

GLOBALISATION AND ASSEMBLER-SUPPLIER RELATIONS : BRAZIL AND INDIA

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Over the past two decades, relationships between suppliers and assemblers in the West have been transformed. Laigle (1995) identifies three major changes in supply relationships in Europe. First, suppliers have taken more responsibility for design. The “catalogue suppliers” who provided ready-designed parts for many different companies have moved towards greater customisation, while companies which formerly worked to the assemblers’ designs have moved towards offering design solutions. Clark and Fujimoto (1991: 140-45) describe this change as a movement towards the supply of “black box” parts. For these parts, the assembler provides overall performance specifications and information about the interface with the rest of the car, but the supplier then designs a solution using its own technology.¹

Second, Laigle observes that there has been a shift towards the supply of complete functions (‘corners’, systems or sub-assemblies) rather than individual components.

A first-tier supplier becomes responsible not only for the assembly of parts into complete units (dashboards, rear axle assemblies, body panels, seats, etc.), but also for the management of the

second-tier suppliers. In many cases, the assembler would previously have put these sub-assemblies or systems in-house, using parts supplied by many different component companies.

Third, the assemblers have become more involved with the production and quality systems of their suppliers.

With the increasing importance of JIT production systems and quality-at-source, even relatively simple tasks become more critical for the overall efficiency of the assemblers’ operations.

The assembler has to invest in the supplier relationship, which increases the benefits of longer-term relationships with fewer suppliers.

The changing role of the component manufacturers has led to a shift in contractual relationships. Assemblers have closer and more complex relationships with fewer suppliers. The change has been characterised as a move from arm’s-length contractual relationships to obligational contractual relationships (OCR), which involve:

- Greatly increased importance given to the reliability of quality and delivery.
- Single- or dual-sourcing for most parts.
- Tiering of suppliers.
- Longer term commitments between supplier and customer.

¹ The use of a supplier proprietary design does not entail single sourcing. With a standard interface, an assembler can use the products of several black box supplier in the same model.

These changes in the relationships between assemblers and suppliers interact with trends towards commonalisation of platforms and models across markets. Auto companies are tending to offer increasing model variety in each market, but offsetting the impact of this by standardising models across markets and building model variety on top of common platforms.

This process began in Europe and was then extended to commonalisation between Europe and North America. Now economic liberalisation in emerging markets has offered the opportunity of extending the process.

This is beginning to transform relationships between assemblers and suppliers and also between the global component companies and locally-based component producers in emerging markets.

This paper focuses on two major emerging markets, Brazil and India, whose auto industries have changed significantly in response to a (in some ways contradictory) combination of trade liberalisation policies and policies designed to promote local auto industries.

It argues that the development of global supply networks in the auto industry changes both the extents of design activities and supplier selection processes in emerging markets.

It further argues that while the developing relationships between assemblers and suppliers in emerging markets showed many of the characteristics of obligational contracting, price remains a critical factor in the relationship.

This paper is based on work carried out in Brazil, India and Europe in collaboration with many colleagues. Many of the ideas expressed here have been developed initially in other work (Fleury and Salerno, 1995; Humphrey, Mukherjee et al., 1998; Salerno, Zilbovicius et al., 1998; Zilbovicius and Arbix, 1997).¹ However, we have attempted to open up discussion in this paper, examining problems and uncertainties and making suggestions about issues which require further study.

The next section briefly discusses recent developments in the auto markets of the two countries.

The third section considers the changing nature of the global components industry. Section four examines design adaptations and supplier selection in emerging markets. Section five considers obligational contracting.

THE EMERGING MARKETS IN TRANSITION: BRAZIL AND INDIA IN THE 1990S

The vehicle markets of Brazil and India developed in different ways. While both developed in the context of import substitution industrialisation policies in the 1950s, the Brazilian industry grew rapidly in the 1960s and 1970s, reaching an output of more than 1.1 million in vehicles in 1980, of which more than 900,000 were cars.

In 1980, cars and light vehicles were produced by Fiat, Ford, General Motors and Volkswagen.

The components industry consisted of a number of large firms, many of which were transnational, and many small locally-owned companies.²

The industry's growth was curtailed in the 1980s economic stagnation, and output of vehicles of all types remained well below the peak reached in 1980 until the 1990s.

In India, government policy was much more hostile to the development of the car industry for the first 40 years of its development. Government regulations restricted output of cars and access to modern designs and technology. Until the 1980s, locally-owned companies produced outdated cars in very low volumes.³ Output of trucks, buses and tractors was considerably greater, but even here models were outdated and the general levels of productivity and quality in the industry were extremely low. In the 1980s there was some liberalisation of the internal constraints placed on the vehicle industry. A joint venture between Suzuki and the Indian government, Maruti Udyog Ltd., expanded production rapidly and came to dominate the market.

In spite of these differences, both markets have undergone similar changes in the 1990s as a result of economic liberalisation policies in general and

¹ As well as our many friends and colleagues in GERPISA, we wish to thank our colleagues at the Institute of Development Studies and the Department of Production Engineering, and the people directly involved in the research which forms the background to this paper - Avinandan Mukherjee, Mauro Zilbovicius, Glauco Arbix and Ana Valeria Carneiro Dias.

² Even in the early 1970s, a majority of the largest 20 component manufacturers were foreign-owned.

³ For further information on the development of the Indian auto industry, see Mukherjee (1997) and Humphrey (1997).

policies designed specifically to promote the auto industry.¹

Firstly, output of vehicles, and particularly of cars, rose rapidly once the initial depressive effects of economic liberalisation policies had passed. Table 1 shows that after 1992 vehicle sales in Brazil increased rapidly: more than doubling in the five years from 1992 to 1997.

In the car sector, there was a significant shift towards sales of small cars which were given special tax breaks by the government.

In the case of India, the market for vehicles had increased significantly in the 1980s. This was checked by the depressive effects of economic liberalisation and stabilisation policies introduced in 1990-91, but after 1992 demand for vehicles of all types increased rapidly, as can be seen in Table 2. In both countries, this rapid increase in demand for vehicles was not sustained in 1997.

In Brazil, the effects of the East Asian crisis on currency stability forced the government to impose tax and interest rate rises at the end of 1997.²

In India, vehicle sales began to slow at the end of 1996. Sales of commercial vehicles declined, while the rate of growth of car sales fell from over 20% to under 10% in 1997.

The rapid growth of vehicle sales in these two markets, combined with the long-term potential for vehicle sales in the Mercosur region³ and the Indian sub-continent, led to a “scramble for position” among car manufacturers in both markets.

In Brazil, the existing vehicle manufacturers invested heavily after 1994-95, and a number of new entrants announced investment plans. These are shown in Table 3.

International auto companies have also rushed into India, and the extent of investment plans is documented in Table 4.

Not all of these investments will materialise. Companies have revised their plans in response to the slow growth of the Indian market and the weakness of the mid-car segment. Peugeot left the market at the end of 1997, and at least one further exit is expected shortly.

In Brazil the auto industry is being transformed by the integration of the Argentine and Brazilian markets and the introduction of new models with a much smaller time-lag behind Europe than in the past.

In the case of India, the transformation is the result of the entry of many new companies, most of which are majority foreign-owned, in contrast to the position in the past.

These changes have been accompanied by even more profound transformations in the component industry.

The assemblers are increasingly looking to have the same parts made by the same companies to the same designs across these different markets.

This is driving a major restructuring of the components sector.

¹ For a more extensive discussion of auto industry policy in Brazil and India, see Humphrey et al. (1998).

² Vehicle output in Brazil fell at the end of 1997 and in early 1998. However, there has been some recuperation since then. It is too early to say whether the market has shrugged off the effects of the East Asian crisis.

³ Mercosur is the regional trade zone formed by Argentina, Brazil, Paraguay and Uruguay. Its emergence was partly stimulated by the auto industry. The auto industries of Argentina and Brazil are increasingly integrated, although trade in vehicles and components is subject to more regulation than almost any other commodity (Laird, 1997).

Table. 1: *Brazilian vehicle market*

Year	Employment (Assemblers only)	Sales (000s)	Production (000s)	Share of "popular cars" ^(a) in car sales (%)
1980-1989 (average)	-	730	960	-
1990	117,396	713	914	4.3
1991	109,428	771	960	11.5
1992	105,664	740	1,073	16.0
1993	106,738	1,061	1,391	28.4
1994	107,134	1,206	1,581	45.9
1995	104,614	1,359	1,635	53.8
1996	101,857	1,506	1,804	56.3
1997	106,145	1,640	2,067	64.0

Source: ANFAVEA.

Note: (a) Up to 1000 cc, and subject to special government incentives.

Table. 2: *India, vehicle production by type: 1983-1996 (000s).*

Year	Cars and Jeeps	Buses, Trucks and LCVs
1983	66.8	87.3
1984	86.2	94.7
1985	129.4	101.2
1986	143.8	95.1
1987	180.9	108.1
1988	195.0	117.3
1989	219.5	117.6
1990	218.7	145.6
1991	209.3	145.7
1992	192.1	128.0
1993	243.9	127.8
1994	286.4	188.7
1995	393.5	242.6
1996	471.8	289.5

Source: ACMA (1997: 10).

Table. 3: new companies and factories for vehicle and engine production, Mercosur, late 1990

Country of origin	Company and Product	Location and anticipated start-up date	Stated investment (US\$ mill.)	Annual capacity
Germany	Mercedes (class A)	Juiz de Fora (MG) / December 98	820	70.000
	VW-Audi (A3, Golf, Passat)	S. José Pinhais (PR) / 99	600	120.000
	VW (trucks)	Resende (RJ) / in operation	250	50.000
	VW (motors)	São Carlos (SP) / in operation	250	300.000
	BMW-L. Rover (Defender)	São Bernardo do Campo (SP) / 98	150	15.000
Korea	Kia (LCVs)	Itu (SP) / not available	50	10.000
	Asia (Towner/Topic)	Camaçari (BA) / ^a	500	60.000
	Hyundai (H1000)	Aratu (BA) / ^a	280	20.000
USA	Chrysler (Dakota)	Campo Largo (PR) / 98	315	12.000
	Chrysler (Cherokee)	Argentina (Cordoba) / 97	250	15.000
	Chrysler/BMW (engine)	Campo Largo (PR) / 2000	600	400.000
	GM (stamping plant)	Mogi das Cruzes (SP) / no date	150	1,6 Mi
	GM (Corsa derivative)	Gravataí (RS) / 99	600	120.000
	GM (Corsa)	Rosário (Argentina) / not available	350	85.000
	Ford (cars)	Gravataí (RS) / 2001	500	100.000
Navistar (trucks)	Caxias do Sul (RS) / 98	50	5.000	
France	Renault (autos)	S. José Pinhais (PR) / 99	750	100.000
	PSA-Peugeot (autos)	Porto Real (RJ) / 2000	600	100.000
Italy	Iveco (LCVs)	Sete Lagoas (MG) / 98	250	20.000
	Iveco (heavy trucks)	Cordoba (Argentina) / 99	70	10.000
	Fiat (engines)	Betim (MG) / 98	500	500.000
	Fiat (pick-up)	Belo Horizonte (MG) / 99	200	100.000
	Fiat (Palio Siena)	Cordoba (Argentina) / 97	600	120.000
Japan	Toyota (cars)	Indaiatuba (SP) / 99	150	15.000
	Toyota (pick-ups)	Zarate (Argentina) / in operation	150	15.000
	Mitsubishi (light vehicles)	Catalão (GO) / not defined	35	8.000
	Honda (cars)	Sumaré (SP) / in operation	100	30.000

Sources: Ministry of Industry, Commerce and Trade, ANFAVEA, Panorama Setorial, the press in general and companies. Given the nature of this information, it should be considered as approximate.

Note: (a) Investment suspended temporarily.

Table. 4: *new ventures in the Indian motor industry*

Companies and stakes (%)	Models	Capacity (000's)	Observations
Government (50) Suzuki (50)	800 Esteem Zen	500	Major expansion of capacity planned.
PAL (49) Fiat (51) PAL-Peugeot	Uno 309	30-50	Originally a wholly locally-owned venture. Peugeot pulled out of this venture at the end of 1997.
Daewoo (91)	Cielo D'Art	80 70	Initially a joint venture with an Indian company. Poor sales of Cielo have shifted focus to new small car.
Mahindra (50) Ford (50) TELCO (50) Mercedes (50)	Escort Fiesta E series	25 100 20	Repeated rumours suggest that Mercedes will take full control.
Birla (50) GM (50)	Astra	25	This project may be made viable by plans to quadruple production and use India as a base for exports to South Asia and Pacific Asia.
Hyundai (100)	Atoz (1000cc) Accent	100	Hyundai have shifted focus to small car.
Shriram (10) Honda (90) Fiat (100)	City Palio	30 100	Shriram has an option to buy back a 30 per cent stake sold to Honda. Fiat's Indian partner in the Uno project has an option to buy a minority stake
TELCO (100)	Indica	150	Small car, to be launched in September 1998, with 99 per cent local content.
Kirloskar (30) Toyota (70)	Kijang utility vehicle Daihatsu Mira		
HML Mitsubishi	Lancer	30	

Sources: Various.

Table 5: *assembler-supplier relationships*

1. Supplier Selection, Contracts and Price	Bidding for new contracts is competitive in the core country, but winner is then in a strong position to win the further contracts. * Prices settled after contract awarded. Open book pricing. Single - or dual - sourcing for particular components or systems. Various suppliers are kept for each system/part across the complete model range. Therefore, there is continued competition for new business.
2. Projected length of trading relationship	Contracts are typically for the life of the part or the model. The extent of further business will depend on performance.
3. Quality, Delivery and Location	Little or no inspection on delivery for most parts. First-tier supplier verifies quality system. * are severe penalties for quality failures. Frequent and reliable deliveries on a just-in-time basis. This leads to an emphasis on the siting of component plants close to the assemblers' operations for those parts which present logistics problems (costs of transport or integration of production schedules). Increased emphasis on supplier service, which is also facilitated by close location. * A however, for parts which have a high value to weight, and for which production schedules do not have to be integrated, economies of scale and cost reduction may still favour centralised production.
4. Tiers of suppliers	Extensive, with the development of systems suppliers responsible for co-ordinating the second-tier.

EMERGING MARKETS AND THE RESTRUCTURING OF THE GLOBAL COMPONENTS INDUSTRY

When auto industries were established in developing countries in the context of import substitution industrialisation, the transnational car producers set up operations which were in many respects quite independent of their core operations. They produced out-of-date models, many of them designed specifically for these markets.

At this time the major Western car producers took responsibility for a considerable part of the design of cars, and in developing countries they either produced parts in-house or passed the designs on to local suppliers.

"Catalogue parts" were brought from subsidiaries of the European producers, or made under license by local companies. The local managements of the assemblers had considerable freedom to develop their own supplier bases. These practices matched, to some extent, the level of independence of the subsidiaries of American assemblers in Europe during the 1960s.

In order to contain design costs, companies have reduced the number of platforms and standardised designs across regions. Final model variations conceal a high degree of commonality in the basic structure design of cars and the components used in them.

Assemblers are standardising their platforms across their constituent companies and divisions (Freyssenet and Lung, 1996). In the 1980s, integration *within* regions was the clear tendency. Regional production systems were developed for Western Europe, North America and East Asia:

As a result of new production techniques and changing market conditions, international activities of the main producers have expanded considerably with a strong focus on regional production. This process has been underpinned by the need to establish top to bottom integrated assembly operations covering design, development, engineering and component sourcing in each region (North America, Europe and East Asia). (Vickery, 1996: 159).

By the 1990s, the commonalisation of design and component sourcing was taking place between

regions. The process was extended to include North America and Europe by Ford and GM. Ford restructured its design operations in North America and Europe to avoid duplication of effort. In the 1980s, Ford's "world car" was an illusion which foundered on the separation of European and North American design activities.

In the 1990s, these design activities have been integrated into a single structure.

This opens up the potential for commonalisation of supplier bases for particular models across regions.

Now that components and systems are increasingly designed in collaboration between assemblers and component manufacturers, so the assemblers want to work with the same suppliers in many different locations. After designing parts in collaboration with the assembler, they should be able to supply it to many different locations. As design becomes global, so must the component manufacturers.

This has led to a considerable concentration of the components industry in the past decade. Within Europe, a considerable concentration of component operations has taken place.

Mergers, acquisitions and the selective transfer of activities between companies have proceeded at great pace. More recently, as a result of the new commonalisation of models, US firms are starting up or extending operations in Europe.¹

The components industry is being increasingly concentrated in companies that can design and provide systems and sub-assemblies across many different markets.

The commonalisation of design and supplier bases now includes developing countries. Auto companies used to produce models which were specifically developed for local markets (for example, the best-selling VW and Ford models in Brazil in the 1970s), or introduced models some considerable time after they had been first produced in Europe and North America.

The developing country operations were run fairly independently, and the subsidiaries had the freedom to introduce design changes. As a result of increasing competition in markets such as Brazil and India, the major auto companies have already updated their model ranges, introducing the same

designs as seen in industrially advanced countries. Brazilian and Indian consumers are presented with models that are very similar, if not identical, to those sold elsewhere. Even so-called 'Third World' cars, such as the Fiat Palio and Honda City, are based on established platforms and will be produced in various markets.²

Ideally, the assemblers want the same part, with the same technology, the same quality system and the same underlying basis for inter-firm communication wherever they are making cars.

Together, the leading assemblers and leading component manufacturers are creating such networks, with clear consequences for the components industries of developing countries.

Assemblers in developing countries appear to have a clear hierarchy of preferences when deciding to source "black box" parts: (1) globally preferred supplier (wholly-owned or in a joint venture); (2) alternative transnational supplier; (3) locally-owned company using licensed technology from one of the globally-preferred suppliers; (4) and least preferable, a local company using its own technology. The most attractive option for the assembler is to source from one of its globally preferred suppliers. If no plant exists in the country concerned, the assembler may encourage the supplier to "follow source", setting up a new plant to meet the customer's requirements. This option is meant to guarantee that the component will be identical to that used in other markets. The first-tier supplier should ensure that not only its own operations, but the rest of the supply chain meets the assembler's standards. Instead of dealing with a large number of local suppliers whose designs, prototypes, production systems and quality systems have to be tested, audited and improved, the assembler deals with a relatively small number (certainly less than 100) of first-tier suppliers providing parts or sub-assemblies.

A simplified model of the structure of the car industry in the import substitution industrialisation period is shown in Figure 1. It shows the structure of relationships between an assembler's core operations, two subsidiaries in developing countries and the suppliers of one particular component to the three operations.

It examines three aspects of the relationships: the flow of components, information about design, and the allocation of contracts. At this time, flows

¹ For a discussion of mergers and take-overs affecting the European auto components industry, see Freyssenet and Lung (Freyssenet and Lung, 1996)

² For a discussion of the Fiat Palio project, see Volpato (1998).

of components remained predominantly within each market, even though some exports from developing countries might occur (illustrated by the dotted line in the top section of Figure 1.¹ The component manufacturer would have received designs from the assembler.

In some cases, the designs would be distributed from the assembler's design headquarters. In others, locally-based design offices would be responsible for providing designs to local component manufacturers.

In Brazil, for example, Ford took over the Corcel I from Willys, who contracted Renault to design it in the 1960s. It then developed a later model, the Corcel II, specifically for the Brazilian market.

Ford's local designers were also responsible for developing the alcohol-powered engine in response to the Brazilian government's policy on alcohol-powered vehicles. Volkswagen developed a hatchbacks derivative of the "beetle" in the 1970s, as well as a locally-designed small car, the Gol, based on a Polo platform.

With the development of standardised designs and global supply systems, the relationships in the car industry shift towards those depicted in Figure 2. Flows of components may not change significantly in the short-term, although it seems likely that eventually there will be a greater international division of labour and an increasing two-way flow of components.

Some possible flows are shown in the top part of the Figure. The extent of these flows will depend on the speed at which tariff barriers and local content regulations are dismantled.

Design relationships and supplier selection are transformed.

In the global sourcing model, access to designs and the contracts that go with them are via the lead company in the global component network. Designs are increasingly developed by the key suppliers in conjunction with the assemblers.

The design then reaches the developing country via the component company's network, and not via the assembler. The same kind of relationships applies in supplier selection and contract allocation.

The critical decision is the choice of supplier in the core market, and once this contract is won, the supplier can reasonably expect to be awarded contracts in other locations.²

These changes in the structure of the industry are associated with new relationships between assemblers and suppliers. Six key features of these relationships are shown in Table 5. They have been referred to as obligational contracting (Sako, 1992), lean supply (Lamming, 1993), etc. The first point arises directly from the previous discussion of supplier selection and contract allocation. The company supplying a part in an assembler's core location is in a strong position to supply in other locations.

The stronger the preference for the established supplier, the greater will be the tendency to establish price through non-competitive means. Secondly, as a corollary of this first point, contracts are fixed for a longer period than in the past. Typically, the contract is for the life-time of the part, if not for the life of the vehicle.

Thirdly, companies in emerging markets are expected to meet the new international standards of quality and reliability of delivery.

This places considerable pressures on companies to locate within a reasonable distance of the assembler. This is associated with the development of supplier parks and the setting up of supplier plants dedicated to particular assembly plants.

However, a preference for the ease of supply and increased service which comes from close locations has to be balanced against the requirements of cost and economies of scale.

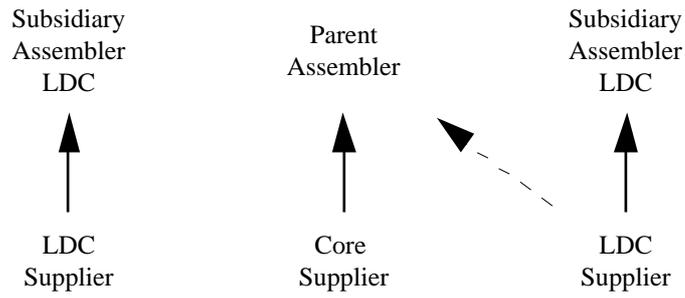
This is particularly important when volumes are low. Fourthly, the supplier base is increasingly organised into tiers.

A limited number of first-tier suppliers are responsible for organising the rest of the supply chain. A greater emphasis is placed on the provision of systems and complete sub-assemblies rather than discrete parts.

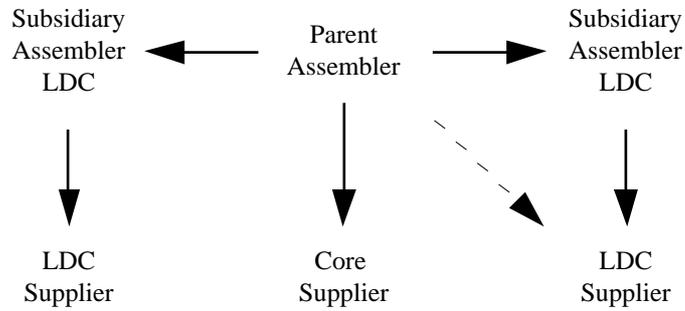
Are these changes visible in the auto industries of Brazil and India, and what is the impact on the structure of the components industry?

¹ Exports from industrialised to developing countries would have been restricted by tariff and non-tariff barriers and local content regulations.

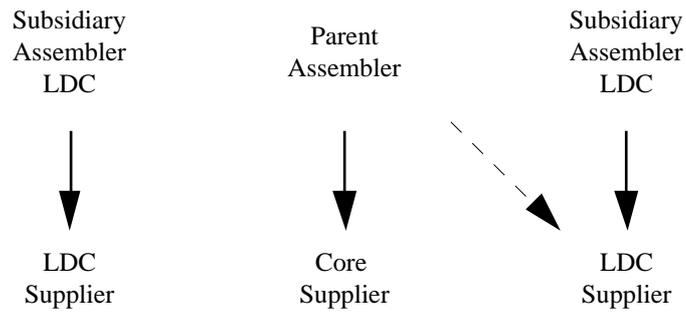
² This is not necessarily a benefit to the company concerned. Rather, the assemblers may pressure their key suppliers into setting up operations in places where they would not otherwise wish to locate (Helper, 1993: 151).



FLOW OF MATERIALS

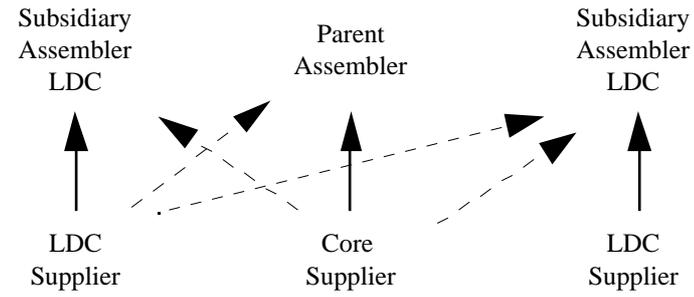


INFORMATION ABOUT DESIGN

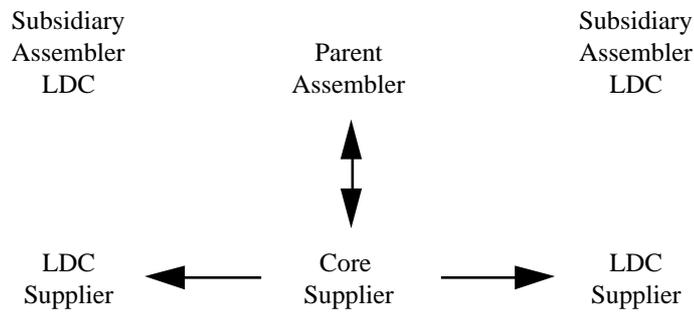


SUPPLIER SELECTION AND ALLOCATION OF CONTRACTS

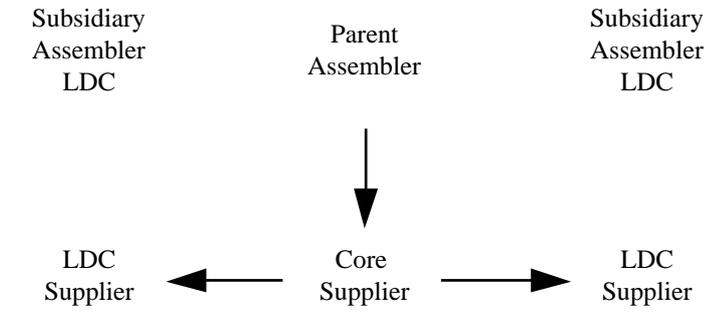
Fig.1. Assembler-Supplier Relations, Detail-Controlled Parts



FLOW OF COMPONENTS



INFORMATION ABOUT DESIGN



SUPPLIER SELECTION AND ALLOCATION OF CONTRACTS

Fig. 2. The Global Supply Network Model

DESIGN AND SUPPLIER SELECTION

Managers in auto companies frequently expressed strong views about the need to standardise design and use follow sources in emerging markets.

The potential advantages of these practices are clear. They provide economies of scale in design and facilitate supplier-assembler relationships. However, such practices may also bring disadvantages, particularly in relation to tailoring cars to the needs of particular markets. How far are these policies being pursued in Brazil and India, both by new entrants and by established producers?

Models and Design Activities in Emerging Markets

Three assemblers in Brazil (one new entrant and two established producers) and one assembler in India were interviewed about design and sourcing policies. In addition, some suppliers were interviewed in both countries. All four cases showed the impact of designs taken from Europe. The new entrant to the Brazilian market, Mercedes, had adopted a rigid policy on design: no adaptations would be allowed.

Company A also began with a policy of not allowing design changes. In the words of some of the company's European managers, the Brazilian operation was given a car and told to make it. Eventually, the subsidiary was able to test the car that it needed strengthening to cope with Brazilian conditions. The third, VW, was the assembler with the most well developed design centre in Brazil; many suppliers developed design and engineering facilities due to VW's policy to locally design cars.¹ However, even VW is now shifting its policy to world platforms, and the design process and choice of suppliers have been centralised in Germany.

In spite of the intent to standardise design, changes were needed. Many European designs in Brazil (and India) require chassis reinforcement because of poor road conditions. Further design changes have been made in response to the preferences of local customers, local materials and

local production volumes. Some of the changes for the Brazilian market were relatively minor. Company A changed such items as the door mirrors and horn to meet the requirements of Brazilian customers. Sometimes, more profound modifications are made.

The General Motors Omega, for example, was provided not only with the usual chassis reinforcement, but also a more powerful engine, changes to cope with Brazilian petrol and modifications to the suspension system. In some cases, such modifications have a cascade effect, since suspension changes may have consequences for the brakes and steering. Design adaptations may also be made because the quality of local materials is different, or because smaller volumes make different production processes more economic.

Even more substantially, a number of assemblers in Brazil have introduced new model variants to meet the demands of the local markets. Small pickups, based on the Corsa, the Fiesta and the Uno have been introduced by GM, Ford and Fiat. Three-box small cars and estate versions of small cars are also popular in Latin America, and these have also been developed by various companies - for instance, GM Corsa has all of these versions, some of them exported overseas.

Company A introduced more substantial design changes for its Indian small car. The same platform was redesigned in order to place it in the lower price segment (a "C" car at a "B" car price) more attractive to cost-sensitive Indian consumers. Various design changes were made in order to achieve the target price, and suppliers were involved in redesigning parts to achieve the target price. At the same time, the body was reinforced, the exterior redesigned, a "three-box" model developed, and the floor pan and roof raised. Less drastic modifications included air conditioning as standard and the addition of electric rear windows.² This model is now attracting the interest of subsidiaries of Company A in other countries.

General Motors is currently developing in Brazil a similar policy to the one Company A is has adopted in India. The Brazilian market is also sensitive to price and purchase conditions (financing, payment period, etc.), and GM is

¹ VW engineering competences were crucial for learning about truck assembly and for technical relationship with truck suppliers. Following the split with Ford from the Autolatina venture, Volkswagen was able rapidly to design a city bus which has been very successful in the Brazilian market.

² The price of cars relative to the price of chauffeurs is very high in India compared to many other countries. * They much higher proportion of mid-segment cars in India are chauffeur-driven, and their owners also want electric windows.

setting up a plant to produce the “Blue Macaw” model, a small Corsa with target price 20% below the standard Corsa. The car is currently being co-designed with some core suppliers in Brazil, after an auction system to select them. Suppliers have large autonomy to design sub-assemblies based on GM parameters. As the model is derived from the Corsa, two suppliers we interviewed were designing in a strategy similar to a de-contenting. One of these suppliers, a subsidiary of a German company, increased its engineering staff from 30 to 60 persons to cope with the project, which is being centralised in Brazil.

It also hired a local design office to achieve a better performance in style. World-wide, this supplier has 12 contracts to supply whole sub-systems, but in only two they are responsible for the design - the Blue Macaw and the Smart car. GM has a team in its Brazilian headquarters specifically concerned with the Blue Macaw project, that aims to be spread out to other developing markets; the suppliers have the promise to follow source.

A significant difference in the development of all these models compared to past practice is that design adaptations are now much more closely controlled by the assemblers’ central design operations. Many of the adaptations were made in Europe - for instance, Mercedes considers that all adaptations to cope with South American roads, fuel, etc. were made in Germany. In the case of Company A in India, no local design capability was set up. While some negotiations about design took place in India, the design changes were made through consultations between the assembler’s European design headquarters and the parent and subsidiaries of the suppliers. All design changes had to be finally approved by the European design office.

Generally speaking, then, design changes in developing countries do take place. These can be viewed in two different lights. On the one hand, they are mainly limited to adaptations of global designs, and even these adaptations may take place in the assemblers’ and suppliers’ core locations. Both assemblers and suppliers in Brazil point to the considerable changes taking place in the engineering of products, components and processes. There has been a considerable decline in local competence in project development. Historically, the auto components sector has

trained and developed engineers who have worked in many other sectors.

It no longer seems to have this role. New models specifically for Brazil are no longer developed, and even local adaptations have to be integrated with the needs of other markets. Even in the case of the Fiat Palio, a lot of the design work was carried out in Europe, although engineers from Brazilian subsidiaries and suppliers spent time in Turin and some co-design activities took place with Brazilian suppliers (suspension, axles, electronic devices, seats etc., according to interviews with Brazilian suppliers).

On the other hand, design adaptations are not ruled out, and in both Brazil and India local engineering competence is a factor in supplier selection. The assemblers want engineers on the ground in Brazil and India to facilitate the development process.

However, this may favour competence in process engineering and gearing production systems to high-quality production of ready-made designs provided by the parent company.

It is possible that the logical extension of these developments will be the design of cars in emerging markets for emerging markets.

These cars would have characteristics which are more generally suited to consumer tastes and driving conditions in other emerging markets. This might then change the dynamics of supplier selection. Some suppliers of the Fiat Palio in Brazil have an agreement either to source the same part in other countries or to participate in the choice of suppliers in countries where they are not located (for instance, Turkey), receiving a “royalty” payment. It is not clear whether this opens up opportunities for locally-owned suppliers, or whether only the global component producers enter into this type of arrangement.

The situation is far from clear at present. There are some contradictory elements, and some possibilities. For instance, computer networks and the ease to travel make possible, to some extent, the decentralisation of some design activities. Specifically for Brazilian industry, the stock of competences, the existing facilities, the importance of the South American market, and the lower wages compared to Europe or the USA could lead the country to become a peripheral design centre for some assemblers. On the other hand, VW, which used to have strong design activities in

Brazil, is introducing models designed in Germany, and all the decisions, including the choice of suppliers, are being taken by a small group of managers at the German headquarters. To a lesser extent, India has some potential as a global design centre. While it does not have a history of design expertise in automobiles, there is a plentiful supply of engineers, and particular skills in software development.

With engineering wages only a fraction of those paid in the West, some specialised work might be transferred there.

Supplier Selection

If designs are held constant, there are considerable advantages in follow sourcing. These include economies of design, speed of introduction of new models, and savings on tests and tooling. If design changes are made and quite distinct “unique parts” are created, then these advantages are lost. Various assemblers in Brazil and India expressed a fairly clear hierarchy of preferences with regard to sourcing “black box” parts: globally preferred supplier for this particular part (wholly-owned or in a joint venture); alternative transnational supplier; locally-owned company using licensed technology from one of the globally-preferred suppliers; and last, a local company using its own technology. However, it is not always possible or economically viable to use the globally preferred supplier, and choices have to be made.

Two examples, one from Brazil than one from India, indicate both the extent and limitations of follow sourcing. The use of follow sourcing by Mercedes in Brazil for the A Car is shown in Table 6. Annual production of 80,000 units was to be based on a set of 80 first-tier suppliers. Clearly, the use of follow sourcing is extensive, and this was facilitated by the large number of European and North American component manufacturers in Brazil.

However, the middle column of the table shows that some important components were not being made by follow sources; in some cases, the follow source was not available, while in others the follow source had facilities in Brazil, but a different supplier was preferred.

Company A followed a similar policy to Mercedes when it introduced its new model into Brazil. In fact, the intention to follow source was so strong that any deviation from this policy had to

be approved in writing by one of the top two managers in global purchasing. This was combined with a low budget for redesign which made modifications difficult. The strict follow sourcing policy was eventually relaxed.

These experiences were then carried over to the company’s Indian operations, where a variant of the same model is being introduced. The extent of follow sourcing is seen clearly in Table 7. In India, the lack of an established components industry means that the follow source frequently has to set up a new operation.

In spite of this, many companies have followed Company A to India, as can be seen in the table. Almost all the components in the left-hand column are being produced by new joint ventures between the globally preferred supplier for the part and Indian companies. Given the complexities of the Indian environment, Company A prefers joint ventures to wholly-owned subsidiaries (a preference not required in Brazil).

For various reasons, the follow source is not always used. In spite of pressure from the assemblers, the OE supplier may refuse to follow source or fail to agree contract terms (prices, volumes, delays, etc.) with the assembler. In such cases, the assembler can ask another component company (sometimes already located in the country, sometimes not) to produce the component/sub-assembly.

The range of possible arrangements can be demonstrated by the case of Company Z in India. This company was part-owned by one of the three leading global producers of this particular component. Its success in winning contracts with the new entrants to the Indian auto market are summarised in Table 8.

The table shows clearly that being the OE supplier is not the sole determinant of supplier choice in India (just as in Brazil). In three cases, the contract was awarded to the OE supplier, which was not Company Z.

In two other cases, Company Z won the contract because the OE supplier did not set up an operation in India. In the sixth case (Assembler 3), Company Z won the contract in spite of the presence of the OE supplier in India. Once again, however, Company Z was a transnational supplier with experience of supplying other parts to these assemblers.

The importance of being a global supplier is confirmed by the results from Mercedes and Company A in Tables 6 and 7. These show that after the OE supplier the clear second preference is to use another of the assembler's global suppliers. This provides the advantages of familiarity, even though new designs may have to be developed.¹ In both tables, it is clear that the resort to locally-owned companies is extremely limited. In most cases, it is restricted to detail-designed parts or standard parts such as fasteners. These cases will be considered further in the next section.

It is worth noting that some of the expected advantages of the follow sourcing policy have been difficult to realise.

Company A found that a number of the follow sources in Brazil were unable to match the performance of the parent suppliers in the core location. Company A only picked up this problem at the stage of the Products Sample Warranty, whereas it had expected the parent company to take control of such matters at an earlier stage.

Communication problems between the assembler and the suppliers and between the different operations of the suppliers were recognised. According to the supply managers at Company A, it should have insisted that the suppliers' parent companies audit their Brazilian subsidiaries at the beginning of the process. Managers believed that a slavish adherence to a follow sourcing policy may have generated complacency among the Brazilian suppliers, and that a greater willingness to use alternative sources when quality and costs were not adequate would have produced better results.

However, some competitors and suppliers attributed this problem to a historical lack of engineering capability in Company A's Brazilian operation. In spite of these problems, follow sourcing is a strong trend.

This has had serious and direct consequences for locally-owned companies in both Brazil and India. In the 1980s, a small number of the largest Brazilian firms attempted to expand into North America and Europe, following up their success in exporting to these markets.

However, they remained small by global standards: the largest Brazilian component manufacturer had a turnover of less than US\$1 million in 1996. Unable to achieve global coverage, these firms have found their position in the domestic market undermined by the follow sourcing trend. Recognising this, a number of the largest Brazilian component manufacturers have sold out to transnational companies. At the end of 1997 only one of the largest 13 component manufacturers in Brazil was locally-owned.

Three years earlier, a further four of these same companies had been wholly or majority Brazilian-owned. In the intervening three years they had sold out to transnational companies.² The options open to locally-owned companies are narrowing. They do not have the global coverage to offer their own technological solutions.

Joint ventures with leading global component manufacturers have been an option, but these manufacturers now appear to want full control.

The case of Freios Varga is illustrative. Lucas had a long-term minority stake in this Brazilian company. By all accounts, it was efficient and successful. However, Lucas-Varity took over full control at the end of 1997.

Similarly, licensing international technology has become more difficult. The leading companies are more reluctant to offer licenses now that the emerging markets have become more integrated into the global production strategies of the assemblers. Is this the end of the locally-owned first-tier supplier?

¹ In the case of the front brakes, product development involved engineers from the Indian joint venture working at one of the parent company's research centres in Europe and liaising with the assembler's core design team. In other cases, one supplier will license the design of another, although this creates problems with royalty costs and knowledge transfer.

² The competitive pressures on Brazilian component manufacturers were greatly increased by the Automotive Regime introduced in 1995. This temporarily reduced component tariffs to under five per cent.

Table 6: Mercedes a car sourcing in Brazil, location and ownership

Location of Supplier	Supplied by Company Supplying in Germany	Supplied by Other Transnational Company	Supplied by Locally-Controlled Company
Germany	engine gearbox		
Supplier Park	engine mounting rear door assembly wiring harness wheel and tyre assembly windscreen/glass	seats exhaust dashboard	
Other Location	heating/cooling system dashboard shock absorbers distributor clutch electrical components air bags trim relays ABS sensors rear axles (Mercedes truck plant)	starter motor headlights torsion bars springs plastic parts steering system brakes	petrol tank taillights wheels aluminium wheels plastic parts set mirrors ^(a)

Source: Adapted from Zilbovicius and Arbix (1997: 36).

Note: (a) This Brazilian company also supplies Mercedes in Germany.

Table 7: *sourcing in India by “company a”.*

Location	Parts from Same Company Supplying as in Core Location ^(a)	Parts Supplied by Other Transnationals ^(a)	Parts Supplied by Indian Firms
Imported	engine	radio/CD	
Next to assembly plant	gearbox		wheel/tyre assemblies
	internal trim	internal panels (major body in white)	
	seats	wiring harnesses	
	exhaust		
	suspension		
Other locations ^(b)	instrument panel cluster		
	headliner	carpets	alloy castings
	glass	plastic mouldings	iron castings
	door seals	rear brakes	small body parts
	headlights and taillights	front brakes	fasteners
	heating/ventilation	gear shifter	
	horn	door handles	
	starter motor	door boards	
	alternator	relays	
	engine management systems	clutch	
	wipers	steering column	
	pedal box	air conditioning	
	steering gear	fuel tank	
	steering wheel		
	seat belts		
	mirrors		
	battery		
	paint		
	cables		
	shock absorbers		

Source: Interviews with managers in India and at headquarters.

Note: (a) Includes joint ventures between OE suppliers and Indian firms.

(b) These parts may be made in the assembler's supplier park, but this is not required.

Table 8: *contracts with new entrants, component manufacturers in India*

Company	Contract History
Maruti	Company Z is a long-term supplier to Maruti. However, Maruti has taken advantage of the greater interest of international component manufacturers in the Indian market to attract a third source for this component
Assembler 1	Assembler 1 visited the company. Currently, this part is imported. Eventually, local production will be split between its main global supplier (80%), which is in the process of setting up operations in India, and the other long-established producer of this component in India (20%).
Assembler 2	For one model, a part is being imported from Company Z's European parent. Trials are taking place for local production. For another part, which Company Z's parent does not supply in Europe, the Indian affiliate of the European supplier has been preferred. Assembler 2 has no budget for testing and approval in India, so there was no opportunity to win the contract. For the assembler's second model, the European supplier does not have a plant in India. The assembler wanted Company Z to produce under license, but the parent did not want to collaborate with a competitor. The assembler asked the two main Indian suppliers to provide a quote for their own designs, and the contract was awarded to Company Z.
Assembler 3	Company Z is not the OE supplier in Europe for the current model. However, it has supplied the Indian partner in the joint venture, and the European parent does make parts for other models. Company Z and its parent will supply a common part for both the current and new models. These will be designed partly in Europe and partly in India. Company Z has managed to win the contract against the OE supplier.
Assembler 4	Company Z made a bid for the contract, but it was awarded to the OE supplier.
Assembler 5	Company Z made a bid for the contract. The assembler's preferred supplier wanted to establish a joint venture in India, but the two established manufacturers of this component refused to enter such a joint venture. The latter set up a joint venture with an Indian component company which had not previously produced this product. This joint venture won the contract.
Assembler 6	The assembler started with a preference for its OE supplier. It wanted an equity stake in a joint venture between an Indian company and the OE supplier. Company Z and the OE supplier discussed the issue. Company Z wanted a licensing agreement, while the OE supplier wanted a joint venture. When choosing between Company Z's own design and the OE supplier's design made by Company Z, Assembler 6 chose Company Z's design on the grounds of cost. This product was designed partly in India and partly in Europe, where the parent company did supply parts for other models made by Assembler 6.

In India the restructuring of the industry is at an earlier stage, but the same tendencies are visible. There are clear signs that minority foreign partners in long-established joint ventures are eager to take control, even when the Indian partner is reluctant. The latter frequently lacks the resources to invest in expansion, and this gives the foreign partner an opportunity to increase its stake. Many Indian suppliers are looking for niches outside the car

sector, tie-ups with smaller transnational companies which have technology but not international resources, or comfortable niches in the second tier. Even for the largest Indian component manufacturers (which typically own a number of different component companies), it is becoming increasingly difficult to sustain wholly-owned operations or even majority stakes in joint ventures.

ASSEMBLER-SUPPLIER RELATIONSHIPS

Once suppliers have been selected, what types of relationship are developed between the assembler and the suppliers? This question will be discussed in terms of the four items listed in Table 5.

Supplier Selection, Contracts and Price

The importance of follow sourcing was demonstrated in the previous section. The follow sources are in a strong position to win the contract. This does not necessarily mean a shift to single sourcing. In Brazil some companies have moved to single sourcing, while others have an explicit policy to have no single suppliers in order to strengthen their bargaining power.

The follow source(s) does not always win the contract. What other factors influence supplier selection?:

- **Quality.** A critical consideration in supplier selection in both countries was quality. Quality was crucial, but so crucial, in fact, that it was an order-qualifying rather than order-winning criterion. Potential suppliers had to meet basic quality standards, expressed increasingly in the QS 9000 standard, which has superseded the basic ISO 9000 standard for American firms in the auto industry, and the German VDA 6 standard.
- **Commitment to new supplier system.** This was expressed as the No. 1 criteria by Company A in India. Suppliers had to accept the logic of single sourcing and the obligations this placed on them. The company was single sourcing, committed to the open book pricing, and passing a considerable degree of responsibility on to the suppliers. According to one of the Company A's suppliers, they were expected to push the development process to a greater extent than with other customers.
- **Engineering resources.** In spite of the commonalisation of platforms, significant adaptations are made for the Brazilian and Indian markets (see above). For "black box parts", it is important for the supplier to have engineering capabilities. These do not necessarily have to be located entirely within the country, but local capabilities are useful for the understanding of local conditions, rapid response and co-operation in testing and "tear

downs". For instance, a global player supplier might lose some contracts in the Brazilian market because of a lack of local engineering expertise.¹

Price remains critical. Mercedes was determined to produce the A Car in Brazil that the same price as in Europe, even though volumes were considerably less (80,000 per year, compared to 200,000 in Germany). Company A in Brazil has the same policy; in India Company A had a target price below the European price, and this was translated into a "European price less x% formula" for Indian components. For some components, the initial bid from Company A put x at over 20%. In spite of a commitment to single sourcing, open book pricing was used to achieve hard bargains. One means of enforcing competitive (ruinous?) prices on suppliers is to threaten to import parts. This was made possible through the large reductions in import duties for components in Brazil, and the lowering of local content requirements in both countries, even though imported parts frequently remained expensive and created logistics problems. In Brazil, the assemblers use "price auctions" for sub-assemblies supply, engaging in successive rounds of negotiations in order to drive down prices; the first-tier suppliers also "squeeze" its suppliers (an expression used by many managers). To some extent, the second-tier suppliers were more vulnerable to both price auctions and the threat of imports. They were more likely to work with detailed designs or supplied fairly standard parts to the first-tier suppliers. Even the first-tier suppliers may be subject to considerable price pressures in the emerging markets. Some suppliers interviewed admitted making losses in Brazil in order not to endanger their contracts in Europe.

It remains to be seen whether the follow sourcing strategy is viable. Follow sourcing has appeared to be successful in Europe and North America, and it certainly leads to economies in design. However, the structure of markets in both

¹ In one meeting at Fiat, which brought together those responsible for discussing a design modification, the supplier's representative (a sales person without technical competence or support) argued that Fiat should ask for help from headquarters. He was unable to take a decision at that moment.

India and Brazil creates serious problems with economies of scale. The largest assemblers in Brazil have certainly achieved the necessary scale. Volkswagen and Fiat are producing over 500,000 units per year, GM 400,000 and Ford 200,000. Most of these cars are based on the same small car platform.

The new entrants will have lower volumes. In India, the most ambitious new entrants (Hyundai, Ford, Daewoo and Fiat) are planning to make 100,000 cars per year. These volumes may be sufficient for assembly (assuming that forecast volumes are reached), but the situation of the components industry is different.

Local components production may be too fragmented. Does India really need four or five producers of light braking systems, or four automotive glass producers for a total car market of less than one million units per year?

For the component manufacturers, a relevant question is not merely the volumes required by particular customers, but how many different customers they can supply. In the case of India, the simultaneous entry of companies from Europe, Korea and Japan may fragment the components market unduly.

Each assembler hopes that its preferred suppliers will find other customers, but the other customers are frequently tied in to their own suppliers. In Brazil, so far, the predominance of the European producers may have prevented such fragmentation, because they frequently used the same European or North American suppliers.

Some means of overcoming this problem are available. For example, Company A has five suppliers of door seals in Europe, each acting as a single source for its particular part. In Brazil, these different parts were allocated to just two of these suppliers. Similarly, first-tier suppliers are offering sub-assemblies and systems as a means of raising the scale of their operations.¹ There are also signs that a more realistic appraisal of market potential is leading to a scaling back of investment plans. One leading supplier to Company A in India is reconsider its investment. It is the follow source, but for this particular product there is already excess capacity in India and a number of highly competent suppliers. The follow source decided to limit its investment in India and import part of the

product. This has led Company A to consider whether it would be better to source from one of the existing suppliers. The final shape of the component industries in the emerging markets is far from clear.

Length of contract

In return for the product with an extremely key price, and international standards of quality and reliability of delivery, component companies in both Brazil and India could expect a long-term contract. For first-tier suppliers, the length of the contract would typically be for the life of the part or the life of the model (including the replacement market after the vehicle had gone out of production).

All the suppliers interviewed in Brazil had part life contracts for the main sub-assemblies. Similarly, in India component companies are being offered long-term contracts. It is less clear what terms and conditions are being offered to second-tier suppliers. As the process of tiering proceeds, more complex operations are transferred from the first to the second-tier. To what extent are comfortable niches available in the second tier?

Quality Delivery and Location

Other things being equal, assemblers preferred to have suppliers located close to their plants. In both Brazil and India, the assemblers are establishing supplier parks near their factories. The extent of these parks in Brazil is shown in Table 9. A number of the new entrants to the Indian auto markets are also setting up similar parks, and Maruti in New Delhi has long had key suppliers located at or near its plant. As can be seen in Table 7, Company A will have a number of suppliers located at the plant. Clearly, the components most likely to be supplied from such plants are seats, dashboards, wheel/tyre assemblies, wiring harnesses, stamped parts (body in white), axles (and axle assemblies including brakes and shock absorbers) and exhausts. In the past, many of these parts would have been produced or assembled in-house by the assembler, and the supplier's location merely represents the transfer of activities to an independent company. Typically, these parts present logistics problems, either because the transport of bulky item is expensive, or because the components and sub-assemblies have to be produced to match the model mix at the assembler.

¹ See the discussion about suppliers to be VW truck plants at Resende in Salerno et al. (1998).

The critical point here is that many other parts do not have to be produced close to the assembler's plant. As long as they can be delivered with the required frequency, they can be produced at some distance.

Particularly when production volumes are small, it may be desirable to have local warehouses rather than local production. Similarly, some plants in supplier parks merely assemble parts made elsewhere. For example, magnetti marelli invested us\$ 40 million in a factory for making

exhausts at betim, close to the fiat plant in minas gerais. For the mercedes plant, it has invested only us\$ 1 million in a final assembly and warehouse operation.

Clearly, maintaining stocks in warehouses and final assembly incurs inventory costs, but there are also costs involved in producing on a small-scale. Local warehousing can balance the desire for economies of scale with the need to avoid disruptions to just in time delivery.

Table 9: *supplier parks in Brazil*

Assembler	Suppliers In The Condominium (Proximity)
Mercedes, Juiz de Fora (A class)	8 firms: seats, painted plastic parts, wheel and tyre assembly, exhausts, dashboards, wiring harness, glass/windscreen
VW, Taubaté	in the surrounding area: seats, axles, bumpers, wiring harness, fuel tanks, pressed parts
VW/Audi	11 firms confirmed: seats, plastic parts, fuel system, axles, tires assembly, exhausts, lightning systems, cooling system, windscreen
Ford, São Bernardo	seats, tires assembly, axles, paint preparation, screws
GM, Gravataí	blanks (sheet cutting), pressed parts (partially), seats + trimming, dashboards, exhausts, steering system plastics, windscreen
Renault	(in definition during the research) seats, cooling, press shop
Chrysler (jeeps)	engines assembly, chassis - being defined

Tiering of Suppliers

This is a strong tendency in both Brazil and India. In Brazil, there is a clear trend towards reducing the number of suppliers and buying-in sub-assemblies. New entrants, such as Mercedes, start with a reduced number of direct suppliers, while the established assemblers are moving in the same direction, both in brownfield and greenfield plants.

In India, tiering of suppliers is a new phenomenon, unheard of until a couple of years ago. It was one of the "Japanese" practices which Maruti did not introduce into India. However, Company A has a first-tier supplier base of under 80 companies, and some of the major new entrants into the components industry, particularly Delphi, are selling themselves as suppliers of complete systems.

This process contains a number of contradictions. For the assembler, it has a number of direct advantages. Inventory costs can be pushed towards the first-tier suppliers, management and transactions costs for the assembler are reduced, and some of the development work with the second-tier suppliers is transferred to the first tier.

On the other hand, the management of the chain by the first-tier suppliers means that some of the rewards of this management are appropriated by the first-tier supplier rather than the assembler, as in the past.

It becomes more difficult to administer open book pricing when many parts are being bought in from other producers. The precise arrangements around tiering may be subject to change.

CONCLUSIONS

The auto industries of Brazil and India entered 1990s with quite distinct structures. Their size, structure and ownership were very different. In Brazil, established transnational assemblers were producing in relatively large volumes, and these volumes increase significantly during the decade. In India, the only large volume producer is Maruti, and the many new entrants are starting from scratch. In spite of these differences, the two auto industries have developed in quite similar ways. In both countries, the transnational auto companies have been extremely optimistic about future growth, and a number of new entrants have been establishing operations.

In both countries, the assemblers have implemented supplier policies based on tiering, sub-assembly supply, life part contracts, and a strong preference for follow sources and standardised design. Quality has clearly become an order-qualifying criterion, while price is frequently the order-winning criterion. In many respects, these policies appear to be the standard international “best practice”.

The findings suggest a number of areas for further research:

- The need to adapt cost to local conditions (road conditions, income levels and idiosyncratic local preferences) is reflected in the continuing amount of design work being carried out. This creates contradictory tendencies: some firms are centralising design activities, and some are decentralising. The world platform is a reality, but the world car is not. To what extent will design activities be distributed across various markets, and does such a distribution offer competitive advantages? Might one imagine a “planetary system” model, with the sun (headquarters) and the planets moving around it (the planets are not the same; some are

bigger than others, some have water and life, etc., but all of them move around the sun)?

- The commonalisation of designs across countries, combined with the transfer of design activities to suppliers imply a much greater degree of follow sourcing. This has undermined the position of locally-owned component companies in both Brazil and India. Is this a permanent phenomenon? Relations between assemblers and suppliers still contain tensions, and if inter-regional trade in components increases, developing country producers may become attractive sources.
- The use of Indian companies to source into both the United States and Japan has been increasing, and further relaxations in trade constraints might further promote this trade.
- How will the assemblers and suppliers manage the risks of entry into the emerging markets? The North American and European assemblers pressure their suppliers to follow source, but they do not assume any of the risks this involves. Suppliers are expected to build dedicated factories for assembly plants whose markets are uncertain. Will the willingness to follow source be diminished by the current uncertainties in emerging markets?
- What are the prospects for the large number of firms in the second tier?
- How to these developments in emerging markets reflect back on the core locations of the auto industry? Are smaller component suppliers in Europe being marginalised as a result of global sourcing? Will the assemblers and the leading suppliers begin to source more of their components from the emerging markets?
- To what extent are the current developments in the emerging markets the result of industrial promotion policies (local content regulations, tariffs, quotas and import preferences for domestic producers) which will eventually be ruled out by the WTO?

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