

# ACADEMY OF BUSINESS & ADMINISTRATIVE SCIENCES

1999 International Conference

Barcelona - Spain, July 12-14

THE AUTOMOTIVE INDUSTRY IN THE CONTEXT OF  
GLOBALIZATION: a comparative study of Brazil & India

**Ivan Antonio Pinheiro** ([iapinheiro@adm.ufrgs.br](mailto:iapinheiro@adm.ufrgs.br))  
**Universidade do Vale do Rio dos Sinos - UNISINOS** ([www.unisinos.tche.br](http://www.unisinos.tche.br))  
**Universidade Federal do Rio Grande do Sul - UFRGS** ([www.ufrgs.br](http://www.ufrgs.br))

**Arun P Sinha** ([asinha@iitk.ac.in](mailto:asinha@iitk.ac.in))  
**Indian Institute of Technology - IIT, Kanpur** ([www.iitk.ernet.in](http://www.iitk.ernet.in))

## Introduction

Globalization has largely determined the political actions and economic initiatives of governments and corporations at the end of this century. The force of its impact has modified the economic and social structures of nations involved in it. The current interrelationship between economies, together with the speed at which the events taking place in one of them are disseminated like shock waves to the other, definitely invalidates analysis and planning which are performed without taking into account the external environment. The strike at the General Motors plant (1998) at Flint (Michigan, USA) illustrates this; it affected production in 24 other plants of this assembler in the United States, and the production lines in Canada, Mexico and Brazil. Furthermore, if 20 years ago, the epicenter of events was located in the developed economies, today the slightest disturbance in peripheral economies may cause significant changes in the level of economic activities in the former.

In this context, this study proposes to review two economies which have, increasingly, taken up space on the globalized scene; Brazil and India. The sector analyzed is the automotive industry, one of the main dynamic pivotal points of industrialized economies, which, paradigmatically, signals corporate trends and has a strong influence on public policies. Considering the range, complexity and specificity of the different segments which constitute the sector, this study focused on the passenger car segment. The data, which were secondary, were taken from various publications, since most of them refer to past events.

The text presents a brief history of local manufacturers, divided into three phases: beginning, consolidation and economic opening. After each history, several specific aspects of the respective manufacturers are discussed: market, technology and relevant events, and others. Finally, the authors present their prospective views for the industry.

## 1 The Brazilian automotive industry

The history of the installation of the Brazilian automotive industry, largely reproduced the trajectory identified by North (1997), who presents the internationalization process of the automotive industry in a succession of the following stages:

1. *“sales and after-sales service;*
2. *semi knock-down (SKD) manufacturing;*
3. *complete knock-down (CKD) manufacturing;*
4. *CKD manufacturing with some local component;*
5. *local manufacturing - only complex components are supplied internationally;*
6. *parts manufacturing and assembly integrated in an international production network;*
7. *development of local product variants;*
8. *development of new products to suit various markets;*
9. *foreign manufacturing operation has worldwide responsibility for product or process innovation - lead factory” (p. 71).*

### 1.1 The first phase – entrepreneurship (1900 - 1950)

The first two cars from one of the oldest assemblers, among the “big ones” present in the country, the **Fabbrica Italiana d’Automobili di Torino (FIAT)** arrived in Brazil in 1903, as a result of personal initiatives to import them – by industrialist Ermelino Matarazzo and Count Sílvio A Penteado (ANFAVEA, 1994). From this personal enterprise was born

*“F. Matarazzo & Cia., which then imported and had the exclusive sales representation of cars of that brand (...)they received the cars semiready from Italy, and took care of the finishing, which often was done by Italian immigrants (...) in the São Paulo neighborhood of Moóca, where all cars from Fiat passed before being sent on to their consumers” (p. 70).*

Founded in 1903, the first vehicles of Ford Motor Co. already arrived in the country in 1904, through the independent initiative of the vendor William T. Right. The oldest assembler established in Brazil began its activities (as a CKD assembler in the city of São Paulo, on May 1, 1919, and

*“.. began by assembling vehicles imported from the United States. The cars, the popular Model T, or Ford Bigode [Ford Moustache, as it was known in Brazil], arrived in crates, and all that the first twelve employees would do was to put in the seats and wheels, hood and windshield, which arrived separately” (op.cit., p. 32).*

Seventeen years after it was founded in the United States, General Motors arrived in Brazil, in 1925. A small assembly line installed in the city of São Paulo assembled 25 cars/day imported from the United States.

In the beginning of the fifties, it was Mercedes-Benz’s turn to begin assembling (CKD) trucks in Brazil.

Three years after the first imports, the first Volkswagen do Brasil line was inaugurated in 1953, with 12 employees. It , "... began by assembling only model 1200 sedans and Kombis, all of them CKD (disassembled vehicles) imported from Germany” (*op.cit.*, p.50).

As can be seen, the first years of the presence of the large assemblers in Brazil confirm the four phases listed by North (1997).

The arrival of Saab-Scania in Brazil, after the initial imports (at the beginning of the fifties), also went through the CKD stage, "... Vemag, in an agreement signed with the then Scania Vabis, begins to import Scania trucks, on the CKD system, to assemble them in Brazil"; and also Toyota of Brazil, whose first imports (also) date from the beginning of the fifties, and

*"The first vehicles assembled here, from the Land Cruiser family, arrived in CKD form (...) five months later [Apr/59], Toyota launched the first Brazilian Land Cruiser. It was 60% nationalized, and received the name of Bandeirante [FlagBearer, referring to the pioneers who opened up the hinterlands of Brazil in the 17<sup>th</sup> Century or to the citizens of São Paulo, the descendants of these Flag Bearers]." (op.cit., p. 157).*

Stages five and six *"local manufacturing - only complex components are supplied internationally; and parts manufacturing and assembly integrated in an international production network"*, due to their greater complexity, require the presence of a physically close production chain. Many events record the growth and maturing of the local automotive parts industry. However, it is December 21, 1955 which definitely marks the entry of the country into the list of vehicle "manufacturers", since, on that day, at Sociedade Técnica de Fundições Gerais S.A (SOFUNGE), a foundry, in response to an order from Mercedes Benz do Brasil.

*"... the first Brazilian engine block was cast, definitive proof that, on the contrary of what was being said, it was perfectly possible to cast engines in countries with a tropical climate<sup>1</sup>."* (ANFAVEA, 1994, p. 11).

This was a phase in which it could be considered that spontaneous growth took place in the industry, impelled above all by market forces (entrepreneurs), beginning in the Twenties.

## **1.2 The second phase –government intervention (1950 - 1990)**

The Federal government, together with the state governments and entrepreneurs, provided the necessary impulse to reach the subsequent phases categorized by North (1997): *development of local product variants and development of new products to suit various markets.*

In March 1952, President Getúlio Vargas, on creating the Sub-Committee of Jeeps, Tractors and Automobiles, connected to the Committee of Industrial Development, signals that "... a [domestic] automobile industry was beginning to take shape"(ANFAVEA, 1994, p.10). The prohibition to import car parts when similar items were manufactured in Brazil (in 1952) and fully assembled vehicles (in 1953) completes the environment required to develop the Brazilian automotive industry.

The Executive Group of the Automobile Industry (Grupo Executivo da Indústria Automobilística - GEIA), in 1956, is one of the milestones of the Brazilian automotive industry (ANFAVEA, 1994; Arbix,1996). The conditions offered by the government, such as tax exemption to import the machinery and equipment for the automobile industry, together with the market that showed promise, were determining factors for several companies to submit projects to GEIA. Eighteen companies presented their candidacy: however, only eleven would really go into production: 1) Fábrica Nacional de Motores (FNM), 2) General Motors (GM), 3) Ford, 4) Volkswagen do Brasil, 5) International Harvester, 6) Mercedes-Benz, 7) Scania Vabis, 8) Vemag, 9) S. A. Industrial de Motores, Caminhões e Automóveis (SIMCA), 10) Toyota and, 11) Willys Overland.

Following this, a concentration process began in the industry:

---

<sup>1</sup> A pioneer fact, also in Latin America (ANFAVEA, 1994, p. 129).

- in 1967 Volkswagen purchased Vemag and, in 1978/9, Chrysler (a late entrant) which, in 1966 already had acquired International Harvester, and in 1969, SIMCA. Thanks to these acquisitions, the Brazilian operation is the only one in the world to produce trucks via Volkswagen Caminhões (Volkswage Trucks), established in 1981;
- Willys Overland, which produced automobiles using the french Renault technology, was absorbed by Ford Brazil in 1969; and,
- FNM, after privatization, when the stock control initially (in 1974) passed into the hands of Alfa Romeo (which supplied them with technology), and, later to Fiat Diesel (1976), closed down in 1985.

The entry of FIAT into the domestic market (as manufacturer) in the seventies was also the result of articulated action between the Federal government ( firmly determined to decentralize the industry) and state governments because “the decisive point to define location was the disposition shown by the Government of the state of Minas Gerais – to take on a participation corresponding to 49% of the capital of Fiat Automóveis S.A ....” (ANFAVEA, 1994, p. 71) – later the state government got rid of its share of the company capital .

Thus, the country changes its status from importer of complete units (a typically commercial activity), *completely knock-down* (CKD), or semi-CKD to that of exporter.

Although in the first phase what prevailed was the entrepreneurial spirit, government action was decisive to enable the second phase.

These were, thus, the first phase – installation, and the second – consolidation, of the Brazilian automotive industry, that, together, correspond to the first eight stages of internationalization of this industry (North 1997).

In 1990, with 13.0 million units, Brazil had the tenth largest fleet in the world, and with 0.9 million units produced, the tenth place in the ranking of manufacturers. The vehicles cover the whole gamut of the automobile industry: passenger cars for the luxury, medium and low-priced markets; light commercials; city and intercity buses; light, medium and heavy trucks; wheel and track-type tractors; tillers; combines; loaders and backhoes and agricultural implements, among others.

### **1.2.1 Government intervention and the oil crisis**

It should also be pointed out that, in response to the foreign oil crisis in the seventies, the Brazilian Government decided to invest in an alternative source of fuel: the Alcohol Program, 1975. Thus, to stimulate the production and use of alcohol-powered vehicles (less polluting fuel, completely manufactured and processed in Brazil), the government supplied a broad range of benefits: subsidized credits for the agricultural sector and for processing plants, tax reduction, longer times and better rates of financing for the purchase of vehicles. Furthermore, there was a time when, despite the lower yield (km/l) of the alcohol engine versus gas, the difference in fuel prices, favorable to alcohol, encouraged the conversion of engines and components. The result of government intervention can be seen in Table 1:

Tab. 1 - Total cars<sup>(\*)</sup> production, alcohol cars production, alcohol powered sales in domestic market and alcohol powered as a % of total domestic sales - 1979/1997

Year	Total Production (**) units	Alcohol Powered Production	Alcohol Powered Domestic Sales	Alcohol Powered as a % of Total Domestic Sales
1979	912,018	3,328	2,271	0.3
1980	933,152	239,251	226,352	28.5
1985	759,141	573,383	578,177	96.0
1990	663,084	71,523	70,250	13.2
1995	1.297,467	32,628	32,808	3.0
1997	1.677,858	1,075	924	0.1

Source: ANFAVEA, Statistical Yearbook, 1998, p. 61, 64, 65 and 71.

Notes: (\*) Passenger cars and station wagon; (\*\*) Including gasoline, alcohol and diesel.

The return to normalcy in the oil market, accompanied by the growing government budget difficulties were decisive in ending the Alcohol Program. Currently, part of the domestic production of alcohol is mixed with the gas (22%), and the remainder supplies the circulating fleet. It is usual, in Brazil's gas stations to offer all three fuels (gasoline, alcohol and diesel), some difference remaining in favor of alcohol: 30% compared with gasoline. What remained of the golden age of the Alcohol Program was technological development also applied to light (vans, jeeps and pick-ups) and heavy commercial vehicles (trucks and buses).

Diesel is used basically in trucks and buses, either because of the higher price, or, mainly, due to the subsidy provided for the fuel, which keeps the government from stimulating the increase in the passenger car fleet, limited to imported models (such as some Mercedes) and the local production of vans, jeeps and pick-ups.

### 1.2.2 Low-cost cars

Beginning in the nineties, the government also provided incentives, establishing a different aliquot of the Industrial Product Tax (IPT) for the sale of the so-called "popular cars". Currently, cars with engines up to 1000 cc – the so-called "popular" cars, pay 8% IPI (Industrial Product Tax), whereas for the others rates may be up to 30%. Table 2 illustrates the growth of this segment:

Tab. 2 - Participation of nationally manufactured cars with 1000cc engines in sales to the domestic market - 1900/1997

Year	Cars with 1000cc engines - units	All cars - units	Share - %
1990	23,013	532,791	4.3
1991	67,292	583,072	11.5
1992	92,573	577,305	16.0
1993	241,964	850,562	28.4
1994	447,867	975,697	45.9
1995	595,845	1,106,591	53.8
1996	701,440	1,245,972	56.3
1997	871,873	1,361,106	64.1

Source: ANFAVEA, Statistical Yearbook, 1998, p. 73.

The incentive to the production and sale of "popular cars" was so significant that it changed the structure of the domestic market. The position of Volkswagen, the market leader (37.1%, 1990,

*Exame Magazine*, 07/16/97, p. 25), above all in the small car segment (constituted until then by cars of up to 1,200/1,500 cc), began to be threatened after the Fiat Mille (1,000 cc) was launched (in 1990), a pioneer car in the new segment. The last of the "large assemblers" to arrive in Brazil, Fiat Automóveis, in 1993, with US\$ 2,696.3 millions in sales, had the 9<sup>th</sup> position among the largest industrial enterprises in the country. In 1997, with US\$ 7,411.2 millions, it attained the 5<sup>th</sup> position, ahead of Ford (US\$ 4,442.9 millions), and slightly behind General Motors do Brasil (US\$ 7,629.5 millions) and Volkswagen (US\$ 8,380.2 millions). Analysts indicate that the fact that Ford fell behind was due, largely, to the association it maintained with Volkswagen from 1987 to 1994, through the Autolatina holding, which joined together the Brazilian and Argentine operations of both companies.

### **1.3 The third phase – The economic opening (1900 - ...)**

F. Collor de Melo's rise to the presidency of the Republic of Brazil, in the beginning of the nineties, led to profound changes in the Brazilian economic and social environment. Various sectors which had until then been protected (textiles, toys, footwear, automobiles, etc), suddenly were faced with competition from abroad, with products whose entry into the country was rendered easier by reducing (and in some cases eliminating) the customs and non-customs barriers, by an Act of the Federal Government. The government's action aimed at two goals: 1) to reduce and control domestic prices – many of them oligopolized, and , 2) to cause the (technological and managerial) modernization of local industry.

The automotive industry, which had benefited and been protected from its inception was hard hit; its products at the time were compared publicly by the President of Brazil to "real horsecars", from the technological standpoint. As a byproduct of technological shock, the government also was seeking greater competitive insertion on the international market, i.e, to transform Brazil into an active agent in the globalization process, a true *global player*.

In establishing its "industrial policy" for the industry - the so-called Automotive Regime<sup>2</sup>, acting on a point in one of the links of the automotive chain, more specifically on the assemblers, the government, once again, caused shock waves with repercussions on many different sectors, and also modified the economic geography of Brazil. The fiscal war between the states of the federation of Brazil also contributed to the currently ongoing regional deconcentration in Brazil.

The assemblers' initial response was to import complete units, and also components manufactured at their sister firms. Imports by independent distributors also grew. They began to bring in vehicles of European (Volvo, Renault, Peugeot) and Asian manufacturers (Kia, Honda, Hyundai, Mitsubishi). Table 3- Vehicle Imports and Trade Balance of the Automotive Industry, below, shows the change that occurred:

---

<sup>2</sup> Reduction of aliquots for the import of parts and components for automotive companies established or about to establish themselves in Brazil.

Tab. 3 - Vehicle Imports (1000 units) and Trade Balance of the Automotive Industry (US\$ million) - 1989/1999

Year	Units	Imports	Exports
1989	-	678	2570
1990	0	733	1897
1991	20	849	1915
1992	24	1079	3012
1993	70	1809	2660
1994	190	2550	2685
1995	369	4795	2415
1996	224	4882	3013
1997	303	5105	3929
1998	345	N.A	N.A
1999 (jan.-apr.)	68	N.A	N.A

Source: ANFAVEA, Statistical Yearbook, 1998, p. 26 and p. 44.  
ANFAVEA, Monthly Newsletter, May/99, p. 5.

However, if imports grew rapidly in the nineties, they are still insignificant as compared with domestic production, as stressed in Table 4 – Local Vehicle Production:

Tab. 4 - Local Vehicle Production - 1957/1997

Year	Cars <sup>(*)</sup>	Commercials		Total
		Light <sup>(**)</sup>	Heavy <sup>(***)</sup>	
1957	1.166	10.871	18.505	30.542
1960	42.619	48.735	41.687	133.041
1970	306.915	66.728	42.446	416.089
1980	933.152	115.540	116.482	1.165.174
1990	663.084	184.754	66.628	914.466
1995	1.297.467	239.399	92.142	1.629.008
1997	1.677.858	306.545	85.300	2.069.703
1998	N.A.	N.A.	N.A.	1.573.100
1999(jan-apr)	N.A.	N.A.	N.A.	404.900

Source: ANFAVEA, Statistical Yearbook, 1998, p. 61.  
ANFAVEA, Monthly Newsletter, may/99, p. 4.

Notes:

(\*) - Passenger cars and station wagons.

(\*\*) - Vans, jeeps and pick-ups.

(\*\*\*) - Trucks and buses.

At the same time the “big” and oldest assemblers established in Brazil (VW, GM, Ford and Fiat),

1. speeded up their internal modernization programs, oriented to the (adapted) reproduction of the “Japanese model”: emphasize total quality management, changes in the modes of work

- organization and management<sup>3</sup>, new forms of relationship with the chain of suppliers<sup>4</sup>, automation<sup>5</sup>, focus, among other programs; and,
2. began to introduce in their most recent launches the devices that distinguished the imports, such as electronic injection (mono and multipoint), 16-valve engines, anti-locked brakes system (ABS), hydraulic steering, cruise control, catalysts, on-board computers, air-bags, lateral protection, new paint technologies, among other technologies and devices (Booz-Allen Hamilton, 1990), mainly seeking to increase efficiency and safety, although there are also, already, concerns about the environment.

The incentives provided by the Federal Government, together with the incentives offered by state government (in a real “war” to attract investments ), the indicators regarding the domestic fleet (aged - an average of 12 years old, outdated in technology and design, and other factors), the success of the Economic Stabilization Plan, and, finally, the consolidation of the Common Market of the South (Mercosur) accounted, together, for a third movement observed on the Brazilian automotive market: the growth of direct investments, applied 1) to modernizing and increasing (including with new plants) the installed capacity of assemblers that were already established here, and, 2) in building new assembly lines : that of the assemblers that had not operated in Brazil up to that time. Table 5 – Recent Investments of Automobile Assemblers in the Brazilian Market, summarizes the initiatives:

---

<sup>3</sup> Substitution of the traditional Fordian line, operated by skilled labor, and producing large batches of homogeneous items, by production cells (and mini-plants) operated by multifunctional metal workers, and diversified production .

<sup>4</sup> Partnership programs are established (allowing simultaneous engineering), deverticalization, target cost/price, and other characteristics.

<sup>5</sup> CAD/CAM. The Ford plant in Taboatão (SP), for instance, increased the number of robots used in production from 6 to 96.

Tab. 5 – Recent Investments by the assemblers in the Brazilian Market.

Company/ Assembler	City/State	Investment <sup>(*)</sup> (US\$ millions)	Beginning of activities
Volkswagen	Rezende - RJ	250	1996
	São Carlos - SP	250/270	1996
VW/Audi	S. J. dos Pinhais - PR	500/750	1999
Honda	Sumaré - SP	100/150	1998
Renault	S. J. dos Pinhais - PR	760/1.000	1998
Hyundai	Simões Filho - BA	286	1999
Iveco	Sete Lagoas - MG	240	1999
Land Rover	S. B. do Campo - SP	150	1998
Mitsubishi	Catalão	35	1998
Daimler-Chrysler	Juiz de Fora - MG	820	1999
Fiat	Betim - MG	500	1999
Fiat/Stola	Belo Horizonte - MG	200/240	1998
General Motors	Gravataí - RS	600	1999
	Mogi das Cruzes	150	1999
Toyota	Indaiatuba - SP	150	1998
Chrysler	Campo Largo - PR	315	1999
BMW/Chrysler		315/500	1999
Agrale/Navistar	Caxias do Sul - RS	200	1998
Peugeot/Citröen	Porto Real - RJ	600	2000
Ford	Guaíba - RS	700	N.A.

Source: Rachid, Truzzi and Bento, 1998; ANFAVEA, 1998.

Note:

(\*) The figures vary according to the sources. Some sources probably consider the total amount of investments, others only the part committed by the assembler.

The economic opening, due to the greater ease of imports (i.e., lower costs), above all in trade with the Mercosur countries (Brazil, Argentina, Uruguay and Paraguay) added a new component to the strategic positioning of multinational corporations: besides supplying the Brazilian market, the new plants articulated (by transferring components and/or trading complete units) with the operations of the other plants established (or to be established) in Latin America. Table 6 - Location of Automotive Plants in Mercosur, below, illustrates the current situation:

Tab. 6 – Location of Automotive Plants (passenger cars) in Mercosul:  
installed and/or about to be installed

Assemblers	Location of the Plant	
	City or State	Country
Daimler-Chrysler	Cordoba	Argentina
	Campo Largo	Brazil
	Juiz de Fora	Brazil
Fiat	Betim	Brazil
	Cordoba	Argentina
Ford	São Paulo (4)	Brazil
	Buenos Aires	Argentina
General Motors	São Paulo (2)	Brazil
	Cordoba	Argentina
	Santa Fé	Argentina
	Santiago	Chile
	Montevideo	Uruguay
Mitsubishi	Goiás	Brazil
Honda	São Paulo	Brazil
Peugeot/Citröen	Rio de Janeiro	Brazil
	Cordoba	Argentina
	Montevideo	Uruguay
	Santiago	Chile
Volkswagen/Audi	São Paulo (3)	Brazil
	Resende	Brazil
	Buenos Aires	Argentina
	Curitiba	Brazil
Toyota	São Paulo	Brazil
	Buenos Aires	Argentina
Renault	Curitiba	Brazil
	Cordoba	Argentina
	N.A.	Colombia
	N.A.	Chile
	N.A.	Uruguay

Source: various

Besides the investments emphasized in Table 5, other assemblers have already announced their intention of establishing a production unit in Brazil : Asia Motors and Daihatsu from Asia, and TVR (in association with Grendene, the Rio Grande do Sul company), from England. The market is broad, as shown in Tables 7 and 8:

Tab. 7 - Mercosur, economic datas, 1997

Economic data	Argentina	Brazil	Uruguay	Paraguay	Mercosur
Population (in millions of people)	35.7	159.9	3.2	5.1	203.9
GDP (US\$ billions)	232.3	803.0	11.1	7.6	1,054.0
Automotive data					
• Production (units)	446,045	2.069,703	5,645		2.521,393
• Domestic sales (local production)	228,493	1.640,243			1.868,736
• Domestic sales (imported)	197,845	303,119	36,133	30,486	567,583
• Exports	210,386	416,872	4,698		631,956

Source: ANFAVEA, 1998, p. 22 and p. 179.

For purposes of comparison, it should be pointed out that the GDP of South America in 1997 was US\$ 1,329 billions for a population of 321.7 million inhabitants.

Despite the size of its fleet of vehicles, ranking 8<sup>th</sup> in the world, Brazil is considered an as yet unexplored market, with a high potential, and this also helps explain the rise in investments. Table 8 - Inhabitants per vehicle in selected countries, below, illustrates and compares the Brazilian situation:

Tab. 8 - Inhabitants per vehicle in selected countries - 1980/1996

Country	1980	1990	1996
USA	1,4	1,3	1,3
Japan	3,1	2,1	1,8
UK	3,2	2,2	2,1
South Korea	74,0	13,0	4,8
Mexico	12,7	8,9	7,9
Argentina	6,6	5,6	5,8
Brazil	11,8	11,1	9,4
Chile	N.A.	N.A.	11
Paraguay	N.A.	N.A.	10
Uruguay	N.A.	N.A.	6

Source: ANFAVEA, 1998, p. 22 and p. 179.

During the course of this relocation of the globally established assemblers' plants, many automotive parts suppliers also began modernization and/or expansion programs. Suppliers who had not yet been operating in Brazil, also attracted by the incentives, directed their investments to this country, some in a direct form, building their own factories, or purchasing existing operations, others in the form of licenses, or constituting joint ventures. Some, because they identified a promising market (Latin America), others as followers, establishing their plants close to the client – assemblers, sometimes in the same industrial district.

The analysts are divided as to the consequences of the new wave which has reached the domestic automotive industry: on the one hand are the pessimists, on the other the optimists.

The pessimists stress the closing down of several companies (causing unemployment), denationalization, the oligopolization which is occurring in the industry, the destructuring of R,D&E activities (previously) performed in Brazil, and the subordination of the course taken by local industry to the logic of international capital. To the argument that the new plants will include

the most modern technologies, they answer that, precisely for this reason, they will not generate many jobs, and that, therefore, other economic sectors should be encouraged. The optimists minimize the closure of companies and localized job loss, focusing attention on speedy modernization (which has already been taking place) in the sector - several Brazilian factories have already attained benchmarking status in the world corporation (the case of General Motors of Brazil – GMB), others are in fact laboratories, such as the Volkswagen plant (Resende –RJ)<sup>6</sup> and the future installations of GMB<sup>7</sup> and Ford<sup>8</sup>, both planned to be the most modern and efficient in the world. It is estimated that the new facilities, the respective processes and products will play a relevant role in disseminating the new technologies, initially in the automotive chain, and subsequently involving, in a positive manner, the other production chains. They call attention to the fact that, if there is unemployment in a region, new jobs are being created in another, in view of the regional deconcentration of investments. They further allege that, to become a global player, it is essential to have a high scale of production, and to be aligned with the great trends of the international market: global sourcing, follow sourcing and supplier systems. As to the concentration of R&D activities at the corporate headquarters, it is a practice which cannot be generalized to all sectors, since it depends on many aspects (Dunning, 1992); however, according to Miller (1994), "...in the automobile industry, concentration of R,D&E at home base is common".

The debate is endless, and there are even those who believe that the automotive industry has exhausted its role as the engine of the domestic economy – if all negative externalities are computed, the incentives given to it (to the industry) would not be justified.

Evaluations aside, it is unquestionable that the changes which are now taking place in the automotive sectors have (and will continue to have) a great impact on the Brazilian socioeconomic structure since, together, the assemblers and automotive part suppliers account for approximately 25% of the national GDP.

Finally, the Brazilian automotive industry is now in the last stage of the nine listed by North: *foreign manufacturing operation has worldwide responsibility for product or process innovation (lead factory)*. The country is becoming consolidated as one of the main pivotal points of the automotive industry worldwide. Table 9, comparing the investments made during the 1995/97 period, confirms this statement:

Tab. 9 - Investments in the automotive sector  
- selected countries - 1995/97

Country	US\$ billions
Brazil and Argentina	10,3
USA	8,3
India	,8
England	3,1
China	2,8
Thailand	2,6
Poland	2,5
Canada	2,5

Source: Automotive News, 1997 (apud Zawislak, 1999)

<sup>6</sup> Modular consortium : all of the assembly is performed by the (first line) suppliers, installed inside the plant of the main assembler, constituting a single assembly line.

<sup>7</sup> The assembler and its main suppliers (16 sub-assemblies) are located on the same site, physically very close, making just in time delivery easier. The streets separating the units are considered production corridors (lines).

<sup>8</sup> Idem.

## **2 The context of India**

The Indian automobile industry is now almost fifty-seven years old. Its growth can broadly be viewed in terms of three phases: 1) autarkic, 2) mass-car and, 3) globalization phase.

- **Autarkic phase**

In the wake of the wartime boom in demand for vehicles, the indigenous Birla group set up, in 1942, the first factory in Calcutta to assemble cars and commercial vehicles from imported components. British Motor and Vauxhall of UK, and General Motors of USA provided the technology and components. Fiat, Italy followed with its collaboration in 1944. The following year, the indigenous Tata group started assembly of Trucks in collaboration with Daimler-Benz, Germany, at what is now the bustling enterprise called Telco. Another indigenous group, Mahindra started the same year to assemble a multi-utility vehicle from Kaiser Jeep of USA. Over the years, these companies were encouraged by government policy to develop manufacturing facilities and local vendors. Increase in import duty was reinforced by explicit instructions from the government to reduce imports in a phased manner. By 1965, these vehicles had almost 85 to 90% of indigenous content.

- **Mass-car phase**

In the 1970's, the world faced dramatic changes in the oil-economy and in the price of petrol. On the other hand, India's growing middle-class generated a burgeoning demand for personal transportation, which the existing manufacturers were unable to meet. Suzuki Motor Corp. of Japan entered into a joint venture with the government of India and started, in 1983, the manufacture of a compact fuel-efficient passenger car, Maruti. This signaled a reversal of the autarkic policy in the auto sector; and a rise in import intensity. This company changed the complexion of passenger car market in India. From an annual market of 30 to 40 thousand, the market boomed, in a decade, to over 200 thousand.

- **Globalization phase**

The third phase of growth of the Indian Automobile sector began with the liberalization of controls in the Indian economy, in 1991-92. The government of India opened the domestic market to foreign companies. A number of multinational players expressed their intention to set up manufacture in India. This included GM, Ford, Honda, Daewoo, Hyundai, Mercedes, Fiat, Peugeot. Many of these entered the premium range. Daewoo, Hyundai, and Fiat entered the small car segment as well. This influx has had far reaching effects. Customers now have choice of the latest technologies, the sellers have introduced attractive features and models, and car-finance and other marketing strategies have come into the Indian market.

### **2.1 The production of vehicles in India**

The Indian production of passenger vehicles has grown from around 4,000 in 1950 to almost 425,000 in 1997-98, valued at over \$ 8000 million. In this growth, some major signposts are as below:

Tab. 10 - Productions of vehicles - 1950/2001

Year	Vehicles - units	
	Passenger	Commercial
1950	4.112	
1955	16.248	22.052
1960	32.523	
1965	38.913	70.985
1983	40.000	
1992-93	163.200	331.000
1993-94	196.000	
1994-95	265.000	410.000
1995-96	345.000	
1997-98	415.000	
2000-01 <sup>(*)</sup>	800.000	

Note: (\*) projected

## 2.2 Emergent features of the globalization phase

### 2.2.1 Changes in consumer attitudes

Even though car-usage in India is still very low (3 per thousand, as compared to 559 in US and 326 in Japan), the Indian car-buyer's attitudes have changed. The car is now perceived as a necessity for "upper middle class" families in the cities. Buying cars through car finance has also become routine.

### 2.2.2 Wider spectrum of choices

Five years back, the cars in the Indian market were "narrowly positioned". The basic positioning was:

- Maruti 800, Premier and Ambassador at the Utility position
- Maruti 1000, Contessa Classic and Premier 118NE at the Luxury position,
- with the in-between brand-extended positioning of Maruti Deluxe.

With the introduction of an array of cars, the "positioning has proliferated". Instead of just three layers, the market is now perceived to have six layers:

Tab. 11 - Market segments and models

Market segment	Models
Classic Premium	Mercedes Benz
Upper Premium	Honda Civic, Opel Astra
Lower Premium	Daewoo Cielo, Maruti Esteem, Tata Sumo/Estate
Upper	Ford Escort, Contessa Classic, Tata Sierra
Extended	Maruti Zen, Fiat Uno, Ford Fiesta, Premier 118NE, Maruti 1000
Utility	Maruti 800, Daewoo Matiz, Hyundai Santro, Telco Indica, Padmini, Ambassador

Obs: Prices range from \$ 58,000 for a Mercedes to \$ 4,000 for a Maruti 800

### 2.2.3 Competition & Market structure

In the US car-market of over 10 million a year, there are just six players that dominate; Europe has eight, Japan has six. Whereas, the Indian car market after globalization has at least a dozen or more contenders. A mega-share of the market is held by Maruti (77% in 1995-96, 82% in 1996-97). Thus, prospective players are left with very small volumes. The largest selling car Maruti 800 is sold at a cutthroat price of \$ 4000. For a greenfield project, the price of such a car may have to be almost doubled. With an estimated market size of 800000 in 2000-1, and with the non-mini segments expected to comprise 70% of volume, the dozen players would be left with market sizes of just 20000 cars each.

Actual sales have concentrated (around 65%) in the “utility” position, which is within \$7000. Another 14% were in the “premium” level. With the entry of more “luxury” vehicles, the premium level is likely to become further segmented.

### 2.2.4 Technology changes

With the new multinational entries, the Indian market has received new Technologies. The Multi-Point-Fuel-Injection system is standard for the new designs. This is not only fuel-efficient, it reduces emission. So, the country now produces cars to Euro-2 norms. Aesthetics and aerodynamics have also improved substantially through the arrival of new models.

### 2.2.5 Manufacturing and volume

Till recently, Maruti was the only manufacturer with an efficient manufacturing system. Now, Daewoo, Hyundai, and Telco, have also set up manufacturing facilities to efficiently produce upwards of 200,000 vehicles each. Such Integrated Manufacturing cannot however be utilized by the other players, because they have planned volumes of just 10,000 to 30,000 which is far too low to justify integrated manufacturing.

## 2.3 The effect on auto-components industry

### 2.3.1 Growth in production, and exports

As a result of the developments in the Indian automobile sector, the components sector has seen major growth in output and exports.

Tab. 12 - Production and exports (US\$ million)

Year	Production	Exports
1995-96	2.588	255
1996-97	3.278	306
1997-98	3.934	366

The sector has thus seen a healthy annual growth of 20 to 26% in production and around 20% in exports.

### **2.3.2 Strategic changes**

“Fewer is better” is now the approach towards the supply-chain in the country’s automobile industry. The auto-makers have started compressing their vendor-base, sourcing sub-assemblies instead of components, and emphasizing on quality. The primary objective is:

- to cut cost,
- to build long-term relationships with vendors so as to manage a rapidly changing environment, and thus
- to implement a strategy for competitiveness.

### **2.3.3 Shift to sub-assemblies**

Automobile manufacturers find it better to let vendors produce entire sub-assemblies, so that they can themselves focus on the essentials of car design, manufacture, and marketing. In order to create specialist vendors that provide sub-assemblies, there is need for massive investment. A hierarchy of vendors has therefore emerged. At the apex are large vendors who supply complete sub-assemblies and systems directly to automobile manufacturers. Vendors at the next tier are those who supply components to the top tier. At the bottom tier are those who supply “unfinished” items like forging or other minor items to both of the above levels.

### **2.3.4 Infusion of finance, and technology**

Technology is a major gap for most vendors. Some auto-majors have helped the suppliers acquire better technology, improve their production systems, and control quality. For this, Finance is a frequent gap. The auto-majors have infused finance by participating in the equity of the supplier. However, many Indian suppliers have been producing components for car models that were phased out abroad. With no worthwhile R&D, they are unable to enter the export arena. Some of them have formed joint ventures with foreign auto-component manufacturers so as to overcome this technology gap.

Quality has been a main gain for the Indian auto supply chain. Out of 365 members of the Automotive Component Manufacturers Association, 169 have received ISO 9000 certification.

## **2.4 Congestion of infrastructure**

With the introduction of the “mass-car”, the population of cars in the Indian metro has increased substantially. Yet, the monopolistic situation of the “mass-car” kept its manufacturer away from aggressive marketing. During the phase of globalization, the competition in the market rose to new heights. Manufacturers began to cut prices and offer newer features and vehicle-finance to attract the buyer. This made further changes in attitudes towards car-ownership. The middle-class Indian who would not have thought of buying a vehicle, is now tantalized by the prospect of owning one. The vocal middle class, which earlier patronized the mass-transportation systems, has also turned away from these overburdened public systems.

As a result, the vehicle population in the metros of India has multiplied. Delhi, in 1995, surpassed its own projections for 2001. The vehicle population was 300,000 in Mumbai in 1981 which zoomed to 750,000 in 1995. A clear measure of the resulting congestion is the effect on average traffic speed shown below.

Tab. 13 - Average Traffic Speed in Indian Metros (in Kmph)  
from 1985 to 1995 - selected cities

City	Area	Year		% of decline
		1985	1995	
Delhi	City	29	21	27
	Suburb	40	24	40
Mumbai	City	19	15	21
	Suburb	38	26	32
Calcutta	City	18	10	44
	Suburb	28	20	29

Thus, the congestion on Indian city roads can be said to have increased by as high as 44 % in the case of Calcutta city, and 40 % in Delhi suburbs. Another measure of the congestion is the number of vehicles per kilometer of roads. This, in Mumbai and Calcutta is some of the worst in Asia.

Tab. 14 - Numbers of vehicles per kilometer of road  
- selectec cities -

City	Vehicles
Singapore	191
Hong Kong	270
Calcutta	345
Mumbai	448

## 2.5 Developments in retail marketing

Since the entry in 1997 of new models from multinationals - Ford, Peugeot, GM, etc. - the market for automobiles became extraordinarily competitive. With rising inventories, the car-makers began to introduce new offers for the premium models. These offers are of two types:

- higher discount to dealers and finance companies
- free gifts, prizes, and Discount coupons to customers.

In addition, car finance companies, as well as car dealers, have introduced a host of attractive financing schemes. These include:

- low interest to Zero interest loans,
- waiver of guarantee, and
- financing of up to 90% of the vehicle cost.

The finance companies were earlier concentrated in the metros. They have now expanded to other cities and service a wider base. Advertising of these offers has also emerged as an aggressive strategy by the finance companies.

## 2.6 The emission problems

With the introduction of new-generation vehicles, there has been a general reduction in polluting emission. Carbon Monoxide, unburnt hydrocarbons, and Nitrogen Oxides are the main polluting substances. The existing manufacturers, in 1993, made fervent appeal for “extension” of

time to reduce emission. In 1999, however, the picture changed dramatically. The use of Catalytic Converter is now mandatory in the region around Delhi and other metros. Further, the judiciary intervened and asked the existing manufacturers to conform to EURO - I norms by mid-1999, and EURO - II norms by April 1, 2000. This can be viewed as another effect of the globalization phase; because there are already vehicles from the new wave of entrants that conform to these norms.

### **3 Brazil & India: the future**

#### **3.1 Brazil**

The Brazilian automotive industry, larger and older than that of India, having become mature a longer time ago, is experiencing slower growth. Besides the inertial effect which renders the accelerated movement of large masses more difficult, it should be taken into account that, for almost 20 years, Brazil has faced successive economic difficulties, with high rates of inflation, imbalances in the foreign balance of payments, continued and growing fiscal deficits. In the academic and entrepreneurial milieu, the eighties are known as the “lost decade”.

The automotive sector faithfully expresses what happened in most others. Growing until 1979, when they attained 1,014,925 units produced and sold on the domestic market, vehicle sales in the period of 1980/92 remained around an average of 738.5 thousand units; and only from 1993 onwards did they return to the one million unit level: on average, 1,354 thousand units during the period of 1993/97, thank largely to government incentives.

The last Economic Stabilization Plan (1994) includes controversial analyses: if, on the one hand price stability created greater confidence and predictability in business, including new segments in the consumer market, mainly by means of credit, consortia and leasing, on the other, the economic opening (one of the cornerstones of the Plan), by introducing the Brazilian economy into the area of industrial modernity has led to growth in the mass of unemployed and informal workers, while productivity indicators grow. The social cost of modernity has led to an increase in the group of opponents (constituted by politicians, union members, entrepreneurs who have suffered losses, government employees and others) of the government policy, which has raised questions regarding the speed at which the opening process has been managed. In this context, due to its size – and the resulting bargaining power, the automotive sectors (especially the assemblers) have still managed to maintain differentiated rates of growth, above all through sectorial agreements which bring together the Federal Government, the state governments, the automotive parts industry and the workers unions.

The institutional changes now ongoing in the country (reforms of the fiscal system, social security, public sector structures, labor contract relations, and others which are slowly – according to some – wending their way between the Executive and Legislative powers), will, over the medium and long term, contribute to sustain Brazilian economic development. On the other hand, the greater insertion of Brazil in the international context also increases its exposure to external movemtns, such as the Asian and Russian crises. The effects of the domestic (currency) adjustment, seen externally as the Brazilian crisis, according to various analysts increased rather due to management errors than to structural difficulties. However, independent of mistakes or appropriate measures taken, the important aspect to be emphasized is that the main crisis management instrument has been the rate of interest. These rates, if raised, have an immediate effect on consumption, above all of high value goods which depend on credit, such as cars. For instance, sales of vehicles financed with external resources brought in by financial institutions connected to the assemblers, have become impossible after the currency adjustment. Thus, over the short term, the sector presents great fluctuations in response to the currency, monetary and fiscal policies adopted by the government.

If up to two years ago the production for the year 2000 was estimated at 2 million vehicles, it is currently accepted that this figure will not be attained. There is also a perception that both the installed capacity (and that which is being built), and the number of assemblers in Brazil, are greater than the absorption and segmentation capacity of the domestic market. However, the maintenance, and even the expansion of the installed park may occur: 1) if plants abroad are closed – the oldest and most obsolete ones, at locations whose cost structure reduces international competitiveness, where union movements are stronger, etc., and, 2) if there is accelerated continuity of reforms which will flexibilize and reduce production costs in Brazil. Along these lines, the relocation of investments in the global automotive sectors to other countries, Brazil would be consolidated as an export platform, both for parts and components and for complete units.

Having said this, it is believed that the maintenance and development of the domestic automotive chain will depend, over the medium and long term, both on the consolidation of institutional reforms, and on the unequivocal definition (by leading elites) as to degree and form in which the Brazilian economy intends to become part of the international market. Highly integrated to Mercosur, the domestic automotive chain will also depend on the directions to be taken by Argentina, where the idea of adopting the US currency (US\$) is gaining followers, in response to the severe crisis they are undergoing, precipitated by the devaluation of the Brazilian currency.

Finally, growing competition may require that assemblers reduce the currently used margins. Due to their size and bargaining power, the assemblers are resisting shrinkage of the margins, and pressuring suppliers who must work with goal cost/price, ensure quality, reliability, just in time delivery, present continuous innovations, and also share the investments in the industrial districts and condominiums, under the leadership of the assemblers.

### **3.2 India**

The second world war generated entrepreneurial forces that led to the birth of automobile industry in India. British and American technology were introduced by assemblers, followed by European companies. In post-independence India - in the 50's - the Nationalist (and autarkic) impulses came to the fore; planning and Government intervention became the basis of industrial policy. For thirty years, the automobile industry received the highest level of protection. Starting from CKD to SKD, the "licensed" auto producers were encouraged - through disincentive and directive - to indigenise their production. While, on the one hand, manufacturers, and vendors, reached over 90% of local content, the licensing regime, on the other hand, ensured a control on price, and a large excess demand continued to rule the market with ages-old technology.

In the aftermath of the two petro-shocks of the 70's, and in view of the growing middle income aspirations, the government helped begin the manufacture of a small "people's car" with new Japanese technology from Suzuki. Fiscal incentives helped the small car sell cheap and boosted the market beyond all comparison.

Liberalization of the automobile sector in India began earlier than other sectors. Licensing control on product-diversification was the first to go. By 1992, under pressure of balance of payments, the Indian government further opened the domestic sector to all foreign automobile makers. A number of international players entered the Indian market. This "globalization" phase brought dramatic changes in the choices and competitive structure in the Indian auto market. Due to intense competition, the manufacturers have invested heavily in retail marketing and auto-finance. Gradually, the middle-income Indian has begun to regard the car as a necessity. The best technologies have reached the Indian roads, and manufacturing facilities have also reached world standards. R&D has received a new thrust, with at least one manufacturer selling a self-designed vehicle. However, the volumes of manufacture are very low for most players. The roads in Indian cities have also not kept pace with the auto-boom; there is severe congestion. And, while the "green" vehicles are yet to dominate the roads, the urban dweller faces increased pollution.

## Conclusion

Brazilian and Indian automobile industries have traversed trajectories with many similarities. Both had some entrepreneurial phase. Both had a substantial government intervention. Using production taxes (excise duty), both countries encouraged small “people’s car”, and helped it capture the major market share. The automobile industry in both countries went through the phases described by North. And both have chosen to “globalize” the sector over the last seven to ten years. There is an influx of international players and a flow of massive international direct investment into the automobile sectors of both countries. Notwithstanding these similarities, it is pertinent to look at some vital differences.

Brazil is two and a half times the size of India, and much less populated. India was under British colonial dominance till 1947, and has a much lower income. The Brazilian market was apt ground for the growth of entrepreneurial impulse of all kinds. Ironically, the source of this impulse in Brazil may be the post war slump of 1919 onwards, while it was the war boom of 1942 that created the Indian industry. The geo-political situation of the two lands would explain the difference. Brazil is close to the automobile producing centers of USA. A slump in USA propelled Ford and GM to set up shop in Brazil. The Indian industry was set up primarily to help in the war effort of UK. Another difference is the nature of ownership of the early start-ups. Brazilian start-ups were subsidiaries of Ford or GM; the Indian ones were locally owned with foreign technological support, perhaps due to the uncertainties of the Indian market and of the war.

Policy shifts in the two countries have not all been similar. Faced with the petro-shock, Brazil made a drastic policy in favour of alcohol. By 1985, the market share of alcohol-powered vehicles had gone to 96%, before the policy was discontinued. India, on the other hand, discouraged the use of vehicles by jacking up the manufacturing taxes and the taxes on petroleum products. It also made efforts to find more petroleum on its own.

With a substantially larger, and more developed, automobile industry, the globalization phase has brought more efficient manufacturing technologies and organization designs to Brazil. The solitary Indian manufacturer of the “people’s car” is able to have volumes enough for integrated manufacture. This unit has also created vendors with its own equity-participation so as to get quality components. However, other players in India have much lower volumes, and work on less efficient manufacturing. On the other hand, there are quite a few units in Brazil that are moving towards novel “assembler-vendor” architecture. Accommodating the vendor on the same premises is one such arrangement to ensure Just-In-Time inventory. A more refined arrangement is to let the vendor ensure the assembly at the appropriate station of the assembler’s line.

The automobile industries of Brazil and India thus have substantial differences, both historical and economic. Yet, the momentum of current global forces may override these differences. Cost-competitiveness is crucial to this sector, and would move the sector across the world. With globalization of markets, the scale economies are also likely to lose their relevance. And, with rapid communication built into current manufacturing, the technologies would reach remote locations much faster than earlier. The future of this sector may no more be country specific and may depend more on the innovations that would drive the sector.

## References

1. ANFAVEA. **Brazilian Automotive Industry** : a history of challenges. São Paulo, Brasil : National Association of Automotive Vehicle Manufacturers, 1994.
2. ANFAVEA. **Statistical Yearbook of the Brazilian Automotive Industry**. São Paulo, Brasil : National Association of Automotive Vehicle Manufacturers, 1998.

3. ANFAVEA. **Brazilian Automotive Industry** : monthly newsletter - january, nº 152. São Paulo, Brasil : National Association of Automotive Vehicle Manufacturers, 1999.
4. ARBIX, Glauco Antonio. **Uma aposta no futuro** - os primeiros anos da câmara setorial da indústria automobilística. São Paulo, Brasil : Scritta, 1996.
5. BOOZ, ALLEN & HAMILTON. **Atualização da estratégia setorial para a indústria automobilística no Brasil**. São Paulo, Brasil : Booz, Allen & Hamilton, 1990.
6. DUNNIG, John H. Multinational enterprises and the globalization of innovatory capacity. In: GRANSTRAND, Ove, HAKANSON, Lars, SJOLANDER, Soren (Orgs.). **Technology management and international business** : internationalization of R&D and technology. England : John Wiley & Sons Ltd., 1992.
7. MILLER, Roger. *Global R&D networks and large-scale innovation* : the case of the automobile industry. **Research Policy**, v. 23, p. 27-46, 1994.
8. NORTH, Klaus. **Localizing global production** : know-how transfer in international manufacturing. Geneva, Swiss : ILO, Management Development Series, nº 33, 1997.
9. RACHID, Alessandra, TRUZZI, Oswaldo M. S., BENTO, Paulo E. G. *Relocalização industrial e novas formas de organização do trabalho*. In: XVIII Encontro Nacional de Engenharia de Produção, **Anais** (CD-ROM), Área: estratégia e organizações. Rio de Janeiro, Brasil, 1998.
10. ZAWISLAK, Paulo Antonio (Org.) **Diagnóstico Automotivo**. Porto Alegre (Brasil) : UFRGS/PPGA/NITEC/FIERS, 1999.
11. Arun P Sinha, Transfer of Computer Technology in India : Case of B-CACHI, **Economic & Political Weekly**, May 31, 1997 (with Shobhit Mathur).
12. Arun P Sinha, APO Survey on Technology Transfer among APO member Countries (Country Report : India), April 1996, in **APO Survey Report SUV-02-95**, Tokyo, book under publication.
13. Arun P Sinha, Transfer of Technology : Towards a Conceptual Framework, **Vikalpa**, July, 1980 (with K Balakrishnan).
14. **Automobile Facts & Figures**, Hindustan Motors Ltd, Calcutta, 1967
15. **Business India**, Mumbai, June 3, 1996
16. **Business India**, Mumbai, May 5, 1997.
17. **Business World**, Mumbai, 6 Sept, 1995
18. **Business World**, Mumbai, 3 Apr, 1996
19. **Business World**, Mumbai, 17 Apr, 1996
20. **Business World**, Mumbai, 26 Jun, 1996
21. **Business World**, Mumbai, 7 Aug, 1996
22. **Business World**, Mumbai, 8 Jan, 1996
23. **Business World**, Mumbai, 16 Apr, 1996
24. **Business World**, Mumbai, 22 Mar, 1998
25. **Business World**, Mumbai, 22 Dec, 1998
26. D G Rhys, **The Motor Industry: An Economic Survey**, Butterworth, London, 1972.

Disk: C:\artigos\abasver99.doc (win98word7.0)