Global Automobile Industry: Changing with Times

By

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Executive Summary

From a humble origin as a 'horseless carriage' manufacturing industry dating back to 1890s, the global automobile industry of 2006 has come a long way emerging as market leader in manufacturing activity, providing employment to one in seven people, either directly or indirectly. Hailed as the 'industry of industries' by the Management Specialist, Peter Drucker, the automobile industry (US) set standards in manufacturing activity by contributing mass production techniques during early 1910s. The Japanese soon followed by offering lean production techniques in the 1970s. Riding high on economical revival in many developing countries in Asia and Europe, the industry's global output touched 64.6 million vehicles in 2005. But with a downward slide in market share, the Big Three was fast losing their dominant position to Toyota, Honda, and Nissan, thereby setting the ground for the emergence of New Six. Meanwhile UK, served as the single largest customer for European auto-makers. Japanese players were the leaders in the light vehicle market and hybrid market. China and India attracted the attention of global auto-makers, vying for setting up a cost-effective export base for meeting the demand from Asian markets. Despite government controls, Chinese market boasted of sales of more than 2.7 million commercial vehicles in 2004. With reports of highest growth in mobility in the world at 3% per annum, further surge in demand was anticipated from Chinese market. A booming economy and a low interest regime helped India to make its mark in the automobile sector in 2004, with sales figures exceeding more than 1 million in the passenger car segment for the first time. The sale of commercial vehicles showed a record growth of 29% over 2003. Foreign auto-makers such as Mercedes Benz, Volkswagen Group, General Motors, Honda, Toyota, Ford, Fiat and Mitsubishi were all making a bee-line to set up their manufacturing units in India to tap the growing demand.

In the environment front, the Kyoto Protocol, which came into force in February 2005, led to the emergence of a closed loop strategy encompassing production, vehicle operation and recycling in the global automobile sector. On analyzing the response of auto-manufacturers to climate change, it is noticed that despite fragmented views on ratification of Kyoto Protocol, auto-makers were in the forefront of popularizing environment-friendly initiatives. They were investing on engine modifications and related pollution-reducing technologies aimed at producing more fuel efficient vehicles. Hybrid vehicles and green vehicles running on alternative fuels are proving to be commercially viable options with customers queuing up for these products, which offered significant savings on gasoline prices.

The report on "Global Automobile Industry – Changing with Times," traces the genesis, and market trends in production and the initiatives to spearhead less polluting technologies. The US automobile industry and Ford Motor Company are taken as classic examples to identify Porter's Five Forces and to do SWOT analysis, respectively. The results stand testimony for the fact that the industry is becoming highly competitive. In the Future Outlook, the growing significance of made-to-order vehicles, and the competitiveness of the emerging markets is dealt with in detail.

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1 Introduction

Hailed as 'the industry of industries' by Peter Drucker, the founding father of the study of management, in 1946, the automobile industry had evolved continuously with changing times from craft production in 1890s to mass production in 1910s to lean production techniques in the 1970s. The prominent role played by the US till late 1990s had of late been cornered by the Japanese auto-makers. The global output from the automobile industry touched 64.6 million vehicles in 2005, thereby retaining its leadership in manufacturing activity, providing employment to one in seven people, either directly or indirectly[1]. This supply mainly catered to meet the demand from households where the automobiles constituted the second largest expenditure item next only to housing. Thus the global automobile industry dominated by Europe, US, Japan, and of late by China and India, continued to have a significant influence on economic development, international trade, foreign direct investment and environment-friendly practices.

"Open borders within Europe, an internal market with potential and no need to fear the large world markets, new members in the EU who see the automobile as a symbol of the freedom and superiority of the free market economy, and – on top of all this – a common currency…[2]" These opening quotes by Prof. Dr. Bernd Gottschalk, President, Verband der Automobilindustrie[3], in the VDA Auto Annual Report 2005, reflected the optimism felt in the European automobile industry, which was till then dominated by the German automotive industry. The recent hikes in raw material prices[4] and the high labor costs[5] continued to plague the region, hailed as the birthplace of the car. Though domestic demand for cars in Europe was sluggish, strong export demand saw the industry spreading its operations over 80 countries, hence remaining competitive in the global market. European Union (EU) members accounted for 26.7% of the world automobile production in 2004, with the new members accounting for another 2.3% share. UK, the most influential player in the European Union (EU), served as the largest single market for European auto-makers, accounting for 16% of the total export demand. In 2004, the German auto-makers exported nearly 44,400 units to UK. In 2003, UK witnessed record number of registrations of new cars but it fell by 12,000 units in 2004 to 2.6 million vehicles. The domestic demand in UK for diesel cars was increasing with 32.6% of the total registrations cornered by diesel variants.

The US automotive industry, the largest automobile manufacturer in the world, witnessed the downward slide of the Big Three, viz., Ford Motor Company (Ford), General Motors Corporation (GM) and DaimlerChrysler (DC) in market share continuing unabated for the last 10 years. Toyota Motor Corporation (Toyota) seemed all set to become the market leader by the end of 2006 (Ulrich, 2006). In the light of rapidly rising healthcare costs and the heavy burden of legacy costs for retirees[6] paid by the Big Three as part of the settlement with the United Auto Workers[7], the Big Three was losing out to Japanese and European auto-makers. Many strategic interventions were initiated by the U.S automakers under the leadership of the Big Three to trigger market growth. GM launched 'Keep America Rolling' campaign after the 9/11 attacks with more emphasis on high incentives and low to zero interest rate loans. Ford offered a free computer along with the

[1] The indirect employment was generated in the retail distribution network and in industries producing intermediate inputs and raw materials like steel and rubber to cater to the demand from automobile manufacturers.
[2] The European Union, founded in 1993 was a union of 25 independent states. UK was one of its founding members.
[3] VDA or the German Association of the Automobile Industry, founded in January 19, 2001 was a joint association of automobile manufacturers, suppliers, manufacturers of trailers, body superstructures and containers, who operate a manufacturing unit in the Federal Republic of Germany.
[4] Generally, any increase in raw material prices resulted in an increase of 10-60% in the cost of supply industry's end products; a huge portion of which was transferred to the customers. In 2004 steel long products registered a price hike of 120% when compared to the previous year. Sheet metal prices rose in the range of 50-70% and price index for iron ore and scrap rose by 40% during the same period. The fluctuations in currency rates also led to a rise in prices for primary plastics, copper and aluminium.
[5] Volkswagen, the leading auto-maker in Europe, employed 176,000 people in Germany alone (320,000 people worldwide) paying an average of 30 Euros/hour (US$ 40/hour). In Slovakia it was as low as 6 Euros/hour.
[6] As of 2004, General Motors was providing health care benefits to 1.1 million Americans. Among them less than 200, 000 were currently employed. All the rest were either dependents of employees or retirees. The foreign players in the US market were free from such payments.
[7] Officially known as the United Automobile, Aerospace & Agricultural Implement Workers of America International Union, the United Auto Workers was the largest labor union in North America with more than 700,000 members. It was founded in 1935 in Michigan.

purchase of Ford Focus vehicle. An entry level passenger car was offered along with a high end Sport Utility Vehicle (SUV)[8]. In 2004, the U.S automakers spent nearly US$ 60 billion in rebates and over 90% of the cars sold had some incentive. But Japanese players were also following suit. In 2004, Toyota's incentives reached a level of US$ 3100 per vehicle. Overall 2006 marked the evolution of the New Six viz, Toyota, Honda, Nissan, GM, Ford and DC, replacing the Big Three (McLaughlin, 2006).

Japan accounted for 16.7% of the world automobile production in 2004. The Japanese auto-makers were the market leaders in the light vehicle market, selling 5.1 million vehicles, an increase of 7% over 2003. At company-level, Toyota emerged stronger, selling more than 2 million vehicles, which was 10% more than in 2003. Exports continued to be the driving force for the automobile sector. Around 5 million cars (out of a total production of 10.5 million) were exported by Japan in 2004. In Western Europe alone, the home ground of German brands, the market share of Japanese cars had increased from 10.4% in 2001 to 13.1% by 2004[9].

China, the fourth largest producer of motor vehicles, next to Germany was fast emerging as the market of the future by providing cost effective export base for meeting the demand from Asian markets. The presence of German auto-makers alone in China had increased by 440% since 1990. China accounted for 3% of the total international locations (722) of global auto-makers in 1988. By 2004, this increased to 7% of a total of 1959. Domestic manufacturers were the dominant players in Chinese market. Despite government initiatives to control domestic demand by tightening credit flow, the market boasted of sales of more than 2.7 million commercial vehicles in 2004. The sales of passenger cars alone increased by 17% over 2003 figures. With reports of highest growth in mobility in the world at 3% per annum, further surge in demand was anticipated from Chinese market.

Riding on a wave of low interest rates and a booming economy[10], India made its mark in the automobile sector in 2004, with sales figures exceeding more than 1 million in the passenger car segment. Maruti Udyog was the market leader with a share of 51%, followed by Hyundai Motor and Tata Motors. The sale of commercial vehicles reached a total of 305,000 units; a record growth of 29% over 2003. Foreign auto-makers such as Mercedes Benz, Volkswagen Group, GM, Honda, Toyota, Ford, Fiat and Mitsubishi were in the forefront of setting up their manufacturing units in India to tap the growing demand.

In the environment front, the Kyoto Protocol, which came into force in February 2005, led to the emergence of a closed loop strategy encompassing production, vehicle operation and recycling in the global automobile sector (VDA, 2005). Despite fragmented views from different regions, auto-makers were in the forefront of popularizing environment-friendly initiatives.

2 Genesis of the Automobile Industry

The genesis of the automobile industry dated back to 15th Century when the famous Italian genius, Leonardo da Vinci suggested the possibilities for power-driven vehicles. Later in 17th Century, the famous English physicist Sir Isaac Newton proposed the concept of a steam carriage which was brought to reality in the late 18th Century by French Army Captain Nicholas-Joseph Cugnot. During the mid 1800s, the attention had shifted to internal-combustion engines which were safer and easy to operate than the steam-driven engines. The first successful version of the internal-combustion engine was built by Jean-Joseph Etienne Lenoir in 1859[11]. This model was revised by a German shop clerk, Nikolaus August Otto in 1876 and hence came to be known

[7] SUV, also referred to as an off-roader or four wheel drive, combined the load hauling feature of a pickup truck with passenger-carrying space of a minivan.
[9] The share of German brands in Western European car market decreased from 46.5% in 2001 to 46.2% in 2004.
[10] India's GDP was expected to grow at an annual rate of 5.5% in the next 15 years.
[11] Liquid hydrocarbons were mixed in the carburetor of the engine, which released the vapor. An electric spark was used to ignite this vapor which released the power to drive the vehicle.

as the Otto engine. His compatriots Gottlieb Daimler and Karl Benz used this model to build the first modern cars, which were launched in 1886. In the US, George Baldwin Selden, made further improvements to the engine, by reducing its weight thereby, making it compatible for light vehicles. The first automobile company was founded in 1896 by Charles Edgar Duryea and his brother Frank and this initiative paved the way for the emergence of an automobile industry.

The automobiles manufactured in the 1890s were called as 'horseless carriages.' This marked the beginning of craft production as all the manufacturing was done by craftsmen employed in metal and machine tool industries. Each car was tailor-made to suit the needs of wealthy customers. But this craft-based production structure demanded skilled workers and resulted in very low production volume. By early 20th Century, the craft-based system was replaced by mass production techniques[12], popularized by Henry Ford. In 1913-14, he upgraded the existing push and move assembly line to a conveyor belt line, which reduced assembly time considerably. His famous Model T was assembled in 93 minutes[13]. The main advantage of mass production technique over craft-production was the ability to manufacture several products simultaneously rather than one at a time. The other features like inter-changeability of standard parts, standardized product design, and centralized hierarchy of tasks helped to realize economies of scale. This increased labor productivity by leaps and bounds but also brought about a reduction of skilled labors. Each worker performed identical tasks using identical tools which were always kept within hand-reach. It was found that the Ford assembler's average task cycle declined from 514 minutes in 1908 to 1.19 minutes with the introduction of moving assembly line in 1913 (Sako, M). The enormous success of mass production resulted in the global sector being dominated by the American car manufacturers. In 1955, North America accounted for 75% of global motor vehicle production. The Big Three, Ford, GM and Chrysler accounted for 95% of all American car sales.

In Europe, mass production was widely adopted in the 1950s through the initiatives of Volkswagen, Renault and Fiat. But rather than production efficiency, the emphasis was more on product differentiation and technical innovation (Sako, M). Their product offerings included compact cars (VW Beetle), sporty cars (MG) and luxury cars. Front-wheel drive, fuel injection, unitized bodies, and five-speed transmissions were some of their innovations in the technical front. Thus with focus on product strategy, the European automobile industry contributed more than the US to the global automobile production during 1960s and early 1970s.

Japanese auto-makers emerged as a force to reckon with in the global scenario with the oil crisis in 1973, and subsequent price increases in 1979[14]. The crisis had resulted in a shift in consumer demand for energy efficient cars, a segment hitherto dominated by the Japanese auto-makers. By 1980s, the Japanese auto-makers were benefited from the voluntary export restraints in the US and set up assembly plants known as transplants within North America. Towards the latter half of 1990s Japanese cars accounted for 40% of the total North American sales. In addition to cost savings by way of cheap labor, they also initiated better manufacturing techniques such as the Toyota Production System, developed by Taiichi Ohno in the 1960s and 1970s based on lean production techniques in the 1980s (Table 1).

"Lean Production is a system of work organization that strives to deliver high quality, low-cost products through the efficient use of resources and the elimination of waste."

- http://www.lir.msu.edu/piers/leanproduction.htm, The School of Labor and Industrial Relations, Michigan State University.

[12] Mass production was highly popular about 100 years earlier in the shipping industry, publication industry and later during the industrial revolution.

[13] The first Model T was built in 1908. By the time its production was stopped in 1927, nearly 15 million units were sold.

[14] The oil crisis of 1973 was the immediate fall-out of the Yom Kippur War waged by Israel against the combined forces of Syria and Egypt. On October 17, 1973, the members of Organization of Arab Petroleum Exporting Countries announced uniform blockade against shipping petroleum to the US and its allies in Western Europe, which set the stage for quadrupling of the world oil prices.

Toyota Production System was built on two main principles namely, 'Just-In-Times' production and 'Jidoka.' The underlying concept of the system was 'Good Thinking Mean Good Product.' The approach helped to manage equipment, materials, and labor in the most efficient manner while ensuring a healthy and safe work environment. Just-In-Time referred to the manufacturing and conveyance of only what is needed, when it is needed, and in the manner needed. Jidoka referred to the ability to stop production lines, by man or machine, in the event of problems such as equipment malfunction, quality issues, or late work, thereby preventing the passing of defects, helping to identify and correct problem areas using localization and isolation, building quality to the production process.

Table 1. Mass Production versus Lean Production - a Comparative Analysis

Mass Production	Lean Production
Complete inter-changeability of standardized parts and the simplicity of attaching them to each other.	More general resources e.g. multi-skilled workers and general purpose machines, for flexible production.
A standardized product design that enabled production in large batches to achieve economies of scale, coupled with large buffers of inventory stock to prevent any interruptions in production.	Small buffers and lot sizes to facilitate a market strategy of responding quickly to demand fluctuations with a greater variety of product designs.
A centralized hierarchy that controlled and coordinated specialized and narrowly defined tasks.	More decentralized authority with greater lateral communication across functional boundaries, team work, and operators' participation in quality circles and continuous improvement activities.
Source: Sako, M.	

Sako, M in his report on 'Automobile Industry,' discussed the research findings highlighting the advantages of lean production. A study undertaken by the International Motor Vehicle Program in 1989 proved that North American and European assembly plants were taking on an average 50% and 100% longer time, respectively to assemble a car than their Japanese counterparts. In 1990, Womack *et al* conducted a study on the quality parameter. Quality was found to be considerably worse for American and European plants than in Japanese plants. The same study, repeated in 1993, indicated that lean production techniques were becoming popular throughout the world. Clark and Fujimoto in 1991, studied product development projects during 1983-87 from auto-makers in Japan, US and Europe and found that the Japanese producers took 47 months of engineering time to design a new vehicle, compared with 60 months in the US and Europe. This was done by fully exploiting the over-lapping product development phases and effectively using the suppliers as part of the development team.

Gutiérrez, 2003, reported that the Toyota Production System heralded the third major revolution in manufacturing[15], and was the brain child of Eiji Toyoda, who served as the CEO and Chairman of Toyota until 1994. The main features of the system included greater product variety, fast response or flexibility, stable production schedules, supply chain integration and demand management. Supply chain management was done with greater effectiveness in Toyota Production System, ushering in steady production volume, leaner processes in terms of cost/flexibility/quality and more profits for the suppliers (Figure 1 and 2).

[15] Adam Smith's 'Wealth of Nations' published in 1776 and Henry Ford's mass manufacturing practices were its predecessors.

Figure 1. Traditional Buffered Supply Chain

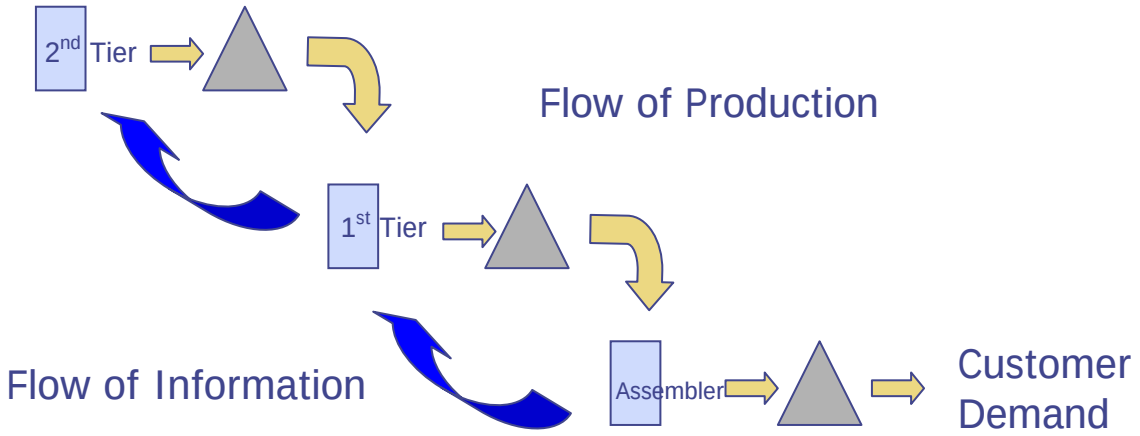
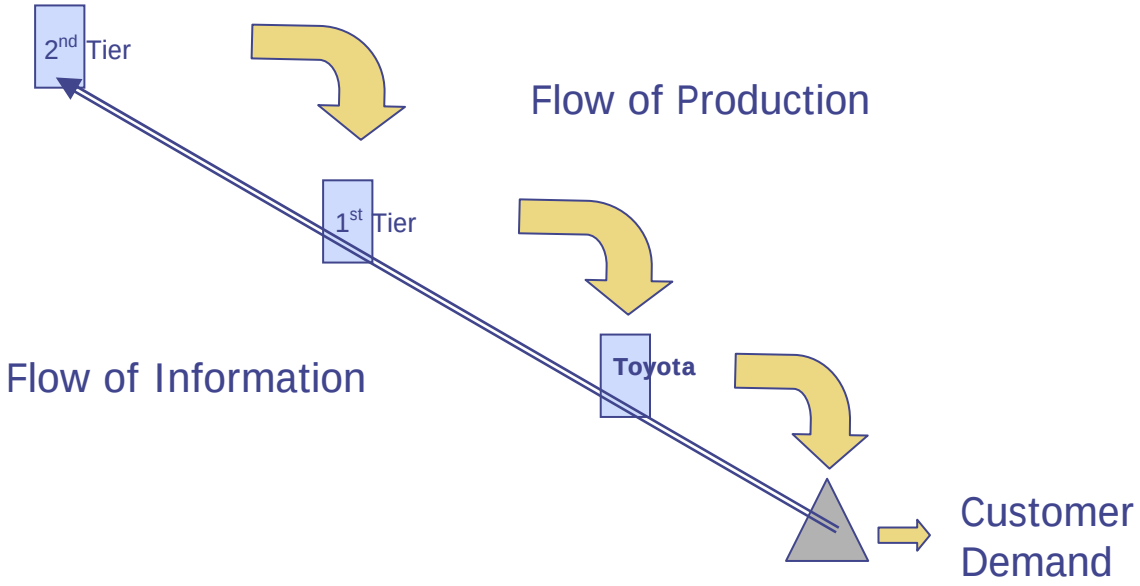


Figure 2. The Just-In-Time Supply Chain



Thus the global automobile industry had covered a remarkable journey spanning through centuries covering craft production, mass production and currently excelling in lean production techniques, setting standards for manufacturing sector (Table 2).

Table 2. Trends in Production Techniques - A Comparative Analysis

	CRAFT PRODUCTION	MASS PRODUCTION	LEAN PRODUCTION
Role of Machinery	Augments the skills of the craftsperson	Displaces the skills of the worker	Same as mass
Organization	Independent or small shop	Hierarchical, workers vs management	Team-based, collaborative
Skill Level	Extremely high, often the point of differentiation	Low as possible.	Very high. Flexibility, responsibility for process improvement are key.
Flow of Product	Little. Worker moves to each "project"	High. Large batches.	High, but small batches.
Production level	Small, somewhat "build-to order"	Large, production level determined by forecast	Large, but break-even point much lower than that of Mass Production. Market pull is ideal.
Supplier relationships	Forced to buy "off the shelf", some "customizing" done before incorporation	Parts often designed by company, order bid on by suppliers	Tier system, high degree of collaboration. Therefore, small # of suppliers.

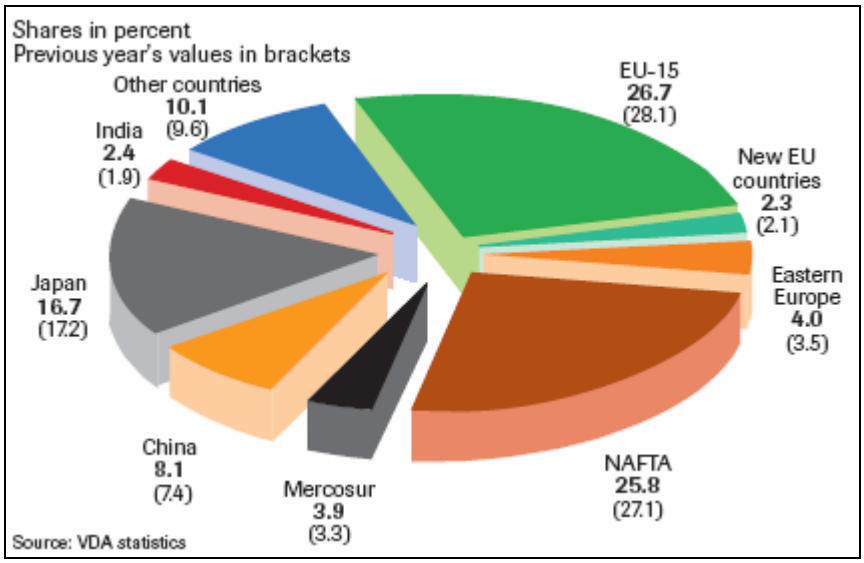
Source: http://camm.queensu.ca/mech426_2004/notes.htm

3 Market Trends

3.1 Production Scenario

The global automobile industry, witnessing robust growth in the face of increased global demand, produced around 63 million motor vehicles in 2004. The Asian countries, mainly by Japan, China and India, registered a 9% increase in production over last year, constituting 35.9% of the global production (Figure 3). In fact China and India posted positive growth rate over 2003. With the opening up of EU markets, the share of EU countries in global automobile production was expected to increase in the coming years.

Figure 3. World Automobile Production in 2004



Source: VDA, 2005.

USA continued to drive the demand, accounting for the sales of around 16.9 million light vehicles. As the share of Big Three fell from 61.8% in 2003 to 60.1% in 2004, Asian brands increased their share from 32.7% to 34.7% in the same period (Table 3). Japan and Korea posted the maximum gains with increased sales of 7% and 8%, respectively. The Mercosur area consisting of Brazil and Argentina also showed buoyant production owing to stabilized economic conditions.

Table 3. Sales of Light Vehicles in the US in 2004

	Units	+/- %	Share 2004	Share 2003
Chrysler Corp.	2,206,024	3.7	13.1	12.8
Ford	3,271,088	-4.8	19.4	20.7
GM	4,357,402	-1.2	27.6	28.3
Big Three	**10,134,514**	**-1.4**	**60.1**	**61.8**
Asian brands	**5,848,828**	**7.4**	**34.7**	**32.7**
BMW	296,111	6.9	1.8	1.7
Mercedes	221,591	1.2	1.3	1.3
Porsche	31,471	10.7	0.2	0.2
Audi	77,917	-9.8	0.5	0.5
VW	256,111	-15.4	1.5	1.8
VW in total	334,028	-14.2	2.0	2.3
German brands	**883,201**	**-3.3**	**5.2**	**5.5**
Total	**16,866,543**	**1.4**	**100.0**	**100.0**

Source: Ward's Communications

Source: VDA, 2005.

In the European sector, Germany's domestic production stood at 5.6 million vehicles and another 4.8 million vehicles of German brands were manufactured abroad in 2004 (Table 4). With the new wave of globalization, VDA members employed nearly 1.5 million people in their

international operations[16] (Appendix 1). This trend was in tune with the growing recognition of low priced production sites in abroad locations.

Table 4. Key Figures of European Motor Vehicle Industry

Production Western Europe ACEA + Others (2004)	Total MV	Mn units	16.9 = 31.6% of worldwide production
	Total PC	Mn units	14.7
New Registrations ACEA + Others EU 15 (2004)	Total MV	Mn units	16.3
	Total PC	Mn units	14.1
Employment (2003)	MV Production	Mn people	1.2
	MV+Suppliers	Mn people	2.0
	Total (incl. Indirect)	Mn people	ca. 12
Turnover (2001)	ACEA members worldwide	Bn €	452
	ACEA members Europe	Bn €	271
Investment (2001)	ACEA members worldwide	Bn €	33 = 8% of turnover
R&D (2002)	ACEA members worldwide	Bn €	19 = 5% of turnover
Value Added (2002)	in EU15 (MV+Suppliers)		8% of manufacturing sector
Exports (2003)	Extra-EU15	Bn €	67.2
Trade Balance (2003)		Bn €	33.4
MV in use (Parc) W. Europe (2003)	Total	Mn units	218
	Passenger Cars	Mn units	191
	Average Age	Years	ca. 8
	Density	per 1000 inhab.	492
New PC Registrations / Specifications W. Europe (2004)	Average CC	Cm^3	1746
	Power	(KW)	81
	Diesel	% Share	48.2%
	4x4	% Share	6.9%
Tax Revenue from MV (2003)		Bn €	346 = 8% of total EU 15 General Government revenue = 3.8% of EU 15 GDP

Source: European Automobile Industry Report, 2005.

UK's foray into the global automobile industry could be traced back to 1911 when Ford set up its first manufacturing plant. This was soon followed by GM, BMW, Honda, Nissan, Peugeot and Toyota. By 2005, the automotive manufacturing sector was contributing around £8.4bn to the economy, accounting for 1.1% of GDP and 9.5% of total UK exports of goods (Table 5). The industry employed 237,000 people in the design and manufacture of vehicles and components. There also existed a niche market for sports and luxury cars.

Most of the leading design engineering companies were also based out of UK. It was estimated that these companies had a 20% stake in the global market. Many of the high-tech innovations were initially tried out in race tracks before being incorporated into the general production system. The industry had effected significant cost reductions to the tune of 30% from quality improvement programs run under the aegis of the Society of Motor Manufacturers and Traders Industry Forum[17]. The initiative was spearheaded by all major automotive component

[16] The international involvements of VDA members had increased by 77% in a span of 10 years.
[17] It was founded in 1902 as a trade association for UK motor industry.

manufacturers such as Delphi, Bosch, Visteon, Federal-Mogul, and TRW Automotive, GKNplc, Unipart and Pilkington.

Table 5. UK Production (in '000s)

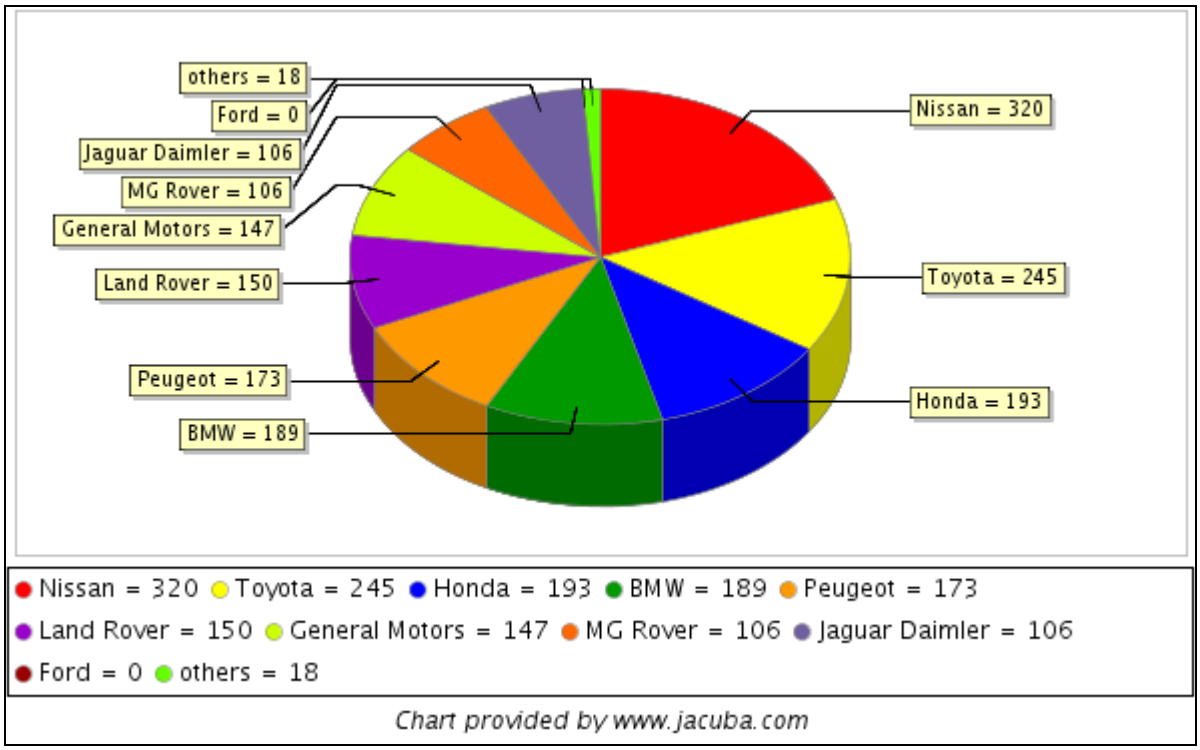
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cars											
Home Market	787	778	738	729	649	578	598	582	514	467	411
Export Market	745	908	973	1,031	1,150	1,063	894	1,047	1,144	1,179	1,185
Total	1,532	1,686	1,712	1,761	1,786	1,641	1,492	1,630	1,658	1,647	1,596
Commercial Vehicles											
Home Market	141	126	132	123	110	96	97	77	86	81	76
Export	92	112	92	92	64	76	96	114	103	128	130
Total	233	238	224	215	190	172	193	191	189	209	207
Totals											
Home market	**928**	**904**	**870**	**852**	**759**	**675**	**695**	**659**	**600**	**548**	**488**
Export	**837**	**1,021**	**1,065**	**1,124**	**1,213**	**1,139**	**990**	**1,162**	**1,247**	**1,308**	**1,315**
Grand Total	**1,765**	**1,924**	**1,936**	**1,976**	**1,976**	**1,813**	**1,685**	**1,821**	**1,846**	**1,856**	**1,802**
Source: "Manufacturing Statistics," http://www.autoindustry.co.uk/statistics/production/uk/Top%20Manufacturers.											

With production touching 320000 units, Nissan continued to be the top manufacturer, a position it had retained since 1999 (Table 6 and Figure 4).

Table 6. Top UK Auto-manufacturers (production figures in '000s)

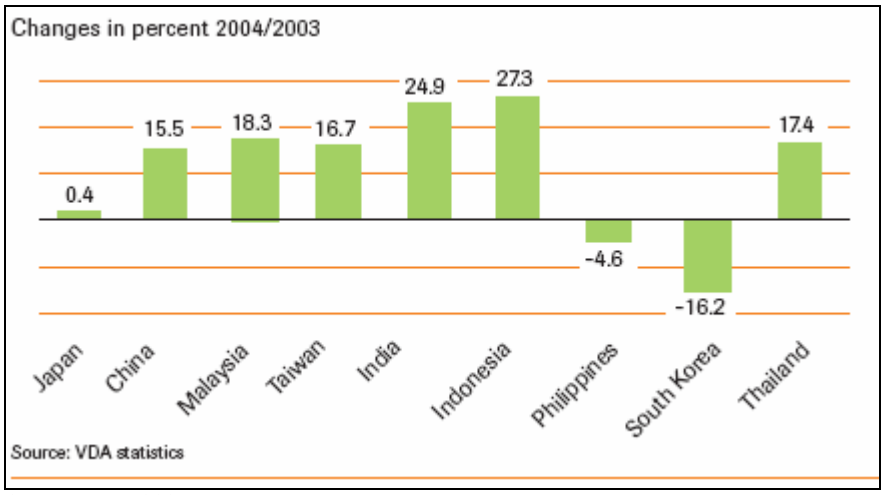
Sl. No.	Manufacturer	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005e
1	Nissan	215	232	272	289	271	327	296	297	332	320	300
2	Toyota	88	117	105	172	179	171	155	212	211	245	250
3	Honda	91	106	108	112	114	75	112	177	185	193	193
4	BMW	0	0	0	0	0	0	42	160	174	189	195
5	Peugeot	78	85	85	71	162	186	186	198	207	173	125
6	Land Rover	100	97	107	149	154	160	139	155	148	150	150
7	GM	262	297	284	277	339	290	193	125	124	147	175
8	MG Rover	374	376	395	329	226	175	163	147	133	106	25
9	Jaguar Daimler	41	39	44	50	86	89	122	123	126	106	106
10	Ford	274	328	302	298	255	155	72	13	0	0	0
	Others							12	23	18	18	18
	TOTAL	**1,523**	**1,677**	**1,702**	**1,747**	**1,786**	**1,628**	**1,492**	**1,630**	**1,658**	**1,647**	**1,537**
Source: "Manufacturing Statistics," http://www.autoindustry.co.uk/statistics/production/uk/Top%20Manufacturers.												

Figure 4. Individual Share of Top UK Auto-manufacturers



The Asian countries were also registering growth in the demand for new vehicles (Figure 5). Indonesia and India showed significant growth in the registration of new vehicles.

Figure 5. Registration of New Vehicles on Asian Markets

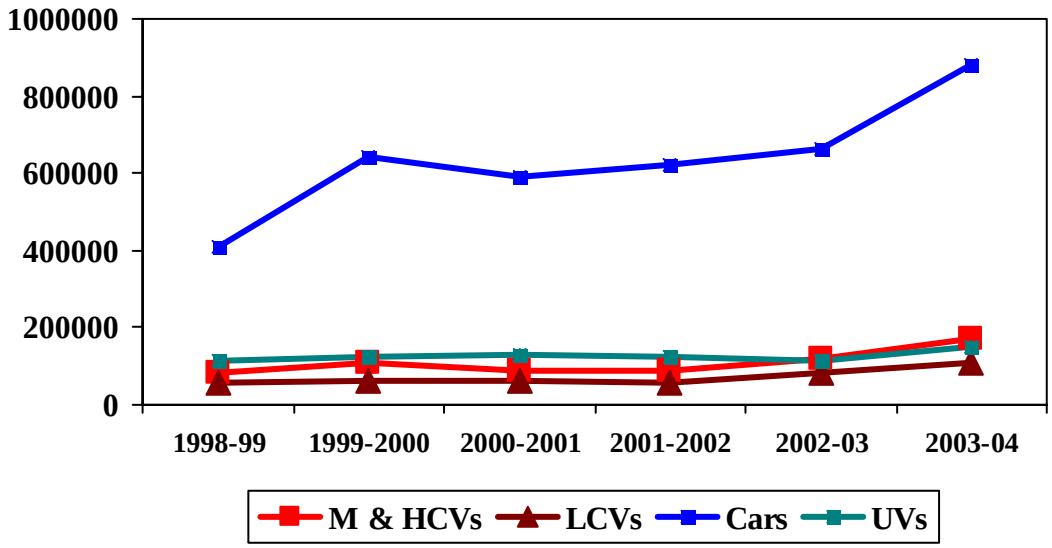


Source: VDA, 2005.

Buoyed by annual GDP growth rate of 8%, the Indian market was showing positive sales growth (Figure 6 and 7). According to the Society of Indian Automobile Manufacturers, the sales

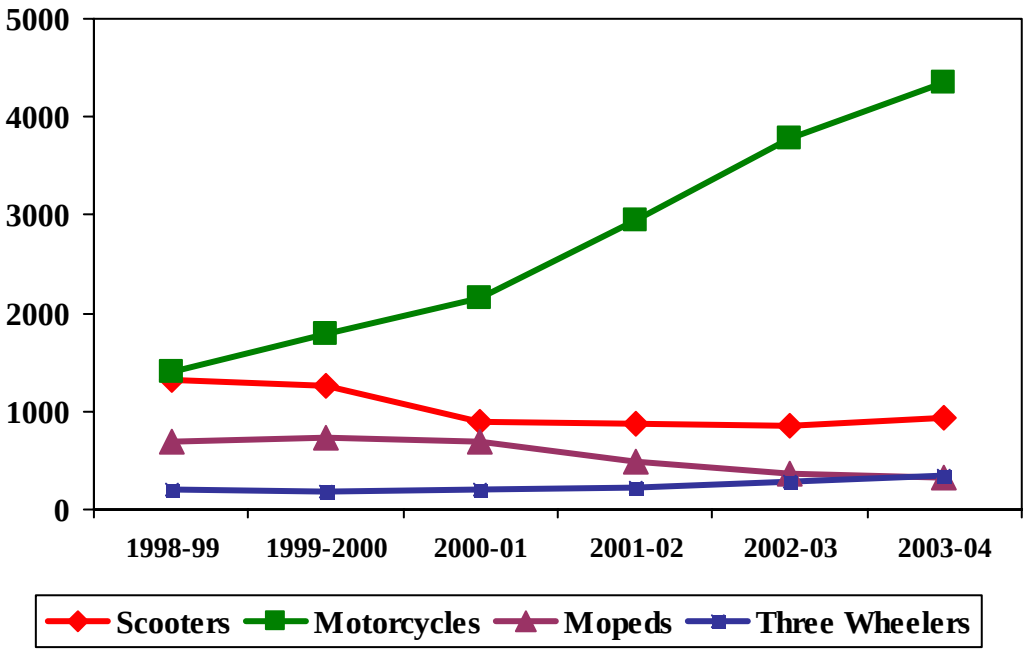
of commercial vehicles alone were expected to grow at an annual rate of 10-15%. India was also making its mark in the auto-components sector (Figure 8).

Figure 6. Total Sales Trend of Four-wheelers in India



Source: SIAM, 2004.

Figure 7. Total Sales Trend of Three and Four Wheelers in India



Source: SIAM, 2004.

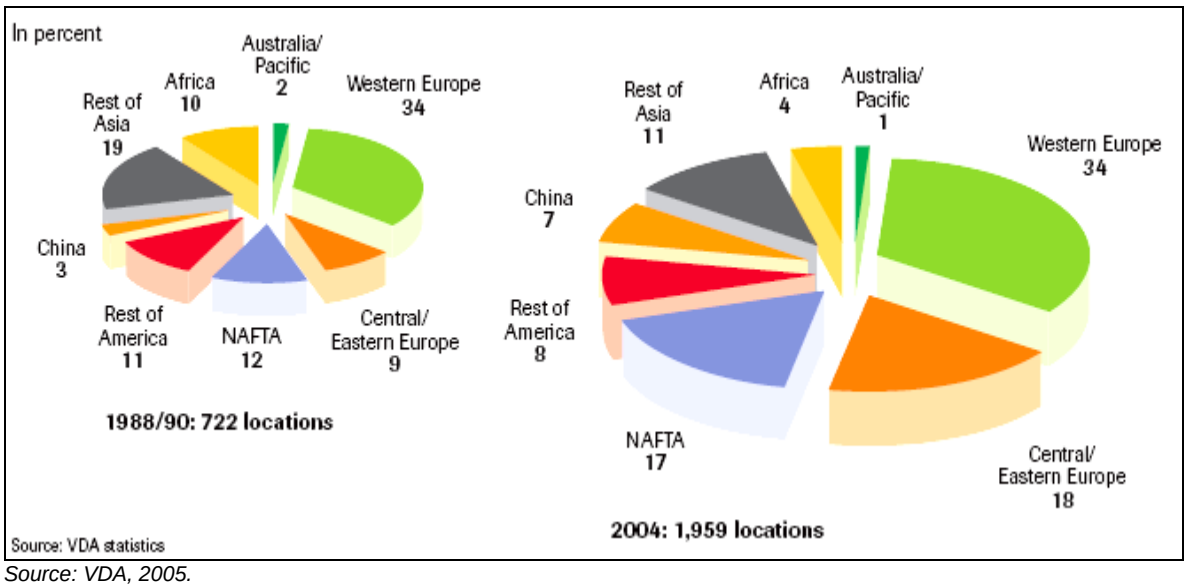
Figure 8. Indian Auto Component Industry Output and Investment

Source: IBEF, 2006.

In Japan, the domestic demand stood at 5.9 million vehicles. Top Japanese automobile component manufacturers such as Ikeda, Yutaka Giken, Denso and Calsonic were making inroads into global markets following the popularity of Japanese vehicles. In China, rising oil prices and decrease in availability of low interest car loans from public sector banks were driving down the domestic demand. But of late many leading auto-makers were moving into China (Figure 9). From a mere figure of 25 companies in 1990, the tally had risen to 137 in 2004.

The auto-makers were reaping the benefits of 'natural hedging,' such as cost advantages even during exchange rate fluctuations happening in sales markets. But analysts opined that several government restrictions existed against the entry of foreign auto-makers in China even after it joined WTO. On the other hand, positive initiatives such as becoming a signatory in the global agreement for technical harmonization aimed at 'tested once – accepted everywhere,' signaled the increasing emphasis given by the Chinese political leadership to become a global player in the automotive sector (VDA, 2005). The uniformity in test procedures across nations helped in considerable cost savings for the auto-makers.

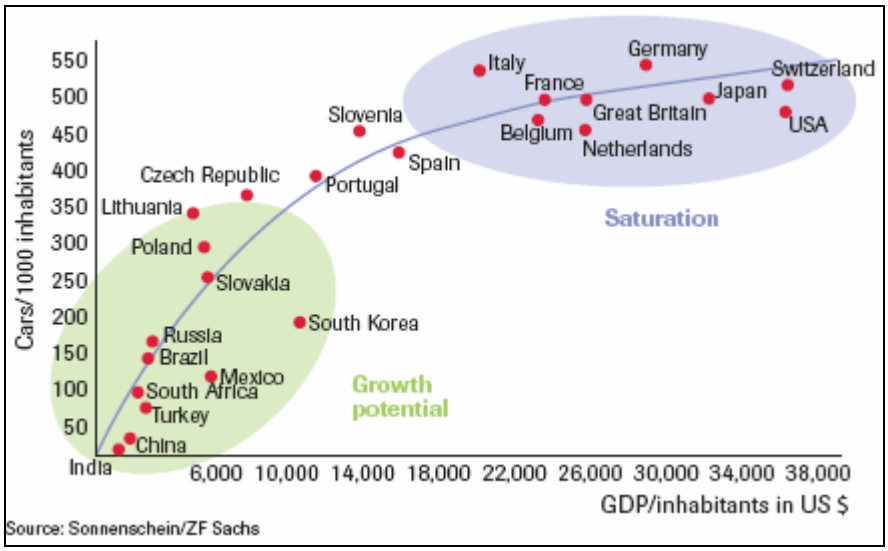
Figure 9. Regional Distribution of International Locations



Source: VDA, 2005.

Among the different means of transport, car continued to occupy the prime slot with increasing trend in opening up national economies to international competition. Mobility 2030, of the World Business Council for Sustainable Development, reported that the per capita mobility in China, Latin America, Russia and rest of Eastern Europe would double by 2030 to 5000-14000 kilometers/year. Accordingly the car density would also register proportionate growth (Figure 10).

Figure 10. Cars per Thousand Inhabitants



Source: VDA, 2005.

3.2 Industry Structure

In the automobile industry, transaction cost economics, and technology shifts determined the structure (Sako, M). During the 1890s, craft production techniques led to the formation of a horizontally disintegrated industry, completely devoid of consolidation. Manufacturing units evolved in regions boasting of skilled labor. By the middle of the 20th Century, automobile companies like Ford and GM brought about consolidation in the industry. The companies themselves were vertically integrated. The market was oligopolistic in nature. Huge production costs deterred new firms from entering the market. GM emerged as the market leader, wielding high influence over market prices. By 1920s, Ford perfected mass production techniques. The company also took initiatives for a high degree of vertical integration by owning its own steel mill and forging factory. Other players followed suit to achieve substantial cost savings. The integration of Fisher Body by GM marked one such instance.

But contrary to the trend for vertical integration by the US auto-makers, Japanese auto-makers practiced 'relational contracting (Sako, M).' The practice of 'Just-In-Time' delivery as part of the lean production techniques gave rise to a healthy relation between the assemblers and the suppliers of automobile components.

By 1980s the industry showed renewed signs of vertical disintegration. Chrysler formed strategic tie-ups with suppliers for major components and in turn concentrated only in designing, assembling and marketing. These initiatives helped Chrysler to realize the highest average profit per vehicle amongst the Big Three. Ford and GM started depending on Visteon and Delphi, respectively, for sourcing their components. All the components of a car were outsourced to suppliers who offered lowest prices (Table 7). This increased the manufacturing capacity of the

auto-makers and the industry was soon saddled with overcapacity. In 1999, the global automobile industry had an excess capacity of 20 million units.

Table 7. Market for Auto-components

U.S. Original Equipment Parts Market					
Year	Size of U.S. OE Parts Market	Imports of Parts From All Countries	Imports as % of Total	OE Parts Sourced From U.S. Suppliers	Imports as % of Total
1997	$147.7	$39.4	26.6%	$108.4	73.4%
1998	$162.9	$41.6	25.5%	$121.3	74.5%
1999	$190.0	$47.7	25.1%	$142.4	74.9%
2000	$178.1	$51.7	29.0%	$126.4	71.0%
2001	$164.8	$48.3	29.3%	$116.5	70.7%
2002	$167.2	$53.4	32.0%	$113.8	68.0%
2003	$160.5	$57.7	35.9%	$102.8	64.1%
2004	$154.8	$64.6	41.7%	$90.2	58.3%
Change	-3.6%	12.0%		-12.3%	

Source: McLaughlin, 2006.

To reap more profits, the auto-makers embarked on enhancing horizontal concentration by forming alliances with global players. DC (Daimler-Benz, merged with Chrysler of US in 1998 and became DC), a German-US merger entered into an alliance with Mitsubishi to spread its operations over three continents. Ford purchased Jaguar, Volvo and Mazda, and Renault's equity stake in Nissan and Samsung for wider reach. Thus the industry once again witnessed the emergence of oligopoly market.

All the major players including the Big Three in the US, BMW, Volkswagen, Fiat and other carmakers from Europe, Toyota, Nissan, Mitsubishi of Japan focused on commercial exploitation of technological advancements with the aim of offering more efficient automobiles to consumers. On one hand DC and BMW focused on luxury vehicles while Fiat targeted diesel engines. The Japanese companies were striving for better fuel efficiency and experimented with sleek and slender designs.

Towards the last quarter of the 20th century, globalization paved the way for deregulation opening up the markets to foreign competition. The consumers stood to gain with more variety to choose from at competitive prices. In order to stem the price war most of the major companies from the US, Europe and Japan entered into alliances with companies from other regions of the world. In 1997, GM entered into a 50-50 joint venture with Shanghai Automotive Industry Corporation (SAIC), a state-owned Chinese auto manufacturer to build a plant in China. In 1999, GM also increased its equity in Japanese companies like Isuzu (raised its stake to 49%), Suzuki (9.9% and later to 20%) and Fuji (20%). All these deals ran into multi billion dollars and GM got access to advanced technologies owned by the Japanese companies. It was widely opined that developing these technologies on its own would have cost GM more money and time. GM's alliance with SAIC helped it to gain access to the fast growing Chinese market much before than any of its competitors.

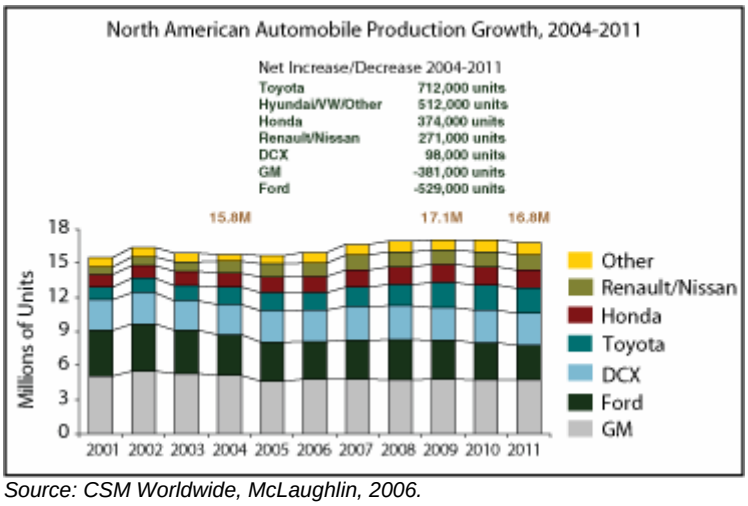
In 2000, GM purchased a stake in Fiat with the option of buying the remaining shares by 2007. But with falling fortunes, GM entered into a US$ 2 billion settlement to cancel the deal in 2004. The only success story was the Renault/Nissan merger, with both companies registering profits in 2004.

By 2005 mergers and acquisitions took a backseat in the automobile industry. DC reduced its share in Mitsubishi from 37% to 14% by 2005. DC also divested its 10% stake of Hyundai. DC was the only one among the Big Three registering increased sales in the US market in 2005.

"The Big Three used to control 90 percent of the North American market. Globalization has created eight near-equal competitors fighting for market share three companies used to control."
- Dennis DesRosiers, President, DesRosiers Automotive Consultants Inc.

As for the Mercedes-Benz merger, the Mercedes section was reporting quality issues resulting in customer complaints. Towards the end of 2005, consolidation activities had brought GM's effective share in the US market to 29.3%, Ford's share to 21% and DC's to 14.3% (Figure 11).

Figure 11. Market Share of Leading Auto-makers in US



Source: CSM Worldwide, McLaughlin, 2006.

3.3 Response of Auto-manufacturers to Climate Change

On February 16, 2005, the Kyoto Protocol with mandatory limits on Green House Gases (GHG) emissions by industrialized countries came into effect. Ratified by 141 countries, accounting for 55% of GHG emissions, the focus naturally fell on the automobile sector, the largest consumer of fossil fuels[18]. In automobiles, where 98% of the energy requirement was met by petroleum, CO_2 was the most significant GHG emitted (2.4 g of CO_2/litre of fuel burned). In addition, vehicle air conditioners leak hydrofluorocarbon- 134a (HFC – 134a), a GHG that was 1300 times as potent as CO_2. The situation was expected to deteriorate with a projected vehicle stock of more than 800 million by 2030. The automobile industry particularly located in developed economies of US, EU and Japan, supported the development of new cost-effective technologies offering improved energy efficiency with lesser GHG emissions. The auto-makers were taking voluntary initiatives to make cleaner fuels.

In the US, despite the political machinery's refusal to ratify Kyoto Protocol, many individual states were enforcing their own fuel economy[19] standards. The State of California mandated reduction of GHG emissions by 30% during the period 2009-2016. Seven other states also joined

[18] Petroleum, natural gas and coal were grouped under fossil fuels (depletable), which on burning released GHGs like CO2 and methane. The main GHGs included CO2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, chlorofluorocarbons, and sulphur hexafluoride. These gases, mainly produced by human actions were trapped in the earth's atmosphere resulting in global warming.
[19] Fuel economy referred to distance traveled per gallon of fuel consumed and was expressed as miles per gallon (mpg).

the fray. The Energy Policy Conservation Act enacted into law by the US Congress in 1975, established Corporate Average Fuel Economy (CAFÉ) standards for passenger cars and light trucks. CAFÉ referred to the sales weighted average fuel economy expressed in miles per gallon (mpg) of a manufacturer's fleet of passenger cars or light trucks with a gross vehicle weight rating of 8500 lbs or less manufactured for sale in the US, for any given model year. As of 2005, the CAFÉ standards stipulated a mandatory standard of 27.5 mpg for passenger cars, and 21.0 mpg for light trucks. The penalty for failing to meet the standards amounted to US$ 5.50 per tenth of a mpg for each tenth under the target value times the total volume of those vehicles manufactured for a given model year. Since 1983, auto-makers had paid more than US$ 500 million in civil penalties. The European manufacturers had paid fine in the range of US$ 1 million to US$ 20 million annually.

The Alliance of Automobile Manufacturers, a trade association of nine car and light truck manufacturers including BMW Group, DC, Ford, GM, Mazda, Mitsubishi Motors, Porsche, Toyota and Volkswagen, founded in 1999 in the US, strived to enforce the commitments on environment. In response to the US President's climate change policy framework, announced on February 14, 2002, the Alliance laid down the initiatives for sustained economic growth by financing new, clean energy technologies and participating in Department Of Energy's (DOE) Business Challenge Program (Figure 12).

Figure 12. Auto-maker's Response to Climate Change (A)

Policy Initiatives

- The Alliance supports a single national voluntary reporting registry under the DOE. Building on the reporting that some members are already engaged in, within one year all Alliance members will be reporting GHG emissions from their manufacturing facilities.
- Alliance member companies commit to achieve at least a 10 percent reduction in GHG emissions from their U.S. automotive manufacturing facilities, based on U.S. vehicle production, by 2012 from a base year of 2002.
- Progress toward this goal can be measured by DOE based on registry reporting by individual Alliance members of their emissions and avoidance, reduction, and sequestration activities.
- Alliance members will continue to support government or industry partnerships that further the development of practical and affordable energy efficiency solutions.
- For energy efficiency of products, automakers will continue to work constructively with National Highway Traffic Safety Administration to improve the fuel economy of America's motor vehicles.
- Industry's aggressive investment in pursuit of fuel cell vehicles, hydrogen vehicles, hybrid electric vehicles, clean diesels, and other advanced design vehicles exemplifies the commitment to move away from dependence on petroleum-based fuels.
- Alliance has joined other automotive and engine trade associations around the world in endorsing the World-Wide Fuel Charter.

Auto-maker's Response to Climate Change (B)

Achievements

- Since 2004, new cars and light trucks are being sold that are 99% free of smog-forming emissions.
- Today's light truck runs more cleanly than a 1993 car.
- Using a chain saw for one hour emits the same amount of volatile organic compounds (VOC) as driving 600 miles in a typical car - the distance from Washington, DC to Atlanta.
- Using a snow-blower for one hour emits the same amount of carbon monoxide as driving

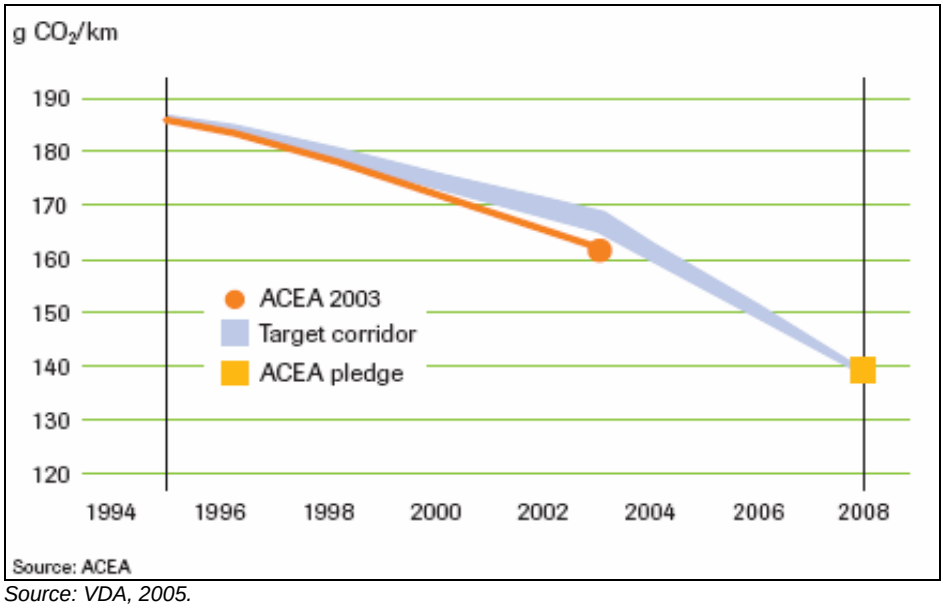
a typical car 305 miles - the distance from Phoenix to Las Vegas.

- Cars and light trucks are now responsible for about one-fifth of smog-related emissions in key U.S. cities.
- Today's ultra-clean autos need ultra-clean fuel. Sulfur levels are being reduced by 90% which has a tremendous impact on the effectiveness of the catalyst.
- The Alliance has taken the lead in calling for ultra-low-sulfur levels in gasoline and diesel fuel, a 1200 distillation index cap for gasoline and other improvements to both gasoline and diesel fuel.
- Alliance members have invested billions in research and development of cutting-edge technologies, such as alternative fuel[20], electric, fuel cell, and hybrid electric vehicles, to bring these vehicles to the marketplace.

Source: http://www.autoalliance.org/environment/cleanvehicles.php, http://www.autoalliance.org/environment/globalclimate.php.

Advancements in 'clean diesel' were another major achievement. The German motor industry was also in the forefront of designing for recycling. In spring 2005, a joint US-EU initiative was launched to continue energy efficient activities. The main focus was on developing the fuel cell technologies. The other measures likely to be adopted include re-introduction of tax incentives for fuel efficient vehicles, use of synthetic fuels, installation of fuel consumption displays, use of low-friction oils and tyres, etc. The European Automobile Manufacturer's Association (ACEA) pledged to cut down CO_2 emissions from 186 grams per kilometer to 140 grams by 2008 (Figure 13). In practice this was meant to reduce the average CO_2 emissions of all newly registered passenger cars in Europe by 25% during the time period 1995-2008.

Figure 13. Pledge made by the European Automotive Industry



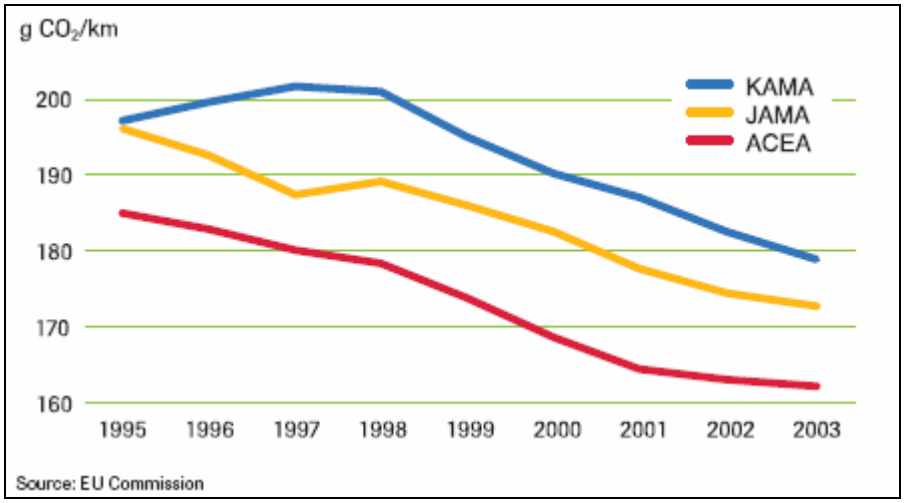
Source: VDA, 2005.

As per the European Commission progress report, the CO_2 emissions from the entire new vehicle fleet were recorded at 163 grams per kilometer. The Japanese and Korean auto-manufacturers were expected to meet their targets by 2009. As of 2003, the Japanese makers

[20] As of 2005, more than 3 million alternative fuel vehicles were plying the road. The main challenge was in developing adequate infrastructure to provide alternative fuels such as bio-fuel, natural gas, and propane.

achieved an average of 172 grams/kilometer and the Koreans an average of 179 g/km (Figure 14).

Figure 14. Trends in CO2 Emissions



Source: VDA, 2005.

The auto-makers were also taking part in the market-based mechanisms offered by the Kyoto Protocol[21]. One such market based system called 'Emissions Trading,' allowed participants to voluntarily take part in a 'cap and trade' scheme (Appendix 2). The 'cap' referred to the individual targets above which trading of emission units was allowed. Ford started participating in the UK emissions trading program in 2002 and the Chicago Climate Exchange in 2003[22]. The company was well prepared to take part in the EU Emissions Trading Scheme, launched in January 2005, which was planning to let auto-makers to participate in trading in the near future.

Toyota was actively pursuing Clean Development Mechanism (CDM) and Joint Implementation (JI) mechanisms offered by Kyoto Protocol. For reforestation work in Australia, Toyota partnered with Mitsui Co. Ltd., and Nippon Paper Industries Co. Ltd to launch a new company, Australian Afforestation Pty. Ltd. Toyota provided most of the investment funds in return for the carbon credits while selling wood to Nippon Paper. The company was also involved in consultancy services in the area of planting forest trees in private lands. In Japan, the Toyota and Mitsubishi Corporation had joined as investors in launching the Japan Carbon Finance Ltd in December 2004 to purchase Certified Emission Reductions and Emission Reduction Units until 2012 from CDM/JI projects. A fund pool worth US$ 140 million was set aside for trading. The Japanese auto-makers voluntarily discontinued the use of CFC 12 as a coolant in automobiles when its harmful effects on ozone layer were discovered. Instead they used less harmful HFC 134a. The auto-companies also agreed on the need to cut down the use of harmful coolants and reclaim and destroy them from vehicles at the end of their useful life.

[21] In Kyoto Protocol, countries were categorized into Annex I parties (industrialized countries, OECD members and Economies in Transition - EIT), Annex II parties (members of Annex I excluding EIT) and Non- Annex I parties (developing countries). The protocol offered three mechanisms namely, Clean Development Mechanisms (CDM), Emissions Trading and Joint Implementation (JI). In CDM, Annex I parties were to implement emission reduction projects like rural electrification using solar panels, installation of energy efficient boilers, afforestation and reforestation activities, etc., in non-Annex I countries in exchange for Certified Emission Reductions (CERs) which could be used to meet their individual Kyoto targets. In Emissions Trading, Annex I parties could acquire units from other Annex I parties towards meeting their emission targets. In JI, Annex I parties could implement projects like power generation using renewable resources that reduced emissions in other Annex I parties in return for Emission Reduction Units (ERUs) which could be used by Annex I parties towards meeting their emission targets. Forest management activities were also included in JI.

[22] Chicago Climate Exchange was the world's first multi-national and multi-sector market for reducing and trading GHG emissions.

3.4 Product Offerings

With increasing consumer awareness about the negative impact of automobile emissions, auto-manufacturers were readily going for technological improvements, thereby launching new products. These innovations were broadly classified under engine modifications and improved transmissions.

Engine modifications were aimed at reduction of pumping losses, reduction in engine friction and improved combustion and some examples included:

- Variable Valve Timing (VVT) or Variable Valve Lift and Timing (VVLT) – This was the generic term used for an automobile piston engine technology. The first functional system was developed by Fiat. Honda developed the Variable valve Timing and lift Electronic Control to improve the efficiency of internal combustion engines. Basically this innovation provided for a better fuel/air mix and improved combustion thereby reducing CO2 emissions.

- Cylinder Deactivation or Displacement on Demand – This technology, generally applicable for larger vehicles with V-6 and V-8 engines, provided for shutting down of one or more cylinders when the extra power was not needed.

- Engine downsizing combined with turbocharger or supercharger – This technology aimed at minimizing the loss of energy power thereby reducing CO_2 emissions.

Stoichiometric burn direct injection, variable compression ratio engines, and homogeneous charge compression ignition engines were other improvements likely to be popularized in the near future.

Improved transmissions enabled the engines to operate at optimal speed more frequently, thereby reducing mechanical losses associated with transmission operation. These included five or six speed automatic transmissions, Continuously Variable Transmissions (CVT) and automatic shift manual transmissions, whose adoption improved fuel economy by 4-8%.

Additional vehicle technologies like a sleeker design to reduce aerodynamic drag, use of a 42 volt electrical system to reduce the engine load, improvements in catalyst technology to reduce N_2O and CH4 emissions, use of alternative refrigerants an low rolling resistance tires, were also helping to reduce GHG emissions (Table 8).

Fuel cell technologies were another major breakthrough witnessed in the auto industry. A fuel cell vehicle utilized the electricity produced by the fuel cell to power motors. But unlike in battery vehicles where recharging was necessary, in fuel cell vehicles, no recharge was needed. These vehicles with onboard storage tanks could be filled at hydrogen filling stations just like the refueling done in gasoline vehicles. But zero-emission was experienced only when pure hydrogen was used as a fuel. When hydrocarbons were used instead, it resulted in emitting pollutants. GM's Hy-wire, DC F-cell passenger car, fuel cell buses (in Europe and Australia) and vans (Europe and US), Toyota FCHV, Volkswagen Bora HY.POWER were some examples in this sector.

Based on technological innovations, auto-manufacturers were offering a wide range of products for consumers. A shift in consumer preference in favor of fuel-effective light trucks in comparison to passenger cars was noticed from 2001 onwards in the US. Of late the demand was more for 'crossover' vehicles which combined the best features of passenger cars and SUVs. These were first offered in 1997 by the foreign players in the US market. Honda's CRV, Mercedes' M-Class, Subaru's Forester, and Toyota's RAV4 were some examples. This was soon followed by Ford Escape, Pontiac Vibe, DC PT Cruiser, Volvo Cross Country, and Subaru Baja.

The sales figures of 'crossover' vehicles posted significant growth. From a meager tally of 195,000 units in 2000, it had increased to 1.9 million units in 2004, constituting 12% of total passenger vehicle sales.

Table 8. Pollution-reducing Technologies

Engine Technologies	Vehicle models
Variable valve Timing and lift Electronic Control	Most Honda vehicles
Variable valve timing	Most Toyota vehicles, Ford F-150 (5.4 L Triton)
Cylinder deactivation	Honda Accord (V6),GM Vortec V8 engine family
Throttleless engine	BMW 3 series
Transmissions technologies	
Continuously variable transmission	Nissan Murano, Mini Cooper, Saturn Ion, Saturn Vue, Toyota Prius, Honda Civic hybrid, Honda Civic CNG
Six speed automatic transmissions	Jaguar S-Type and XK series
Dual clutch transmission	Audi TT 3.2 quattro
Hybrid Electric Vehicles	Honda Civic, Honda Insight, Toyota Prius, Toyota Camry Ford Escape

Source: "Greenhouse Gas Reduction and Off- the-shelf technology, http://www.ucsusa.org/clean_vehicles/cars_pickups_suvs/technologies-to-reduce-vehicle-greenhouse-gases.html

'Green vehicles' constituted another product range witnessing growing demand. These vehicles offered lower emissions and better fuel economy. GM's all-battery EV-1 and Honda's EV Plus were the initial offerings in this category, which appeared in the market in 1997. But even after concerted efforts only 1400 units could be sold in the next five years. Studies proved that consumers were ready for environment-friendly vehicles as long as they were comfortable with operating economy, comfort, performance, and price, especially in the light of government regulations like the CAFÉ standards. Alternative fuel vehicles, which came under the category of 'green vehicles,' also showed immense potential for future growth. As of 2005, more than 3 million alternative fuel vehicles were plying the road. The main challenge was in developing adequate infrastructure to provide alternative fuels such as bio-fuel, natural gas, and propane. VW GofTDi, Ford Taurua, Dodge Ram 1500 truck, Dodge Stratus, Chrysler Setring, GM Sierra Chevrolet Tahoe, GMC Yukon, Chevrolet Silverado, and Chevrolet Cavalier were some examples for vehicles plying on alternative fuels.

These market situations paved the way for hybrid vehicles (Appendix 3). Japan was the pioneer in developing a gas electric hybrid. The resulting product named Toyota Prius was launched in 1997 in Japan. While US auto-makers were focusing on hydrogen fuel cell engines, Japanese auto-makers prepared to enter the US market. Honda Insight was the first hybrid launched in the US. This was on December 1999 and was priced at US$ 19570. But due to small power backup the product failed to catch up in the market. Honda also launched a remodeled version of Honda Insight, namely Honda Civic in 2002. By 2003, nearly 2000 units of Honda Civic were being sold per month. In 2004, Honda launched the first hybrid with a V6 engine, viz, Accord sedan, and a fuel economy of 37 mpg in highway and 29 mpg in city. By December 2004, Honda hybrid sales jumped to a total of 74, 608 units.

Toyota also made significant gains from hybrid sales. In 2000, Toyota Prius, priced at US$ 19995 entered the US market. The product had a fuel economy of 55 mpg and recorded

sales totaling 20, 000 units in 2002. A higher version was launched in 2003 which sold 25, 000 units. In 2004, there was an increase of 119 percent in the sales figures (54, 000 units).

Ford and GM also entered the hybrid scenario by 2004, but had lost the head-start to Japanese auto-makers. DC on the meantime concentrated on clean diesel technology and came up with Dodge Ram pick up truck in 2004. Advanced engine and emission control strategies and use of ultra-low sulfur fuel contributed to making the diesel a clean fuel. Ford Mondeao TDCi, BMW 530d and 740d sedan, Liberty jeep, Mercedes E320 CDi, Volkswagen Passat TDi, AudiA8 TDi,Chevrolet Duramax, Ford Focus TDCi

3.5 Porter's Five Forces and SWOT Analysis

Porter's Five Forces

Globalization had indeed left its impact on the automobile industry. Now foreign auto dealers were facing lesser restrictions to operate in overseas markets. Michael E. Porter in his book "Techniques for analyzing industries and competitors" dealt with five competitive forces that shaped all industries. This helped to analyze the intensity of competition which had an impact on the profitability of an industry.

The US automobile industry was considered as a force to reckon with from the days of craft production and hence would serve as a standard use case to identify Porter's five forces. With low level of entry barriers, the Big was facing increasing competition from foreign players like Toyota and Honda.

The relationship among Porter's five forces in the US automobile industry, detailed below clearly proved its' competitive nature.

1. Threat of New Entrants – The existing loyalty to major brands, incentives for using a particular buyer, higher fixed costs, scarcity of resources, high costs of switching companies, and government regulations constituted the barriers to entry which in turn reduced the competition in an industry. The success of foreign car manufacturers like the Honda Motor Co. had disproved the general belief that the Big Three were invincible. The only factors expected to retard the growing significance of foreign auto dealers were the loyalty to American made vehicles and the after-sale services offered.

2. Power of Suppliers – The presence of very few suppliers of a particular product, and the absence of any substitutes for the product supplied reflected the pressure exerted by the supplier. Sometimes the product was extremely important to the auto-maker and the alternatives proved to be very costly. In such cases the suppliers were in a better position to dictate terms. A lot of suppliers depended on automakers to buy their products. But if the automaker decided to change suppliers it would badly affect the supplier's role in auto manufacturing.

3. Power of Buyers – Small number of buyers, purchases of large volumes, prevalence of alternative options, and price sensitive customers were some of the factors that determined the extent of influence of the buyers in any industry. American consumers were driven towards foreign cars mainly because most of the auto-makers sourced their key auto-parts from different suppliers. But this raised doubts on the reliability of the vehicle itself.

4. Availability of Substitutes – If substitutes were available offering similar services, the likelihood of buyers switching over to another competitor depended mainly on the cost. The cost of the automobiles along with their operating costs was driving customers to

look for alternative transportation options. The rising gasoline price was bound to influence the buyers.

5. Competitive Rivalry – The presence of many players of about the same size, little differentiation between competitors, and a very mature industry with very little growth were the features of a highly competitive industry. Higher the competition in the industry lower would be the profit margin. To remain ahead in competition, auto-makers were tempted to offer value added services to the customers incurring more costs. Easy-finance options and long term warranties were offered to lure the customers. But these measures cut into the profit margins.

Thus the US automobile industry in the face of global competition from foreign firms was offering better deals to cater to diverse needs of customers.

SWOT Analysis

An analysis of the fortunes of Ford, a global leader in the automotive industry based in Michigan, wielding significant influence since the inception of global automobile industry, would serve as a classic example to diagnose the strengths, weaknesses, opportunities and threats existing for auto-makers (Appendix 4).

Strengths

- Ford owned a vast array of brand names, which had world wide recognition and respect. Ford, Lincoln, Mercury, Mazda, Volvo, Jaguar, Land-Rover, Aston Martin were the famous vehicle brand names owned by the company. Ford Credit, Genuine Parts & Service and Motorcraft were its' automotive service brands.
- Huge size of the business operations allowed Ford to reap the benefits of economies of scale. As of 2005, Ford's distribution network spread over 200 markets across six continents, supported by an employee base totaling 300,000 and 108 plants worldwide.
- Business diversification initiatives of past decades helped Ford to focus on financing sector in addition to manufacturing, with the help of its subsidiaries. Most of the vehicles sold to dealers and distributors were financed by Ford Credit at wholesale rate. The diverse product line was another positive outcome of business diversification. As of 2005, Ford was the second biggest player in US with a total market share of 18.2%. In Europe, the market share stood at 10.8%.

Weakness

Ford's large size could pose serious impediment to its efforts to adjust to the dynamics of global automobile market. Unlike its Japanese counterparts, Ford had to ride on heavy incentives to boost sales of models, which failed to catch the attention of consumers. Financial constraints prevented Ford from channeling investments towards the manufacture of new models. Failure to control plant capacity also cut down the profit margin.

Opportunities

The opening up of Asian markets, wherein lied the potential for growth in commercial vehicle sales, offered a big opportunity to Ford in the near future. The big size and extended global reach, which some identified as a weakness, was helping Ford to become a major player in these markets. Meanwhile in the US, consumers in the higher income category were expected to spend more on high-end models more frequently. The growing trend in energy prices[23] was paving the way for a huge market for full and medium sized SUVs and hybrid vehicles with better fuel economy. Despite losing the first mover advantage to Japanese auto-makers, Ford was

[23] The gasoline prices in the US crossed $ 2.00 per gallon in 2005.

making headway in this growing market. And in order to leverage on its brand image, efforts were on to differentiate brand identities to the potential consumers. By this initiative, Ford was trying to cut down its incentives. To check capacity issues, Ford made plans to close 10 plants and 30,000 jobs by 2008. Its ultimate aim was to boost capacity utilization to 95% from the current level of 72%.

Threats

The main threat to Ford's market dominance came from Japanese auto-makers, particularly Toyota, whose products were of high quality. Ford was losing out customers, who went for higher quality vehicles from Japanese auto-makers, despite absence of incentives. The negative ratings given by most of the credit rating agencies in 2005 also demanded attention as the decision reflected concerns over Ford's cash flow and profitability, declining market share, excess industry capacity, industry pricing pressure and rising health care costs.

3.6 Future Outlook

Internet, telematics and other technological innovations were expected to serve as future drivers for global automobile industry. The new age of internet-savvy consumers configured the precise vehicle they wanted on-line. Such 'built to order' vehicles marked the era of mass customization. Technological innovations were likely to be brought in by the auto-suppliers who were handling the outsourcing deals from the auto-makers. The auto-makers themselves were going in for industry-wide electronic market for components to reduce their dependency on suppliers.

Telematics referred to the art of using information technology inside the vehicle. Sako, M reported that such equipments might include enhanced mode of personal communication (phone/fax, email), convenience facilities (travel and restaurant reservations, interactive shopping), safety sensors to ensure safe distance between adjacent vehicles, security aspects (stolen vehicle tracking), toll collection options and navigation (GPS locators with directions to destination).

The German automotive industry was in the forefront of adopting the new technical breakthroughs. Digital Audio Broadcasting, which offered continuous broadcasting at high speeds on long-distance journeys, was launched on a big scale with options for internet connections. The system helped to locate a driver's position every second to the nearest meter. Also it helped the driver by giving accurate information about obstacles on the roadway, traffic jams, uneven road surfaces, etc.

Hybrid vehicles and fuel cell technologies were regarded as the breakthrough innovations likely to alter the very structure of the industry in the days to come. The market was being driven by consumer sovereignty. Ford was producing hybrid SUVs to stem the falling demand for the non-hybrid versions whenever the gasoline prices went up. Here the wants of the consumers had a say in the product strategy adopted by the auto-maker. Consumers were not willing to pay high prices for the complimentary good (fuel). Instead they were ready to pay more for hybrid versions. So the producers were altering the product and reallocating their resources to launch the hybrid version.

Though the price of hybrid car was more than the normal car, the consumers could save on fuel expenses. The political machinery supported the market growth with attractive tax incentives. Generally, the US government provided a federal tax deduction of US$ 2,000 for the purchase of a hybrid vehicle and some states provided additional incentives or tax credits. This was mainly done to offset the disadvantages faced by the buyers of hybrid vehicles like high cost of repair, higher price (nearly US$ 3000 more than the conventional one), and lack of trained mechanics on the new engines. In 2004, 88000 units of hybrid vehicles were sold in the US,

which constituted about 0.5 percent of the total market. But studies conducted by J. D. Power and Associates had forecasted for a phenomenal increase in hybrid sales, which was expected to constitute 3% of the US market by 2010.

Hybrid market in the US was becoming highly competitive with auto-makers getting ready with new launches in both passenger car and SUV sections. Toyota entered the SUV market with the launch of Lexus RX330 and Toyota Highlander in April 2005. They were also serving as technology providers for other auto-makers like Nissan, Subaru and Ford. While GM's project to enter the hybrid market in SUVs suffered a set-back due to technological glitches, Ford was able to make a head start by licensing the required technology from Toyota. Ford's hybrid version of the Mercury Mariner SUV would be launched in 2007. GM was credited with bringing the first hybrid pick-up truck to the US market in 2005. This mild-hybrid version of Silverado at 18 mpg in city and 21 mpg in highway registered 10% improvement in fuel economy over the conventional model and was rated as the most fuel efficient full-sized truck in the US market. GM was collaborating with DC to develop a full-hybrid version by 2007. In 2006 GM was planning to launch the Saturn Vue SUV, a market segment where Ford had the first mover advantage among Big Three. Meanwhile, DC's diesel-hybrid version of the Dodge Ram pick-up truck was giving a 15% improvement in fuel economy over the conventional version.

The auto-makers were also focusing on innovative marketing campaigns to increase the consumer awareness among the customers about hybrid vehicles. In February 2006, Ford introduced a national marketing campaign along with Kermit the Frog, to increase consumer awareness of the benefits of the Escape Hybrid, world's first full hybrid-electric SUV, giving 36 miles per gallon on the city cycle (as per Environment Protection Agency's norms). The price tag was nearly US$ 28000. In March they introduced zero percent financing for up to 60 months. In April they launched a new hybrid tax hotline, to educate customers about the federal, state and local government tax incentives available to Ford hybrid customers. The customers could save up to US$ 6000 as tax relief on both the Ford Escape Hybrid and Mercury Mariner Hybrid. Ford Escape Hybrid was complying with the strict Super Ultra Low Emissions Vehicle and Advanced Technology Partial Zero Emissions Vehicle standards[24]. Ford Motor Company with more than 150 patents from technological innovations developed for its hybrid program was planning to increase its global hybrid production ten-fold to nearly 250000 units annually by 2010.

Fuel cell technologies were another revolutionary concept expected to change the entire landscape of the automobile industry. Backed with federal support, the technology was scheduled to become marketable by 2020. It was developed on similar lines of powering a space shuttle. In a fuel cell, the chemical reaction between hydrogen and oxygen produced electricity to run the motor. A joint initiative, namely the Partnership for a New Generation of Vehicles (PNGV) between the automobile industry players and the US Government was launched way back in 1994 for developing a five-passenger car, running on fuel cell technology with a fuel economy of 80 mpg. But it was replaced by another larger initiative with a project cost of US$ 500 million to develop 'FreedomCAR' (where CAR was an acronym for Co-operative Automotive Research) in five years. This was supplemented with another US$ 1.2 billion project on commercializing Hydrogen Fuel. Fuel cells were expected to surpass the 3:1 cost advantage realized in gasoline powered vehicles. Also, since the byproduct was only water vapor, fuel cells would result in zero emissions. Another advantage expected was a drastic reduction in the consumption of steel and cast iron as fuel cells had no moving parts.

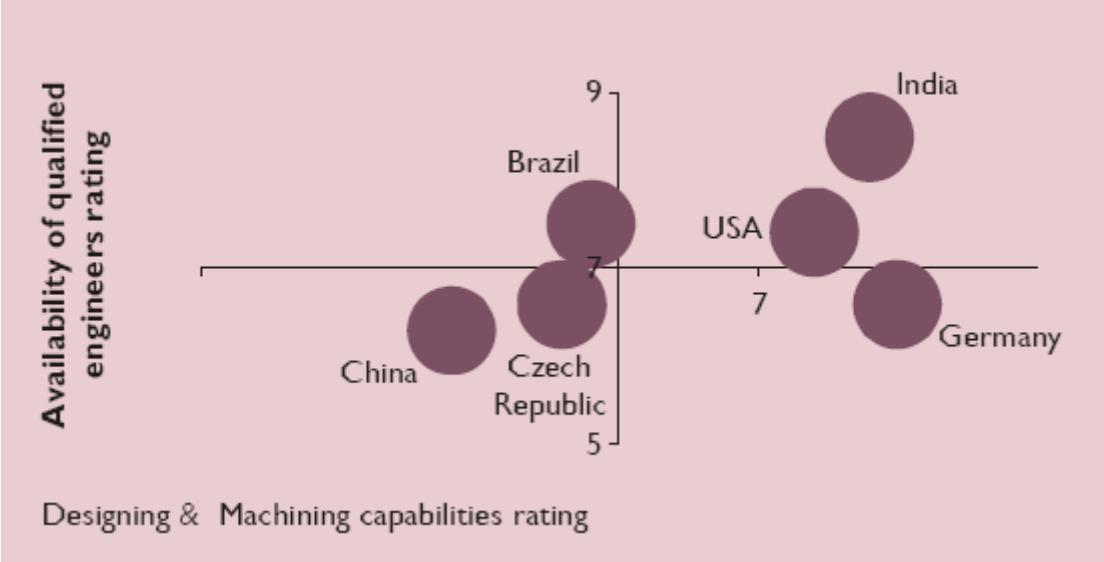
The concept of fuel cell vehicles were already in the demonstration stage both in Europe and Japan. Fuel-cell transit bus demonstration projects were being undertaken in several cities in the US like Chicago, Vancouver, California, etc. GM had plans to launch 40 vehicles by 2008. By 2010 GM was planning to launch a commercially viable fuel cell vehicle. The pertinent problems included limited range, extremely high costs, difficulties in starting in cold weather, and

[24] It was a full hybrid meaning that it automatically switched between pure electric power, pure gasoline engine power or combined operation to maximize efficiency and performance. The Mercury Mariner Hybrid was named "2006 Green Car of the Year" by Green Car Journal.

development of a hydrogen infrastructure. For targeting the latter, Florida and California were working with Chevron to start hydrogen refueling stations. GM was working with Shell to create an "East Cost Hydrogen Corridor," estimated to cost US$ 20 billion. As a beginning, refueling stations were already set up in Washington, D.C.

The good performance of Asian countries in the economy front heralded the emergence of a strong market demand. The future potential of India's automobile sector was mainly based on the growing demand and availability of skilled manpower with design and engineering abilities (Figure 16). SIAM estimated that from 2005 to 2010, global automotive vehicle manufacturers would likely invest nearly US$ 5.7 billion in the Indian market. Bosch, the leading player in Europe was investing in R&D through MICO, in the area of fuel injection equipment, ignition systems and electrical. GM started a technical center in Bangalore to focus on R&D. Ford started the Ford Information Technology Services India in Chennai to cater to the software requirements.

Figure 15. India's Competitiveness Compared to Other Countries

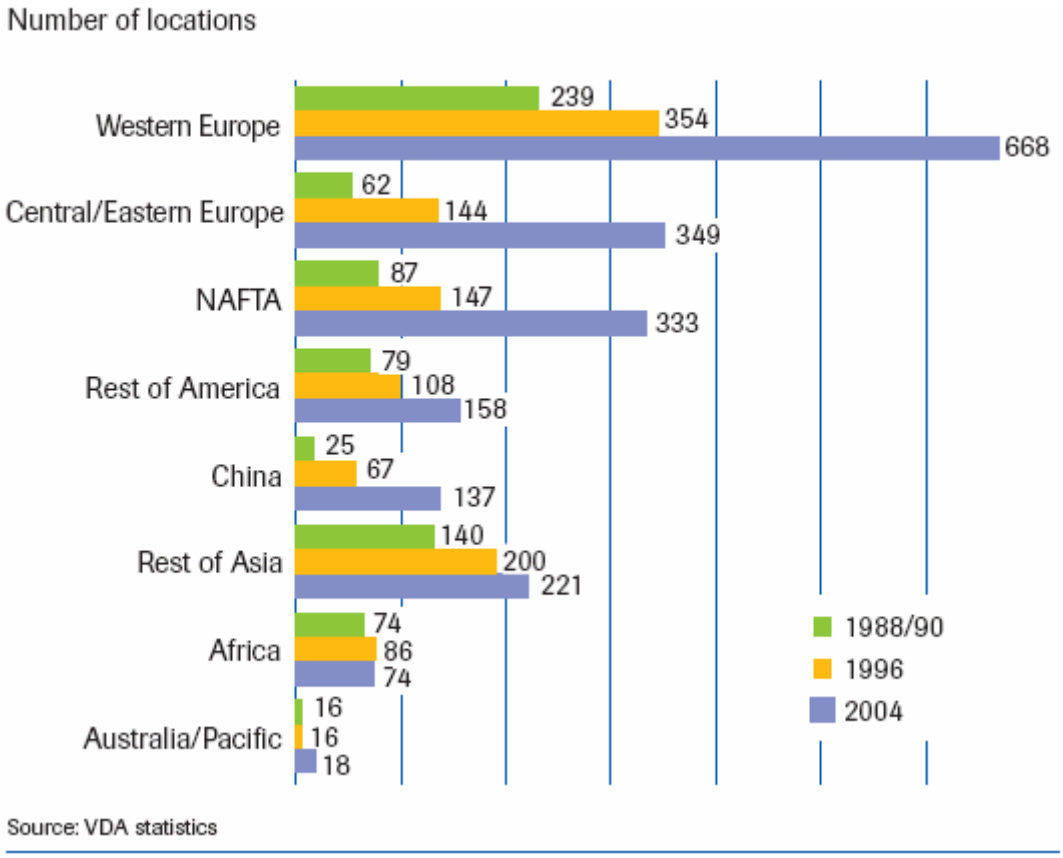


Source: IBEF, 2006.

Thus by the end of 2005, the global automobile industry had transformed itself into a highly competitive market. Initiatives to check product prices by way of collaboration with the auto-component manufacturers and innovations in vehicles with better fuel economy were fast becoming mandatory if one needed to stay ahead of competitors. All the major players acknowledged that fast depleting gasoline resources was a reality and were soon in the forefront of adopting a bold approach investing on fuel efficient technologies, even rising against political machinery. As quoted by William Clay Ford Jr, Chairman and Chief Executive Officer of Ford (2005), this approach went beyond anything they had done in the past.

4 Appendices

Appendix 1. International Locations of the German Automotive Industry



Appendix 2. General Principles of Emissions Trading

The general principle of how emission reduction trading works is as follows: If it can put together the financing, Company A can undertake a project/activity that creates real, verifiable and quantifiable emission reductions. Company B needs to make emission reductions to meet an emissions limit (or cap). One option that Company B has is to pay for making emission reductions at its own facility. Where this cost is exorbitant, Company B can offer to pay Company A to make emission reductions (where Company A can do so at much lower cost). Company A finds that it can recover the costs of its emission reduction project, thus being able to finance it. If it agrees to sell its emission reductions at a price that is higher than the cost of the project though still lower than the cost to Company B of implementing reduction measures itself, it can actually make a profit in making its real emission reductions. The air-shed emission reduction objective is achieved, but at a lower overall cost to the economy, and both businesses benefit. A full-scale emission reduction trading system would apply these principles in hundreds or thousands of transactions in real delivered emission reductions.

Source: "Emissions Trading Backgrounder," http://www.carheaven.ca/ON/about/emiss_trad.asp

Appendix 3. Hybrid Vehicles

Hybrids used two motors, namely, a small combustion engine with an electric motor and battery. The combined use of the two technologies helped to reduce fuel consumption and tailpipe emissions. The use of electric power permitted the use of a smaller combustion engine increasing the gas mileage and emitting fewer pollutants. A vehicle powered only by an electric motor provided limited driving range and required lengthy recharge time. Also its performance depended on battery strength. If vehicles were run only on internal combustion engines, only a very small percentage was utilized. By combining both electric power and gasoline, hybrid vehicles provided better fuel economy. A hybrid engine also operates more efficiently and produces less pollution than does combustion alone. Hybrids captured energy lost during braking and returned it to the battery, called 'regenerative braking.' In regenerative braking, on applying brakes, the electric motor became a generator and captured the energy that would be lost as heat through the breaks. It was transformed into usable electricity which recharged the batteries. This resulted in greater fuel economy.

Studies had proved that hybrids reduced smog pollution by more than 90% compared to the conventional vehicles. Hybrids also consumed significantly less fuel than vehicles powered by gasoline alone.

Source: "Hot hybrids," http://www.edmunds.com/advice/specialreports/articles/101677/article.html, "Hybrid-electric vehicles," http://www.ucsusa.org/clean_vehicles/cars_pickups_suvs/hybridelectric-vehicles.html

Appendix 4. Operating Highlights of Ford Motor Company

		2005		2004
Sales and Revenues				
Worldwide vehicle unit sales of cars and trucks by automotive business unit (in thousands)				
The Americas		3,779		3,915
Ford Europe and PAG		2,542		2,476
Ford Asia Pacific and Africa/Mazda		497		407
Total		6,818		6,798
Sales and revenues (in billions)				
Automotive	$	153.5	$	147.1
Financial Services		23.6		24.5
Total	$	177.1	$	171.6
Financial Results				
Income/(loss) before taxes (in billions)				
Automotive	$	(3.9)	$	(0.2)
Financial Services		5.9		5.0
Total	$	2.0	$	4.8
Net income (in billions)	$	2.0	$	3.5
Diluted net income per share of Common and Class B Stock	$	1.05	$	1.73
Cash and Spending				
Automotive capital expenditures				
Amount (in billions)	$	7.1	$	6.3
As a percentage of automotive sales		4.6%		4.3%
Automotive cash at year end (in billions)				
Cash, marketable and loaned securities and assets held in short-term VEBA trust (a)	$	25.1	$	23.6
Cash net of debt (b)		7.2		5.2
Shareholder Value				
Dividends per share	$	0.40	$	0.40
Total shareholder returns % (c)		(45)%		(6)%

Source: Ford Motor Company 2005 Annual Report.

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