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DISCUSSION PAPER

Automotive Industry Trends and Prospects for Investment in Developing Countries

Yannis Karmokolias

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The World Bank
Washington, D.C.

Manufactured in the United States of America
First printing August 1990

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ISSN: 1012-8069

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Library of Congress Cataloging-in-Publication Data

Karmokolias, Yannis. 1946–
Automotive industry trends and prospects for investment in developing countries / Yannis Karmokolias
p. cm.—(Discussion paper / International Finance Corporation, ISSN 1012-8069 ; no. 7
Includes bibliographical references.
ISBN 0-8213-1592-7
1. Automotive industry and trade—Developing countries.
I. International Finance Corporation. II. Title. III. Series: Discussion paper (International Finance Corporation) ; no. 7.
HD9710.D452K37 1990
338.4'76292'091724—dc20 90-38701
CIP

Summary

The automotive industry represents a significant portion of global economic activity with extensive upstream and downstream linkages to many diverse industries and sectors. For this reason, many developing countries that aim to develop rapidly through industrialization have regarded the automotive industry as the best way to achieve this objective. Given the importance of the industry and the continuing interest therein by many developing countries, this study reviews recent major changes in the industry worldwide and their impact on prospects for automotive investments in DCs.

The automotive industry has been changing at a very rapid pace during recent years. It has become truly international with respect to production, marketing, technology transfer and widespread intercompany collaboration. The rapidly growing use of electronics and other innovations, particularly in passenger cars, have resulted in radically different products while a much greater number of models are being introduced at an accelerated pace. Production and management methods have been revolutionized through computer-aided design, automation and assembly line flexibility, and just-in-time inventory methods. Finally, there has been a profound change in the relationship between vehicle and component manufacturers. The latter have assumed greater responsibility for design and production of component systems, while striving to improve quality standards and lower costs.

During the next decade, keener competition among major producers and the effort to reduce costs will present opportunities for developing countries mainly in component manufacturing. However, the ever-increasing sophistication of management, production, and delivery systems will require manufacturers in developing countries to maintain high quality and reliable delivery if they are to be competitive in the international market. Production of heavy commercial vehicles may also be suitable for some developing countries because labor intensive production processes and high transport costs would give them a comparative advantage in servicing their respective local and regional markets over distant OECD production sites. In view of the promising prospects for component and commercial vehicle manufacturing in developing countries the IFC intends to follow up on this study with more detailed analyses of investment opportunities in automotive components and commercial vehicles.

Acknowledgments

This study is based in part on:

- Research funded by the Swedish Agency for International, Technical and Economic Cooperation on the European automotive industry's involvement in developing countries.

- Interviews with officials of the following companies and institutions:

Europe: Fiat, Peugeot/Citroen, Renault, Saab-Scania AB, Teocar ABEE, Volkswagen A.G., and Volvo AB.

India: Anand Group, Ashok Leyland Ltd., Automotive Component Manufacturers' Association, Confederation of Engineering Industry, DCM Toyota Ltd., Goetze (India) Ltd., Hero Honda Motors Ltd., Invel Transmissions Ltd., Maruti Udyog Ltd.

Indonesia: Chase Manhattan Bank, Citibank, Imora Motor, Ministry of Industry, Pt. Astra International, Pt. Garmak Motor, Pt. Indomobil Utama, Pt. Indonesian Republic Motor Co., and Pt. Prospect Motor.

Japan: Akebono Brake Industry Co., Confederation of Japan Automobile Workers' Union, Hitotsubashi University, Hosei University, Institute of Developing Economies, Isuzu Motors, Japan Automobile Manufacturers' Association, Japan Auto Parts Industries Association, Keio Business School, Mazda Motors Corp., Mitsubishi Motors Co., Osaka City University, Toyota Motor Corp., and the University of Tokyo.

Philippines: Automotive Parts Producers Association, Board of Investments, Citytrust Banking Corp., Francisco Motors Corp., Pilipinas Nissan, Philippine Automotive Federation, Toyota Motors Philippines Corp., Truck Manufacturers' Association, and the University of the Philippines.

USA: Bankers' Trust, Ford Motor Co., General Motors Corp., Merrill Lynch, and the MIT Center for Technology.

Their significant contributions to this study are greatly appreciated.

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Abbreviations

CIF	Cost-Insurance-Freight
ckd	Completely knocked down (Vehicles for assembly)
DCs	Developing Countries
EEC	European Economic Community
HVC	Heavy Commercial Vehicles
JIT	Just-In-Time Inventory System
LCV	Light Commercial Vehicles (Pickup trucks and vans)
NICs	Newly Industrializing Countries
OECD	Organization for Economic Cooperation and Development
skd	Semi-Knocked Down
SPC	Statistical Process Control

1. INTRODUCTION

The automotive industry represents a significant portion of global economic activity with extensive upstream and downstream linkages to many diverse industries and sectors. Despite its size, it is concentrated in only a few countries, and creates a substantial impact on their respective economies. For example, in the United States, the industry accounts for an estimated 5 percent of GNP and 17 percent of industrial employment.[1] In Brazil, where the industry participates only modestly in manufacturing production (6 percent of the total) and industrial employment (3 percent of the total), it is considered to be most important to economic development because of its strong backward linkages and its large share in the total consumption of selected inputs.[2] For example, it absorbs 76 percent of aluminum alloys produced in the country, 43 percent of zinc alloys, 36 percent of cast iron, and 18 percent of uncoated flat-rolled iron and steel products. In addition, there are strong forward linkages in the marketing, shipping, insurance, and service sectors.

Because of the industry's widespread and far-reaching linkages many Developing Country (DC) governments that aim to develop rapidly through industrialization have regarded the automotive industry as the best way to achieve this objective. For this reason, these governments have given special support to the private sector and, in some cases, have substituted for it, in an effort to develop local vehicle assembly or manufacturing capabilities. Experience has demonstrated, however, that few countries can support an economically viable automotive industry and, fewer still, automobile manufacturing. Given the importance of the industry and the continuing interest therein by many DCs, this study reviews recent major changes in the automotive industry and their impact on investment opportunities for DC producers.

Not all aspects of the automobile sector are covered in this review. The automotive industry is extremely diversified. Major product categories include passenger cars, buses, trucks, utility vehicles, two-wheeler and three-wheeler vehicles, and components. The characteristics of each of these products vary with respect to demand, production processes and organization, technological requirements, marketing, and distribution. This paper presents findings of an initial survey covering four-wheeled passenger and commercial vehicles (CVs) and components. A key finding of this survey is that although passenger vehicle production may be economically and financially viable in a few DCs, a relatively greater number of DCs has a comparative advantage in the production of components and CVs. These two product categories, will, therefore, be covered in greater detail in subsequent studies to be carried out by the IFC.

The automotive industry in the developing world offers numerous important contrasts to its counterpart in the industrialized world. DC automotive production is typically small volume and key operations such as research and design are virtually nonexistent. To compensate for this, most DC manufacturers are linked with foreign companies in either a subsidiary, joint venture, or licensing arrangement. Also, in many DCs government policies with respect to this industry are characterized by high levels of protection and substantial local content requirements. Although in many instances these policies have stimulated local manufacture of vehicles and components, they have at times resulted in local industries that are, by and large, inefficient. In a few DCs, however, automobile production has reached a level of efficiency that enables their products to compete successfully in international markets, while a larger and growing number of DCs efficiently produce parts and accessories ranging from the technologically simple to the rather complex and sophisticated.

1. *New York Times*, May 28, 1989.
2. Fischer, B., Herken-Kraver, J.C., Lücke, M., and Nunnenkamp, P. *Capital Intensive Industries in Newly Industrializing Countries; The Case of the Brazilian Automobile and Steel Industries, 1988.*

2. THE MARKET FOR AUTOMOBILES

Demand

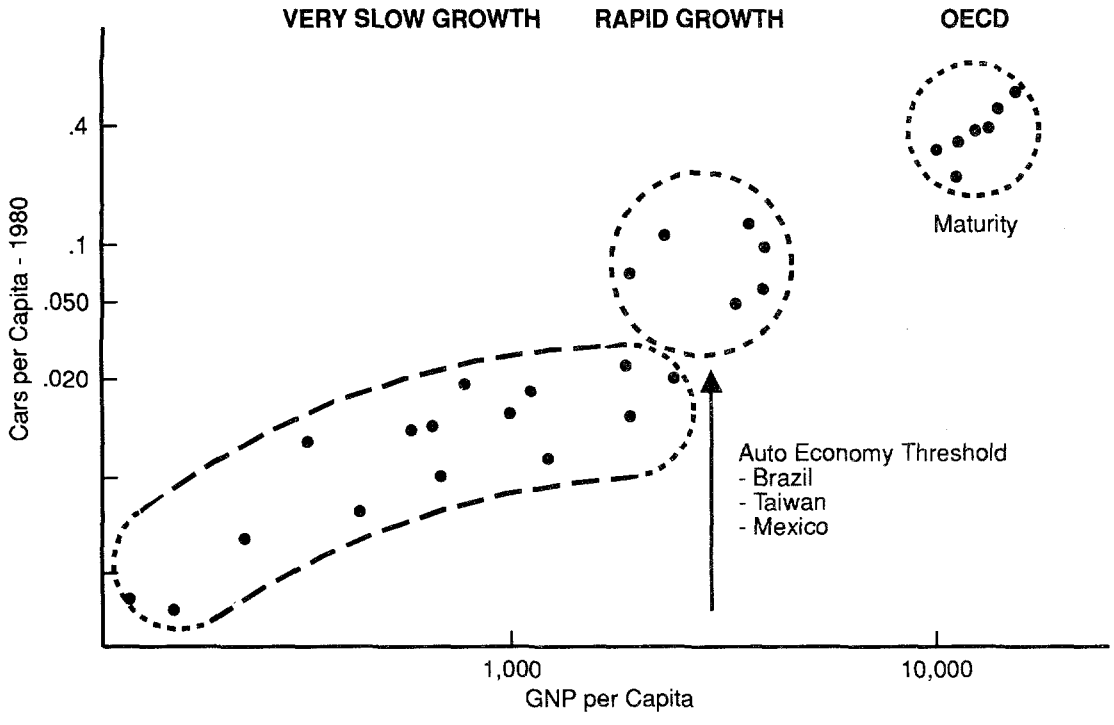
The global demand for automobiles has been rising steadily since World War II except for brief downturn periods of marked economic decline and the aftershock of the two oil crises. It is becoming increasingly evident that the industry is now at the beginning of a slow growth period, although regional performance is, so far, uneven. Sales in DCs have generally remained unchanged except in South America where they have declined. In Japan and in Western Europe, sales have not dropped but many European producers believe that a slowdown is imminent. In the United States, lower demand has already resulted in production cutbacks and labor force reduction. Most industry analysts predict that it could take three to four years before consistent demand growth is

Table 1: Car Ownership in Relation to GNP for Selected Countries, 1965 and 1975

Regions	GNP per capita		Cars per thousand persons		Percentage change 1965–75	
	1965	1975	1965	1975	GNP per Capita	Cars per thousand persons
	US$		Units			
Africa						
Benin	100	170	3.0	4.7	70	57
Cameroon	130	310	3.0	7.2	138	140
Kenya	100	230	7.4	7.1	130	(4)
Malawi	60	120	1.6	1.9	100	19
Nigeria	100	430	1.0	2.1	330	110
Senegal	200	340	7.2	9.3	70	29
Zaire	180	300	2.1	3.7	67	76
Asia						
India	100	160	0.9	1.2	60	33
Indonesia	30	210	1.6	2.9	600	81
Korea	130	580	0.6	3.0	346	400
Malaysia	320	820	16.7	33.1	156	98
Pakistan	110	140	2.3	2.9	27	26
Philippines	180	360	4.3	8.9	100	107
Thailand	130	360	2.2	6.4	177	191
Europe						
Greece	700	2,370	12.2	48.5	239	298
Portugal	410	1,480	34.9	99.4	261	185
Yugoslavia	870	1,380	9.7	71.9	59	641
Latin America						
Argentina	1,020	1,810	41.0	79.1	77	93
Bolivia	180	360	2.6	6.0	100	131
Brazil	270	1,070	13.5	44.7	296	231
Chile	630	870	11.4	25.1	38	120
Colombia	320	560	6.7	16.0	75	139
Honduras	210	350	4.5	5.9	67	31
Mexico	470	1,360	17.1	38.8	189	127
North Africa and Middle East						
Egypt	170	310	3.3	5.8	82	76
Iran	250	1,320	5.6	17.9	428	220
Iraq	290	1,010	6.8	10.5	248	54
Morocco	220	500	12.2	18.5	127	52
Turkey	270	830	2.8	9.6	207	243

Source: World Bank. *Social Indicators of Development 1988.*

Figure 1: DEMAND FOR NEW CARS AS A FUNCTION OF GNP
Relationship of GNP to Car Ownership



Source: Booz, Allen and Hamilton, 1989

restored and the existing worldwide excess capacity is eliminated. Although some automotive companies and those dependent on the industry for their sales will suffer during this period, and a few may not survive intact, the medium- to long-term outlook appears optimistic. As will be discussed later, both the pessimistic short-term outlook and the optimistic longer-term outlook have important implications for DCs.

Income and price are the major variables determining the demand for automobiles. Income distribution is also important as the existence of a large middle class is necessary for big volume sales. Other important determinants are availability of infrastructure, credit, and government policies, such as taxes or import quotas, that affect either the price or the supply of vehicles. As shown in Table 1, there is a positive correlation between GNP per capita and car ownership for most countries. However, in several cases, the rate of growth of GNP per capita was higher than that of car ownership, usually because of taxation and other restrictions prevalent in many DCs. In most countries, the two rates were rather close (Table 1).

Most of the global vehicle fleet is concentrated in the wealthier regions of the world—that is, North America, Western Europe, and Japan (Figure 1). In 1988, North America had 37 percent of the world's registered vehicles, Western Europe had 28 percent, and Japan had 10 percent—a combined total of 75 percent. In terms of growth, however, vehicle registration between 1981 and 1988 increased fastest in Asia, by 46 percent, followed by Central America, by 43 percent, and by North Africa and the Middle East, by 47 percent. In South America, it increased less rapidly during the same period, by 17 percent, because of their strained economies. Registration growth was relatively strong in Eastern Europe, by 34 percent, while in Western Europe it increased by 25 percent, mostly in the Mediterranean countries. In sub-Saharan Africa growth reached 22 percent on the strength of increases in South Africa with 28 percent, and Nigeria with 41 percent. Registrations in both these countries declined substantially in recent years because of their deteriorating economies. In North America, a mature market, registrations increased by only 13 percent. The total number of registered vehicles reached 519 million worldwide in 1988, compared with 417 million in 1981, a 25 percent increase (Table 2). In relation to population, the global vehicle registration was approximately one vehicle per ten persons. Regional distribution was quite uneven, however, with one vehicle for every three persons in Organization for Economic Cooperation and Development (OECD) countries, compared with one vehicle for every fifty persons in the rest of the world.

With respect to future developments, forecasts for the next decade indicate that demand will increase slowly in the OECD countries. Most markets are almost saturated,

and population growth is very small. With the exception of southern Europe, demand in most OECD countries will consist primarily of vehicle replacement (Table 3). The total number of vehicles projected to be sold in the OECD countries in the year 2000 is about three times greater than in DCs, 45 million compared with 16 million. Industry analysts, however, project much faster demand growth in DCs and Eastern Europe than in the OECD—220 percent, 133 percent and 10 percent respectively. In terms of value, sales in the DCs would be substantially lower as a smaller percentage would consist of upscale models compared with the OECD countries.

Table 2: Automobile Registrations by Region, 1981 and 1988 (thousands)

Regions	1981	1988	Percentage change 1981 to 1988
North America			
Canada	13,384	15,340	14.6
United States	155,890	179,045	14.9
Subtotal	169,274	194,385	14.8
Central America & Caribbean			
Mexico	5,655	7,786	37.7
Other	2,745	4,235	54.3
Subtotal	8,400	12,021	43.1
South America			
Argentina	4,192	5,542	25.8
Brazil	10,291	11,937	16.0
Venezuela	2,123	2,159	1.7
Other	2,664	2,851	7.0
Subtotal	19,270	22,490	16.7
North Africa & Middle East			
Algeria	800	1,205	50.6
Egypt	556	672	20.9
Iran	1,485	2,108	41.9
Iraq	356	521	46.0
Turkey	1,135	1,812	59.7
Other	5,427	8,487	56.4
Subtotal	9,759	13,599	39.3
Sub-Saharan Africa			
Kenya	237	271	14.2
Nigeria	981	1,379	40.6
South Africa	3,466	4,433	27.9
Other	2,345	2,512	7.1
Subtotal	7,030	8,595	22.3
Eastern Europe	30,627	41,140	34.3
South Pacific	9,270	11,333	22.3
Western Europe	116,609	145,527	24.8
Asia			
China	930	4,123	343.3
India	1,518	2,883	89.9
Indonesia	1,294	2,005	55.0
Japan	37,856	49,902	31.8
Korea	519	1,611	210.8
Taiwan, China	482	1,728	204.6
Thailand	881	1,326	50.5
Subtotal	43,479	63,578	46.3
World Total	416,817	518,964	24.5

Source: Automobile International. *World Automotive Market.* 1983, 1989.

Table 3: Demand for Automobiles by Region, 1988 and 2000
(millions of vehicles)

Regions	1988 Cars	1988 Commercial	1988 Total	2000 Cars	2000 Commercial	2000 Total	Percentage change 1988–2000 (Total)
OECD Countries	30	11	41	34	12	45	12
Eastern Europe	2	1	3	4	3	7	133
DCs	3	2	5	11	5	16	220
Total	35	14	49	49	20	69	41

Source: Consultants for Trade and Industry. *European Industry's Investment Outlook in LDCs*, June 1989.

Among the most promising DCs are the Asian newly industrializing countries (NICs), which are expected to sustain the favorable economic growth and rising incomes achieved during recent years. Eastern Europe and the USSR have substantial unfulfilled demand that may be realized if economic growth accelerates and recently instituted policies favoring liberalization and greater availability of consumer goods are not derailed. The larger Latin American countries have been expected, for some time, to be a major growth area for automobile sales. These expectations have not materialized and the outlook regarding economic growth during the next few years is not optimistic. Another group consists of countries with large populations but limited purchasing power—such as, China, India, Indonesia, Pakistan, Turkey, the Arab Republic of Egypt, Iran, and Nigeria. Given their large populations and low vehicle registration even a small increase in purchasing power could result in substantially higher automobile sales. Most of the other countries in the Middle East and Africa do not represent significant market potential in the foreseeable future.

Supply

Global automobile production has increased from about 28 million in 1970 to about 50 million in 1988. Until the late 1960s automobile production was concentrated in North America and Western Europe, but since then other regions have developed into major producers (Figure 2).

The most spectacular production increases have taken place in the Far East where Japan and the

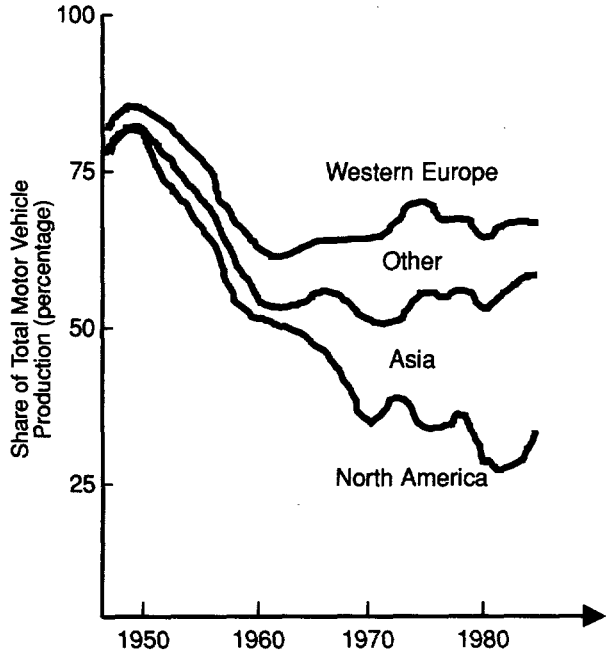
Table 4: Automobile Production[a], 1970–1988
(millions)

	1970 volume	1970 percentage of total	1980 volume	1980 percentage of total	1988 volume	1988 percentage of total
W. Europe	12.4	43	12.9	33	16.0	32
E. Europe	NA	-	2.5	7	3.2	6
N. America[b]	9.5	33	9.4	24	13.2	26
Asia[c]	0.2	1	0.3	1	1.5	3
Japan	5.3	19	11.0	28	12.7	25
Korea	NA	-	0.1	d	1.1	2
Australia/ New Zealand	NA	-	NA	-	0.6	1
L. America	0.9	3	2.2	6	1.8	4
Africa	0.3		0.4	1	0.4	1
Total	28.6	100	38.8	100	49.7	100

a. Passenger and commercial vehicles
b. United States and Canada
c. Except Japan and Korea
d. Less than 1 percent

Source: Automobile International. *World Automotive Market*, 1971, 1981, 1989; and *Financial Times*, January 23, 1989.

Figure 2: VEHICLE PRODUCTION SHARE BY REGION



Source: Booz, Allen and Hamilton, 1989

Republic of Korea increased their respective shares of world production between 1970 and 1988 from 19 to 25 percent and from less than 0.1 to 2 percent, respectively. Other Asian countries also increased production during this period, from 0.2 to 1.5 million vehicles corresponding to 1 percent and 3 percent of global production, respectively. Western Europe's share declined significantly from 43 to 32 percent and North America's (primarily the United States) dropped from 33 to 26 percent. Other regions experienced little change, although it is important to note that between 1980 and 1988 Latin America's share declined from 6 to 4 percent, a reflection of the region's economic difficulties (Table 4).

Car manufacturing is a highly complex undertaking. It requires significant financial, technical, managerial, and organizational resources and expertise. It also needs large production and sales volume if payback is to be achieved within the life of a particular design. As will be discussed in the following paragraphs, the combined requirements for large investments, advanced technical and organizational levels, and large-volume marketing techniques do not allow the majority of DCs a place on the car manufacturing industry map. CV manufacturing is different, in some important respects, than car manufacturing: Production volumes are much lower so labor content per vehicle is higher; design changes and subsequent retooling occur less frequently; and the transport cost of bulky bus and heavy-truck bodies is higher than for cars. These factors render production of heavy commercial vehicles (HCVs) more suitable for DCs than car production.

The initial investment required for setting up a car manufacturing facility is substantial. It can range from US$1.5 billion for development, engineering, and tooling for a new passenger car in Europe, to US$150 million for a 35,000 car per year for the assembly of completely knocked down (ckd) cars and light commercial vehicles (LCVs) in China. The high initial investment cost and the need for frequent additional reinvestments to remain competitive make large-scale production essential. Traditionally, a volume of 250,000 cars per year, integrated with engine manufacturing, has been considered as the minimum economic size of a car manufacturing plant. The importance of scale is illustrated by the total unit cost of a small car produced at 100,000 units per year, which is estimated to be 80 percent greater than if the same car is produced at a volume of 400,000 units per year.[3] Because of this difference in costs and the need to produce several models to satisfy different market segments, most major automobile companies have been trying to develop management and production processes to make car manufacturing profitable at lower volumes. These efforts have achieved a certain measure of success as recent developments in product design and organization of production have enabled some companies to produce different models with minimum retooling. Already there are some highly efficient Japanese plants operating profitably at volumes of 100,000 to 150,000 cars per year. This development may increase opportunities for investments in some DCs that are now constrained by the small market size.

The minimum economic size for car assembly operations is not so well defined. It is indicative, however, that an assembler with a 25,000 car per year production in Southeast Asia and another with a 16,000 car per year production in southern Europe both believe that they cannot remain competitive in the long run unless they can increase their production volumes to at least 40,000 cars per year to achieve lower unit costs. IFC's experience has shown that minimum volumes can be much lower for CVs. For example, HCV plants in Brazil and Turkey and LCV plants in India and Indonesia with annual capacities of about 6,000 and 30,000 vehicles, respectively, can be operated profitably.

Automotive Production in Developing Countries

DC production of automobiles started during the 1950s in the larger Latin American countries and was followed shortly afterward with production in India and the Arab Republic of Egypt. Two major characteristics of DC automobile production at that time were its import

3. Consultants for Trade and Industry. *European Auto Industry's Investment Outlook in LDCs*, June 1989.

substitution orientation and government ownership, often in partnership with multinational firms who provided technological expertise and capital goods. As other DCs in Asia and Africa entered into production, these characteristics remained largely unchanged until the first oil crisis of the early 1970s.

The oil crisis brought about a sharp increase in the demand for fuel-efficient compact cars, particularly in North America, which opened the door for massive imports from Japan. The success of the Japanese producers in exporting to the U.S. market prodded some DC automotive producers and their governments, as well as multinational firms, to attempt to use DC production sites as cheaper sources for exporting to developed country markets. A parallel development has been the economic growth of NICs, which fueled domestic demand and prompted the development of indigenous automobile production for both local sales and exports. But no DC has yet managed to replicate the success of Japan and most of them have not been able to achieve large-scale production nor make substantial inroads into export markets, with the exception of Korea and, to a lesser extent, Brazil.

At present, about twenty-five DCs produce automobiles, manufactured or assembled, but only a handful have achieved a sizable output. In 1988 six among them—Korea, Brazil, China, Mexico, India, and Taiwan, China—accounted for 69 percent of all DC vehicle production, or about 3.3 million vehicles from a total of 4.7 million (excluding Eastern Europe). Only four of these, Korea, Brazil, Mexico, and Taiwan, China had a national car output, for that year, exceeding 200,000 units, which

Table 5: Automobile Production in Developing Economies, 1980 and 1988[a]

	1980		1988	
	All vehicles	Passenger car share (percentage)	All vehicles	Passenger car share (percentage)
Latin America				
Argentina	281,669	78	164,160	83
Brazil	1,165,207	84	1,068,754	73
Chile	0	-	10,468 [b]	56
Colombia	42,415	76	79,518	77
Mexico	490,006	62	338,020	62
Peru	18,699 [b]	57	6,938 [b]	34
Venezuela	155,087	75	113,415	60
Asia				
China	222,288	2	455,000	4
India	113,326	27	312,487	51
Indonesia	212,674	13	162,630 [c]	21
Korea	123,135	46	1,083,655	80
Malaysia	100,879	81	97,930	76
Pakistan	NA	-	32,878 [c]	49
Philippines	55,574	54	17,456	63
Taiwan, China	NA	-	280,834	79
Thailand	NA	-	101,614 [c]	28
Turkey	50,845	62	149,675	81
Africa				
Egypt	NA	-	23,455 [c]	82
Kenya	NA	-	10,758 [c]	17
Morocco	NA	-	16,596 [c]	73
Nigeria	NA	-	42,650 [c]	72
Europe				
Portugal	103,854	44	136,524	52

a. Excludes Eastern Europe.
b. Minimal local content.
c. Data for 1987.

Source:Automobile International. *World Automotive Market.* 1981, 1989; and MVMA. *Motor Vehicle: Facts and Figures.* 1988, 1989.

is the traditionally accepted optimal size for a single manufacturing plant. Clearly, most DC producers are below the minimum size for achieving the economies of scale necessary to be internationally competitive in car manufacturing but some, particularly China, Thailand, Indonesia, India, and Portugal produce significant numbers of CVs (Table 5).

DC vehicle production, on aggregate, is characterized by a larger proportion of CVs (39 percent in 1988), compared with that in OECD countries (27 percent in 1988). Product mix varies significantly among different countries. Korea, Malaysia, Turkey and Taiwan, China, produced mostly cars, whereas CVs predominated in China, Indonesia and Thailand, and, to a lesser extent, India. In most Latin American countries cars accounted for at least 60 percent of their respective national outputs. Although investment costs can be amortized more rapidly through mass production of cars than through low-volume production of CVs the latter is often more suitable for DCs because: CV production is more labor intensive; design changes less frequently and, therefore, design and retooling costs are significantly lower, over time, than for cars; and the high cost of transporting bulky truck and bus bodies favors local assembly (often with imported tractors). At the same time, export prospects for CVs from DCs to the OECD countries are limited compared to cars because of high transport cost and domination of most major international markets by OECD producers. LCVs, however, can be competitively manufactured in DCs for both domestic and export markets because their production is more labor intensive compared to cars and they are less costly to transport than HCVs. Korea, Indonesia and to a lesser extent Thailand have been able to sell LCVs both locally and in foreign markets.

Table 6: Foreign Ownership of Automotive Companies in Selected Developing Economies, 1987 (No. of companies)

	Percentage of equity participation			
	0–25	26–50	51–75	76–100
Argentina	1	1	2	3
Brazil	2	1	1	5
China	-	3	-	-
Colombia	1	1	-	1
India	4	3	-	-
Indonesia	1	3	-	-
Korea	3	1	-	-
Malaysia	1	4	-	-
Mexico	1	2	-	5
Taiwan, China	3	1	1	-
Thailand	1	1	4	-
Venezuela	1	-	-	3

Source: O'Brien, Peter, *The Automotive Industry in the Developing Countries: Risks and Opportunities in the 1990s.* The Economist Intelligence Unit, London, 1989.

Ownership Patterns and International Cooperation

Multinational companies have a very strong presence in DC automotive production. Foreign equity participation is very prominent in Latin America, often reaching 100 percent, particularly by U.S. and European firms. With respect to individual companies, Ford, General Motors (GM), Volkswagen (VW) and Fiat have large holdings in Latin America, but among the Japanese only Nissan, in Mexico, has a major presence. In Asia ownership is locally controlled and in only a few cases foreign equity participation exceeds 51 percent (Table 6). Japanese companies are very active in Asian DCs where almost all Japanese firms have equity holdings. Toyota, Mitsubishi, and Mazda are the most active, followed by Suzuki, which recently increased its participation in India, Indonesia, and Pakistan. European companies do not have a large ownership role in Asia.

In addition to joint ventures, cooperation between DC and OECD country firms takes place through a multitude of arrangements including licensing, technical agreements, sub-contracting, cooperative production, and management contracts. This is because most DCs do not have the capability with respect to design or technological innovation necessary for competitive products. Of a sample of 18 IFC-funded automotive projects (excluding tractors and two-wheel vehicles) there have been fifteen joint ventures, three technical cooperation agreements and five combinations of both joint venture and technical cooperation agreements. It would be difficult to assess, except on a case by case basis, which arrangement is best as issues relating to control, independence, marketing restrictions, management philosophy, transfer of technology and of management practices, fairness of fees and royalties, transfer prices, and other factors vary among projects.

Prospects for DC Producers

The global excess capacity forecast for the next few years would impact export-oriented car producers more than those who market within their protected domestic markets. The latter would not be affected significantly unless they plan to start exporting, in which case they would face difficulties. When automobile production started in the DCs as an import substitution measure, local markets were the primary focus. Given their small size and the vulnerability of local economies to internal and external pressures, underutilization of capacity was a common occurrence. As the marketing focus for some

DC producers shifted to the export markets, these markets, rather than the domestic ones, became the determining factor of capacity utilization. Current DC exporters would be affected by global conditions as much as, if not more than, by the strategies of the multinationals involved. Specifically, DCs that are chosen by multinationals as cheaper sources of exports could benefit. Mexico as a supplier to the United States is an example. More recently, VW has announced plans to produce cars in East Germany, in cooperation with Trabant, for both Eastern and Western Europe, while a similar strategy is reportedly being followed by Suzuki in Hungary and Fiat in Poland. In general, a few DC vehicle producers may benefit during the next decade but which ones is open to discussion.

3. TRADE

Traditionally, the vast majority of vehicles produced have been sold within their respective domestic markets. A change occurred with the boom of Japanese exports to the United States, which started the practice of large volume production specifically for export. Most automotive trade has taken place within OECD, but DC-OECD trade, although smaller, is on the rise. In 1987, OECD automotive exports to DCs amounted to US$21.3 billion, of which cars and components amounted to about US$8 billion each. Japan was the leading exporter with about US$8.5 billion, of which US$3billion was earned from sales of cars and another US$3 billion from components. By comparison, U.S. exports to DCs totaled US$3.5 billion, mostly from the sale of components, which amounted to US$2.6 billion. Although DC imports have been rising in terms of value, their percentage of total OECD exports has declined from 22 percent in 1982 to 9 percent in 1987. The largest decline occurred in Asia as a result of the growing local production in Asian NICs and other countries.

Automobile products imported by DCs cost significantly more at the retail level than in the OECD countries. This cost is mainly attributed to significant import duties and taxes. Distribution costs are often higher for DC imports because individual countries import relatively small quantities resulting in diseconomies of scale in distribution and marketing.

Table 7: Proportion of Traded Vehicles for Selected DC Producers, 1987

	Exports as percentage of total production	Imports as percentage of total sales
Argentina	1	1
Brazil	30	1
Colombia	1	8
China	1	1
India	1	1
Indonesia	1	1
Korea	53	1
Malaysia	1	11
Mexico	41	1
Taiwan, China	1	16
Thailand	1	1
Venezuela	1	1

Source: O'Brien, Peter, *The Automotive Industry in the Developing Countries: Risks and Opportunities in the 1990s.* The Economist Intelligence Unit, London, 1989.

The Role of Developing Economies

Available data indicate that DC automotive exports worldwide amounted to about US$8 billion in 1987, of which about US$5.5 billion reflected sales of vehicles—mostly subcompact passenger cars and LCVs—and the remaining US$2.5 billion sales of components.[4] DC vehicle exports are highly concentrated with respect to origin and destination. Only three DCs—Korea, Brazil, and Mexico—have managed to export sizable volumes—mostly to the United States—with export sales in 1987 of US$3 billion, US$1.5 billion, and US$1.5 billion, respectively, which accounted for over 90 percent of all DC vehicle exports. The lack of diversification into several markets is dangerous because if the U.S. market contracts, as is now the case, it would be difficult for these exporters to develop alternative marketing systems in the short run. Other DCs have had minimal involvement in automobile trade (Table 7). Of these three, only Korea has locally owned automobile companies, although with minority ownership or collaboration agreements with foreign firms, while Brazilian and Mexican producers are largely owned and controlled by multinationals. This is particularly significant for DCs because, in almost all cases, the extent to which a particular production site may be used as an export base depends not only on its international competitiveness but also on how it fits the strategy of its respective multinational owner or partner.

Following the success of Japan, many DCs hoped that they could repeat its performance in exporting to the OECD countries and particularly to the United States. These hopes have not materialized. Even Korea which has made significant inroads into the North American market was hit hard during the recent sales slowdown. Some industry analysts now doubt whether Korea will recover its previous sales level and market share in North America. There are several reasons for the inability of DCs to replicate Japan's success: (1) Japanese producers operated for several years in a large and very competitive domestic market upgrading and refining their production, marketing, and management skills before tackling the U.S. and European producers in the international markets;[5] (2) conditions in the late 1960s and early 1970s were more conducive to a new entrant's success because trade barriers were lower, new technology could be easily obtained with fewer restrictions on subsequent mar-

4. The international trade in components involving DCs is discussed in Chapter V.

5. George C. Eads, "Geography is not Destiny: The Changing Character of Competitive Advantage in Automobiles," Paper, 1987.

keting, and market demand in the OECD countries was growing more rapidly than today;[6] (3) the growing production of Japanese transplants in the United States has filled a good part of the demand for compact cars and has left less room for DC imports; (4) quality requirements are higher at present; and (5) it would be very difficult for a newcomer to penetrate the market today because the competition is already very keen among established producers who offer high quality products at down-to-the-bone prices. The experiences of the Proton from Malaysia and of the Yugo from Yugoslavia, although different from each other, illustrate the difficulty of penetrating the U.S. market. The Proton's introduction to the United States was delayed several years because it could not meet U.S. specifications. This problem was overcome with Mitsubishi's assistance but given that about half of the car's components were imported from Japan, the appreciation of the yen made the total cost per unit significantly higher than for competing models sold in the United States. The Yugo suffered primarily from design, performance, and maintenance problems, which led to the virtual withdrawal of the car from the U.S. market. A wiser course is being followed by an Indian company producing engines and LCVs in a joint venture with a European manufacturer, funded in part by IFC. It recently started exporting small quantities to Europe, with the help of its partner, but has no immediate plans to break into the U.S. market which is expected to contract during the next two to four years and expand only slowly after that.

Although breaking into the very competitive OECD markets is very difficult, DC market penetration is not much easier. Intra-DC trade is constrained by numerous and varying formidable barriers, including tariffs, duties, surcharges, or other schemes that often double the CIF price of a car and, in a few cases, raise it to about 400 percent. Perceptions concerning quality can also be a constraint because consumers in many DCs are skeptical about non-OECD products. Another serious obstacle to trade is raised by local content requirements prohibiting the sale of vehicles unless a certain portion of the vehicle is locally made. In some cases, utility vehicles are more suitable for intra-DC trade, particularly among neighboring countries, because their bulk may constrain long distance transport. Also, because governments and public enterprises often purchase trucks and buses, these are often traded in inter-government barter transactions. Hungary, India, Indonesia, and other DCs have been exporting utility vehicles. Similarly, IFC-funded projects for HCV production in Yugoslavia, Turkey and Brazil have been able to export part of their production to Eastern Europe, the Middle East and South America, respectively. However, these projects have also demonstrated the difficulty of sustaining large export volumes for long because of high domestic inflation and overvalued currencies in the exporting countries, as well as market volatility in the importing countries.

Intraregional Cooperation

A few attempts have been made at intraregional cooperation to facilitate trade. The best known is the Autolatina joint venture by Ford and Volkswagen formed in 1986 when both companies were experiencing financial difficulties in South America. The joint venture sought to reverse the losses being accumulated by both companies by using one company's strengths to remedy the other's weaknesses. Basically, VW had a good supply of engines suitable for the South American market but not equally good vehicle bodies. The reverse was true for Ford. By sharing in-house capacity and technology and combining administrative functions, the two partners were able to reduce costs by increasing economies of scale and benefiting from each other's expertise. As examples of the rationalization process that followed the merger, white collar employees were reduced by 30 percent, a 200 vehicle per day plant was shut down, and gradual adaptation to a just-in-time inventory system trimmed inventory costs from US$900 million in 1986 to US$500 million in 1989. Autolatina employs 75,000 persons in fifteen plants, has a capacity of 900,000 vehicles per year and is the world's eleventh largest producer. In 1990 it plans to launch a new jointly developed car with a Ford body and VW engine to be sold by their respective dealer networks.

The Autolatina agreement enabled the two partners to reverse declining market share to control of 60 percent of the Brazilian market in 1989. The number of units sold, however, has dropped as the total sales volume in Brazil decreased from about 1.0 million units in 1980 to about 650,000 in 1989. Similarly, exports have declined, particularly to the United States, because of keen price competition, primarily from the Far East. To a large extent, export sales have been hurt by the overvalued Brazilian currency and by local content requirements that prevent the importation and use of modern technology components. In the domestic market, the company and other producers (GM and Fiat) have been affected by price controls on vehicles disproportionately greater to those of raw materials. For example, although in early 1989 the Government authorized steel prices to rise by 500 percent, car price increases would have been held to 200 percent. Whether this was enforced during the subsequent period of hyper-inflation or during the recent price freeze is not clear.

A key factor to Autolatina's success was the agreement among Brazil and Argentina to ease trade restrictions on vehicles and components. A similar program by ASEAN countries to allow components produced in any of them to meet local content requirements of the others has fall-

6. Booz, Allen and Hamilton. "Automotive Industry Development Issues,"Processed, 1989.

en short of expectations as each has continued to protect its domestic producers. Nonetheless, Toyota and Mitsubishi have been able to source selected components from specific countries within ASEAN to supply their operations in this region, thus benefiting from specialization and economies of scale.

Projected Developments

Although some automotive analysts have predicted that the vehicle trade structure involving DCs will remain largely unchanged in the medium term, some important exceptions have recently begun to unfold. There is a growing presence of multinationals in Taiwan, China who may use it as an additional source of subcompacts and LCVs. Thailand has intermittently exported small quantities of LCVs, mostly kits, to Europe but it is still unclear whether this can be sustained on a regular basis. Suzuki has reportedly adopted a strategy of locating about 50 percent of its productive capacity outside Japan. Some of this would be in "under-served" but potentially big markets where competition is not yet very keen. By the time demand and competition in these markets become stronger, Suzuki expects to have been firmly established. In line with this strategy Suzuki has formed joint ventures in India, Hungary and Pakistan, the latter with IFC involvement, from where it plans to serve the respective local or regional markets. In the HCV category, both Iran and Iraq have been discussing possible production agreements with foreign companies. Should these materialize, they could further complicate operations of HCV producers in Turkey and Yugoslavia who have been counting on the Middle East market to counterbalance slack domestic demand. Finally, recent developments in Eastern Europe would certainly affect the structure of the automotive industry although the timing and type of investments which may materialize there are not yet clear. There is a large pent up demand for efficient vehicles in Eastern Europe but limited purchasing power, inadequate infrastructure, low productivity and the still unsettled political climate make any supply and demand predictions very uncertain. Nonetheless, Poland, Hungary, East Germany and the USSR are reportedly negotiating or have reached agreements with expatriate companies to modernize and expand their vehicle and component production for both domestic and export sales.

4. RECENT AND PROSPECTIVE CHANGES IN THE AUTOMOTIVE INDUSTRY

Globalization

Almost all major vehicle and component manufacturers have adopted a global perspective in defining their strategies. Even manufacturers who are domestically oriented must consider international developments because of the possible need to collaborate with a foreign company or because some of their foreign competitors may try to penetrate their domestic markets. The globalization of the industry is manifested in several areas:

- *Marketing*: Exports play a major role and receive special attention in many companies' plans for three reasons. First, exports have been an important source of revenue, especially for Japanese and Korean vehicle producers, for major component manufacturers, and for some small specialty producers. Foreign sales also form an important part of the strategy for some companies in DCs who are constrained by small domestic markets and limited foreign exchange. Second, imports have posed a significant competitive threat in the home markets of many companies that have had to devise ways to counteract them. IFC-funded automotive projects in India, Turkey, Yugoslavia, Mexico and elsewhere have largely depended on exports to gain foreign exchange and to supplement revenues from domestic sales. Results have been mixed as the Mexican and Indian companies, both component manufacturers, have been able to secure a market niche, whereas the Turkish and Yugoslav companies, both HCV producers, have run into difficulties because of new competition and from high domestic inflation and overvalued currencies.
- *Supply*: The shifting economic, financial, and political dynamics of the industry have resulted in keener competition across national borders. They have forced manufacturers to seek locations accessible to regional markets with, preferably, lower production costs. Japanese production facilities in North America, begun in response to U.S. import restrictions (in the form of voluntary export restraints), are expected to reach 2.5 million cars by 1992. Virtually all major Japanese car makers, as well as Korea's Hyundai, are now producing in the United States or Canada. What began as assembly operations quickly became integrated with engine production and the establishment in North America of numerous Japanese component producers. A similar pattern is emerging in Europe, particularly in the United Kingdom and, to a lesser extent, in Spain, where major Japanese car manufacturers are rapidly expanding production to supply the European market. North American manufacturers have not stood idle with respect to overseas production. Their foreign presence is manifested through large production facilities in Europe and Latin America, and part ownership of Japanese companies, for example, G.M.'s part ownership of Isuzu, Daewoo Motors, and Suzuki; Ford's part ownership of Mazda and Kia; Chrysler's part ownership of Mitsubishi; and joint ventures with both Japanese and European manufacturers. European firms are concentrating their attention principally on Europe, partly because of the strong market there and partly because of the radically different market conditions anticipated in the EEC after 1992. The globalization movement is rapidly affecting component manufacturers as well. Examples include the growing capacity of Japanese component manufacturing in Southeast Asia and North America and the already large presence of American component manufacturers in Mexico. Since the recent liberalization in Eastern Europe, however, the possibility of producing components there for export to the West is receiving greater attention. There are also reports that some European component manufacturers are now assessing Southeast Asian countries with a view to production for export to Europe as well as to serve the Asian replacement market.
- *Collaboration*: The very high cost of research, design, and fixed investments has resulted in several joint projects as well as mergers by previous competitors across national and continental boundaries. Recent examples are the agreements by Renault and Subaru to jointly develop and manufacture engines, by Honda and Rover to manufacture certain models for the European and North American markets, and by Volvo and Ssangyong Motors to produce a Volvo model in Korea and to jointly develop a new car. This trend of jointly undertaking special projects covering the entire range of research, production, and marketing is particularly important for DC producers who need to collaborate with foreign manufacturers to obtain technical expertise and to secure marketing outlets. Practically all IFC funded projects involve collaboration between OECD and DC companies either in the form of joint ventures or technical agreements covering part or all aspects of the industry from component or vehicle design to production, marketing and after sales service.
- *Internationalization of technology*: The accelerating rate of joint ventures, mergers, partial or complete acquisitions, and joint special projects has resulted in rapid and wide diffusion of innovations. In most cases, multinationals with plants in DCs apply the same technology there as in their developed country locations. This affords some DCs the opportunity to rapidly adopt the latest technology with considerable benefits from improved quality and lower costs. Meanwhile, DCs must be able to provide the infrastructure, administrative procedures, and business practices necessary for the successful transfer of modern technology. While this is

often necessary to ensure that the product is of competitive quality, especially in export markets, it may not be true for process technology. Specifically, a high degree of automation or other capital intensive methods may not always be cost effective in DCs with relatively inexpensive labor.

Product Changes

During the last ten years three types of major changes affecting primarily passenger cars have been taking place at an increasing pace and with widening applicability—the rapid pace of new model introduction and the proliferation of models; the increased use of electronics in many aspects of a vehicle's operation; and the broadening application of new materials in car manufacturing. Although product differentiation is often only skin deep, there is a proliferation of different models and this presents both opportunities and problems for DC producers. The opportunities present themselves to car manufacturers who cannot compete in a mass production environment but can utilize their relatively small facilities to produce specialty vehicles for export, provided that they can maintain low costs and high standards. Problems arising from the existence of many models in a small DC market relate to extensive market segmentation, to the point where production of each model is very low and the corresponding per unit cost is very high. The situation in the Philippines during the 1970s is an example. The proliferation of car producers and models contributed substantially to the shutdown of most of these companies and the establishment of legislation to limit their number. A somewhat similar situation exists in an IFC-sponsored project in Pakistan where the company and the Government have agreed to freeze the design for ten years while restricting imports, to compensate for low throughput and to allow capital investment to be amortized over a longer period of time. Such measures, however, may be counterproductive in the long term as for example in Brazil where, according to the country's Association of Automobile Manufacturers, the industry has fallen seriously behind in competitiveness because of excessive Government intervention which has constrained innovation.

The application of electronics and lighter materials such as aluminum, plastics, and composites has been gaining steadily. The main product innovation area is electronics, widely regarded as the driving force in automotive technology. Although estimates vary, the general consensus is that by the end of the century electronic items—affecting vehicle performance, efficiency, and safety—will represent around 20 percent of the value of a passenger car and computers will facilitate the entire driving process from the pistons to the wheels (Table 8).

The sale of electronic components is expected to enter a boom period during the next few years. The world market for automotive electronics amounted to US$15 billion in 1988 but is expected to more than double by 1995, reaching US$35 billion. During the same period, the value content of electronic equipment in an average car is estimated to rise from US$500 to about US$1,200. Although the increase in value is impressive, the corresponding volume increase will be even larger as unit prices for many components will decline because of greater economies of scale and amortization of production equipment. This development could present substantial opportunities for DCs in auto-electronics production.

Table 8: Use of Vehicle Electronics in New U.S. Cars, 1986–2000

	1986	1990	2000
	(percentage of cars)		
Door locking	5	10	100
Anti-lock braking	5	25	90
On-board diagnostics	-	30	90
Electronic fuel injection	25	60	90
Shock damping	-	20	75
Climate control	-	10	65
Digital displays	10	20	60
Transmission	-	5	25
Active suspension	-	-	10

Source: *Financial Times*. October 1988.

The increasing importance of electronics has prompted some car manufacturers to strengthen their capability in that aspect of production and bring it under their own control (Ford, Daimler-Benz). Ford just opened two new plants in Portugal and Spain, respectively, for the production of audio and other electronic equipment to supply both its U.S. and European operations. Component suppliers, however, believe that the trend is for most vehicle manufacturers to rely on outside sources for most components, including electronics, as long as the suppliers make the heavy investments in research and development necessary to keep abreast of technological innovations.

A possible development of interest to DCs is the future use of multiplexing to replace traditional wire harnesses. At present, wire harnesses are commonly produced in DCs because their manufacturing is labor intensive and requires simple technology. Multiplex systems economize on space and weight and allow a much greater number of other electronic systems to operate in a vehicle under integrated control. Some analysts predict that after the mid-1990s, the increasing use of multiplexing will drive down the demand for wire harnesses so that within ten to fifteen years it will level off at quantities required as replacement parts. This view is contradicted by others who maintain that fiber-optic wire tech-

nology would be applied to very few models in the next ten to fifteen years with minimal impact on DC wire harness production. Given that only Mazda has reportedly announced plans to introduce a simple multiplex system in its top-of-the-line models, it appears that wire harnesses will continue to be widely used for many years.

The replacement of sheet steel with plastics is gradually increasing. The percentage of steel in an average German-made car is expected to drop to 60 percent in the year 2000 from 72 percent in 1989, whereas aluminum and plastic materials are expected to rise from 3 to 8 percent and from 7 to 17 percent, respectively, during the same period (Table 9). The GM Lumina van recently received a lot of attention because of its plastic body panels which are bonded to the metal frame. Lumina is not the first "plastic" car, as East Germany's Trabant, GM's Fiero, and Renault's Espace, among others, preceded it. It is the first, however, to be made in volumes expected to exceed 200,000 units per year.

Table 9: Estimated Development of Material Content, 1989–2000

	Iron/Steel	Aluminum	Plastics
Model Year 1989	72	3	7
Model Year 1990	65	5	13
Model Year 2000	60	8	17

Source: Consultants for Trade and Industry. *European Industry's Investment Outlook in LDCs.* June 1989.

The main advantage of plastic is that it weighs less than sheet steel and can be molded into complex shapes without any bonding or welding. It is also more durable because it is rust resistant. Perhaps its greatest advantage is that it allows retooling to be accomplished much faster at a cost of about 20 percent of that required for conventional metal parts. This is extremely important for car manufacturers trying to produce many different models and introduce new ones more frequently. Plastics could allow them to reduce by as much as 30 to 50 percent the period required between designing and marketing a new model.

Before a complete plastic car becomes the industry standard, some major problems must first be resolved. There are technical problems relating to structural integrity, which is higher for steel; bonding or attaching a plastic body to a metal engine or other parts; and the long cycles required to produce plastic components, which still make mass production uneconomical.[7] Then, environmental issues arising from the disposal of plastic bodies must be resolved. Although these constraints are important, the use of plastics entails significant advantages for both the automotive and chemical industries. The specific implications for DCs are not yet certain. DCs capable to compete in the production of electronics, specialty metals, and plastics would benefit. But which DCs would be in this category and how they would, and other DC producers, be affected by the developments of new materials with respect to production, transport, trade, and evironmental considerations need to be examined further.

Changes in Production Methods

Significant changes have come about in all facets of automotive production, ranging from the design stage to the assembly operations and from component procurement to organization and management.

To bring a completely new car model to the market requires both a rather hefty initial investment of about US$1.5 billion and high operating costs. To amortize such huge outlays, mass production over several years is necessary to lower unit costs. Until about a decade ago, at least seven years would have elapsed from model design to market introduction, and the car would have been produced for fifteen years or so with only superficial modifications. The optimal size of a car manufacturing plant was considered to be 250,000 cars per year operating with a high degree of automation and job specialization. These conditions have changed radically. Because of more intense competition and with new technological capabilities such as computer-aided design and manufacturing systems (CAD/CAM), the time between design and production of a new passenger car model is about four to six years (three to five years in Japan), and its lifetime rarely exceeds six to seven years. The effort to reduce these intervals continues.[8] Design changes do not occur nearly as frequently for CVs and when they do, it is often for functional instead of cosmetic reasons. Therefore, the pressure to achieve high CV throughput before the design is modified is not as great for CVs as for cars.

The reduced product development and production periods have been made possible by drastic changes in both the design and production stages. Design constitutes a key phase in the process because about 70 percent of the production cost is determined during this stage. Subsequently, only marginal adjustments can be made to reduce costs. Once the vehicle is designed, this means that production architecture, layout, logistics, and technology have essentially been determined, and any major modifications thereafter would result in equally major costs and delays. As a result, design and production engineering are highly integrated in what is

7. Fiat may have solved this problem at least in the production of the tailgate for its Tipo model. These plastic parts are injection molded and take only twenty seconds to produce.

8. Honda claims it can bring a new model to the market within twenty-four months.

becoming known as "concurrent engineering." This has been greatly facilitated by computerized design which is becoming a common feature for many vehicle and large component manufacturers.

A parallel development has been the flexibility of the assembly line, which allows the production of different models with little or no retooling. This has been made possible by increased robotization and flexible automation, procurement of subassembly systems rather than individual components, increased use of plastics, and new management techniques, which allow workers on the plant floor greater initiative and responsibility for production decisions. Robotization and flexible automation are commonly regarded as labor-saving techniques, but their greatest contribution is that, together with appropriate management, they allow greater flexibility and better quality control. An indication of the trend toward more robotization is given in Table 10. Today, robots are used by most automotive companies in the OECD countries and are gradually being introduced to DC operations as well. Robots are no longer perceived as a cure-all for quality and productivity problems and, as a result, the degree of robotized activities will continue to increase but at a slower pace (Table 11).

Table 10: Robotization at Renault, 1980–1987 (Number of 6 axes NC robots)

1980	1982	1984	1986	1987	Percentage change 1980 to 1987
69	231	358	459	513	643.5

Source: Consultants for Trade and Industry. *European Industry's Investment Outlook in LDCs.* June 1989.

Table 11: Percentage of Selected Activities Performed by Robots in the Japanese Automotive Industry, 1980–2000

Activity	*1980*	*1990*	*2000*
Spot welding	45	75	90
Arc welding	15	55	75
Coating & sealing	10	50	70
Material handling	15	50	65
Engine production	10	40	60
Measurement inspection	10	40	55
Component manufacturing	5	35	55
Assembly operations	5	40	45

Source: Consultants for Trade and Industry. *European Industry's Investment Outlook in LDCs.* June 1989.

It is therefore important for all producers, but especially those in DCs, to select technologies appropriate to their manufacturing environment and to the types of products that they produce. In many instances these do not call for adopting the latest and most sophisticated technology. For example, an IFC-funded project in India considered highly automated and integrated processes but found them inappropriate for the production levels and market requirements envisaged. The company, with help from foreign technical collaborators, opted for design modifications to existing products and for comparatively labor-intensive production methods. The results have been excellent in the domestic market and there are good prospects for exports. Similarly, a producer of truck frames and structural components in Mexico, also funded by the IFC, has adopted a semi-automated process which has enabled it to be succesful in a market niche for orders requiring short to medium production runs. Such orders are below the scale required by fully automated producers of similar products.

Procurement of Components

Component supply is an area receiving major attention in vehicle manufacturers' efforts to reduce costs and improve quality, particularly since the beginning of the 1980s, when the Japanese manufacturers established themselves as leaders in production organization and management. They introduced a new logistics concept with four interlinked parts—Just-in-time, Single sourcing, Outsourcing and Quality focus.

Just-in-time (JIT) is the key element in achieving an efficient material flow, reducing waste and storage costs, and achieving production flexibility. The other three elements of this logistics concept are more or less a necessary result of—or a precondition for—the JIT delivery system. In its most extreme form, JIT means that suppliers feed the assembly line five or six times a day, with no inspection and virtually no storage area. Since its introduction by the Japanese, most major manufacturers worldwide, and some of the smaller ones, have adopted the system with varying degrees of success. Several IFC-funded projects in Brazil, Mexico and elsewhere, resulted, at least in part, from the need to ensure frequent and reliable delivery of components and were, therefore, constructed near vehicle assembly operations. On the other hand, a HCV project in Yugoslavia has had serious financial difficulties partly because it failed to adopt the JIT system, maintaining instead large stocks of both components and finished goods. In contrast, many U.S. and European manufacturers maintain their stock of parts, on average, for as little as two days.

Ideally, the JIT system works best under the following conditions:

- *Reliable and timely delivery*: This is best achieved if the transport network is efficient, there are no bureaucratic

delays, and there is close communication between the supplier and the assembler. Some manufacturers insist on geographic concentration, but others argue that this is not always necessary and that for certain components, low-cost distant locations are preferable to high-cost nearby ones.

- *Dependable quality*: Zero-defect-concept for quality assurance is an important element during all stages of the process.
- *Manageable supplier network*: A minimum number of suppliers delivering to the assembly.
- *Manufacturing flexibility*: The supplier must be able to react quickly to deliver whatever part the assembler needs, and the assembler must be able to adapt his production to the stock on hand.
- *Elimination of formal receiving operations.*
- *Strong management commitment.*

A related significant development is the dramatic decrease of primary suppliers and the increase in outsourcing. These practices have two dimensions: Companywide sourcing of components from one supplier for any given component or component systems; and allowance for individual plants to source from local suppliers. The main advantages of single sourcing consist of logistical efficiency, easier quality assurance and control, and economies of scale at the supplier level. The rapid reduction of first-tier suppliers (those supplying directly to vehicle manufacturers) is exemplified by the five companies (depicted in Table 12) that trimmed the number of their suppliers within four years by a high of 70 percent for Ford (North America), to a low of 23 percent for Peugeot. Although the number of first-tier suppliers has been reduced, they, in turn, deal with a large number of subcontractors. For example, one Japanese manufacturer directly procured engine parts from only twenty-five primary suppliers, but the latter dealt with 912 subcontractors, who, in turn, procured from 4,960 third-tier suppliers.

The reduction in the number of first-tier suppliers does not mean that more components are produced in-house. On the contrary, outsourcing of components has increased substantially because it affords vehicle manufacturers increased flexibility and potentially lower costs. At present, as little as 30 percent of an average car in Japan is produced in-house, whereas for most U.S. and European manufacturers, the proportion is about 40 percent. GM is an exception, because it has chosen to restructure and strengthen its component production subsidiary and maintain its in-house supply of parts at about an average of 50 percent per car. In many ways, this subsidiary acts as an independent supplier to GM's automotive divisions and also sells about 15 percent of its output to non-GM buyers. In some DCs the relative scarcity of reliable producers of quality components has forced automobile manufacturers to produce in-house more then they would normally prefer. Thus, the development of an efficient supplier network in DCs presents both opportunities and a challenge for the successful development of an indigenous automotive industry.

Naturally, the trend for more outsourcing has meant bigger sales for component manufacturers. At the same time, they have been assuming more and more responsibility, particularly with respect to design, production of component systems, and, above all, quality control and cost reduction. Mainly because of the JIT requirements and keener competition, quality is stressed as never before as manufacturers attempt to minimize incoming inspection. Training of employees in a zero-defect concept, changing work organization, and investing in statistical process control systems (SPC) are all increasingly being applied in an ongoing effort to improve quality. The application of a company's management and production systems in all its operations worldwide, the JIT system, and especially the emphasis on quality have caused problems in some DCs, which have not been able to perform accordingly. Even for protected DC market operations, the multinationals involved are becoming more insistent on cutting costs and raising profits. Consequently, DCs that hope to attract automotive investments must be able to provide the necessary

Table 12: Number of Component Suppliers to Selected Vehicle Manufacturers

	1985	1989	Percentage change 1985–1989
Ford (North America)	20,000	6,000[a]	(70.0)
Ford (Europe)	2,500	900	(64.0)
Austin Rover	1,200	700	(41.7)
Renault	1,415	900	(36.4)
Peugeot	1,229	950	(22.7)

a. 1989 estimate. The target is reportedly 1,700 by 1991.

Sources: Data for Ford (North America) from *BusinessWeek*, January 9, 1989 p. 69, and for other companies from *Financial Times*, June 8, 1989 p. 11.

conditions for efficient operations by international standards.

Marketing and Distribution

Marketing and distribution are key determinants to the success of an enterprise. Numerous resources are devoted to these activities—about 30 percent of the pretax price of an average car, which includes delivery costs from factory to dealer, stockkeeping charges, advertising, promotion, and the dealer's margin. A wide network of distributors to sell and service vehicles is indispensable for revenue generation and constitutes an effective way to register changes in consumer tastes and preferences. Manufacturers, therefore, compete most fiercely to attract dealers, sometimes luring them away from each other.

Marketing organization varies among different regions. In Europe most manufacturers market cars through exclusive dealerships; therefore, it is very difficult for new automotive companies to develop a network of their own. In North America megadealers have become common in recent years, and sell products produced by several different manufacturers. It is, therefore, easier for new car manufacturers to contact potential agents, who can negotiate contracts and reach agreements with a number of dealers. As a result, it has been relatively less difficult for Japanese and Korean companies to develop distribution networks in the United States than in Europe.

Car distribution is extremely expensive because an extraordinary amount of capital is tied up in the process. With total annual sales of about 45 million units, at least 3.5 million vehicles (corresponding to one month's sales) are in stock in the distribution-dealer network.[9] Meanwhile, another 3.5 million units are in production, and approximately 1.5 million units are in transport from manufacturers to dealers. This amounts to about 9 million vehicles in distribution at any one time, which represents more than US$100 billion in value.

Despite this magnitude, manufacturers have not yet systematically tried to reduce the size of the resources tied up in marketing and distribution. The JIT concept will certainly be one of the future key issues in rationalizing the transport and distribution network with the objective of ensuring that delivery from suppliers to assemblers to the final consumer is subject to the same rigorous efficiency standards as vehicle manufacturing. Presently the typical delivery time in Europe is approximately three months, but in Japan, where flexible manufacturing and application of JIT principles to delivery have already started, it has been reduced to about two months, and in the case of Toyota, to three or four weeks.

After sales service—that is, availability of spare parts and repair facilities—is essential to a company's success, particularly in recent years when warranties have become more extensive. Another important aspect of the distributors' network is the secondhand trade, which many manufacturers believe is a strong feature in building consumer loyalty.

9. The actual stock is probably higher because in the USA it often corresponds to two months' sales.

5. Automotive Components

Component manufacturing and selling has grown to sizable volumes and constitutes a large part of the automotive industry. In 1988, the value of the worldwide component production as original equipment has been estimated at US$400 billion, while that for the aftermarket, i.e., accessories, replacement, and servicing parts, may be at least as great. Although component manufacturing is concentrated in the OECD countries, more than twice as many DCs (fifty to sixty) produce components as produce vehicles (about twenty-five). The reason is that the vast array of components, ranging from capital to labor-intensive and from the highly complex to the relatively simple, allows countries with different types of resource endowment and unequal levels of technical and managerial capability to produce and export components. For example, the United States, Korea, Portugal, the Philippines, and Morocco all have successful component manufacturing companies. Although the volumes and export earnings vary considerably among them in absolute terms, they all make sizable contributions to their countries' foreign exchange earnings relative to their respective total exports. As will be discussed in the following paragraphs, for many DCs, automotive component manufacturing provides more opportunities for profitable investments than vehicle manufacturing or assembly because the former is comparatively more labor intensive; has a lower wage structure; and requires lower overhead. Certainly, the field is very competitive and success, on both financial and economic terms, is predicated on consistently maintaining high quality standards, up-to-date expertise, flexibility, and strict adherence to delivery schedules.

Value of Trade

The global value of component trade in 1987 amounted to about US$60 billion, of which US$3.7 billion originated in DCs.[10] In the same year, OECD component exports to DCs declined to 18 percent of total OECD exports compared with 25 percent in 1982, as a result of growing production in DCs and larger inter-DC trade. DC exports of components are lower than DC vehicle exports because of the enormous increase in vehicle exports from Korea, and to a lesser extent, Mexico, and Brazil. Nonetheless, many more DCs are involved in component production, and the rate of growth in component exports has been much higher than in vehicles. Among major DC vehicle exporters, i.e. Korea, Brazil, Mexico and Taiwan, China, only Korea has had higher earnings from vehicle than from component exports. The bulk of DC component exports in 1987—61 percent—were to the United States, although Japan and the EEC are also important markets.

Most leading DC exporters increased their component export earnings between 1980 and 1987. In particular, some of the Far Eastern and North African countries as well as Portugal made spectacular increases. In terms of value during this period, Taiwan, China increased its exports from about US$95 million to over US$600 million, Korea from US$20 million to US$180 million, and Portugal from US$7/million to US$130/million. In terms of rate of growth, Tunisia increased its component exports by over 6,000 percent (from US$300,000 to almost US$20/million), Portugal by 1,875 percent, and Korea by almost 800 percent. Although data is incomplete, it appears that, with the exception of Mexico and Brazil, most Latin American countries experienced a decline, which is a reflection of the adverse economic situation, especially the effect of inflation and distorted exchange rates and government policies ultimately constraining innovation (Table 13).

Industry Structure

The structure of the component industry is just beginning to undergo major changes similar to those that transformed the motor vehicle industry. Component manufacturing has traditionally been carried out by a few large component firms and a large number of small- and medium-sized companies producing to the design and specifications ordered by vehicle manufacturers. For example, in Japan 300 component manufacturers employ 75 percent of all workers in the subsector, while another 2,000 firms or so employ the remaining 25 percent. In the EEC there are about 1,500 component firms, and 15 percent of these employ 75 percent of the subsector's labor force. Until recently, most component companies had been domestic-oriented, although some of the larger have had overseas manufacturing operations. For the most part, component firms have been locally owned as foreign direct investment (FDI) had been limited to countries where vehicle assemblers had set up operations. The bulk of their production has been sold locally with the value of internationally traded components amounting to 25 percent of the total value of production in 1987, either to other component manufacturers or to vehicle assemblers. Consequently, the leading component firms were found in countries with large auto industries and in only a few instances did they expand beyond national boundaries.

Starting with the OECD countries but with an impact already felt on DCs, the component industry recently started going through major transformations. Signifi-

10. This estimate is based on incomplete data and the actual value may be US$5.0 billion.

Table 13: Automotive Component Exports from Developing Economies, 1980–1987 (US$ millions)

Country	1980	1985	1987	Percentage change 1980–1987
Argentina	63.3	62.9	67.2	6.2
Brazil	NA	424.6	1,500.0[a]	-
Colombia	20.6	6.0	NA	-
Hong Kong	0.8	1.8	2.2	175.0
India	72.1	48.7	NA	-
Korea	20.5	93.0	181.0	782.9
Malaysia	2.7	3.7	5.7	111.1
Mexico	NA	499.0	1,000.0[a]	-
Morocco	7.4	10.0	15.9	114.9
Philippines	30.3	20.9	NA	-
Portugal	6.6	66.0	130.4	1,875.8
Singapore	82.6	78.5	98.4	19.1
Taiwan, China	94.7	345.6	618.3	552.9
Thailand	9.3	11.4	21.3	129.0
Tunisia	0.3	4.4	19.1	6,266.7
Turkey	43.0	65.5	71.6	66.5

a. Unofficial estimates.
Note: Excludes Eastern Europe.

Source: United Nations Trade Data, 1989.

cant among these are the fast-developing new relationships between vehicle and component manufacturers in an intensified effort to reduce costs, raise productivity, and improve quality. The probability of success for vehicle manufacturers now also depends in part on their suppliers as the latter have assumed a great deal of the responsibility for research, design, manufacturing, and stock maintenance. Thus, both vehicle and component manufacturers are now directly and fully involved with all phases of the process—that is, research, design, manufacturing, and marketing—of their respective products. GM, for instance, reportedly expects its first-tier suppliers to devote 1 percent of their sales revenue to research and development. If not, the relationship may be terminated.

Another important element of the transformation of the component industry relates to the changing nature of competition in the vehicle industry. The expansion of Japanese transplants in the United States, the increased investment by European and non-European firms in Europe in anticipation of the post-1992 single EEC market, the possibility of a more open Japan, and the selection of a few DCs as production sites have raised competition to a truly global level. As more component manufacturers have followed vehicle manufacturers to their overseas locations, their perspective has also changed and the strategies of many more companies are becoming global rather than national. Mexico and Taiwan, China, which have relatively few restrictions on foreign ownership, have benefitted substantially from these developments (Figure 3).

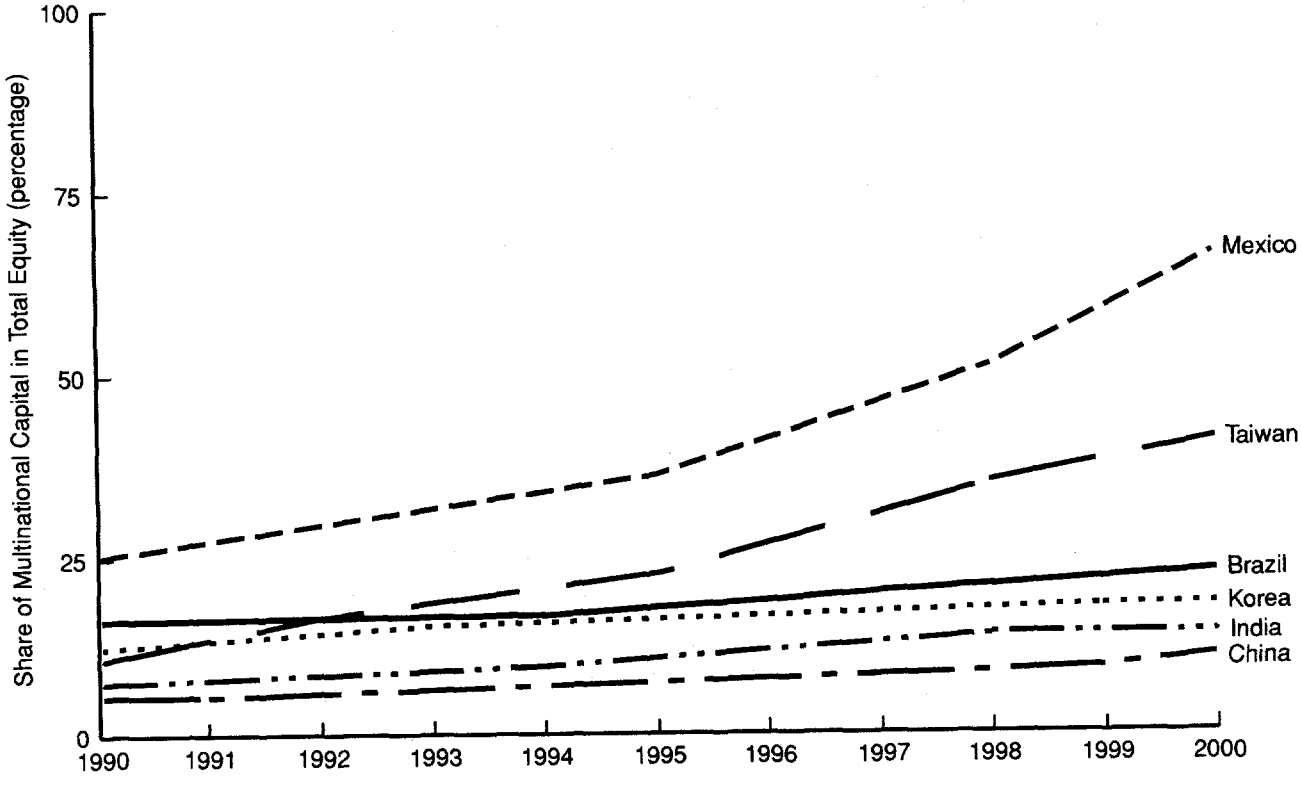
Although vehicle manufacturers have drastically reduced the number of their suppliers, the proportion of outsourced components has increased. This has led many first-tier suppliers not only to produce individual parts but also to assemble component systems and has resulted in a different type of relationship between manufacturers and first-tier suppliers. The production of component systems has two important implications for car manufacturers. It reduces costs through improved quality and increased economies of scale as component firms become increasingly specialized in both producing certain parts of a car and supplying them to several vehicle assemblers, and it results in considerable savings in assembly time. For example, GM's use of preassembled sunroofs made by Rockwell International for one of its British-made models, has reduced sunroof installation in its car assembly line from twelve minutes to three. Rockwell plans eventually to supply complete car roofs and doors.[11]

Product Quality

Quality is of utmost importance and the supplier must strive to apply a "zero defect" philosophy to his op-

11. "The Arrival of Haute Carture."*The Economist*, July 29, 1989. p.54.

Figure 3: PROJECTED FOREIGN EQUITY OWNERSHIP OF COMPONENT PRODUCTION FACILITIES IN SELECTED DEVELOPING COUNTRIES, 1990-2000



Source: Booz, Allen and Hamilton, 1989

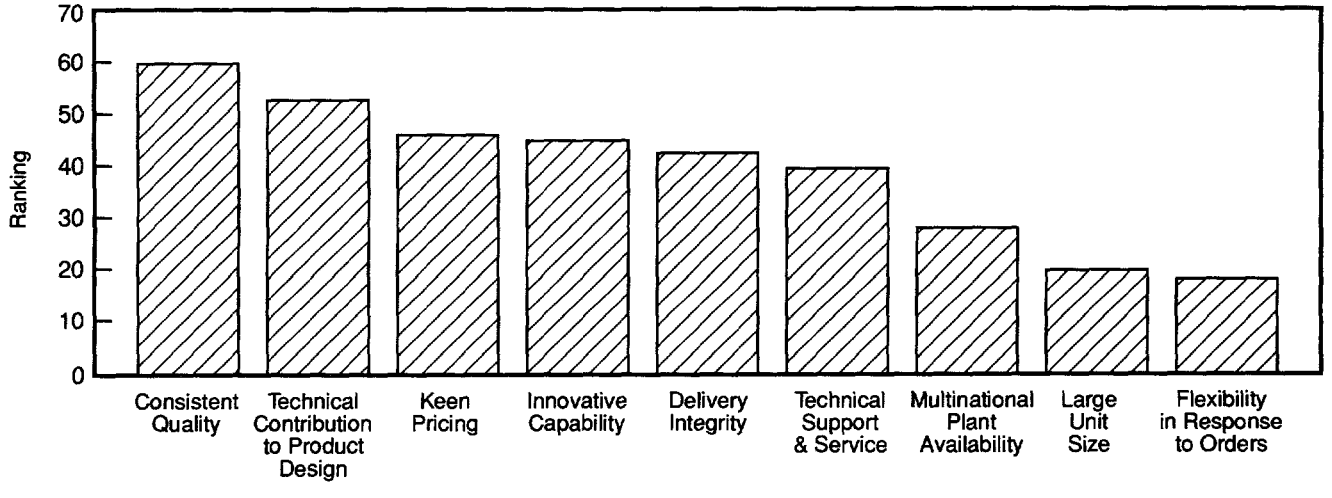
erations as well as to ensure that his product performs harmoniously with the other parts of the car. For example, all Ford suppliers are systematically rated on quality, and underperformers are eliminated. At the same time, car manufacturers require their suppliers to develop strong capability in product design and technological innovation. That means that they must invest in R&D programs that are highly sophisticated and require substantial computer application. Also, technology changes so rapidly that it is impossible for a car manufacturer, or even a multiproduct component manufacturer, to keep abreast of developments across a wide range of products. As a result, vehicle and component manufacturers are increasingly bound by long-term relationships involving close cooperation and intimate knowledge of each other's needs, capabilities, and modi operandi. For example, Ford's new suspension systems are designed by its supplier company through a fully computerized system in a hands-on collaborative arrangement with Ford's engineers. Another aspect of the relationship relates to timely delivery and cost effectiveness, which are crucial if the relationship is to survive. Chrysler recently requested a 1 percent price reduction from its suppliers across the board, and Ford has a standing arrangement with its long-term suppliers for an average price reduction of 5 percent a year.[12] Other important features required by car companies, in descending order of importance, relate to after sales service, multinational plant availability, large unit size, and flexibility in response to orders (Figure 4).

Opportunities for Developing Economies

The long-term nature of the relationships between manufacturers and suppliers means that if the former establishes transplants overseas, the latter is often expected to follow either by setting up subsidiaries or by entering into joint ventures or technical collaboration agreements with local firms. In any of these cases, the component manufacturers would need to rely on local firms as second- and third-tier suppliers, thus opening

12. Treece, James, "Now Carmakers Are Really Burning Rubber" *BusinessWeek*, January 9, 1989, p. 69; and Woodruff, David "Ford Has a Better Idea: Let Someone Else Have the Idea," *Businessweek*, April 30, 1990, p. 116.

Figure 4: SUPPLIERS' DESIRABLE ATTRIBUTES RANKED BY SELECTED VEHICLE MANUFACTURERS



Source: Financial Times, September 13, 1989

up opportunities for local production. This has been the experience with IFC-funded vehicle production projects in Turkey, Yugoslavia, Pakistan, India and China which have prompted the development of indigenous component production. Correspondingly, several IFC-funded component production projects in several countries were established or expanded, in response to the demand created when vehicle assembly or manufacturing projects came into operation.

The 1980s have witnessed major shifts in the location of component manufacturing within the OECD and from the OECD to DCs. In the OECD, the dominant movement has been of the Japanese establishment of vehicle transplants first in the United States and, more recently, in Europe, followed by their suppliers. The movement into DCs has involved U.S., Japanese, and European, particularly West German, firms, as they have been trying to reduce costs and take advantage of changing patterns in the geographical distribution of vehicle production. A significant feature of this movement relates to the type of components produced in DCs. As a result of many recent investments in medium and advanced levels of technology, DC component production increasingly consists of more sophisticated products such as alternators and electrical or electronic equipment, along with traditional simple technology, and labor-intensive products, such as wire harnesses.

As component companies have searched for less expensive sites or have followed car manufacturers into other countries, and as DC producers have sought access to technological expertise, certain patterns have emerged in the ties between specific OECD and developing countries. For example, U.S. companies have favored mostly Mexico and Korea and, to a lesser extent, South American countries, particularly Brazil. Mexico's major advantage is its proximity to the United States; for Korea and Brazil, it is their growing domestic markets. Japanese companies first undertook a major expansion into Southeast Asia, later moved into the United States, then started getting into Europe, and most recently into Eastern Europe. Japanese presence among DCs is strongest in Korea where forty-seven joint ventures and seventy-three technology collaboration agreements for component production were reported in 1988. Taiwan, China, is also becoming a preferred location for Japanese entrepreneurs because of the economy's strong manufacturing base, availability of inputs, proximity to Japan, good communication and transport facilities, abundance of private firms of different sizes from which to select a partner, and a liberal economic system. The Japanese also have links with firms in most other countries in the region, particularly in Thailand, Singapore, and Hong Kong—the latter two for auto electronics—and, to a lesser but growing extent, in Indonesia, Malaysia, China, and the Philippines. In South Asia, Suzuki's operations in India prompted about thirty collaboration deals between Japanese and Indian companies. In Latin America, Japanese interest is concentrated in Mexico, with about twenty operations, while another twenty are scattered in the rest of Central and South America. The large majority of these entail technical cooperation and only about 20 percent manufacturing.

Although European component manufacturers are present in all DC areas including North Africa (Morocco), the Middle East (Turkey), Latin America (Mexico, Brazil) and Asia (Thailand, Malaysia, China, India), they have not matched their U.S. and Japanese counterparts in establishing themselves outside Europe. One explanation is that, similar to the European vehicle manufacturers, they have been focussing on the growing European market and, more recently, on post-1992 Europe and the developments in Eastern Europe. Nonetheless there have been reports of some European component producers investigating the possibility of establishing or expanding operations in Southeast Asia.

For many DC component producers the aftermarket is at least as important as the original equipment market. In the United States, the demand for replacement parts is expected to grow 2.7 percent annually between 1988 and 1993, and for accessories by 2.9 percent during the same period. The main advantages of the aftermarket for DC producers are: (i) potential buyers are far more numerous than for original equipment components; (ii) research and design requirements are very limited; (iii) delivery schedules are not as stringent; and (iv) the need for constant technological upkeep is less urgent. However, the field is very competitive and the requirement for high quality standards, at least in the international markets, is great.

6. FACTORS AFFECTING DECISIONS TO LOCATE IN DEVELOPING ECONOMIES

The transformation of the industry, particularly with respect to technology and organization, which have had a major impact on production, procurement, and marketing, has often made it essential for DC entrepreneurs to associate with established foreign manufacturers if they are to operate competitively, especially in export markets. This is the case for passenger cars, commercial vehicles and components except for those which are produced with simple or well known technology. As discussed earlier, this association can be in any one of many forms, from management contracts or licensing to joint ventures or mergers. Perceptions vary as to which is the preferred arrangement. Interviews with several multinational companies indicated that most Japanese and some European firms prefer joint ventures through which they can apply their own management style and exercise better control over quality standards and marketing practices. Other European firms preferred licensing arrangements which although often less profitable than joint ventures, are also considered less risky. U.S. firms have in most cases established fully owned subsidiaries or joint ventures. Opinions also differed among DC auto producers some of whom prefer joint ventures partly because of the infusion of capital and partly because of the continuous commitment and support expected from the foreign partner. Others prefer licensing arrangements because they perceive joint ventures to be restrictive and unbalanced in favor of their, usually larger and stronger, foreign partners. Either way, DC entrepreneurs recognize the benefits, often the necessity, to associate with a foreign company. This is well reflected in IFC-funded automotive projects. Of a sample of 18 projects, 15 had foreign equity participation, 3 technical collaboration agreements, and 4 both types of arrangements (Table 14).

When vehicle or component multinational producers decide to participate in joint ventures or to establish subsidiaries, (although the latter has not been very common in recent years) several factors influence their location decisions. The three major factors are market potential, production and transport costs, and company strategy. These have mostly pointed to OECD locations. Of the total value of components traded in 1987 (US$60 million) only about 6 to 8 percent (US$3.7 - 5.0 million) originated in DCs. And of the total 1986 production of nine vehicle manufacturers, about 25 percent was produced outside their respective home countries and less than 5 percent in DCs (Table 15). Volkswagen is the

Table 14: Collaboration between DC and OECD Automotive Companies; A Sample of IFC Experience

DC Country	OECD Country	Product	Joint Venture	Technical Agreement
Brazil	Italy	Castings	X	
Brazil	Sweden	HCV	X	
China	France	LCVs	X	
India	Japan	Carburetors/ Fuel pumps	X	
India	UK/Germany	Joints	X	
India	Germany	LCVs	X	
India	USA	Forged parts		X
India	France	LCV/Engines	X	X
India	Japan	HCV/Engines		X
Indonesia	Japan	Engines	X	
Mexico	USA/Japan	Stamped parts	X	
Mexico	USA	Parts	X	X
Mexico	Italy	Auto cable	X	X
Pakistan	Japan	Cars/LCVs	X	
Turkey	Germany	Trucks	X	
Turkey	Germany	Diesel engines	X	
Yugoslavia	Germany	Clutch assembly		X
Yugoslavia	Germany	HCV/Engines	X	X

Source: IFC data.

Table 15: Automobile Production of Major Corporations in the Home Country and Abroad, 1986 (thousands)

Company	Total production	Production abroad Volume	Production abroad Percentage of total	DC Production Volume	DC Production Percentage of total
GMC	8,390	2,560	30.5	290	3.5
Ford	5,760	2,590	44.9	260	4.5
Toyota	3,740	80	2.1	4	0.1
Volkswagen	2,770	910	32.7	490	17.7
Nissan	2,590	320	12.3	70	2.7
Peugeot	1,960	340	17.5	-	-
Renault	1,940	360	18.6	50	2.6
Chrysler	1,900	450	23.7	60	3.2
Fiat	1,770	180	10.2	170	9.6
Total	30,280	7,790	25.7	1,394	4.6

Source: Motor Vehicle Manufacturers' Association (United States), 1988.

leader in DC production with almost half a million vehicles produced in DCs in 1986—primarily in Mexico and Brazil—which is 18 percent of its global output. GM and Ford produced 290,000/vehicles and 260,000/vehicles in DCs, respectively, which is less than 5 percent of the global output in each case. The only other company with a relatively large output in DCs is Fiat with 170,000/vehicles—9.6 percent of its total output. The rest produce only negligible volumes in DCs. Some of the smaller companies, such as Suzuki and Mitsubishi, have moved aggressively in recent years to increase their DC output, but this would not have a noticeable impact on the aggregate DC automobile production.

The limited use of DCs by multinationals as vehicle production sites reflects what is, in most cases, the most important factor influencing the location decision—the size of the domestic market. Thus, large or growing economies are attractive because of their sales potential, stemming either from rapid economic growth (Taiwan, China) or a large population (China), or a combination of both (Indonesia). The question of whether to service the market through exports from the home country or through production facilities in the DCs is affected by the respective costs and by other factors, including ease of transport, government intervention, or company strategy. Transport costs favor DC production of utility vehicles and several manufacturers have set up production or assembly operations in DC locations. Sometimes a company will assume a defensive strategy, which means that it establishes a facility in a country in spite of uncertain sales potential in the near future because its competitors may do so, and the company wishes to obtain a foothold in that market for future considerations. Examples include the interest of multinationals in China and the USSR.

Another important consideration is accessibility to a large foreign market, ideally in combination with a large or growing domestic market. Mexico, for example, is very well situated with respect to the United States, whereas a similar role has been assumed by Spain and Portugal with respect to Western Europe, and by Taiwan, China and Thailand with respect to Japan. In the future, Eastern Europe, Turkey, and North Africa could be used as export bases to Western Europe while the Pacific rim countries could play a similar role for Japan.

The importance of market size and accessibility is applicable to both vehicles and components. Among most DCs, components—original equipment and replacement parts—constitute the bulk of automotive imports, an indication of large DC market potential for components (Table 16). Producing for the domestic market would allow DCs to hone their technical and competitive skills so that, in combination with their lower cost structure, they can successfully compete in foreign markets. Because of the ease of transport and the often low-wage, low-overhead and labor-intensive nature of component manufacturing, many multinationals produce in DCs for re-export. Examples include U.S. companies manufacturing in Mexico for the U.S. market, Japanese companies producing in Thailand or Taiwan, China for the Japanese market, and the interest by many multinationals to produce in Eastern Europe for the Western European market.

Costs are, of course, a very important consideration. DCs enjoy an advantage with respect to labor costs that are substantially lower there than in OECD countries. In 1987 hourly wages for Latin American unskilled autoworkers ranged from US$0.50 to US$2.00 equivalent and for semiskilled workers from US$1.50 to US$3.50 equivalent. Korean, Malaysian, and Taiwanese auto workers' wages ranged from US$1.75 to US$4.00 equivalent.[13] During the same period, wages in the auto industry for production workers were about US$14 in the United States and West Germany, and, although less in

Table 16: Product Structure of Automotive Imports of Leading Developing Economies, 1986 (US$ millions)

Region & importing country	Total value of automotive imports	Passenger cars		Commercial vehicles		Chassis with engines		Bodies		Parts & accessories	
		Value	Percentage	Value	Percentage	Value	Percentage	Value	Percentage	Value	Percentage
Latin America											
Argentina	262.9	10.7	4.1	27.8	10.6	-	-	26.0	9.9	198.4	75.5
Brazil	314.3	-	-	8.2	2.6	-	-	-	-	304.6	96.9
Colombia	263.5	120.9	45.9	25.3	9.6	15.0	5.7	-	-	99.6	37.8
Mexico	279.7	39.5	5.0	54.6	6.9	-	-	-	-	695.8	88.0
Venezuela	673.0	410.5	61.0	139.3	20.7	-	-	-	-	122.5	18.2
Asia											
Indonesia	582.4	160.2	27.5	34.4	5.9	-	-	-	-	387.9	66.6
Korea	376.6	18.5	4.9	32.0	8.5	-	-	-	-	236.1	86.6
Malaysia	275.3	153.6	55.8	64.1	23.3	7.2	2.6	-	-	50.1	18.2
Thailand	333.9	66.1	19.8	25.4	7.6	177.0	53.0	-	-	65.4	19.6

Source: O'Brien, Peter, *The Automotive Industry in the Developing Countries: Risks and Opportunities in the 1990s.* The Economist Intelligence Unit, London 1989.

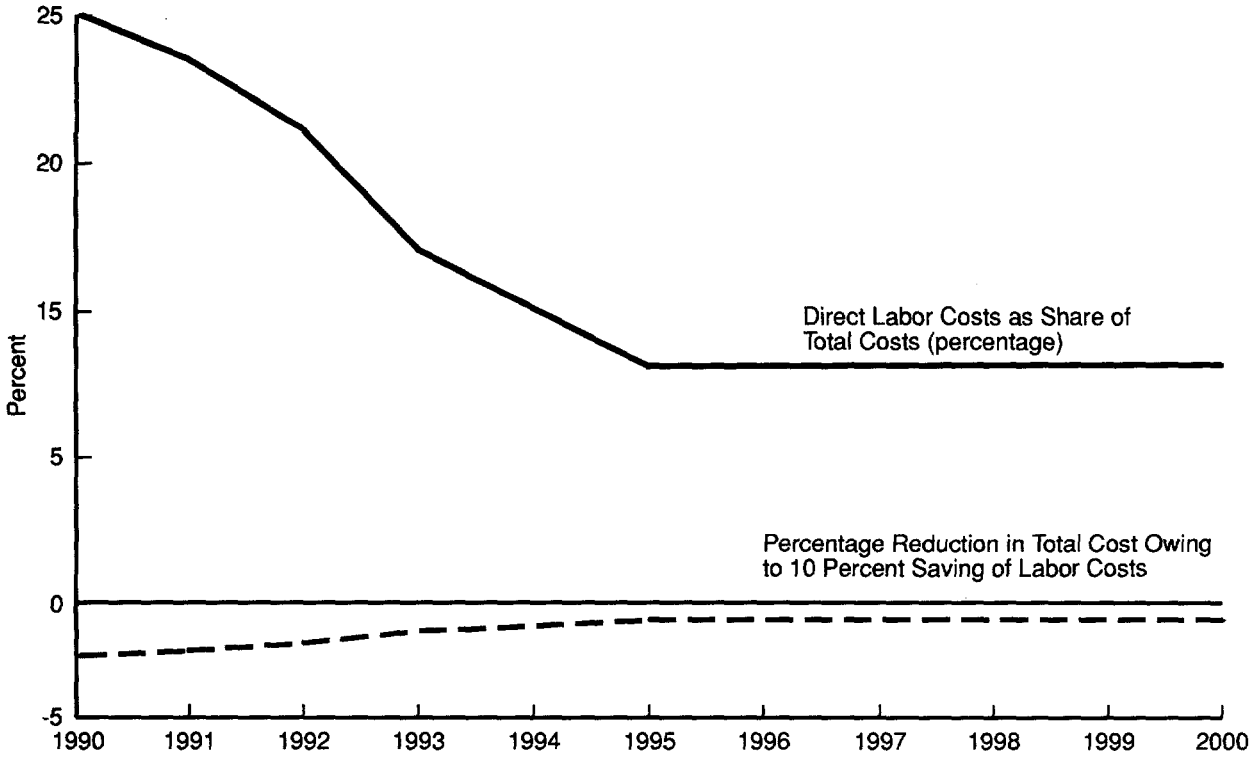
most other OECD countries, always substantially higher than in DCs.[14] Still, the labor cost advantage enjoyed by DCs loses much of its significance because labor accounts for only 20 to 25 percent of the total cost of producing an average car. By the mid-1990s, it is expected to drop to about 10 percent of the total cost (Figure 5). Thus, although labor costs are important, particularly for labor-intensive operations such as production of commercial vehicles and components, they are just one of many factors considered by multinationals when weighing their options regarding facility location. IFC experience shows that in some cases components produced in DCs are more expensive than in the home country of the multinational concerned. This is due to import duties on raw materials, taxes, lower productivity and higher inventory costs. But if the mix of locally produced and imported components is properly balanced, substantial cost reductions can be attained. For example, with 60 percent local content in a new car assembly operation in Pakistan, overall savings of about 30 percent of the CIF value per vehicle can be expected.

An efficient component supply network is essential for successful vehicle production, particularly in view of the growing adoption of the JIT system and the trend toward outsourcing. Multinationals prefer a supplier network to be in place before they locate in a country. But even if the network is not as developed as they would like, they may nonetheless decide to locate there because of other overriding considerations e.g. market potential or to counteract a competitor. In many such instances, key suppliers follow the automobile company into the foreign country. For example, after Volkswagen established a plant in China, it was followed by about sixty of its suppliers, while Toyota's decision to take 22 percent ownership of Kuozui Motors in Taiwan, China prompted about 20 component manufacturers to begin operations in that country. Once Japanese companies started producing cars in the United States more than two hundred Japanese component manufacturers followed. The IFC has assisted with several joint-venture projects by foreign and DC component producers supplying vehicle manufacturers in the respective DCs. Examples include projects for the production of carburetors, transmissions and forged components in India, clutch assemblies in Yugoslavia, truck engines in Turkey, and iron and aluminum castings in Brazil.

Government policy is critical for an investment decision and can affect it in many different ways. General government policies regarding expatriate investment, repatriation of profits, local content requirements, labor laws, regulation of the economy, and others are closely evaluated by interested companies. In general, the less interventionist the government and the more its policies remain consistent and unchanged over time, the more attractive the policy environment for a multinational. This is not to say, of course, that a company would mind obtaining favorable intervention from the government with respect to taxation, subsidies, exceptions to labor laws, and so on. Particularly during the present climate favoring foreign investment, the multinationals can be selective and often negotiate favorable arrangements with the host government in both DCs and OECD countries. For example, U.S. and Canadian state and local

13. Current exchange rates.
14. Excludes benefits.

Figure 5: CHANGES IN SHARE OF LABOR COSTS IN TOTAL VEHICLE PRODUCTION COSTS IN LEADING DEVELOPING COUNTRIES, 1990-2000



Source: O'Brien, Peter. THE AUTOMOTIVE INDUSTRY IN THE DEVELOPING COUNTRIES: EIU. Risks and Opportunities in the 1990s. London 1989.

governments reportedly subsidize automotive projects by as much as 30 percent of the investment cost through free land, reduced utility rates, tax holidays, and other incentives. Similarly, recent investment projects by Nissan and Toyota in the United Kingdom benefited not only from cost-free sites and fiscal incentives but also have been able to deal with only one plantwide union instead of the customary multiple unions representing different trades. Another common form of favorable treatment entails protection of locally operating companies ranging from import restrictions (Thailand and Indonesia) to limiting the number of companies allowed to produce and market cars (Philippines).

Exchange rates are significant, particularly if a large proportion of inputs are imported or a large proportion of output exported. A case in point is a ckd assembly project in Turkey funded by the IFC. The project encountered serious problems when the local currency depreciated by 65 percent in 1985 and another 65 percent in 1986 against the German mark. The project, which imported the components from West Germany, was at a considerable competitive disadvantage because other assemblers imported components from other countries against whose currencies the Turkish lira had depreciated less, e.g., by 29 percent and 31 percent against the US$ during the same period. Another IFC-funded project in Yugoslavia experienced declining exports when high domestic inflation pushed up prices of raw materials faster than the local currency depreciated against the US$. On the other hand, DCs have often benefited from exchange rate movements. The wave of Japanese foreign direct investment in Southeast Asia, particularly by component manufacturers, which started several years ago and is expected to continue, has been motivated principally by the rise in the yen vis-a-vis the U.S. currency.

Availability of skilled labor is important but not considered crucial by multinationals. In any case, DCs that are serious candidates for automotive investments usually have a relatively skilled labor force. Also, all multinationals conduct substantial training programs and can bring in a few expatriate specialists, if necessary, until local residents are adequately trained. Infrastructure to ensure adequate power supply, communications, and efficient transport are most important, as is a broad "manufacturing tradition," so that the civil service, the banking sector, and the labor force are accustomed to the needs and operating methods of an automotive manufacturer.

Local content requirements have been instituted in most DCs to promote and protect local businesses and to save on foreign exchange. However, only three countries, Argentina, Brazil, and Korea, have reached a sufficient level of sophistication for an automobile to be

completely made in the country. Korea and Brazil export part of their production and are, therefore, obligated to maintain high standards of quality and performance to remain competitive. In contrast, Argentina's automotive industry has been in a decline, and, in view of the country's economic situation, it may not be able to recover in the near future. Local content requirements will present serious problems for DC automotive industries because design and technical innovations are likely to become even more concentrated in the headquarters of multinationals, especially as the pace of innovation accelerates. It will become, therefore, an increasingly greater challenge for DC producers to have quick access to innovation, to provide the financing required, and to upgrade their manufacturing skills to the level necessary for efficient production. This challenge cannot be met if access to innovation is hampered by restrictive local content regulations, a problem recently cited by Brazil's new President as partly responsible for the country's declining automotive production and exports.

Mexico, India, Thailand, and Taiwan, China, have achieved local content levels of 50 to 65 percent. It is unlikely that any of them will reach a much higher level because it is increasingly more difficult to increase local content at higher than at lower levels, and because Mexico, Taiwan, China, and, perhaps, India are relaxing their local content requirements.[15] They realize that they cannot be competitive in the vehicle export markets if locally made parts are of inferior quality or cost more than those made abroad. Countries with less than 50 percent local content produce relatively simple components, usually with labor-intensive production methods. (Table 17).

Unfortunately, local content regulations are often unrealistic and do not reflect a country's comparative advantage. In such cases, they result in higher production costs or lower quality, which make for a less competitive vehicle. Although these inefficiencies can often be passed on to the consumer in protected domestic markets, this is not possible in export markets. This is exemplified by a joint venture project in China with a French company, partly funded by the IFC. Originally the project was expected to attain 98 percent local content in four years at a cost equivalent to 86 percent ex-works France. It is now recognized that maximum local content cannot exceed 75 percent with questionable savings over imported components. Major reasons include low productivity, inferior quality because of low technical skills and unavailability of some raw materials, and delivery problems.

15. O'Brien, Peter, *The Automotive Industry in the Developing Countries: Risks and Opportunities in the 1990s.* The Economist Intelligence Unit, London 1989, p.12.

Table 17: Local Content of Vehicle Production in Selected Developing Economies, 1988 (percentage)

Region & country	Passenger cars		Commercial vehicles	
Latin America				
Argentina	>90		>90	
Brazil	>90		>90	
Colombia	45		25	
Mexico	60	(only 30 for exports)	70–90	(recently revised downward)
Venezuela	26	(target of 44 by 1996)	15	(target of 20 by 1996)
Asia				
China	12.5		-	
India	62	(target of 90 for 1989)		
Indonesia	-			Target of 100 for components by 1990
Korea	95		70–90	
Malaysia	18–22		-	
Taiwan, China	60	(50 by 1989)	-	
Thailand	54		40–50	
Africa				
Egypt	40		-	
Kenya	15–25		-	
Morocco	50	(can be reduced to 40 with Government permission)	60	(can be reduced to 50 with Government permission)
Nigeria	15–30		-	

NB: Figures are approximate. Definitions of local content differ from country to country (e.g., Korea considers a vehicle to be produced locally even if only 30 percent of the parts are made in the country) and vary between parts-based and cost-based data.

Source: O'Brien, Peter, *The Automobile Industry in the Developing Countries: Risks and Opportunities in the 1990s.* Economist Intelligence Unit, London 1988.

7. SUMMARY REMARKS

During the 1980s, the automotive industry has undergone significant changes that have transformed its structure. Technological innovations and new organizational and managerial approaches have resulted in different products and production processes. Product changes have come about primarily from the expanding use of electronics, plastics, and composites. Process changes have come about from the closer integration of design and production, the widespread use of computers and robotics, and the realignment of relations and respective responsibilities among auto manufacturers and their component suppliers. These have resulted in faster model introduction, shorter production cycles, and lower-volume plants while maintaining profitability. Although vehicle manufacturing is dominated by multinational companies operating mostly in the OECD countries, some DCs have also found a niche as producers and have become an integral part of the international network. Others have been operating successfully in their respective domestic markets, many in the production of commercial vehicles. The component industry structure is also undergoing substantial changes. Similar to vehicle manufacturers, component producers are beginning to concentrate design and development in a single location while spreading production among numerous sites in both OECD and developing countries.

The role of developing countries in the industry has changed. Governments are taking a less active part in production than they once did, but they still exert a strong influence on the industry in their respective countries through local content requirements, trade regulation, taxation, and licensing controls. A more cooperative spirit has evolved between DC governments and multinationals. It has become clear that in most cases DC producers need to collaborate with foreign companies who have the resources to develop new technology and the necessary marketing networks. Collaboration can either be in the form of equity participation or technical agreements or management contracts, depending on the needs of the respective partners. At the same time, the globalization of the industry, rapidly rising demand in DCs and the development of several production locations by each multinational to supply different regions has strengthened the position of the developing countries that have the necessary conditions to play a role in this industry.

It is difficult to precisely predict the role of DCs in the automotive industry during the next decade as both the industry and DCs have diverse, complex and dynamic characteristics. It is certain, however, that several developing countries can be successful in at least some facets of automotive production. These countries may be grouped into: (1) a relatively small number of DCs with a large domestic market or ready access to nearby developed country markets, advanced technical and managerial expertise, and developed supplier network that can produce the whole range of automotive products from components to commercial and passenger vehicles. Examples of such countries include Mexico, Brazil, Portugal, Korea, Taiwan, China and the Eastern European countries provided that the latter can rapidly achieve political and social stability and upgrade their management capabilities; (2) countries with an advanced level of technical, managerial and organizational expertise which can produce parts and accessories of medium to advanced technological sophistication for the domestic market and for export as well as vehicles, passenger and commercial, primarily for their domestic markets with some exports. Examples include India, Pakistan, Turkey, Indonesia, Venezuela, Argentina and Colombia; (3) countries with average technical and managerial capability and an abundance of inexpensive labor which can be used in labor-intensive manufacturing of simple components and accessories and assembly of commercial vehicles. Examples include the Philippines, Kenya, Nigeria, Zimbabwe, Morocco, Tunisia and Algeria. These groupings are neither exhaustive nor static as countries can, and often do, move from production of components and assembly operations to more difficult and complex operations. The extent to which specific DC producers will be successful in the automotive industry according to both financial and economic criteria will depend on many factors, including domestic and global economic conditions, the development of relevant policies by the developing countries themselves, access to technological innovations, adoption of appropriate technologies, strategies of automotive multinationals and international trade policies. For the majority of the developing countries that can play a role in this industry, most investment opportunities will be in the areas of component and commercial vehicle production. These will be the focus of future studies to be undertaken by the IFC.

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ISBN 0-8213-1592-7

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