 1991: 101). In 1960, Toyota also relocated and substantially enlarged its R&D facilities in Nagoya.

Figure 14.1
Toyota: Distribution of Major Facilities in Japan 1994



In addition to its own assembly operations, Toyota attracted suppliers and parts to the area which were strongly, often exclusively tied to Toyota (Miyakawa 1980: 48-52). A key initiative in this regard was the formation in 1939 of the Association of Co-Development with Toyota Motor, the *Kyoho Kai,* an association of about 25 'first tier' parts suppliers largely based in Tokyo. After World War 11 this association was expanded and divided into three branches located in the Kansai region (centred on Tokyo), the Tokai region (centred on Nagoya and Toyota city) and the Kanto region (centred on Osaka). By the 1950s, the largest was the Tokai *Kyoho Kai*. In the late 1970s, for example, this association comprised 136 members, compared to the 25 in the Kansai *Kyoho Kai* and 65 in the Kanto *Kyoho Kai* (Figure 14.1). In fact, the members of these associations comprising Toyota's first tier suppliers have change little since at least the late 1960s and until at least the late 1980s (Odaka, Ono and Adachi 1988: 316: see also Morales 1994: 102). Moreover, the majority of the members of the Tokai *Kyho Kai* are located within Toyota City, within minutes driving time of Toyota's four assembly and several other plants in the city, and almost half sold at least 50% of their output to Toyota (Miyakawa 1980: 49). In addition to the *Kyoho Kai,* an association of component suppliers, Toyota created two other associations: the *Seiho Kai* and the *Eiho Kai* (Adaka, Ono and Adachi 1988: 256; Miyakawa 1980: 49). Thus, the *Seiho Kai* has typically comprised 21 members which manufacture machine tools, dies and gauges while the *Eiho Kai* which typically has 36 members which supply various kinds of services related to the construction and building of facilities. Members of both these associations are largely located in Toyota City and nearby Nagoya (Miyakawa 1980: 49).

Each of the members of these associations , in turn, have nurtured the development of their own suppliers. By 1980, the 11 Toyota facilities (four assembly plants) subcontracted with 220 first tier suppliers who subcontracted with some 30, 000 'lower' tier firms (Sheard 1983; Morales 1994: 108). Toyota City remained a company with 83% of its employment in auto related activities (Fujita and Hill 1987). In 30 years or so after 1937, from a rural silk growing area, Toyota City had become a major industrial district specializing on autos. In this district, the cause and effect relations between geographic concentration and flexible mass production is most acutely defined.

THE SOCIAL DIVISION OF LABOUR IN THE JAPANESE AUTO INDUSTRY

The production system of the Japanese and US auto industries evolved according to different organizational and geographical principles until the early 1980s since when the differences have lessened, but not disappeared, especially as aspects of Japanese production systems have been incorporated within the North American industry.

Within both Japan and the US, auto assembly and parts production historically concentrated in core industrial regions. In the US, however, once established in the mid-West, the dominant corporations pursued strategies of branch plant dispersal from the 1920s until the 1980s (Rubenstein 1991: 130). In Japan, on the other hand, with the main exception of Mazda in Hiroshima (Takeuchi 1990), the leading firms have favoured geographic concentration in the Tokyo-Nagoya regions. It has only been within the last decade that the leading firms have considered locating branches in remote regions. Toyota and Nissan, for example, have built new state of the art plants in the Northern Kyushu-Yamaguchi area in southern Japan.

In important respects, the Japanese industry is more competitive than its US counterpart. Thus, there are a greater number of core firms in Japan than in the US. Thus, while the latter has been dominated by the ‘Big 3’ (GM, Ford, Chrysler) in Japan there were seven core firms in 1950, 14 in 1959, 12 in 1968 and 11 in 1987 (Nissan, Toyota, Honda, Mazda, Mitsubishi, Isuzu, Subaru, Hino, Daihatsu and Suzuki) and while a couple are relatively specialized and affiliated to a larger company, each has promoted the development of an intricate social division of labour (Odaka, Ono and Adachi 1988: 1). That is, to a far greater degree than in the US, Japanese core companies rely on ‘buying’ rather than ‘making’ inputs (Table 14. 4). Thus, compared to the US, West Germany or France, Japanese auto firms have consistently exhibited a stronger preference to "buy" and in 1980, for example, Japanese firm, on average, bought 80% of their inputs. This difference remains in evidence. Thus, in 1989 Toyota’s sales of $60 billion wereabout half that of GM's $127 billion but its workforce of 91, 790 was 11. 9% of GM’s employment, even though GM had spent the previous decade rducing jobs. Moreover, the organization of the social division of labour has evolved in fundamentally different ways in the Japanese auto industry compared to its North American counterpart.

Table 14.4

"Make" or "Buy" in Automobile Manufacturing: An International Comparison[a]

Year	Purchased inputs to net sales %				Goods and services purchased/ production cost Japan[e]
	U.S.A.[b]	West Germany[c]	France[d]	Japan[e]	
1955	58	n.a.	n.a.	72	87
1960	47	n.a.	n.a.	78	83
1965	53	63	53	73	82
1970	57	61	n.a.	77	81
1975	61	59	n.a.	80	81

Source: Odaka, Ono and Adachi 1988: 54

Notes: [a] Straight international comparisons are subject to some qualifications and should be adjusted for different tax systems, production subsidies, and so on. In the present table, no such adjustments have been attempted.

[b] 1955-65: weighted averages of G.M., Ford, Chrysler and American Motors (the 1955 figure is a geometric average of the four corporations, making use of a l953 figure for A.M.C.); 1970-75: weighted averages of G.M., Ford and Chrysler.

[c] Weighted average of Volkswagen and Benz, except for 1970 where the Volkswagen figure is not available.

[d] Figure for Renault.

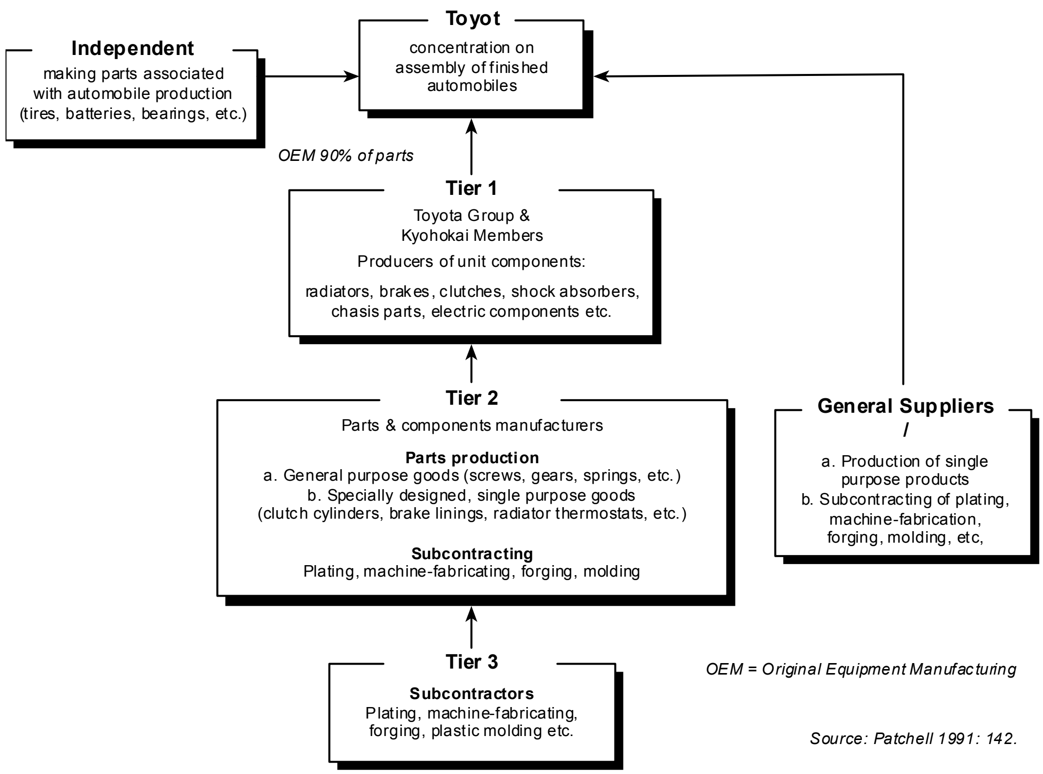
[e] Weighted averages of seven to eleven corporations. Note that the numerator includes materials cost.

In particular, while Japanese companies have developed strongly hierarchical production systems US companies have preferred lateral systems featuring many more direct contacts with subcontractors or suppliers (Figure 13-2).

The structure of subcontracting

The key feature of contemporary Japanese auto production systems is a closely delineated set of 'subcontracting layers' (Sheard 1983) or 'inter firm relationships' (Asanuma 1989) which are arranged in a hierarchical type manner around the core firms (Figure 14.2).

Figure 14.2
The Toyota Production System



Source: Patchell 1991: 142.

According to Sheard (1983:), 'The defining criteria of a subcontracting layer is transactional distance from the automaker.' Thus the core firm deals directly with the first layer of subcontractors, or the first tier of suppliers, who in turn deal with the second layer of subcontractors, or the second tier of suppliers, who in turn deal with a third layer, and so on. The exact number of suppliers is hard to state conclusively but, circa mid-1980s, if the main assemblers use between approximately 100-300 first tier suppliers the number of second and third tier suppliers is probably in the range of 1000-4000 (see Sheard 1983; Odaka, Ono, Adachi 1988: 2).

Although the social division of labour is extensive, this hierarchical system means that the core firms only deal directly with very few suppliers. Toyota, for example, deals directly with about 220 component suppliers while Takeuchi (1990: 175-6) notes that Nissan subcontracts more than 50% of its production its direct purchases from the 105 members of its main cooperative association, Takara *Kai*.. In addition, core firms purchase 'basic material supplies' (steel, plastic, rubber) from a few other core firms in other industries. In the US (and Canada), the Big 3 have traditionally chosen to make internally a much bigger share of component parts. In contrast, in 1986, GM obtained 80% of its materials by direct purchases from 5,500 suppliers. If suppliers of basic raw materials, machine tools, services and marginal inputs are included GM dealt with around 35,000 suppliers (Asanuma 1987). At the plant level, in 1986 a new GM plant typically dealt with approximately 300 suppliers while an old GM plant obtained supplies from over 1200 firms. On the other hand, Toyota dealt directly with about 125 suppliers in a plant which had twice the capacity of a GM plant. In other words, GM deals directly with many more suppliers, many are marginal and many only serve one plant.

The refinement of the social division of labour inherently implies specialized roles for participating members. Core firms such as Toyota and Nissan have traditionally been more specialized than their North American counterparts. Toyota, for example, specializes in engine and final vehicle assembly of components and parts (Figure 14.1). In addition, the vast majority of the firms which comprise the social division of labour are small and specialized. Even the first tier firms comprise few firms that are truly large.

According to Sheard, about 8% of major parts suppliers employ 3000 workers or more and even these tend to be specialized, such as the tire manufacturers. Most second and third tier suppliers employ less than 20 workers.

Within the social division of labour underlying the core assemblers there are two general principles organizing firm specialisms. First, tier 1 suppliers are largely product manufacturers, for example, of steering systems, radiators, head lamps. Lower tier suppliers are more likely to provide processes, such as stamping, machining, molding and forging (Odaka, Ono and Adachi 1988: 258-60). Second, between the layers or tiers of suppliers specialization also occurs as, in general, labour intensive, small batch and low value added operations are transferred down to the second and third layers. Sheard (1983: 59) provides an example:

> "A large stamping firm (first layer subcontractor) might undertake to supply a side-door sub-assembly to a certain auto-maker. The firm would use its large transfer presses to make the large stampings but would farm out all smaller stampings to a smaller firm (second layer subcontractor) which would use smaller and less expensive presses. Even this firm would find it less costly to engage a local workshop (third layer subcontractor) to provide some of the component stampings. Thus, through specialization between different-sized firms with varying productive capacities, capital intensity ratios and labour costs, there results a production chain linking workshop to automaker."

The evolution of the Japanese auto industry to a large scale producer of high quality, reliable autos required the development of a sophisticated machine tools industry and constant improvement among all firms within the social division of labour. In this regard the core firms played a 'core' role; they established foreign markets, coordinated the production system and helped develop the abilities of the supplier firms by providing financing, sometimes on an equity basis but not necessarily so, by creating stable and growing demands, and by providing expertise through informal contact, demonstrations, joint projects and loans of workers and engineers. The core firms vary in aspects of their subcontracting relations in terms of number of first tier suppliers, degree of control over them and degree of exclusivity. Nissan and Toyota developed closely related 'associations' in which exclusive relations and parent equity investment were, and remain, important features. Even Nissan and Toyota, however, do not have that many first tier suppliers. Moreover, to an important degree the other companies 'tapped' into their supplier base in creating their own production systems. Consequently, one emerging trend is towards the interlocking of production systems although this is a gradual process. The core firms still retain their own families of suppliers and supply relationships are strong.

The kanban system

In the Japanese auto industry (and others) the development of a specialized, highly interlinked production system has been associated with the development of Just in Time (JIT) delivery systems, sometimes also called kanban systems. In fact, 'kanban' means card or visible record and is a specific type of JIT system developed by Toyota. The terms are often used interchangeably, however.

In brief the idea of JIT is simple: "Produce and deliver finished goods just in time to be sold, subassemblies just in time to be assembled into finished goods, fabricated parts just in time to be transformed into fabricated goods" (Schoenberger 1982: 16; see also Linge 1991). Conventionally, the main justification for JIT is that it reduces the need for inventory and for inventory control, thereby reducing costs. JIT reduces costs because materials do not have to be stored which represents tied up capital (they have to be paid for) and also involves an expenditure in buildings, space and inventory management. These advantages are important but there are other benefits. Thus the whole practice of JIT typically means deliveries are made in frequent but small lots; that is, JIT reduces lot size. In turn, small lots allow for better quality control as defects are more easily recognized at either the point of origin or destination. In other words, it is easier to check small lots and maintain higher quality standards. Indeed, to be successful JIT requires quality standards are strictly met since too many and frequent rejects would defeat its purpose. Moreover, JIT provides for more opportunities for greater involvement by labour in terms of, for example, the exchange of information regarding the timing and size of deliveries, and minor variations, as well as in quality control.

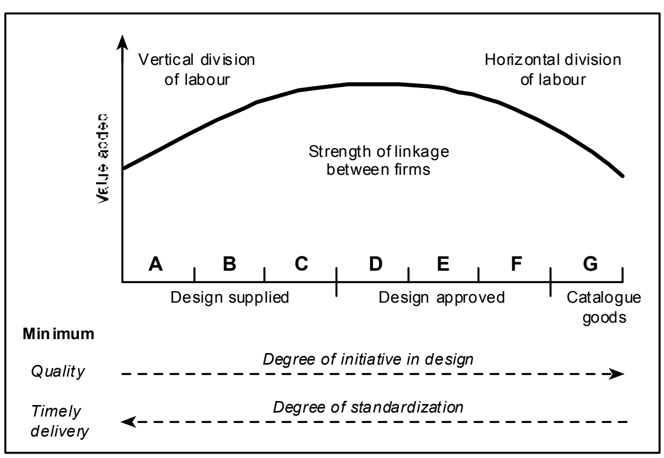
As Sheard points out, JIT was first introduced in the US in the form of the conveyor belt which moved a product 'just in time' to the next worker to perform his/her task. In Japan, JIT principles have been extended to the social division of labour to create a 'factory without walls' (see Sheard 1983). The limited JIT system of the conveyor belt, however, was always associated with large inventories reflecting a so-called just in case mentality. That is, large inventories require less cooperation among firms but provide the core firm with insurance against disruption of supply. Yet, in Japan, such disruptions have been noticeable by their absence. It is true that in recent years, bearing in mind that the Japanese road system is not particularly well developed, traffic congestion and accidents have created problems in the operation of JIT which is becoming increasingly computerized so that information about road conditions and accidents involving the JIT trucks, can be transmitted quickly and remedial measures taken. In other respects, the operation of JIT has been utterly reliable. To get a better understanding of this reliability we need to place the kanban system within the context of inter-firm relations in the auto industry in general.

Ties That Bind To Mutual Advantage: The Relation Specific Skill

As an expression of the quality multiplier process, Asanuma's (1989) concept of the relation specific skill provides the analytical basis for understanding both the dynamism and stability of Japanese auto production (see also Patchell 1993a and b). According to Asanuma, the relation specific skill defines inter-firm relationships in terms of their technological characteristics. In particular, Asanuma makes a fundamental distinction between design approved (DA) and design supplied (DS) firms or suppliers (Table 14.5). Thus, DS parts are parts manufactured according to drawings supplied by the core firm, that is, the core firm provides or dominates the technological expertise. DA parts, on the other hand, are parts manufactured according to designs developed by the supplier, that is, the supplier provides or dominates the technological expertise. Depending on the degree of technological initiative undertaken by the supplier in relation to the core firm, DA and DS parts can be sub-divided further. In addition, there is the special case of catalogue goods which are bought 'off the shelf' and have researched, developed and designed exclusively by the supplier. That is, there is no exchange of 'know how' and these firms are outside of the interactive supplier network.

The actual degree of cooperation, or what Patchell (1993a) terms "technological bonding," between supplier and core firm in the development of a product or process is greatest in the DA and DS categories which are adjacent to one another (Figure 14.3).

Figure 14.3
The Binding of Firms by the Relation of Specific Skill



Source: Patchell 1993: 811

As Patchell notes, the strength of technological bonding declines both towards less sophisticated DS suppliers and increasingly sophisticated DA suppliers (and is least of all with respect to catalogue good suppliers). In this model, suppliers may develop expertise which is even greater than that held by the core company.

Table 14.5

Parts manufactured according to specifications provided by the core firm ("ordered goods")						
	Parts manufactured according to drawings provided by the core firm			Parts manufactured according to drawings provided by the supplier		Parts offered by catalog ("purchased goods")
A	B	C	D	E	F	G
the core firm provides minute instructions for the manufacturing process	the supplier designs the manufacturing process based on blueprints of products provided by the core firm	the core firm provides only rough drawings and their completion is entrusted to the supplier	the core firm provides specifications and has substantial knowledge of the manufacturing process	intermediate region between D and F	though the core firm issues specifications, it has only limited knowledge concerning the process	the core firm selects from catalog offered by the suppler
small parts assembled by firms offering assembly service	small outer parts manufactured by firms offering stamping service	small plastic parts used in dashboard	seat	brake, bearing, tires	radio, electronic fuel injection system, battery	

Classification of Parts and Suppliers according to the Degree of Initiative in Design of the Product and the Process

Source: Asanuma 1986: 32; see also Asanuma 1985 a and b

The relation specific skill is the key for understanding why there is both a high level of stability and a high level of dynamism or competitiveness. Long term stable relationships among firms in Japan's auto production systems do exist while at the same time there is a constant striving for lower costs, better quality and new products. A key strategy in developing behaviour among suppliers which is both competitive and cooperative is the provision of incentives to them, in the form of more business from the core firm and greater profits, to develop their technological expertise. In other words, there are rewards from shifting from a DS supplier to a DA supplier. A more detailed look into the nature of inter-firm relationships provides an understanding of how this strategy works.

The basic contract - In the Japanese auto industry, as Asanuma notes, there is no single written contract between core firm and supplier which prescribes specifications of the items to be delivered, their quantities, price etc. Rather, there are a set of contracts, related documents and established practices. The foundation of inter-firm relationships in the Japanese auto industry is provided by the so-called "basic contract" which is exchanged when a core firm enters into a business relation with a supplier. The duration of this contract is usually one year and is automatically renewed unless either side raises an objection. This contract defines only <u>general</u> obligations of both parties. For example, basic contracts typically state that once monthly schedules have been set and consented to by the supplier then this arrangement constitutes a contract. A basic contract will also typically state that kanbans are fine tunings which the core firm can introduce if the supplier agrees to the introduction of the kanban system. Typically, basic contracts require that price negotiations will occur at regular intervals, usually six months.

The specific details of inter-firm relationships are then set out in a delivery or quantity contract and in a price contract.

Quantity contract - The length of a quantity contract is normally the life of a model which Asanuma found to be typically four years, with minor model changes introduced after two years. Once a core firm selects a supplier from among rivals the core firm rarely switches to another supplier during life of the model or component. In addition to this "non-switching" policy core firms pursue a "two vendor" policy which applies to broad groups of parts, such as head lamps or brakes. In practice, the core firm will use at least two firms within such a category of parts as insurance against sudden disruption in supplies from one supplier and to put pressure on all suppliers for a cooperative attitude regarding prices and quality. Then, with respect to a particular part, for example, a headlamp or brake system for a particular model of car ('sub-category of part') the core firm will typically use one supplier whose status is stabilized during the life of the model. Sometimes an identical part may be split among two suppliers if demand is big enough; in this case, alternate suppliers might get a fixed share of the business or the business may be split by market area, say between domestic and foreign markets.

Once supplier arrangements are established and in operation, quantities are adjusted each month depending on demand. In this regard, it might be noted that it is not widespread practice to use suppliers as capacity buffers as is in the case in the west (Taylor and Thrift 1983). Both core firm and suppliers suffer during a recession for a given model.

Of course, with the introduction of a new model, formal competition among suppliers resumes. In this regard, the 'two vendor' policy ensures that there will always a few firms capable of vigorously competing for new business because they will have the relevant expertise. This competition is surely not of the 'invisible hand' type characterized by an infinite number of suppliers (and consumers) but, as Itoh (1989) said, it is "the face you can see competition." Everybody knows the competition. The core firm allocates new business among competing suppliers based on its ratings of suppliers which is influenced by past performance; its policy concerning allocation of business among them; and its assessment of specific proposals. It might also be noted in this regard that core firms typically stagger model changes which allows the core firm to keep its suppliers in constant competition for new business.

On the other hand, as we have noted, a remarkable aspect of the Japanese auto industry, is the stability of suppliers and the fewness of suppliers, especially within a core firm's association. For example, Asanuma notes that in 1984, there were 171 firms in Toyota's supplier association of which 153 have been continous members since 1973 and there had been only 3 exits. Such stability

> "..has contributed to nurture a feeling among suppliers that they are in the same boat as the core firm and share a common fate, despite the fact that they have to face ratings from the core firm and engage in renegotiations individually on business terms with the core firm at regular intervals" (Asanuma 1989: 6).

Asanuma's comments neatly summarize the combination of trust and paternalism with fierce competition that are such features of the Japanese auto production system.

Price contract - Prices are initially set by negotiation between core firm and supplier taking into consideration such factors as cost, relative contributions to design and acceptable levels of profit. After six months, however, prices are renegotiated. At this time, the core firm may well ask for a price reduction from 2-10% on the basis of the argument that the supplier will have had the opportunity to move up the learning curve which defines the productivity improvements a labour force can achieve as it becomes familiar with how to manufacture a new product and as they produce more volume.

For DA suppliers who have undertaken considerable initiative to research and develop a part or process the core firm may waive the price reduction for a year as a reward for innovativeness. If design has been shared equally by core firm and supplier the price waiver may be six months. Clearly, the size of this reward can vary from a complete price reduction waiver over varying time periods to varying percentages in the price reduction requested. Essentially, this behaviour allows the core firm to reward suppliers according to degree of innovation so suppliers are continually encouraged to improve. Such rewards clearly help the core firm also by improving the quality of its products and by enabling it to produce more efficiently. In addition, as suppliers become more innovative, their ratings increase and they will receive more business and more challenging tasks from the core firm which will widen opportunities to be innovative.

Japanese and western auto industrial districts : summary comments - In North America and Europe, as well as Japan, the auto industry's evolution was closely associated with a geographic concentration of production in large scale industrial districts. In the US, the geographic focus centred on Michigan, in Canada on southern Ontario and in the UK on the west Midlands and London. All of these districts created external economies of scale. The anatomy of these districts varied, however, in terms of the organization of entrepreneurial and labour market networks and innovation (Figure 13. 6).

Thus, typically Japanese core firms have relied more on subcontracting than their US counterparts; in the early 1980s the former typically subcontracted out about 75% of vehicle production while the latter about 52% (Shimokawa 1985: 8-9; Yaginuma 1993: 24). That is, US industrial districts feature higher levels of ownership integration (Figure 13.6). On the other hand, in Japanese auto industrial districts such as Toyota Town, core firms organize high levels of cooperation with their suppliers and achieve greater stability than western counterparts. That is, the Japanese industrial districts feature higher levels of coordination (Figure 13.6). The lateral system of subcontracting developed by the US core firms involve them in a large number of direct relationships with suppliers based largely on cost. In the US, the general rule of competition favoured suppliers offering a better price in which the stability of subcontracting relations is constantly threatened by the search by core firms for lower prices. In Japan, the hierarchical system of subcontracting implies fewer direct contacts for core firms who, in contrast to their US rivals, place emphasis on the stability of relations in order to help suppliers develop high quality products and processes. In Japan, and less so in the US, core firms provide better incentives for suppliers to improve quality as well as to reduce prices.

Traditionally, highly stable firm supplier relationships in Japan has featured many 'exclusive' relationships in which suppliers rely on one core firm as a market and other transactions. There is, however, a gradual but nevertheless clear trend for such exclusive links to decline in importance in the auto indsutry (Yaginuma 1993). This trend is of course a matter of degree and key relationships remain fundamentally stable.

The higher level of coordination achieved in the Japanese industrial districts is institutionally underpinned by keiretsu relationships, which include the supplier firm cooperatives, and the JIT system. In this system, strong incentives to innovate exist throughout the social division of labour. The organization of internal R&D also evolved differently among US and Japanese auto along the lines suggested by Freeman (1988). In particular, in Japan, firms emphasize reverse engineering and a 'loopy' approach in which there are close, interactive relations between R&D groups, production and marketing throughout the innovation process. In contrast, the US auto makers historically favoured a 'linear' approach which emphasized, extending the principles of scientific management, the formal separation of specialized functions in an innovation process, conceptualized as a linear sequence from research to marketing.

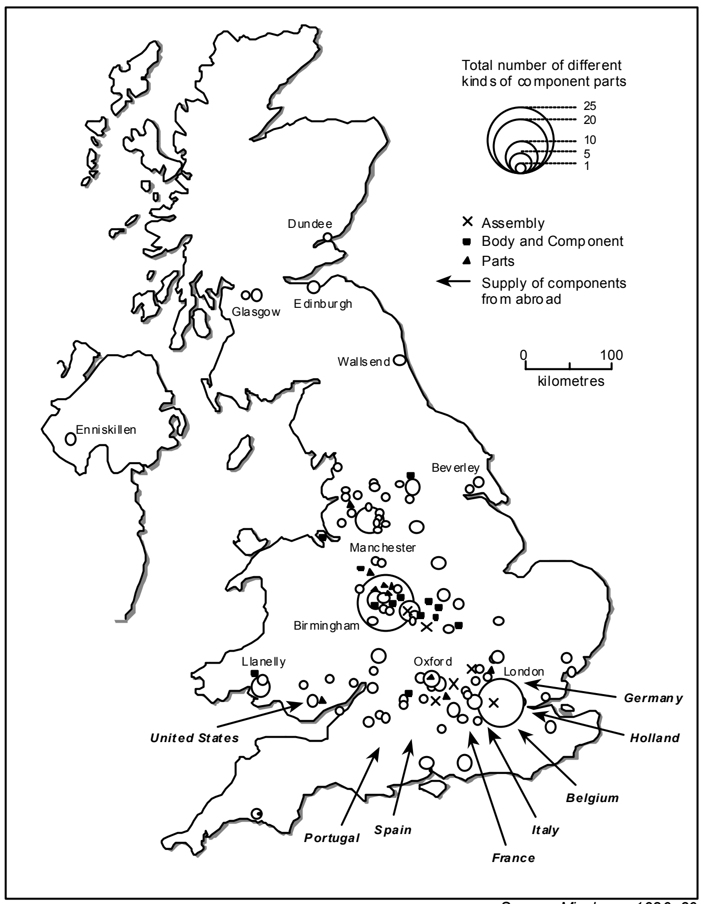
The Japanese auto industry is considered a quintessential example of flexible mass production or lean production in which high levels of efficiency are combined with high quality production and economies of scale and scope are combined with responsiveness to highly differentiated demands. In this latter regard, during the 1970s Japanese auto makers rapidly escalated the number of variations of individual types of autos based on different combinations of body type, engine type, transmission type, degree of luxury, optional parts, colours and other features. Asanuma (1989), for example, reports that Crown Toyota was sold in the form of 322 variations in 1966 but by 1978 it was offered in 101, 088 variations. While Japanese auto firms recently have cut back on these variations for cost reasons, the industry by the 1980s had established itself as the world bench mark for flexible mass production in which labour productivity and product quality are mutually reinforcing trends.

One geographical consequence of the different traditions between North American (and UK) and Japanese auto makers is the greater willingness of the former to seek out lower cost supplies from geographically dispersed sources. The greater tendency to demarcate functions, the greater reliance on the internal division of labour and a greater pre-occupation with costs combine to facilitate and motivate this search. During the 1960s and 1970s, in both North America and Europe, auto manufacturers were increasingly seeking to locationally diversify purchases as well as of auto assembly itself, in part to reduce labour costs, in part to access government support programmes and in part to reduce risks associated with geographic concentration, such as reliance on one particular pool of labour. One example is provided by the supplier network of British Leyland's Cowley plant in the late 1970s (Figure 14. 4).

Thus, in the same period, that Toyota had geographically concentrated its facilities and supplier network in Toyota City and environs to its maximum extent, the Cowley plant in Oxford was relying on supplies from three metropolitan areas in the UK (in order of importance, Birmingham, London and Manchester), as well as many other places, while also importing components from the US and seven European countries.

The world car strategy - Even before the post 1950 rise of the Japanese industry, the Big 3, especially Ford and GM, were already MNCs with extensive investments outside of North America, especially in Europe. Moreover, foreign operations had evolved according to distinct, independent strategies and structures reflecting the belief that particular types of cars were needed for particular markets. Traditionally, for example, Ford and GM saw Europe as more of a small car market than North America, because of high energy costs and narrow streets. Thus, in the 1970s, facing with a growing competitive challenge from Japan, attempts to restructure by the Big 3 necessarily had to take into account that their existing operations were already global and significantly decentralized.

Figure 14.4
British Leyland's Factories and the Supplier Network for the Cowley Assembly Plant, 1978

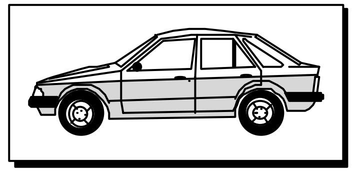


Source: Miyakawa 1980: 30

For the Big 3, restructuring meant a growing commitment to the integration of production sytems on continental and indeed on global scales (Bloomfield 1981; 1991). This integration was heralded by the North American Auto Pact of 1965 and in the 1970s underllay the so-called 'world car concept' (Bloomfield 1991: 44). Ford, in particular, sought to integrate its large North American and European operations with its more dispersed facilities in Brazil, Argentia, Mexico, Australia and South Africa in order to produce a world car. From a marketing perswpective, the world car meant a car that could be sold around the globe or at least in many parts of the globe. From a production perspective, the world car meant intergrating research and development, servicing and producing operations to jointly design, develop and manufacture a particualr car. Ford's initial attempt at a world was the Fiesta, different parts of which were researched in the UK (the engine), Germany (drive train and brakes) and the US (interior). Assembly operations were assigned to the UK, Spain and Germany, each plant drawing on a common set of suppliers located throughout Europe including 45% from Ford's own branch plants (Dicken 1992: 300). Plans to build the car in Brazil were shelved, however. Ford's subsequent development of the Escort developed global integration to an even further degree (Figure 14.5). Thus, the Escort is assembled in just two locations in Europe and draws on suppliers located throughout Europe, the US and Canada and Japan. These inputs include wheel nuts and glass from the US, alternators from France, cylinder heads from Italy, mirrors from Spain radiators from Austrai, hose clamps from Sweden and exhaust flanges from Norway. Even so, in the case of the Escort, Ford failed to produce a car manufactured on one continent and sold on others with only minor modifications as the US Escort was manufactured separately from the European Escort, and with little integration (Barnet and Cavanagh 1994: 270-1).

Ford, at least, has not given up on the world car strategy which, with its emphasis on a global supply base from affiliated operations, contrasts to the Toyota model which emphasizes a local supply base from a social division of labour. At the same time, as the Japanese companies have internationalized, their own production systems are being constantly modified.

Figure 14.5
Ford Escort in Europe: Component Sourcing Network



Denmark .... fan belt
Canada .... glass, radio
Norway .... exhaust, flanges, tires
Netherlands .... tires, paints, hardware
Austria .... tires, radiator & heater hoses
Belgium .... tires, tubes, seat pads, brakes, trim
Switzerland .... underbody coating, speedometer gears
U.S.A. .... EGR valves, wheel nuts, hydraulic tappet, glass
Italy .... cylinder head, carburetor, glass, lamps, defroster grills
Sweden .... hose clamps, cylinder bolt, exhaust down pipes, pressings, hardware
Japan .... starter, alternator, cone and roller bearings, windscreen washer pump
Spain .... Wiring harness, radiator & heater hoses, fork clutch release, air filter, battery, mirrors
France .... alternator, cylinder head, master cylinder, brakes, underbody coating, weatherstrips, clutch release bearings, steering shaft & joints, seat pads & frames, transmission cases, clutch cases, tires, suspension bushes, ventilation units, heater, hose clamps, sealers, hardware

ASSEMBLY IN:

West Germany .... locks, pistons, exhaust, ignition, switches, front disc, distributor, weatherstrips, rocker arm, speedometer, fuel tank, cylinder bolt, cylinder head gasket, front wheel knuckles, rear wheel spindle, transmission cases, clutch cases, clutch, steering column, battery, glass

United Kingdom .... carburetor, rocker arm, clutch, ignition, exhaust, oil pump, distributor, cylinder bolt, cylinder head, flywheel ring gear, heater, speedometer, battery, rear wheel spindle, intake manifold, fuel tank, switches, lamps, front disc, steering wheel, steering column, glass, weatherstrips, locks

Source: US Department of Transportation (1981) The US Automobile Industry, 1980, Washington DC: USGPO, 57. (see also Dicken 1992: 304)

In particular, Japanese assemblers in foreign countries have relied on (long distance) inputs from established domestic suppliers, a tendency which in turn is modified by foreign investments by the suppliers themselves. In addition, Japanese firms, including Toyota, have experimented with the sourcing of supplies in low wage locations. Indeed, for all producers, as global competition has intensified, pressures to seek out lower cost sites remain. In addition, lean production should not be regarded as an end state or without internal conflicts.

After lean production

The lean production system was pioneered by Japanese auto makers, especially Toyota after the 1950s and took years to fully develop (Womack et al 1990). It continues to change (Benders 1996). At the core of lean production is still the assembly line which in its case, not only requires fast paced, short rhythm work but also constant attention to quality control. Consequently, Japanese workers, as elsewhere, have experienced problems of stress and fatigue. Indeed, by the early 1990s Japanese auto makers were experiencing some problems of labour recruitment and core companies, including Toyota, began to re-think the principles of lean production from the perspective of work organization. Thus visits were undertaken to Saturn and Uddevalla (see chapter 12) and Toyota, for example, chose to build a new plant in Miyata, on Kyshu Island to experiment with new ideas of work organization. The Miyata plant, it might be noted, is Toyota's first major manufacturing plant in Japan not built in its home region (Figure 14. 1).

According to Benders (1996), a major theme of Toyota's plant at Miyata is to improve the quality of working life (QWL) through ergonomic changes, creating more interesting jobs and changing the reward structure. In terms of ergonomics, Toyota has reduced noise levels (for example, by use of anti-noise covers in the press shop), reduced heavy work by automation, introduced high adjustable platforms on the assembly line, and improved lighting in the assembly area. With respect to work organization, Toyota has divided the assembly line into 11 mini lines which are separated by (time) buffers of approximately five minutes to allow workers to observe the beginning and end of their part of the work in the hope of providing for a greater sense of accomplishment. Within the mini lines, tasks have been further re-arranged to enhance meaning (in contrast to established system in which tasks are fragmented with and without logical relationships between them). The *kaizen* system has also been changed. In the established system at Toyota workers are expected to provide a minimum number of suggestions which in turn is stressful and leads to trivial comments. At Miyata, there are no obligations except that the suggestions made have to be meaningful. In addition, in a general way, at Miyata Toyota has given more attention to introducing automation in a way that does not isolate workers and which can be improved, maintained and repaired on the shop floor. Finally, Toyota has changed its wage structure at Miyata so that 60% is fixed and 40% is age-based and there is no bonus for direct productivity change (although *kaizen* still functions in this manner).

Toyota is seeking related kinds of changes in working conditions that have been achieved at Saturn and were attempted at Uddevalla for similar reasons - to ensure workers are more interested, comfortable - and productive. As with Saturn and Uddevalla, Toyota has also preferred to experiment at a new location with the hope that successful behaviour can be transferred to its existing plants. The next section examines Japanese branch plant operations in North America and Europe and raises the question of the international transfer of Japanese practices. Three prefatory points can be re-stated. First, transfer of know-how is a two way process and, for example, if Japanese auto companies are now leading innovators they continue to observe and learn from others and to practice reverse engineering. Second, Japanese practice itself is dynamic. Third, practices in one location may not easily duplicated elsewhere.

JAPANESE FIRMS IN NORTH AMERICA AND EUROPE

In the 30 years following 1950, the Japanese auto production system transformed itself from the destruction of World War 2, to a producer of cheap trucks and cars with foreign help, to an indigenous producer of cheap cars to a producer of reliable, high quality small cars to a high value producer of a full range of cars. By the early 1970s, Japanese firms had developed technology that was transferred to the US; for example, anti-pollution equipment innovated by Honda was first sold to Toyota and in 1973 to Ford, Chrysler and GM (Miyakawa 1991: 102). Moreover, a consistent and high level commitment to R&D has helped enable Japanese firms to go well beyond reverse engineering and establish technological leadership, as well as organizational leadership. Indeed, it is probable that Japan's massive auto trade surpluses with North America and Europe would have been even greater in the absence of voluntary export limits and if Japanese firms had not partially replaced visible exports with direct foreign investment.

Whether or not Japanese production systems can be duplicated in other economies is a matter of debate. There is a view that in Japan business organization, including with respect to inter-firm relations, is intimately related to cultural attitudes, notably deeply held Confucian values which underlay cooperative behaviour, respect for leadership and an unusually strong work ethic. Other differences may relate to differences in entrepreneurial attitudes, values and capabilities. For different, frankly ambiguous reasons, Williams *et al* (1993) claim that there is little chance of effectively transferring Japanese industrial success elsewhere, particularly that associated with Toyota whose competitive strengths are considered unique. Womack *et al* (1990), on the other hand, argue that lessons can be learned from Japanese models and incorporated within western economies.

Outside of a Pacific Rim context (see Edgington 1990), a major wave of foreign investments by Japanese auto makers in the 1980s focused on the US (Figure 6. 4) and Canada. These investments occurred as wholly owned branch plants and joint ventures with the Big Three (Table 14. 6). In Europe, the Japanese auto makers invested later and so far on a smaller scale; by the mid-1990s Honda, Nissan and Toyota had established assembly operations in UK (Dicken 1987; Foley et al 1996; Garrahan and Stewart 1992; Jones and North 1991; Peck 1990). The motives of the Japanese companies in pursuing strategies of horizontal (and vertical) integration are primarily to expand or maintain market share in distant markets threatened by tariff barriers, import quotas and competitive responses by local firms. For the host countries, Japanese investment promises to transfer leading edge know-how as well as jobs. In the joint ventures, a major motive of the Big 3 is to gain access to this know-how.

In the context of the transfer of Japanese production systems to North America and Europe, debate has focused especially on labour relations and subcontracting relations.

With respect to labour relations, Japanese auto firms, whether in wholly owned branch plants or as part of joint ventures, have introduced at least aspects of Japanese style management and work practices, notably flexible work rules and broad job classifications.

Table 14.6

Japanese Transplant Production Facilities in North America 1989

Firm	**Location**	**1989 Production**	**Announced Capacity**
Assembly Plants:			
Honda	Marysville, Ohio	351,670	360,000
	East Liberty, Ohio		150,000
	Alliston, Ontario	86,447	100,000
NUMMI[1]	Fremont, California	192,235	340,000
Toyota	Georgetown, Kentucky	151,150	240,000
	Cambridge, Ontario	20,859	50,000
Nissan	Smyrna, Tennessee	238,640	480,000
Mazda	Flat Rock, Michigan	216,200	240,000
Diamond Star[2]	Bloomington, Illinois	91,839	240,000
CAMI[3]	Ingersoll, Ontario		200,000
SIA[4]	Lafayette, Indiana		120,000
ASSEMBLY TOTAL		1,349,000	2,520,000
Engine Plants:			
Honda	Anna, Ohio		
Nissan	Smyrna, Tennessee		
Toyota	Georgetown, Kentucky		

Notes: (1) Commenced operations in 1989.
(2) General Motors/Toyota joint venture.
(3) Chrysler/Mitsubishi joint venture.
(4) Subaru/Isuzu joint venture.

Source: Womack, Jones and Roos 1990: 202

Mixed results have been reported as to the effectiveness and appropriateness of these practices. NUMMI, the joint venture between GM and Toyota, and managed by the latter, has performed extremely well. Toyota, it might be noted, did not re-hire any of the plant's previous managers and employees were flown to its Takaoka plant for three weeks on the job training (Rubensein 1991: 140). The plant is recognized as one of the most efficient in the US and its products have been well received. Nissan has received more criticism at its Smyrna plant in Tennessee and its plant in Washington, near Sunderland where job flexibility is judged more as job intensification than functional flexibility (Garrahan and Stewart 1992).

Local subcontracting

From the perspective of local development, subcontracting linkages are a critical issue since they substantially define the extent of quantity and quality multiplier processes. In addition to the extent of local subcontracting, important questions relate to whether or not Japanese firms operating in European and North American contexts can create efficient supplier networks based on JIT principles and with a mutual commitment to enhancing quality as implied by the relation specific skill. In practice, the local content debate has been controversial in both the US and Europe although the latter's policy response has been stronger (Jones and North 1991).

In the US case, as of 1987, Japanese branch plants and joint ventures relied on parts from US sources for about 50-60% of their needs, or at least anticipated this level of sourcing from within the US (Table 14. 7). In practice, the level of US sourcing of parts for these plants has increased since their start-up. A large share of US-source parts to Japanese branch plants or joint ventures is provided by Japanese tier 1 suppliers who have followed their core company to the US. The number of Japanese suppliers increased extremely rapidly in the US (and Canada) during the 1980s and most of their output is destined for the Japanese core companies. Japanese firms obtain some of their parts from

US suppliers but these inputs are typically bulky, low value products, such as carpets, glass and tires (Rubenstein 1991: 126). Japanese suppliers in the US or Japan still retain the high value components, such as suspension systems, brakes and engines. Compared to the US-owned assemblers, the Japanese transplants rely on a significantly higher level of imported parts.

Table 14.7

Domestic content at US assembly plants, 1987

	Percentage of parts produced in US
US-owned assembly plants	
Chrysler	91-88[a]
Ford	86-99[a]
GM	94-99[a]
Japanese-owned assembly plants	
Honda	60
Mazda	50
Nissan	
Cars	63
Trucks	56
Subaru/Isuzu	50[b]
Toyota	60[b]
Joint ventures	
NUMMI	
General Motors	60
Toyota	50
Diamond-Star (Chrysler/Mitsubishi)	55[b]

[a]Varies by model.
[b]Anticipated.

Source: Rubenstein 1991: 127

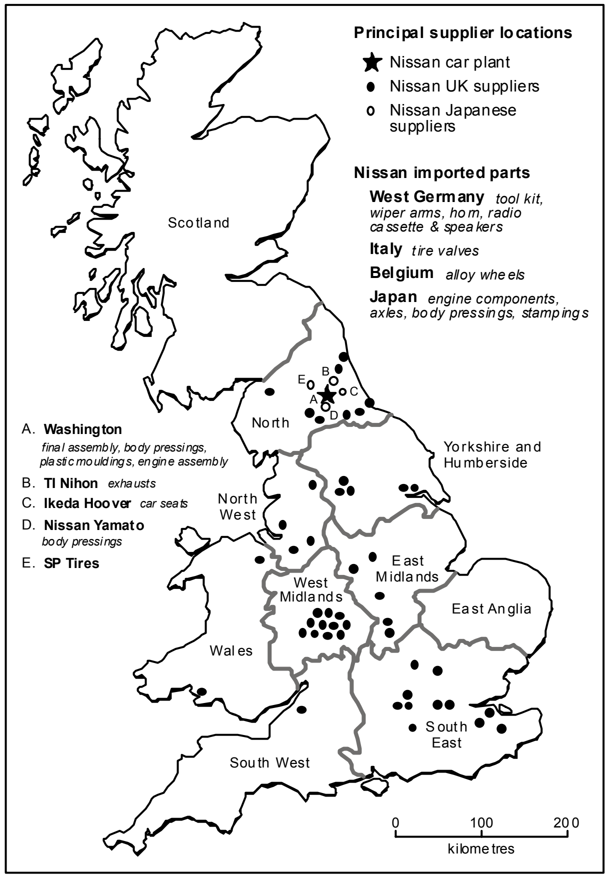
According to Rubenstein (1991: 125) Japanese firms in the US are sensitive to increasing domestic content and Honda, for example, announced in 1989 its intention of sourcing 75% of its from US sources. Subsidies from state and local governments and the rising value of the Yen have encouraged such a trend. By the early 1990s, however, the Japanese production systems had not duplicated the same level of localization found in Japan. Morris (1989) notes, on the basis of Canadian experience that just in time systems in Ontario are based on one per day deliveries (rather than multiple daily trips) and that the scale of operations is not yet sufficient to justify dense localized networks. n the US (and Canada). Within North America there is also the tension that exists between the advantages of concentrating supplier networks and the advantages of a low cost labour location in Mexico. Japanese firms in electronics and autos have already invested in macquiladoras (Kenney and Florida 1994). Mazda, as part of its arrangement with Ford, for example, produces a car, the Tracer, in Hermosillo, Mexico and it purchases components from Mazda affiliates in South Korea as well as Japan (Rubinstein 1991: 123). In other words, if Japanese transplants are seeking to duplicate supplier networks in North America along Japanese lines there are also signs of a willingness to disperse supply sources along North American lines.

Nissan's supplier network in the UK - Nissan's plant in Washington, near Sunderland opened in July 1986 as the first of the Japanese European plants with a direct employment of 1, 300, since expanded to 3, 500. Since then, within the UK, Honda has established an assembly plant in Swindon and Toyota at Burnaston in Derbyshire. However, it was Nissan's plant in Sunderland that sparked the European debate about subcontracting practices of Japanese firms especially n relation to local content (Peck 1990). Local content is defined by the EC as the 'ex-works price of a car less than the value of imports from outside the European community' (Peck 1990: 354). At start-up, Nissan's plant was a knock down assembly plant with limited local content. By 1988, Nissan had achieved 60% local content when the first exports to the continent occurred. Indeed, Nissan saw the UK primarily as a staging point for the EC as a whole (Jones and North 1991). The

French and Italian governments, however, concerned with protecting national producers refused to allow tariff free imports from the Sunderland plant unless local content was 80%, a level Nissan reached in 1991 (Peck 1990). In practice, Nissan's interest in creating a JIT system also reinforced its commitment to local content.

The supplier network Nissan has developed in the EC is relatively dispersed and draws from three European countries and Japan in addition to the UK (Figure 14. 6). However, while the Northeast region of England did not have an established supplier network, nine of Nissan's tier 1 suppliers have established their own branch plants adjacent to the assembly plant and on land owned by Nissan. These suppliers are high quality manufacturers which perform their own R&D, largely oriented to Nissan's needs. So, Nissan has achieved very close proximity to many of its high value components. It still imports important components from its supplier base in Japan. Lower value components are sourced from West Germany, Belgium and Italy and from a variety of suppliers, 70 by 1989, in the UK. These latter are mainly found in the traditional auto producing regions of the west Midlands and the Southeast but are located in several other areas as well.

Figure 14.6
Nissan's Principal Supplier Locations in the U.K.



Source: Peck 1990: 356

Each potential supplier is checked by Nissan's purchasing department and then by its engineering group to ensure appropriate quality and design capabilities and potentials. If these checks reach mutual approval, prices and delivery schedules are arranged. It might also be noted that Nissan's supplier network for its Sunderland plant, as of 1989, did not include low wage locations in developing countries.

In both North America and the UK, investments by Japanese companies have exerted profound direct effects on the geography and organization of the auto industry. The strength of the Japanese challenge has also encouraged adaptation by North American and European firms.

Adaptation by North American firms

Over the past decade or so, US auto producers have been forced to respond to the competitive threat posed by the Japanese. In terms of corporate strategy, the integration of production systems on a continental and global basis, including through the world car concept, are attempts to promote competitive advantage by promoting efficiency. The Big 3 have also sought to learn directly about the nature of Japanese production systems by entering into joint ventures and strategic alliances (see Table 14.6). The joint ventures in the US have generally been based on the assumption that while costs would be shared and US partners would facilitate entry of Japanese partners in the US, the latter would provide the management and organization, including many parts from Japan, in order to manufacture higher quality, more fuel efficient cars. The Ford-Madza partnership is of a more comprehensive nature and stems from Ford's (friendly) acquisition of a quarter share of Mazda in 1979. This 'strategic alliance' was important to Mazda not simply to help access North American markets but as a source of finance while Ford got control over the production of profitable cars at a time it was experiencing great difficulty in North America. Subsequently, Mazda helped Ford design the Escort and re-started manufacturing at Ford's idle Flat Rock, Michigan factory. The Escort was both successful (many were sold) and unprofitable. But according to Barnet and Cavanagh (1994: 273-4), Ford ahs learnt much from this project and alliance with Mazda: "Thanks to Mazda's strict scheduling, the new Escort has about 60 percent fewer last minute design changes....executives learned to pay more attention to what the workers thought about improving production. Top management learnt that up-front investment to retrain workers, the organization of a 'downsized' work force into 'quality of work' teams, and the modernization of plant and machinery would pay off in future profits.' In addition, Ford has greatly increased the number of robots it uses while many old plants have been closed and jobs lost.

Indeed, among the Big 3 a substantial effort has been made to learn Japanese practices and adapt at least some of them to North American conditions, notably with respect to work practices (Holmes 1991), reconfiguration of the R&D-production-market interface, and to restructuring supplier relations. With respect to the latter at least, Asanuma (1987) sees no reason why US firms should not be successful. He argues that the reliability of Japanese suppliers in maintaining delivery schedules and quality requirements is not based on some distinctive "general moral attitude" of the Japanese. Rather, he notes the economic incentives encouraging suppliers to be reliable. These incentives begin with the 'basic contract' which allows core firms to claim financial compensation if losses occur owing to a delivery delay from the supplier. Likewise, core firms can obtain compensation if, within a specified period after receipt, defective parts are found in the plant of the core firm or after shipment of the product to the market.

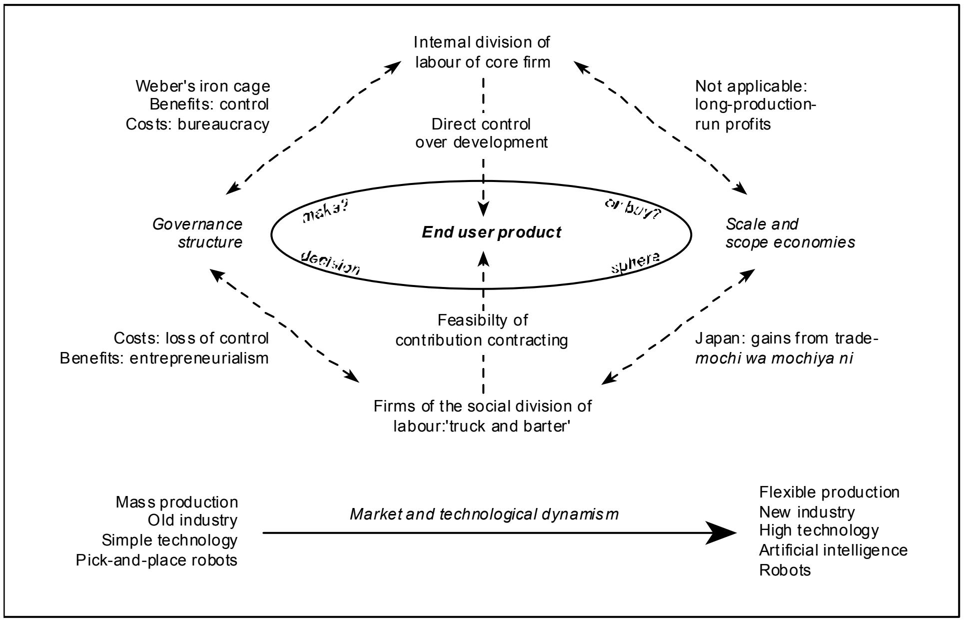
In addition, in the US, until recently, contractual obligations have meant that once a part has been purchased by a core firm that part becomes the responsibility of the core firm with respect for any malfunction. Such a tradition reflects the tendency, to borrow Asanuma's terms, for parts suppliers in the US to be DS suppliers. That is, in the US, the core firm has frequently provided blue prints, specified materials, specified manufacturing methods and the ways to test performance. As such, it is natural for core firms to assume responsibility for product liability. In Japan, supplier responsibility extends to the final consumer market so that a defective part is a joint responsibility of core firm and supplier. Again, this tradition is an incentive to suppliers to be quality conscious and is potentially a practice that can be adopted elsewhere. Similarly, in the US the length of 'contract' has traditionally been a lot shorter than in Japan and, with exceptions, typically for just one year. Consequently, among US automakers there is a tradition of many contract terminations which reflects a continuing emphasis on finding the cheapest sources even when parts are unchanged. Such uncertainty, however, constitutes a disincentive to undertake R&D. It is also a practice that can be changed.

US firms are attempting to adapt the key features of Japanese production systems, notably the just-in-time system, a hierarchical tier system of suppliers, longer and closer relationships with suppliers including by developing stronger technological liaisons, by increasing the priority assigned to quality and by purchasing more modular components from suppliers, and by reducing inventories (Rubenstein 1991: 128-9). In addition, US firms have begun to reduce their reliance on affiliated companies in favour of the social division of labour and in some cases US firms have signed contracts with Japanese suppliers who have located in the US. At the same time, US firms have been active in establishing assembly and parts supplies in Mexico.

CONCLUSION: JAPAN AND FLEXIBLE SPECIALIZATION

Japan, and Japanese industry, has been at the forefront of the transition from the fordist to the IC techno-economic paradigm (Table 2. 3). Across a wide cross section of industries by the 1980s Japan provided global benchmarks, its competitive strengths based on principles of flexible specialization. Moreover, while Piore and Sable (1984) conceived of flexible specialization in the context of SMEs, in Japan flexible specialization has been developed in large scale industries, including the auto industry, organized by core firms. At the core of flexibly specialized industries is an insistent emphasis on the social division of labour. As Patchell (1993a: 813) notes, the relevation of the social division of labour is "to conceive of the evolution from production systems to learning systems" (Figure 14. 7). Historically, the strategy of 'reverse engineering' placed the commitment to learning at the centre of Japan's approach to industrialization while within firms learning underlies *kaizen* (continuous improvement), quality circles, on the job training, polyvalence, and loopy R&D. Among firms, the relation specific skill defines a process of mutual learning.

Figure 14.7
From Production Systems to Learning Systems



Source: Patchell 1993a: 812

All production systems involve debates over 'make or buy' or the employment of either an internal or social division of labour (Figure 14. 7). As Patchell (1993a) notes, the relative importance of scale and scope economies provide some guidance as to the resolution of this choice. Unfortunately, in practice decisions are made under uncertainty which contributes to the arbitrariness of make/buy choices ; there are, for example, no mechanical rules for comparing the advantages of control over production, permitted by the internal division of labour, with the creative potential of the social division of labour. Also, "skill differences among firms can cloud this issue substantially" (Patchell 1993a: 813). In the west, the prevailing (fordist) philosophy has placed emphasis on the internal division of labour and cost reduction. In Japan, emphasis is placed on the social division of labour and value maximization. The relation specific skill reflects the ingenuity of Japanese firms to more fully exploit the potential of the social division of labour without sacrificing production stability or market power. These benefits are particularly acute in situations characterized by market and technological dynamism.

Japan's pursuit of flexible specialization reflects what Marshall and Taylor (1992) label the high performance model (Figure 11. 4). It is a strategy that puts priority on increasing wage levels through innovation and the fine balancing of the forces of cooperation and competition evident in the relation specific skill. Whether or not Japan will be able to retain its present highly coherent production systems or whether other economies can and should seek to duplication remains to be seen. The social division of labour in Japan is dynamic and is subject to the intensifying forces of globalization. A degree of 'hollowing out' of the Japanese economy' has occurred (Edgington 1995). At the same time, the integrity of core industries within Japan, such as the auto industry remain intact. Toyota Town still provides powerful testimony to the potential of geographic concentration.