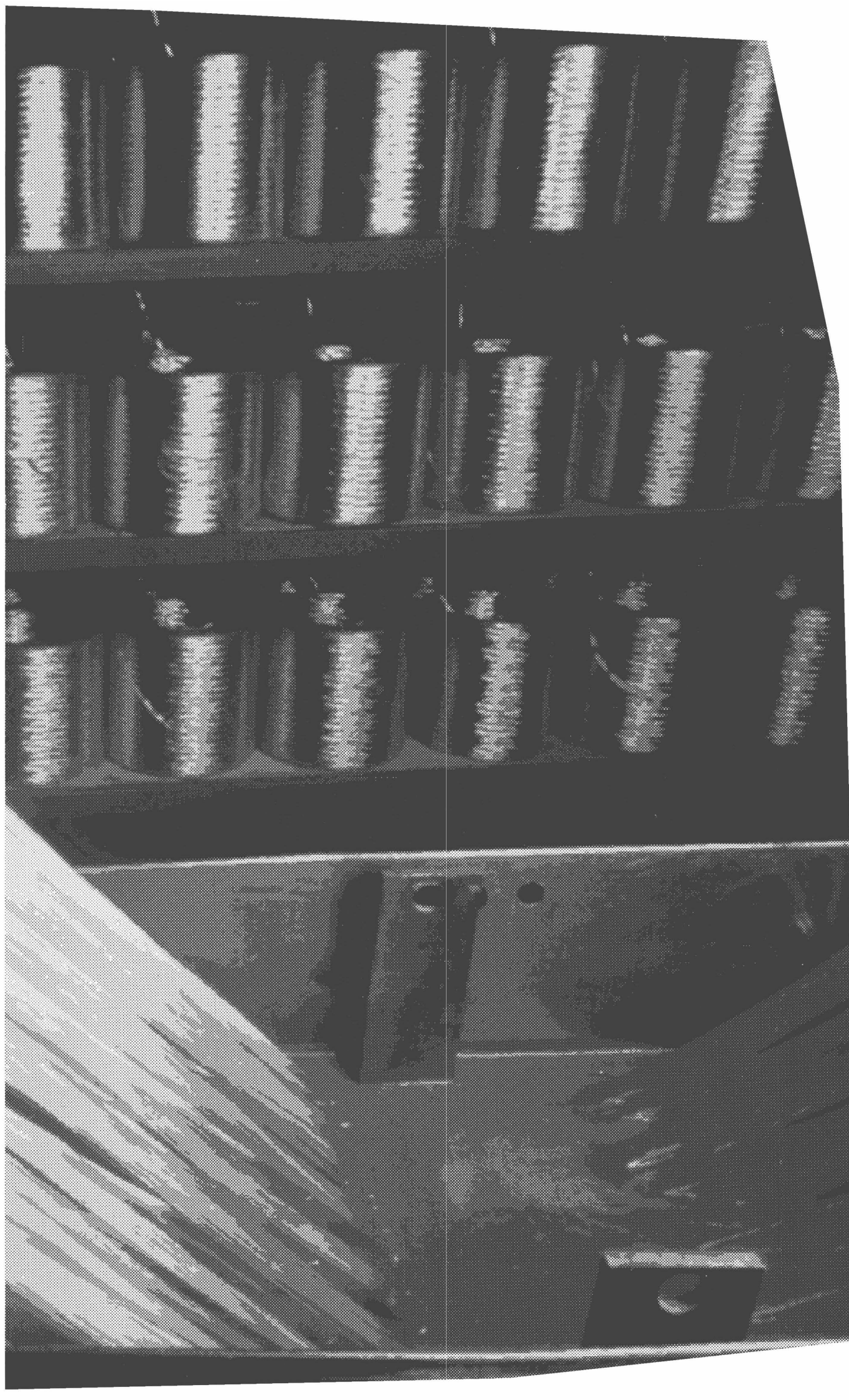


# Rubber and plastics



The rubber and plastics industry is a particularly dynamic sector of the EC economy. It has the advantage of ever growing demand thanks to the continual development of new products, particularly in the plastics sector, which frequently open up new areas of application, often as a result of close collaboration between manufacturers and users.

Plastics are increasingly used in all spheres. Their advantages over conventional materials such as wood, glass, paper or metal lie in their price, physical or chemical properties, ease of implementation, ease of use, etc.

The turnover for these two branches combined was around 76 billion ECU in 1989, i.e. an average increase of 4.3% per year since 1980 (constant value). Almost 900,000 people work in this sector.

### Description of the industry

The rubber and plastics processing sector (NACE 48) encompasses: the rubber industry (NACE 481), tyre retreading and repairs (NACE 482) and the processing of plastics (NACE 483). The plastics processing sector is made up of companies which buy resins and plastic components and convert them into semi-finished and finished products. Plastics processing firms produce finished goods which are used by other industries such as the agro-food industries or building and construction sector, or sold to final consumers and end users.

The rubber sector includes tyres as well as a wide variety of goods such as glue, tubes, belts, footwear, hygiene and surgical products, sports goods, floor coverings,

etc. Transport equipment provides half of its outlets, the rest being absorbed by a large number of activities in every area of the economy.

### Economic importance of the industry

**Current situation** With an output of 76 billion ECU in 1989, which was 5.8% up on 1988, the rubber and plastics processing industry accounts for 3% of EC manufacturing output. The plastics industry which accounts for 66% of this total figure (49.8 billion ECU in 1989) saw its output grow by 5.9% between 1980 and 1989 (constant value). The EC is a net importer (7 billion ECU), extra-EC imports having grown at a faster rate than exports since 1980.

# 20

**Table 1**  
**Rubber and plastics**  
**Main indicators, 1980-1989**

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(1)</sup>
Production (million ECU)	44 590	45 096	47 100	51 441	56 687	60 389	62 283	64 568	71 653	75 783	78 000
Employment (in thousand)	961	906.5	873.2	850.3	848.5	852	904.1	891.4	906.1	918	860

<sup>(1)</sup> Estimates  
 Source: Eurostat (Inde, Comext)

Output levels in the rubber industry were more stable over the same period 1980 - 1989 (an average increase of 0.4% in terms of constant value) reaching 26 billion ECU in 1989.

The EC is the world's largest producer, with American and Japanese output at around 20 - 22 billion ECU. The EC is a net exporter, in the case of both tyres and industrial rubber.

**Output and consumption** In terms of output value, the plastics industry is roughly twice the size of the rubber industry: 49,800 million ECU for plastics in 1989, 26,000 million for rubber, representing increases of 5.6% and 6% respectively compared with 1988.

Plastic or rubber components are used in practically every sector of the economy. The principal markets for processed plastics are shown in figure 1.

Rubber processing is made up of two separate sectors, the tyre industry (56% in

terms of volume) and industrial rubber which covers a wide range of products. The transport equipment sector accounts for between 40 and 50% of consumption, the rest being spread over numerous branches of the economy.

**External trade** International trade in plastic and rubber products represents 2% of world trade in goods. The main exporters are Southeast Asia and the European Community. The United States is the largest importer followed by the European Community. EC exports of rubber and plastic products amount to 10.7 billion ECU; they account for around 2.9% of the EC's total exports and 1.9% of imports (7.1 billion ECU). Extra-EC imports have increased rapidly over the past ten years (nearly 13% per year), particularly between 1986 and 1989 (an increase of 14% per year). In 1989, plastic products represented 65% of imports. Exports increased more slowly (approximately 8% per year from 1980 to

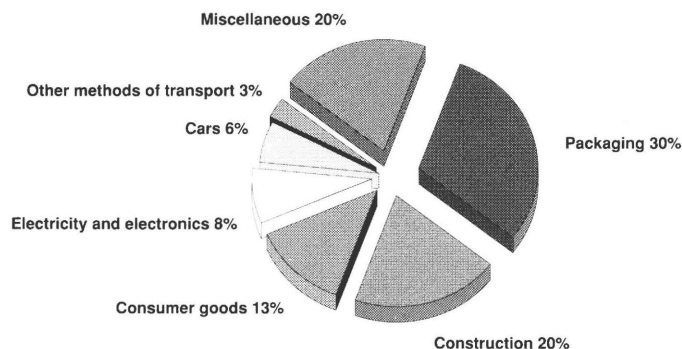
1989). In 1989, plastic products represented 65% of exports. The exports/imports ratio dropped from 2.2 in 1980 to 1.5 in 1989. The EC's main trading partners are the EFTA countries and North America. Intra-EC trade has expanded greatly (12.6% per year from 1980 to 1989), increasing from 7,415 million ECU in 1980 (17% of output) to 21,473 million in 1989 (28% of output). Plastic products account for 69% of this trade and rubber products 31%.

## Employment

The plastics processing industry currently employs nearly 583,000 people, around 70% of whom are production or maintenance workers. After several years of job cuts, there was a steady rise from 1984 onwards. The sector is faced with a growing need for skilled workers in order to replace the 60,000 or so people who annually retire or move to other sectors and in order to fill the 30,000 to 35,000 new jobs created each year.

The rubber industry employs a large workforce. In 1989, the number of people employed was approximately 335,000. The sharp decline which began in 1980, when the total number of employees in Belgium, West Germany, France, the United Kingdom, Italy, Luxembourg and the Netherlands amounted to 390,000, was checked in 1988. The deteriorating performance of the major rubber manufacturers however, raises the prospect of further job cuts in

**Figure 1**  
**Rubber and plastics**  
**Converted plastics market, 1989**



Source: Sema Management Group Consultants

**Table 2**  
Rubber and plastics  
External trade

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(1)</sup>
Import extra-EC	2 363	2 586	2 989	3 289	4 029	4 472	4 299	4 929	6 116	7 069	7 104
Export extra-EC	5 272	5 978	6 043	6 668	7 896	8 810	8 455	8 748	9 507	10 662	10 235
X/M	2.23	2.31	2.02	2.03	1.96	1.97	1.97	1.81	1.55	1.51	1.44
Trade intra-EC	7 415	8 138	8 980	9 968	11 365	12 936	15 264	16 825	18 932	21 473	N/A

<sup>(1)</sup> Estimated  
Source: Eurostat (Comext)

1990 and beyond.

## Investment

In the plastics and industrial rubber sectors, investment represents over 6% of production.

Recent technical improvements in the processing of the more common industrial plastics as well as rubber are changing the structure of the sector. The changes mainly stem from a higher degree of automation in the case of certain processes, the increase in machine production rates and improved monitoring systems.

The large-scale investments undertaken by processors often result in increased productivity with the same, if not smaller, number of workers.

## Structure of the industry

Apart from the tyre sector, which is highly concentrated, this industry is basically composed of small and medium-sized firms.

The plastics processing industry comprises over 17,000 firms, mainly independent processors employing an average of 33 employees. The main tyre producers are found in Europe, the United States and Japan, three areas which also happen to have the highest density of cars.

The six leading tyre producers account for 80% of world output. The industrial rubber sector however, is still highly dispersed: on the one hand, one finds a few large firms with international operations and on the other, a large number of small, locally or regionally based firms.

Plastics and synthetic rubber manufacturers, mainly large chemical firms, are currently seeking to integrate the various firms which make up the sector. In so doing, they acquire outlets for their products and an opportunity to diversify into products with a higher value added than

basic plastics. Upstream integration is evidently much more common in the plastics sector than in the rubber sector however. The current wave of mergers and acquisitions should continue in the years ahead. Larger units will thus be created and will be more highly specialised in terms of their products ranges and processing techniques. The partnership with raw material manufacturers and users will continue to develop.

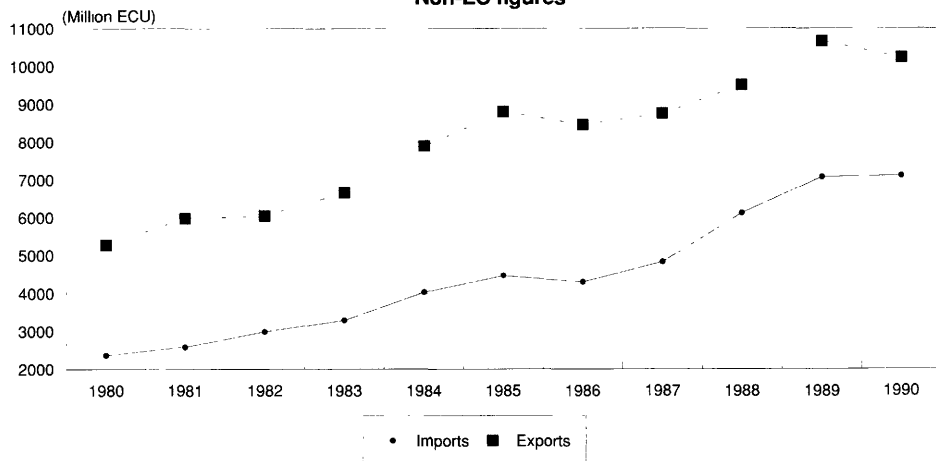
## Risks and opportunities

**Technology** New applications for plastics are constantly being discovered and the medium-term prospects for growth remain good. Considerable effort has gone into research and development in order to improve products and develop application services. The new technologies will require capital investment and a highly skilled workforce.

**Environment** Up until now, plastics have made their mark thanks to the qualities which they offer (low costs, ease of use, etc...). The next step is to prove that they do not harm the environment. With this end in view, the industry is now developing recycling processes for certain products, or the use of biodegradable plastics. Recycling techniques could well become a major feature of the plastics processing industry in years to come. Numerous operations involving selective collection and recycling are already under way throughout the EC.

Another topical issue is that of used tyres

**Figure 2**  
Rubber and plastics  
Non-EC figures



Source: Sema Management Group Consultants

and major efforts are being made to develop material upgrading processes or in the energy sphere.

**The single market** Tyre manufacturers have already largely developed a global strategy. The single market will therefore have little effect on this sector of the market. In the case of industrial rubber or plastics, however, we can expect to see moves towards greater concentration, mainly in order to obtain the necessary funds for research and development involving new products. Another possibility is that rubber and plastics manufacturers will become further integrated into large groups, such as chemical groups which supply plastics. The amalgamation of medium-sized European firms is yet another possibility.

### Competition from third countries

Extra-EC trade is still in its early stages. In 1988 and 1989 there was insufficient supply of plastics and EC producers were unable to meet the demand for plastic products. The market share of imports increased, even though firms scaled down their exports in order to concentrate on the domestic market. The balance of trade has deteriorated. With the creation of new production capabilities, the next few years should see a reversal of this trend.

### Prospects

Over the past few years the rapid growth in domestic demand in construction, transport and other applications has curbed the EC's export potential. In addition, newly industrialised countries are becoming major

competitors in the rubber and plastics sectors because they have the twofold advantage of a ready supply of raw materials and cheap labour. This trend is expected to continue for the time being. The rapid growth in exports should slow down whereas imports are expected to make increasing headway. In the short term, fluctuations in the price of plastic products reflecting capacity constraints on the supply side may well undermine growth and hinder the development of new applications.

As a result, EC demand for rubber products should grow at a slower rate in 1990 - 91, bearing in mind the slowdown in the car market, and then stabilise in the medium and long-term. This should trigger a relative slowdown in the growth rate of imports of rubber products. Demand from the Eastern bloc could provide EC producers with a few openings, however, and EC exports to the region are expected to grow in the course of the 1990s.

At the same time, the prospects for the plastics processing industry will remain good. According to the forecasts, the markets will witness further expansion and the large-scale investments in new plant may well lead to increased productivity and improved profit margins. Finally, thanks to a more highly skilled yet at the same time more costly workforce, overall profitability should improve.

Finally, the expected increase in oil prices

following the Gulf war could have far-reaching effects on the industry's European raw material producers, in the case of both plastic resins and synthetic rubber: cut-backs in production and exports, lower profits for producers linked to recent investments, overcapacity and restructuring. The processing industry would be affected at a number of levels:

- shrinking markets due to the increase in oil prices and lower growth rates. The slowdown in the carmaking industry, in particular, will have serious repercussions on the plastics processing, industrial rubber and tyre industry;
- loss of export market shares, bearing in mind the increase in EC production costs and the fluctuating parity of the various currencies;
- weakening of EC producers, linked to the increased cost of raw materials and energy, shrinking markets and recent investment.

**Table 3**  
**Rubber and plastics**  
**Production forecasts**  
(million ECU, constant value 1989)

	1989	1990	1991/1990	1992/1991
Plastics	49 800	51 500	+3.1%	+3.0%
Rubber	25 983	26 500	+2.0%	+2.0%

Source: Sema Management Group Consultants

Written by: DRI Europe  
Revised by: Sema Group Management  
Consultants

The rubber industry is composed of two quite separate sectors, similar in size: the tyre industry (56% of the rubber industry's output) and industrial rubber, which encompasses a wide range of products, half of them intended for the transport market. The tyre industry, for its part, is entirely orientated towards the latter. In 1989, EC output increased to approximately 26 billion ECU: the EC is the world's largest producer, with American and Japanese output at around 20 - 22 billion ECU. The EC is a net exporter in both the tyre and industrial rubber sectors.

### Tyres

**Description of the sector** The manufacturing sector has two client groups: on the one hand, carmakers, for first installation operations (40% of tyre sales) and on the other, the motorists themselves, who constitute the replacement market (60%).

The first installation market is highly competitive. Technical and economic criteria (mainly prices) are paramount.

On the replacement market, producers find themselves faced with a multitude of clients, from private car owners to owners of fleets of vehicles (transport, rent-a-car operators, etc). Operating via their subsidiaries or sales network, manufacturers do more than just place products: they also provide a service and technical advice.

Tyres can be subdivided into tyres for passenger cars, tyres for light and heavy commercial vehicles, tyres for agricultural purposes and miscellaneous.

**Current situation** In 1989 as in 1988, the automobile industry provided the rubber industry with a very buoyant market. Growth was achieved in all the producer countries

except for the United States. 1990 is expected to see a drop in demand for tyres, whether for passenger cars or heavy vehicles, due to a drop in car sales in the United States and Europe.

In addition, the development of longer-lasting tyres has led to a reduction in the replacement market. In terms of geographical distribution, France and West Germany account for 29% and 23% of EC output respectively, followed by Italy, the United Kingdom and Spain.

**Structure of the industry** The main tyre producers are situated in Europe, the United States and Japan, three areas which also happen to have the highest density of cars. According to the medium-term forecasts, the number of motorists will remain stable in the United States, grow only slightly in Europe (except for the Comecon countries) and increase significantly in Southeast Asia.

Europe accounts for 34% of the world market, whereas the United States accounts for only 23% and Japan 27%.

Each of the three major producers commands a sizeable share of its own domes-

**Table 1**  
**Rubber**  
**Main indicators, 1980-1990**

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(*)</sup>
Production	16 157.5	16 043.9	15 715.9	16 964.9	18 826.6	20 119.6	21 327.4	21 554.5	24 503.4	25 983.0	26 500.0
Employment (thousands) <sup>(1)</sup>	394.7	368.0	350.3	332.4	322.3	315.6	351.9	333.0	333.0	335.0	N/A
Trade intra-EC	2 756.2	3 035.4	3 210.1	3 480.1	3 761.8	4 223.8	5 159.4	5 564.6	6 084.3	6 632.4	N/A
Import intra-EC	1 081.0	1 131.4	1 291.1	1 361.1	1 597.3	1 781.9	1 604.9	1 794.9	2 163.1	2 451.7	2 483.0
Export extra-EC	2 266.6	2 628.6	2 431.9	2 640.1	3 092.4	3 374.3	3 204.7	3 245.2	3 462.8	3 733.2	3 465.0

<sup>(1)</sup> 1988 and 1989 estimated

<sup>(2)</sup> estimated

Source: International Rubber Study Group (Rubber Statistical Bulletin), Eurostat (Comext)

tic market: Bridgestone controls 36% of the Asian market, Goodyear 33% in North America and Michelin 36% in Europe. Recent efforts to expand into Asia can be explained by the fact that the share controlled by other groups is much larger there than on the European and American markets, and projected growth levels are much higher. The six leading tyre producers account for 80% of world output. As the car market becomes increasingly internationalised, tyre manufacturers have no choice but to adopt

a worldwide strategy. The legal concept of "dominant position" at both national and EC level, is thus becoming defunct, given the worldwide scale of the market. Numerous structural changes have taken place in recent years, all aimed at increasing the size of the major world groups, often via the take-over of smaller groups. These structural changes were not dictated by constraints relating to the scale of the European continent alone but rather the world market as a whole. Various mergers and acquisitions have

taken place. The Japanese firm Bridgestone acquired the American-owned Firestone, while Michelin took over Uniroyal-Goodrich in September 1989. Pirelli is currently seeking to amalgamate its tyre business with that of Continental (West Germany). Other smaller-scale acquisitions or joint ventures have taken place between EC companies (Continental, West Germany, - Mabor, Portugal), and European, Japanese (Continental-Toyo agreement), American or Eastern European companies (Pirelli, commercial agreement

**Table 2**  
**Rubber**  
**Production, value added and investment**

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987 <sup>(*)</sup>	1988 <sup>(*)</sup>	1989	1990 <sup>(*)</sup>
Production in current prices											
EC <sup>(1)</sup>	16 157.5	16 043.9	15 715.8	16 964.9	18 826.6	20 119.6	21 327.4	21 554.5	24 503.4	25 983.0	26 500.0
Index	80.3	79.7	78.1	84.3	93.6	100.0	106.0	107.1	121.8	129.1	131.7
USA <sup>(2)</sup>	12 333.0	17 481.0	19 173.0	22 909.0	20 058.0	28 841.0	21 939.0	19 099.0	19 632.0	22 273.0	23 382.0
Index	43.0	61.0	67.0	79.0	70.0	100.0	76.0	66.0	68.0	77.0	81.0
Japan <sup>(3)</sup>	7 028.0	9 342.0	9 391.0	11 544.0	13 715.0	15 207.0	15 607.0	15 502.0	18 792.0	N/A	N/A
Index	46.0	61.0	62.0	76.0	90.0	100.0	103.0	102.0	124.0	N/A	N/A
EC											
Production at constant prices <sup>(4)</sup>	18 567.0	16 788.0	15 150.0	15 675.0	16 366.0	16 608.0	20 614.0	20 863.0	18 978.0	19 279.0	N/A
Index	111.8	101.1	91.2	94.4	98.5	100.0	124.1	125.6	114.3	116.1	N/A
Value added at current prices <sup>(5)</sup>	5 273.0	5 248.0	5 055.0	5 367.0	5 576.0	6 018.0	6 698.0	6 885.0	7 645.0	8 157.0	N/A
Index	87.6	87.2	84.0	89.2	92.7	100.0	111.3	114.4	127.0	135.5	N/A
Productivity <sup>(6)</sup>	19.2	18.7	17.8	19.1	19.0	19.8	18.9	20.9			
Index	97.0	94.4	89.9	96.5	96.0	100.0	95.5	105.6	0	0	N/A

<sup>(1)</sup> Excluding Luxembourg

<sup>(2)</sup> Estimated

<sup>(3)</sup> Census of Manufactures and Eurostat estimates

<sup>(4)</sup> West Germany estimated

<sup>(5)</sup> Excluding West Germany, Ireland, Portugal and Luxembourg

<sup>(6)</sup> Value added at constant prices estimated for Denmark (1982, 1989),

The Netherlands (1980-85, 1988-89) and U.K. (1980-85, 1988-89)

Source: Eurostat (Index)

in Eastern Europe, talks between Pirelli and Taurus Hungary...). In 1975 there were 169 tyre factories worldwide compared with 153 in 1988.

**Trade trends** Although still largely positive, the extra-EC trade balance has deteriorated since 1980. The export/import ratio decreased from 2.4 in 1980 to 1.4 in 1989.

Part of the reason undoubtedly lies in the weakened position of certain manufacturers on their own domestic market. As regards exports, the EC, Canada and Japan are now

having to compete with countries like Korea, Brazil, Mexico, Taiwan, Malaysia and China.

Tyres for bicycles and inner tubes are two products which have contributed to this decline in the trade balance vis-à-vis Japan.

In the case of bicycle tyres, stiff competition from Southeast Asia over the past few years has led to the closure of many plants in Europe. In spite of the anti-dumping measures taken by the EC, the situation is growing worse. France and Italy are the only countries which still produce

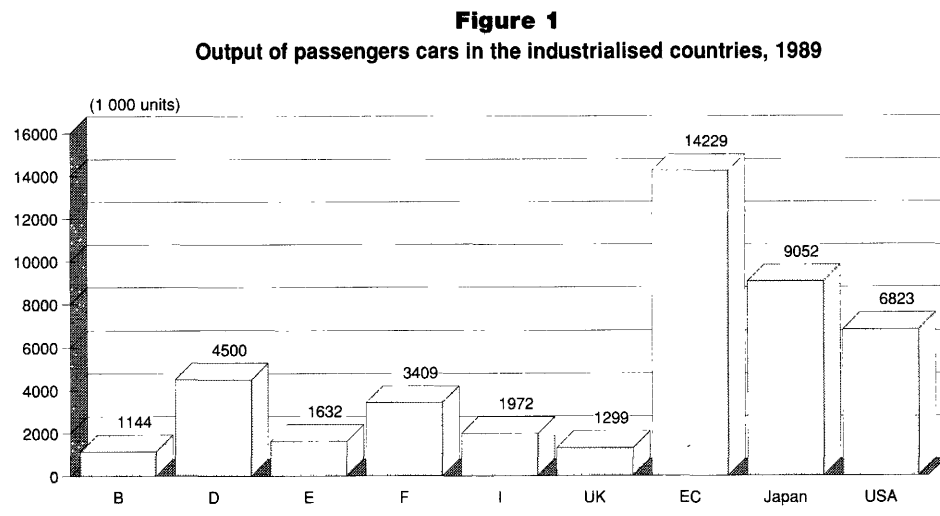
tyres for bicycles. The gradual demise of tube manufacturing in Europe is due not

so much to the growth of tubeless tyres, but rather fierce competition between producer countries, including Southeast Asia.

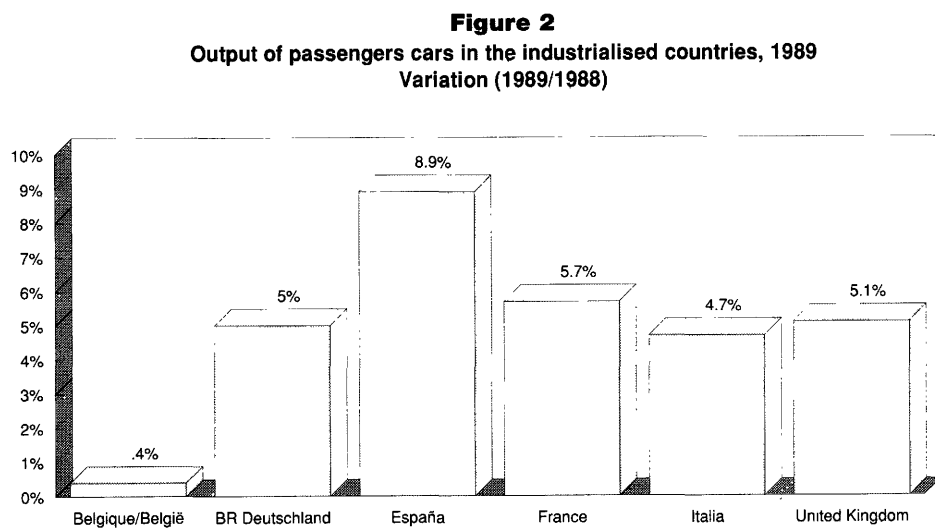
This phenomenon is all the more remarkable considering that the raw material is not natural rubber, which is produced in some of these countries, but rather synthetic rubber. Intra-EC trade has continued

to grow, from 799,000 tonnes in 1980 to 1,250,000 tonnes in 1989, i.e. a growth rate of 56%, which can be attributed to greater concentration and the decrease in the number of production units within the EC. Manufacturers are already operating on an EC-wide market.

**Employment** With a total of 335,000



Source: Caoutchoucs et plastiques



Source: Caoutchoucs et plastiques

people in 1989, employment levels have remained relatively stable over the past 3 years. The reduction in the number of jobs is linked to the drop in output (until 1983) and the rationalisation of production. In 1990, however, the combination of increases in raw material and energy prices and the reversal in the market makes further restructuring likely. Firms will be forced to shed surplus staff, in both the tyre business and industrial rubber sector. These job cuts, which will partly be aimed at production staff, will have to be accompanied by an increase in skill levels.

**Investment** Fierce competition and the struggle by the largest groups to survive are driving tyre manufacturers to invest as heav-

ily as possible in research and development, rationalisation and increases in capacity. The various moves involving restructuring and take-overs have greatly increased their indebtedness. The growing internationalism of the market, however, is prompting the principal manufacturers to set up in all the major markets. The changeover to radial tyres is almost complete and current technological developments tend to focus on lightness, safety and comfort, fuel saving and durability. The various manufacturers are competing against each other in all these areas.

**The single market** The completion of the single European market should not entail any major changes for the tyre industry. The latter is already highly concentrated and the



**Table 3**  
**Rubber**  
**National production of passenger car tyres**

(thousands)	1984	1985	1986	1987	1988 <sup>(1)</sup>	1989
EC	146 372	149 785	159 001	174 527	184 799	N/A
Belgique/België/Luxembourg	7 580	7 659	6 950	5 794	6 223	5 800
BR Deutschland	35 402	36 507	38 838	42 892	43 627	46 000
Hellas	315	305	540	769	800	N/A
España	16 500	15 700	16 641	19 523	21 075	N/A
France	42 360	42 255	45 627	49 980	54 156	54 839
Ireland	1 802	1 702	1 840	2 033	2 200	N/A
Italia	19 021	21 947	23 478	26 408	27 082	29 600
Portugal	1 699	1 784	1 773	2 049	2 100	N/A
United Kingdom	21 693	21 926	23 314	25 079	27 536	28 109
USA	172 934	162 584	159 350	167 522	174 341	175 026
Japan	78 976	83 886	88 067	90 373	97 351	N/A

<sup>(1)</sup> Greece, Ireland and Portugal estimated  
Source: International Rubber Study Group (Rubber Statistical Bulletin)

**Table 4**  
**Rubber**  
**National production of commercial vehicle tyres**

(thousands)	1984	1985	1986	1987	1988 <sup>(1)</sup>	1989
EC	18 935	18 346	19 415	20 513	22 408	N/A
Belgique/België/Luxembourg	1 077	1 169	1 254	1 339	1 608	1 702
BR Deutschland	3 805	3 970	4 023	4 192	5 017	5 366
Hellas	469	467	458	504	525	N/A
España	2 400	2 900	2 463	2 709	3 127	N/A
France	5 460	4 249	5 499	5 590	5 767	6 052
Italia	2 847	2 795	2 805	2 974	2 946	3 027
Portugal	455	502	584	666	750	N/A
United Kingdom	2 422	2 294	2 329	2 539	2 668	2 972
USA	36 441	34 339	30 939	35 455	37 010	37 844
Japan	48 287	48 259	44 009	45 518	49 877	N/A

<sup>(1)</sup> Greece and Portugal estimated  
Source: International Rubber Study Group (Rubber Statistical Bulletin)

EC dimension has already been largely incorporated in company strategies.

#### Factors influencing the development

**of the tyre industry** In spite of its leading position, the EC is vulnerable, whole sections of the industry having suffered greatly (bicycle tyres, inner tubes).

Special efforts are needed as regards increases in productivity, research and development, the modernisation of plant and increased penetration of all the major world markets. The profits of the major tyre producers dropped in 1990 as a result of:

- the increase in oil prices which had a two-fold effect:
  - ❖ on the car industry, which is the main

consumer of tyres;

- ❖ on the prime cost of tyres (oil contributes to the cost price of tyres both as a form of energy and as a raw material).
- a fall-off in the growth of the market which affected the USA in 1989 and the European Community in 1990,
- strong pressure exerted by carmakers on the sale price of tyres,
- the depreciation of the dollar, which benefited the USA while weakening the Europeans. The latter's position on the American market is more difficult and they are having to contend with stiffer competition on the mass exports market.

It seems likely that tyre producers who have just completed an initial restructuring

phase will be forced to continue their efforts. The three world leaders, for example, Michelin (France), Goodyear (USA) and Firestone/Bridgestone (Japan) have already announced plant closures and are forecasting a downturn in their profits for 1990 and 1991. The smaller producers (Portugal, Greece, Spain, Ireland) are in danger of being weakened.

The environmental factor which is affecting both production plants and recovery operations, particularly in the case of used tyres, may well give rise to a profitable waste upgrading sector.

**Prospects** In the run-up to 1992, the EC tyre market will grow at a slower rate than the gross national product, based on fairly stable growth in car production: the maximum projected growth rate is 1.3% as against 2.5% for the GNP.

In addition, the opening up of Eastern bloc countries will force Eastern European tyre manufacturers to adapt and invest in order to survive. Their production plant is in many cases obsolete and their standards relating to technology, manufacturing and management lag far behind those developed in the United States and Europe. Various investment opportunities are thus open to Western European groups, on an Eastern European market with a capacity of over 100 million tyres per year, via a network of over forty units.

### Industrial rubber

**Description of the sector** The industrial rubber industry produces a wide range of goods, such as glue, tubes, belts, footwear, hygiene and surgical products, sports goods, floor coverings, etc. The transport equipment sector provides half of its outlets, with the rest being absorbed by numerous activities in every area of the economy.

The manufacturing processes are highly varied: some require considerable investment while others are performed on a very small scale and involve only light plant work. The sector thus consists of both large firms (over 1,000 employees) and small units employing less than twenty people.

**Current situation** The industrial rubber markets are highly dispersed in the case of both industry and mass consumption, except for the car fitting sector which accounts for 40 to 50% of consumption of industrial rubber. In 1989 as in 1988, the automobile industry provided industrial rubber with a very buoyant market.

The fairly stable overall growth is hardly a true reflection of individual cases: while certain highly specialised sectors are thriving, others are on the decline.

EC output is affected by two factors:

- the inroads made by plastics as a substitute for rubber in numerous traditional sectors;
- competition from Southeast Asia and Eastern Europe in the case of certain products with a high labour input.

**Structure of the industry** Industrial rubber is a highly diversified sector made up of a few large firms with international operations and a large number of small often locally or regionally based firms.

Medium-sized firms (200 to 500 people) are often integrated into large industrial groups.

Although no major changes in this distribution are expected in the medium term, amalgamation is beginning to take place, such as the acquisition of two German firms Felix Bottcher and Plastex by Stowe Woodward and Mound Hope or the setting up of Mg Silikon, a venture between Ger-

land (France) and Metzeler (West Germany), in the industrial rubber products sector. Since the industrial rubber industry still supplies a large number of other sectors, rubber producers in some countries are now tending to tailor their products to those of the main local client industries. The Italian industry, for example, specialises in sole components for footwear, while the Germans specialise in conveyor belts (for the mining industry), etc.

**Trade trends** Owing to the structure of the different markets and the nature of the products, which are closely linked to consumer sectors, this sub-group is less affected by international trade than tyres.

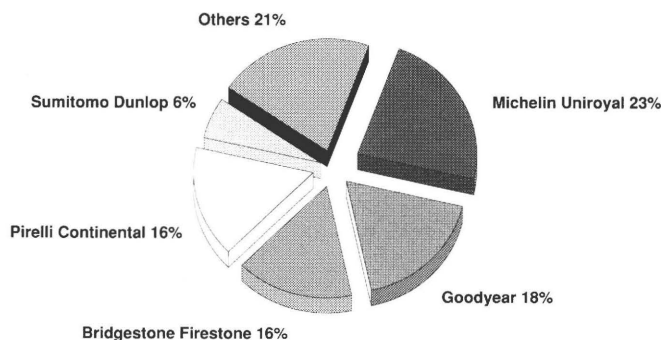
The cover rate varies greatly but the overall trend is downward. The export/import ratio declined from 1.9 in 1980 to 1.2 in 1989. The Comecon countries and Southeast Asia are steadily increasing their market share in Europe, particularly in the case of products with a high labour input.

Intra-EC trade remains stable, at around 80 - 100,000 tonnes.

The advent of the single market will no doubt lead to an increase in intra-EC trade, with Spain and, to a lesser extent, Portugal and Greece seeking to increase their share of the EC market by exploiting

**Figure 3**

**The major producers on the world tyre market, 1989**  
Total: 50 Billion ECU



the temporary opportunities afforded by lower pay.

**Employment** With just under 200 000 people in 1987, the industry continues to depend heavily on labour. Thanks to the economic recovery, it has managed to stabilise its workforce over the past two years.

The massive influx of certain bottom-of-the-range goods with a high labour input, however, is leading a growing number of firms to shift their production operations abroad, in order to take advantage of lower costs.

**Factors influencing the development of the industrial rubber industry**

The future of the industrial rubber industry will be influenced by a number of factors, including:

- the industrial and commercial expansion of Japan, particularly as regards car fitters and that of Southeast Asian coun-

**Table 5**  
**Rubber**  
**Estimated turnover of the top companies, 1989**

(million dollars)	Turnover
Bridgestone	12.38
Goodyear	11.05
Michelin	8.67
Pirelli	7.54
Cooper	5.13
Continental	4.46
Sumitomo	3.48
Yokohama	2.67

Source: SEDICA

**Table 6**  
Tyres  
EC trade in current value

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(*)</sup>
Exports extra-EC <sup>(1)</sup>	501	492	423	465	588	595	577	681	644	669	633
Index <sup>(2)</sup>	95	93	80	88	99	100	97	114	108	112	106
Imports extra-EC <sup>(1)</sup>	209	172	188	214	238	270	310	371	445	474	488
Index <sup>(2)</sup>	81	64	71	81	88	100	115	137	165	175	181
X/M	2.4	2.9	2.3	2.2	2.5	2.2	1.9	1.8	1.5	1.4	1.3
Trade intra-EC	799	782	823	819	839	910	1 026	1 072	1 180	1 250	N/A
Index	91	88	92	92	92	100	113	118	131	137	N/A
Share of total (%)											

<sup>(1)</sup> 1980 EC9; 1981-1984 EC10  
<sup>(2)</sup> Taking into account changes in EC membership  
<sup>(\*)</sup> Estimated  
Source: Eurostat (Comext)

**Table 7**  
Rubber  
Debts of the main world rubber manufacturers  
(billion ECU)

Firm	Turnover 1989	Net profit 1989 (% of turnover)	Debt/ Equity capital (%)
Goodyear	9.3	1.9	146
Continental	3.7	2.9	48
Bridgestone	6.4	0.6	94
Michelin	8.2	4.2	138
Pirelli	3.1	3.1	55

Source: Sema Group Management Consultants

- tries, which has led EC producers to:
- ❖ shift their production operations to these countries (e.g. Hutchinson Mapa, London Rubber and others have moved their glove production operations to Malaysia);
  - ❖ abandon traditional articles in favour of technical products with a higher value added.
  - the opening up in the East, bringing with it the promise of new markets yet at the

same time increasing competition between large firms in these countries,

- ever greater technical requirements entailing major efforts in terms of research and innovation, increased investment as well as training and standardisation. It seems likely that only competitive, high-performance companies will be able to bear the costs.

**Prospects for the sector** The growth in demand for the rubber industry, which is closely linked to developments in the car industry, in the case of both tyres and industrial rubber, should slow down in 1990 and over the next few years.

**Table 8**  
Industrial rubber  
External trade, 1980-90

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(*)</sup>
Exports extra-EC <sup>(1)</sup>	298	316	312	339	346	363	338	347	267	290	274
Index <sup>(2)</sup>	86	91	90	93	95	100	93	96	74	80	76
Imports extra-EC <sup>(1)</sup>	158	149	159	154	164	171	193	221	214	244	251
Index <sup>(2)</sup>	95	89	95	91	96	100	113	129	126	142	147
X/M	1.9	2.1	2	2.2	2.1	2.1	1.8	1.6	1.3	1.2	1.1
Trade intra-EC	463	443	469	460	508	547	593	617	433	483	N/A
Index	89	84	89	87	93	100	108	113	80	88	N/A

<sup>(1)</sup> 1980 EC9; 1981-1984 EC10  
<sup>(2)</sup> Taking into account changes in EC membership  
<sup>(\*)</sup> Estimated  
Source: Eurostat (Comext)

**Table 9**  
Forecasts for rubber production  
(million ECU, 1989 constant price)

	1989	1990	1991/1990	1992/1990
Production	25 983	26 500	+2.0%	+2.0%

Source: Sema Group Management Consultants

Written by: Sema Group Management  
Consultants on the basis of Panorama 1990.  
The industry is represented at EC level by: BLIC:  
Bureau de liaison des industries du caoutchouc  
de la Communauté Economique Européenne.;  
Address: 2, avenue des Arts, bte 12,  
B-1040 Brussels; tel: (32 2) 218.49.40;  
fax: (32 2) 218.61.62

Community production of plastic sheets and films increased by 3% in 1989, and a similar performance is expected in 1990. The high cost of certain plastic materials combined with certain production output deficiencies have showed a more sustained growth in consumption.

### Definition and transformation technologies

Plastic sheets and films are mainly manufactured by the three following plastic material transformation technologies: extrusion, rolling and coating. In the extrusion process, the mass to be moulded is heated, plastified (i.e. softened) and homogenised in an extrusion machine. The plastic mass then travels through a linear or circular matrix which gives the required shape to the material. The extruded material is stretched as a single sheet or film of the required thickness. Stretching the material lines up the macro-molecules and improves their mechanical properties. Co-extrusion enables multi-layer films or sheets to be produced. Consequently, several extrusion machines are linked to one matrix. The properties of various plastic materials are thus combined in a single film or sheet with

new properties. In the case of rolling, the heated then softened material is then rolled through a cylinder assembly until a continuous sheet is formed. Coating consists of covering with a plastic layer cloth, felt, cardboard, paper, metal or even plastic by extrusion, rolling or combing procedures.

### Production

Plastic resin consumption for plastic sheets and films production in the European Community was about 7 million tonnes in 1989, being 3.2% more than in 1988. Sheets and films production represents about 40% of the total consumption of plastic resins used for this application, that is to say mainly low and high density polyethylene, rigid and plastified polyvinyl chloride, polypropylene, thermoplastic polyester. EC Plastic film and sheet production is higher than that of the United States (by about 30%) and that of Japan (by about 70%).

## Consumption

Plastic sheet and film consumption can be segmented by resin and by market.

**Segmentation by resin** Polyethylene films and sheets, with about 4.5 million tonnes in 1989, represented 65% of total plastic materials films and sheets production. They also represent almost 60% of total polyethylene consumption, more than 90% of which is low density polyethylene and low density linear polyethylene. High density polyethylene is the alternative to low density for certain packaging, especially small and medium-sized sachets. The main markets for polyethylene films and sheets are:

- ❖ packaging (small and medium-sized sachets), accounting for 70% in competition with paper;
- ❖ agricultural films and shrink films, accounting for 20%;
- ❖ large volume bags, accounting for 10%, in competition with Kraft paper or textiles.

Linear low density polyethylene, as an alternative to low and high density polyethylene, has been perfectly developed for certain applications, due to its advantages:

- ❖ high resistance to breaking and stretching;
- ❖ greater rigidity for a given density;
- ❖ excellent elasticity qualities;
- ❖ high resistance to perforation.

Penetration by linear low density polyethylene in the polyethylene films and sheets markets has gone from 6.4% to 12% between 1984 and 1989, in a film resin market growing by 8% per annum. Out of a volume of 4.2 million tonnes of low density polyethylene used in 1989 for film manufacturing, linear product represented 500,000 tonnes, of which 45% was for packaging. Out of a total volume of 5 million tonnes of vinyl resins consumed in the EC in 1989 for sheets and films production, almost 65% was for rigid

**Table 1**  
World consumption of plastic sheets and films

(in tonnes)	Total consumption	Films and sheets	% of total consumption	Variance %
	1989	1989	1989	1988/89
<b>Western Europe (1)</b>				
LDPE (2)	5 074	4162	82	2
HDPE	2 649	360	13.6	3.7
Rigid PVC	3 285	570	17.4	2.3
Plastified PVC	1 739	852	49	2.8
Polypropylene	3 257	565	17.3	14.8
Thermoplastic polyester	N/A	N/A	NA	N/A
Acrylic	203	203	100	5.2
Polyamide	323	76	23.5	2.7
<b>United-States</b>				
LDPE (2)	4 142	2 756	66.5	-4.1
HDPE	3 692	511	13.8	4.9
Rigid PVC and plastified PVC	3 777	N/A	N/A	N/A
Polypropylene	3 301	337	10.2	4
Thermoplastic polyester	867	274	31.6	2.2
Acrylic	224	224	100	7.2
Polyamide	271	51	18.9	27.5
<b>Japan</b>				
LDPE (2)	1 294	611	47.2	0.5
HDPE	881	303	34.3	3.8
Rigid PVC	1 000	N/A	N/A	N/A
Plastified PVC	847	N/A	N/A	N/A
Polypropylene	1 681	387	23	4.9
Thermoplastic polyester	na	NA	N/A	N/A
Acrylic	123	N/A	N/A	N/A
Polyamide	161	29	18	16

(1) EC countries and Austria, Finland, Norway, Sweden and Switzerland

(2) LDPE includes LLDPE

Source: Modern Plastics International, January 1990

PVC and 35% was for plastified PVC in 1989. The main uses of rigid vinyl films and sheets (570,000 tonnes, being 17% of the total rigid PVC consumption) are:

- ❖ watertight seals for the building industry;
- ❖ protective covers;

- ❖ labels and adhesives;

- ❖ thermoformed packaging.

Plastified vinyl films and sheets (852 thousand tonnes in 1989, being 49% of total plastified PVC consumption) have three main outlets:

**Table 2**  
Penetration of LLDPE (1) in the LDPE (2) markets

	1984	1984	1989	1989
Applications	Total Market (1000t)	% LLDPE	Total Market (1000t)	% LLDPE
Films	2 863	6.4	4 162	12
Non films	999	20	912	27
<b>TOTAL</b>	<b>3 862</b>	<b>10</b>	<b>5 074</b>	<b>15</b>

(1) LLDPE = Linear low density polyethylene

(2) LDPE = Low density polyethylene

Source: Sema Group Management Consultants

- ❖ coated cloth (21% of the market), for furniture, automobiles, leisure and protective clothing;
- ❖ floor coverings (30% of the market);
- ❖ sheets and films for other uses, in particular agro-alimentary packaging films (6% of the market), office products, toys or medical products.

The annual growth of the PVC films and sheets market is estimated at 2-3%. Consumption of polypropylene resins for films and sheets reached 565,000 tonnes in 1989; an increase of 15% in relation to 1988. Aligned polypropylene films at present represent almost half of this market, with 260,000 tonnes per annum. Since the end of 1988, new production capacities for aligned polypropylene have been planned and will be operational in 1990/91. This new capacity will result in over 100,000 tonnes per annum of extra production. The Community market for polyester films in 1988 was about 114,000 tonnes. Production in Europe is in the hands of four companies: Hoechst AG (German Federal Republic), ICI (United Kingdom), Rhone Poulenc Films (France) and Dupont (United States). Market growth is estimated at 6%. Community consumption of plastic resins for polyamide sheets and films production is estimated at 76,000 tonnes in 1990. Polyamide films of the extruded or co-extruded type are mainly used for producing single and multi-layer films for packaging, particularly in the agro-alimentary sector. The growth of the polyamide films market is estimated at about 3-4% per annum.

**Segmentation by market** Packaging represents by far the main sector of application for plastic sheets and films.

As well as the qualities of durability and light weight, plastic packaging is particularly interesting because of its low require-

**Table 3**  
LLDPE resins for films

(thousand tonnes) Applications	1984	1987	1990(*)
Packaging (small and medium sized sachets)	79	175	235
Films (stretch and shrink)	97	168	185
Large volume bags	8	82	100
<b>TOTAL</b>	<b>184</b>	<b>425</b>	<b>520</b>

(\*) Estimates  
Source: Sema Group Management Consultants-SMC

ments in energy and raw materials for its production and transformation. Replacing traditional packaging materials by plastics cuts by half at the same time packaging waste volume and energy consumption. Furthermore, new prospects are opening up for the packaging market thanks to the development of new material properties as well as technological innovations. Finally, awareness on the part of public opinion and the authorities on the undesirable effects of consumption on the environment and on raw materials represents a new challenge for the industry. Optimising plastic packaging waste processing requires new structures and new technologies, thus incineration with energy recovery and recycling will tomorrow be powerful forces in this industry. The flexible packaging industry is built up of some 500 companies across Europe which transform the different materials into bags, sachets or rolls ready for use on automatic packaging machines. Alongside paper and aluminium film, polyethylene, polypropylene, polyamide and polyester films have achieved considerable market share. Protective properties are obtained by coatings, particularly based on polyamide, PVDC and EVOH. Vacuum metal coating of plastic films has also experienced major developments over the last few years. Extrusion layering and rolling

operations and blending various materials amongst themselves have enabled a number of properties to be combined to respond to the specific requirements of the food industries.

**Construction** Rigid and plastified PVC sheets, used in the construction industry, represent an important market. Watertight seals, floor and wall coverings are all applications in this field. The growth of plastics in this sector is following the evolution of the construction industry.

**Transport** Whether it is in the manufacture of waterproof tarpaulins for trucks or in the manufacture of rolled PVC sheets as car interior coverings, transport represents a significant market for PVC sheets and films.

**Agriculture** Polyethylene low density or PVC films and sheets are used in agriculture for ensilage of forage crops, ground cover for spring crops, forced growth under cover or greenhouse construction.

**Other market segments** Here we can list adhesives, films for graphics use, magnetic and video tapes, credit cards, office products, imitation leathers, various medical usages.

### Structure

The plastic films and sheets industry is created by transformation companies that can be put into two categories:

- ❖ those who are integrated upstream and are subsidiaries of plastic resin producers;
- ❖ independent transformation companies,

generally smaller in size.

An increase in company buy-outs has been registered, as well as the creation of Community groups for commercial or production activities.

## Outlook

The packaging market, which represents almost 80% of films and sheets consumption, will continue to be a promising one. High growth levels are forecast:

- ❖ polyethylene sheets and films, 4 - 5% per annum;
- ❖ polyvinyl chloride sheets and films, 2 - 3% per annum;

- ❖ polypropylene sheets and films, 10 - 12% per annum;

- ❖ polyamide sheets and films, 3 - 4% per annum

**Prepared by: Sema Group Management  
Consultants**

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198**



In 1989 the production of the plastics processing sector of the European Community totalled 50 billion ECU. The sector provides employment for almost 583,000 persons.

Thanks to competitive prices plastics continue to substitute metals, glass, paper, wood and other traditional materials, a fact that has enabled both production and consumption to enjoy an annual growth rate of the order of 6% in recent years. The trade balance in this sector has always shown a slight surplus.

In future, growth should be sustained by the enhanced demand for new products.

### **Definition of the sector**

The plastics processing sector consists of companies who buy resins and plastic raw materials, converting them into semi-finished and finished products. The processing of plastic materials is based on very diverse technologies such as injection moulding, blow moulding, extrusion, thermoforming and rotational moulding as well as certain finishing processes (printing, decoration, welding etc.).

The processors of plastic materials create finished articles used in other industries including agricultural and food, housing and construction, or are sold to consumers and end users. Some of these companies are involved throughout the processing chain producing the resins and transforming them into finished and semi-finished products.

The principal markets for processed plastics are construction, packaging, electrical and electronic, automotive, furnishings and

fittings and agriculture. Virtually all manufacturing industries make use of articles made from processed plastics. These articles range from mass produced items such as wrapping film made from low density polythene to specialist products like artificial cardiac valves.

### **Current situation**

The industry represents the largest share of the total consumption of plastics processed in the EC. The balance is processed directly by companies belonging to other sectors.

The plastics processing sector includes more than 17,000 companies, basically independent processors with an average of 33 employees. Overall in the EC the sector provides employment for 583,000 people. Their salary levels are appreciably lower than those in comparable sectors despite a higher proportion of skilled labour than the plastics materials manufacturers.

**Table 1**  
Plastics processing  
Main indicators, 1980-90<sup>(1)</sup>

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Apparent consumption	26 710	27 158	29 471	32 375	35 488	37 523	38 400	40 544	45 003	47 488	48900
Net exports	1 723	1 894	1 913	2 101	2 372	2 746	2 556	2 469	2 147	2 312	3100
Production	28 433	29 052	31 384	34 476	37 860	40 269	40 956	43 013	47 150	49 800	51500
Employment (thousands)	566	539	523	518	526	536	552	561	573	583	595

<sup>(1)</sup> 1987/88 and 1990 estimated  
Source: Panorama 1990

## Structure of the industry

The structure of the plastics processing industry is very different from that of the plastics production industry.

- ❖ plastics processors are generally smaller in size than the producers, require less capital but more labour intensive;
- ❖ the processing of plastics may be a company's sole operation (annual turnover up to 1 million ECU) or one of a number of corporate activities.

In most countries the plastics processing industry has developed as a result of the following factors:

- ❖ the development of applications and the demand for products with a high technological input;
- ❖ the aid and support given by suppliers of plastics materials or by the major users (e.g. the automotive industry);
- ❖ The downstream integration of plastics producers and the development of processing technologies.

The low prices for base resins and the low capital investment requirement have

encouraged a certain number of engineering firms to become involved in this sector. In addition firms that manufacture products from competing materials have gone into plastics processing for offensive or defensive reasons. Recently a certain number of firms belonging to sectors which use processed plastics have carried out upstream integration; typical of these are agricultural and food industries particularly active in the field of mineral waters and soft drinks, manufacturing bottles from PET, PVC and other plastics on their own production lines. Some suppliers of resins have also integrated the processing of plastics downstream. Finally it is important to remember that this industry includes a substantial proportion of sub-contractors. Over the past three years when demand was rising sharply, the producers succeeded in increasing their output to a significant degree and developing their exports.

However the price of raw materials has also increased considerably, a tendency

only made worse by the customs barrier of the EC which is fixed at 13% for plastic raw materials.

## Production

Production in the plastics processing sector achieved a level close to 50 billion ECU in 1989, that is an average annual growth rate of 6% since 1980 (constant value 1985). Since 1980 both the production and consumption of plastics have continued to grow in the EC. The increase has primarily benefited the area of industrial and engineering plastics with materials such as ABS, polyamide (nylon), polycarbonate and the thermoplastic polyesters, while the plastics in more current usage (high and low density polythene, polystyrene, polypropylene and PVC) have enjoyed a somewhat less spectacular expansion.

At the same time the search for characteristics such as weight reductions, ease of design and conception and the ability to combine different functions has led to an increased substitution of metals by techni-

**Table 2**  
Plastics processing  
Industry structure

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Number of companies <sup>(1)</sup>	11 867.0	12 544.0	12 334.0	13 715.0	15 575.0	15 501.0	16 821.0	17 222.0	17 380.0
Average number of employees per company <sup>(1)</sup>	48	43	42	38	34	35	33	32	33
Sales per employee (ECU) <sup>(1)</sup>	49 565.0	53 444.0	59 914.0	66 490.0	75 553.0	77 092.0	74 169.0	76 617.0	82 272.0
Average hourly labour cost <sup>(2)</sup>	6.6	7.2	7.7	8.3	8.8	9.4	9.9	10.4	10.7

<sup>(1)</sup> Excluding Greece

<sup>(2)</sup> Excluding Spain and Portugal; Estimated  
Source: Panorama 1990

cal plastics for automotive components.

## Consumption

Consumption by the plastics processing sector is slightly less than production, attaining 48 million tonnes in 1989.

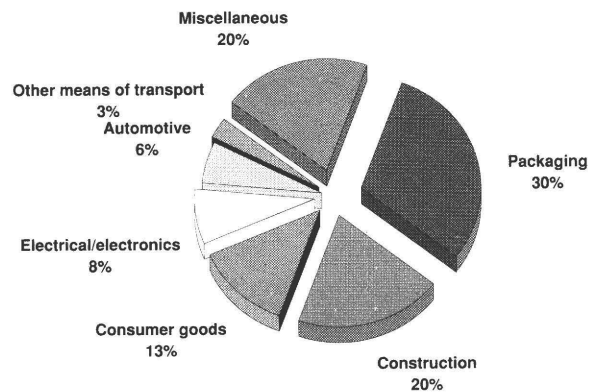
Consumption per capita indicates broad differences among the various members of the EC (128 kg/capita in Germany, 59 kg in France, 53 kg in the United Kingdom, 126 kg in Belgium, etc.) and the growth potential will vary in the long term.

The structure of the end market for processed plastics is shown in figure 1.

Low density polythene foils are the main plastic product used in packaging, but bottles made of high density polypropylene as well as PET (polyester terephthalate) also play a significant role as do thermoformed film and injection moulded articles and expanded sheet. Multilayer films (complex soft packaging films) are currently enjoying a growing role in the packaging of food products.

The food industry as well as the chemicals and affiliated sectors represent 75% of the market for plastic packaging materials. It is a market that has good growth potential for the next five years given the rapid strides being made in integrated packagings and distribution systems as well as the guiding influence of the powerful agricultural and food groups. The part played by plastics in most processed products will gain further impetus as interest increases in environmental issues and the desire to minimise waste products. The obvious advantages offered by a reduction in both the weight and consumption of raw materials compared with the more traditional packaging materials as well as the new technologies for recycling plastic waste constitute important factors for the future.

**Figure 1**  
Structure of end user market for processed plastics, 1989



Source: Sema Group Management Consultants

The evolution in the cycle of the market for plastic goods can be described in three phases.

The first phase is the launch of new products which requires market studies and the analysis of opportunities as well as technical research and development. In the EC the growth rate in this sub-sector has frequently exceeded 25% per annum. Phase two of the cycle is the development stage of the products which, while enjoying a high growth rate, begins to level off compared with phase one. Although plastics are still widely accepted in certain segments of the market, growth is essentially due to innovations resulting from the huge evolution in applications and to a lesser extent to the growth of the markets themselves.

The third and final phase of the cycle is that in which the market where the materials and products are broadly accepted matures. As a result, the potential for innovation is far less broad and growth is due virtually exclusively to the expansion in existing markets.

In each of these three stages, growth is the result of a combination of two interdependent factors, national economic growth

and innovation. The identification of various stages of growth in the consumption of plastics is not a simple theoretical exercise but it is important, since the firms involved must either adopt new strategies or modify existing strategies in order to cope with changing situations.

## Geographic Characteristics

The various members of the EC differ in the structure of production and consumption, their rate of exports within the Community, their productivity and their technological level.

The four main plastics processing countries of the EC, Germany, France, Italy and the United Kingdom, have seen their markets grow in terms of both production and exports. In 1989 Germany had approximately 2,200 firms employing some 260,000 people and a turnover of 48 billion DM, including one quarter exports. Germany's processing industry is specialising increasingly in contract converting in large volumes, especially for the automotive sector, electrical/electronics and domestic electrical appliances. Close on 26% of Germany companies employ between 100 and 499 persons, and some 3% em-

**Table 3**  
Plastics processing  
Production, value added and investment (1)

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<b>Production in current prices</b>											
EC	28 433.0	29 052.0	31 384.0	34 476.0	37 860.0	40 269.0	40 956.0	43 013.0	47 150.0	49 800.0	51 500
Index	71.0	72.0	78.0	86.0	94.0	100.0	102.0	107.0	117.0	124.0	128.0
Quantities (thousand tonnes)	18 240.0	18 111.0	18 320.0	20 198.0	21 335.0	21 945.0	22 959.0	24 064.0	25 126.0	N/A	N/A
Index	83.0	83.0	83.0	92.0	97.0	100.0	105.0	110.0	114.0	N/A	N/A
Turnover (2)	26 795.0	27 439.0	29 865.0	32 730.0	37 901.0	39 447.0	41 645.0	43 969.0	48 050.0	50 500.0	N/A
Index	67.9	69.6	75.7	83.0	96.1	100.0	105.6	111.5	121.8	128.0	N/A
USA (1)	12 333.0	17 482.0	19 173.0	22 908.0	28 063.0	28 841.0	21 939.0	N/A	N/A	N/A	N/A
Index	42.8	60.6	66.5	79.4	97.3	100.0	76.1	N/A	N/A	N/A	N/A
Japan (2)	18 231.0	25 041.0	26 188.0	32 888.0	41 540.0	45 761.0	48 742.0	48 737.0	56 988.0	60 307.0	N/A
Index	39.8	54.7	57.2	71.9	90.8	100.0	106.5	106.5	124.5	131.8	N/A
<b>EC</b>											
Production at constant prices(4)	36 801.0	35 617.0	36 257.0	38 581.0	42 351.0	44 025.0	47 513.0	51 675.0	56 637.0	61 399.0	63 495.0
Index	83.6	80.9	82.4	87.6	96.2	100.0	107.9	117.4	128.6	139.5	144.2
Value added at current prices (5)	10 391.0	10 587.0	11 473.0	12 676.0	14 361.0	15 618.0	17 596.0	19 481.0	22 587.0	25 555.0	N/A
Index	66.5	67.8	73.5	81.2	92.0	100.0	112.7	124.7	144.6	163.6	N/A
Productivity (6)	24.1	24.5	25.7	27.4	28.4	29.3	31.9	34.3	37.1	39.5	N/A
Index	82.3	83.6	87.7	93.5	96.9	100.0	108.9	117.1	126.6	134.8	N/A
Net investment (7)	1 423.0	1 307.0	1 432.0	1 781.0	2 001.0	2 362.0	2 525.0	2 761.0	2 957.0	3 200.0	N/A
Index	60.2	55.3	60.6	75.4	84.7	100.0	106.9	116.9	125.2	135.5	N/A

(1) 1987/88 and 1990 estimated

(2) Excluding Greece; 1987/89 estimated

(3) Census of manufactures and Eurostat estimates

(4) The Netherlands estimated for 1980-84, 1988-89

(5) Excluding Luxembourg and Portugal

(6) The Netherlands estimated for 1980-84, 1988-89

(7) Excluding Greece, Spain, Netherlands and Portugal; 1987/89 estimated

Sources: Panorama 1990 and Sema Group Management Consultants

ploy over 500 persons, including some with staff in excess of 1,000.

In 1989 France had some 4,000 firms with 127,000 employees and turned over 74 billion Francs of which one quarter went to exports. Only 12% of French processors employ between 100 and 499 persons and 2% employ more than 500.

Italy whose turnover attained 16,500 billion Lire in 1989 has around 5,000 companies and employs close on 115,000 persons.

The Italian plastics processing industry consists of a large number of small traditional moulders.

Thus it is that only 9% of firms employ between 100 and 499 persons and only 1% have over 500 persons.

In 1989 the United Kingdom had 4,000 processors with 180,000 employees and a

turnover of 9.5 billion pounds. Almost 19% of companies employ between 100 and 500 persons.

### Trade tendencies

The EC is a net exporter but the surplus is just 4.6% of production, a level that has remained fairly constant for the past ten years. Exports to outside the EC attained 6.9 billion ECU in 1989 and imports reached 4.6 billion. The ratio of exports to imports has declined, falling from 2.3 in 1980 to 1.5 by 1989. Intra-Community trade achieved around 15 billion ECU in 1989, continuing a steady growth pattern since 1985.

In terms of exchanges, intra-Community trade constitutes the major portion of exports while direct exports to non-Community destinations are less significant.

Most of the national plastics processing industries in the EC are basically able to meet their domestic demands, and only a relatively small part of their output goes to exports. Processing plants in general are fairly small and frequently located not far away from their end users, all the more so since some plastic products do not travel well and are therefore not ideal for export purposes. Nevertheless plastic components do go into finished products such as domestic appliances and motor vehicles, and they therefore represent a category of indirect exports. The percentage of direct and indirect exports of total production is, however, generally below 25%.

The relative share of exported production is usually greater in the small than in the larger EC members. In 1988 the export

rate in Belgium stood at 64% and at 49% for Denmark, while West Germany, the Community's Number One exporter in monetary terms, exported 23.6% of its production, or 4.9 billion ECU. France and Portugal both returned an export rate of 16% while the United Kingdom and Spain exported 7.2% and 5.6% of their production respectively.

## Employment and productivity

While staffing levels remained virtually unchanged in the course of the 1980s and increases over the coming decade should still be minimal, the sector is faced with a growing requirement for skilled labour to replace the 60,000 individuals who either retire every year or migrate towards other sectors and to fill the 30,000 to 35,000 new jobs that are created every year. At present the plastics processing industry provides gainful employment for some 583,000 individuals, approximately 70% of whom are production or maintenance workers. As regards training policies, it is desirable to achieve standard levels in the quality of education and training so that skilled operatives are able to work in any EC country. Sales per employed production worker increase with the growing

use of sophisticated control systems, the automation of plant and machinery and the integration of finishing operations carried out downstream of production.

Production per employee went up from 65,000 ECU in 1980 to 82,000 in 1985 and 105,000 by 1989 (constant value 1985). Net investments represented 3.2 billion ECU in 1989, that is 6.4% of production and an increase of 8.2% over 1988.

Wages and salaries account for 20 to 25% in the cost of production.

## Investments

Investments constitute more than 6% of production.

Many companies currently feel that they will have to review their policies and strategy on investments, in particular with regard to the replacement of obsolete equipment.

Recent technical advances in the processing of industrial plastics and frequently used articles are changing the structure of the sector. These changes are being brought about primarily by the growth in automation of certain processes, an increase in machine output rates and improvements in quality control systems. The substantial investments made by proces-

sors are often able to achieve increased productivity with the same or even lower manning levels.

The present interest rate structure - the average industrial rate stands at 12% - is forcing firms to improve their levels of profitability in order to ensure the influx of capital they need for investment purposes.

Some sources say that almost one third of companies have not managed to achieve a rate of return on capital of 15 to 18%, which means that fresh price rises will be needed in certain sectors which will in their turn influence the demand for plastics as a whole.

Inflationary pressures and the lack of working capital with which plastics processors and their user industries are currently faced threaten to have negative effects on investments, and on technological investments in particular. An improvement in the technical competitiveness of the sector requires not just substantial working capital but also investments of fixed capital as well.

## Technological development

Two major developments dominate the plastics processing sector. In the first instance new technologies will involve capi-

**Table 4**  
Plastics processing  
EC trade in current value

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Exports extra-EC Index (1)	3 005.0 54.0	3 349.0 62.0	3 611.0 66.0	4 028.0 74.0	4 804.0 88.0	5 436.0 100.0	5 250.0 95.0	5 503.0 99.0	6 100.0 110.0	6 929.0 125.0
Imports extra-EC Index (1)	1 282.0 48.0	1 455.0 54.0	1 698.0 63.0	1 927.0 72.0	2 432.0 90.0	2 690.0 100.0	2 694.0 98.0	3 034.0 111.0	3 953.0 144.0	4 617.0 169.0
X/M	2.3	2.3	2.1	2.1	2.0	2.0	1.9	1.8	1.5	1.5
Trade intra-EC Index (1)	4 659.0 54.0	5 103.0 58.6	5 770.0 66.2	6 488.0 74.5	7 603.0 87.3	8 712.0 100.0	10 105.0 112.0	11 260.0 125.0	12 848.0 142.0	14 841.0 164.0
Share of total (%)	61.0	60.0	61.0	61.0	61.0	61.0	65.0	67.0	68.0	68.0

(1) Taking into account changes in EC membership  
Source: Eurostat (Comext)

**Table 5**  
**Plastics processing**  
**Forecasts**

(million ECU)	1989	1990	91/90	92/91
Production	47488	48900	+3.1	+3.0

Source: Sema Group Management Consultant

tal investments and will necessitate a highly skilled labour force as equipment becomes increasingly sophisticated, as robotics and operations carried out downstream develop and as policies of "just in time, zero defects" are taken on board by these organisations. These investments should be made during the next three to five years, with good prospects of profitability in the medium term.

Secondly, improvements in materials and processing techniques open up new applications with greater profit margins than those achieved so far, although these will in turn necessitate greater capacities in terms of innovation and training.

### **Environmental protection**

In the past the increase in the consumption of plastics was due mainly to their being substituted for other materials for reasons of economy and distribution. Given the growing interest in environmental issues, it is becoming increasingly important that the marketing of plastics is done by placing the emphasis on arguments such as the protection of the environment compared with the materials which plastics replace and the feasibility of the techniques available for the recycling of waste products. The use of recycling processes could become a major feature of the plastics processing industry over the years to come. Numerous schemes for selective collection and recycling are currently in operation in a number of EC countries.

### **The impact of "1992"**

For the plastics market in the EC the lifting of trade restrictions of all kinds after 1992 will bring about only limited changes. The strong position of Germany in the world market for plastic products is based on exports to other EC members. To a certain extent this factor also applies to France, Italy and the United Kingdom, and there is no particular reason to hope for an increase in global capacities as a result of the creation of the single market nor a change in the competitive environment, since a certain number of transnational companies are already active in this sector. However a change in production with regard to costs and environmental protection could be easier to achieve within the domestic markets of each country. A certain number of companies have recently merged and/or have restructured, a tendency that is likely to continue with the prospect of a single European market after 1992, with substantial movements towards mergers and take-overs. This will lead to the creation of larger groupings who will specialize even further in ranges of products and processing techniques. Partnership with the manufacturers of raw materials on the one hand and users on the other will continue to expand. By contrast with the situation in the United States, the most diversified companies in this sector in the EC are generally the small ones. These developments should bring about a 50% reduction in the num-

ber of firms in the sector.

### **Outlook**

In recent years the increase in the volume of processing in the sector has been largely affected by the rises in raw materials costs. During the same period, profit margins have thinned. The decrease in prices for raw materials and the counterbalancing of supply by demand led to a new low in profit margins in 1989 as was generally the case during previous periods of fluctuation. Given the investments that are necessary in order to prepare for the single market, and concerned to improve its international competitive position, the plastics processing industry could appear less attractive to investors due to fluctuations in the raw materials prices.

It will be possible to create greater price stability by opening up the EC market more to base materials, a step that would also stabilise the supply-demand equilibrium.

In the next five years the overall prospects for the plastics processing industry look healthy, and markets traditionally dominated by conventional materials such as glass, metals, wood and ceramics will enjoy further expansion: substantial investments in new plant and equipment could bring about increased productivity and broader profit margins.

Elsewhere, thanks to a better skilled, though more expensive, workforce overall profitability should improve.

Total consumption stated both as a tonnage and as a value of processed products has enjoyed steady growth of 6% per annum over recent years and will continue to expand into 1992, with the processing of plastics growing by some 3% per annum. In Germany consumption has increased by

8% and amounts to 128 kg per capita of population, which constitutes a very high level. With the introduction of new applications, especially in the automotive industry and electrical/electronics, and thanks to improvements in some products and technologies, the rate of consumption should rise by at least 4 to 5% in 1990 and even more in 1991 and 1992.

In France, consumption has risen markedly in recent years due essentially to an increase in applications in the packaging sector. The annual increase of approximately 9% recorded for the last three years is set to continue over the coming three years albeit at a slower rate.

In Spain, forecasters predict annual rises in consumption in excess of 10% (growth having attained 12.2% in 1987) on the basis of continued industrial growth. The annual growth rate in sales by EC plastics processors will probably amount to 3%. As for the increase in sales per capita employed, which is an indicator of productivity, this will reach approximately 4 to 5%. Growth rates will vary widely among individual Community members. As an example, the increase in sales by Germany and the rise in sales per employee, currently standing at 5% and 1% respectively, is not expected to grow very much in 1990 given the already high degree of mar-

ket saturation and productivity levels. By contrast the increase in sales in Spain and the rise in sales per employee, each amounting to 10%, could hold at that level through 1990 and 1991.

**Reviewed by: Sema Group Management  
Consultants on the basis of Panorama 1990  
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The EC fibre-reinforced plastics industry produced over 1 million tonnes of plastic composites in 1989, a 9% increase over 1988. This sector comprises of approximately 4 000 small enterprises, employing approximately 80 000 people at a variety of skill levels. Industry concentration is low and the number of jobs it provides has increased by more than 50% in six years. European production and consumption should increase by 2 or 3% annually over the next three years and by 7 to 9% annually in the longer-term as the compression technique for making medium-range car parts becomes widespread.

### Description of the sector

Plastic composites are a comprehensive range of engineering materials where the physical, mechanical and economic properties are uniquely determined by the reinforcement, the matrix or the processing technique employed.

This sector is defined as the manufacture of articles consisting of a plastic matrix reinforced with long fibres. Plastics include both thermoplastic and thermosetting resins, as shown in table 1.

### Current situation

For historical reasons, and given the nature of the fabrication techniques employed, the EC composites industry remains dominated by small and medium-sized enterprises which employ an average of 25 people. "Small" in this sector sometimes means a very profitable entrepreneurial operation, supplying high-quality products to a very specialised market using only a small labour-force and a highly capital-intensive plant.

The European fibre-reinforced plastics industry produces more than one third (39%) of the estimated world total of more than 3 million tonnes, it is in the same order of magnitude as the United States (42%) and more than Japan (19%) as shown in table 2. EC trade in this industry is negligible.

The EC market for plastic composites (thermoset and thermoplastic glass reinforced composites) rose by roughly 12% per year during the three last years, to reach over 1 million tonnes in 1990, against only 520 000 tonnes in 1981.

By contrast, the average annual increase in the USA during the period was 4.5% to reach a consumption of 1.3 million tonnes in 1989. In Japan, the reinforced plastics market developed from 232 000 tonnes in 1980 to around 600 000 tonnes in 1989. As presented in table 4, the EC market is dominated by standard composite commodities which account for 70% of the market in volume, but only 25% in value.



**Table 1**  
Fibre-reinforced plastics  
Major types of plastic materials used by type of composite

Type of matrix	Type of composite		
	Commodity polymers	GP polymers	Heat resisting GP polymers
Thermoplastic resins	Polypropylene Polyamide	Polyamide Polycarbonate Polyacetal Polyphenylene oxide	Polysulfone Phenylene polysulfide Fluorinated polymers Polyetherimide
Thermosetting resins	Polyester Epoxide Phenoplast	Polyester Polyepoxide	Polyimide
Elastomers		Polyurethane	Silicone

Note: GP means great performance  
Source: Sema Group Management Consultants

Developing markets include those for engineering composites and GP (Great Performance) composites which have higher prices than commodities, and are used in more technical applications.

As indicated in figure 1, four major end-use

- transportation equipment (automotive, aerospace industries);
- building and construction;
- industrial and agricultural equipment (mechanical articles, machine tools, mainly).

**Table 2**  
Fibre-reinforced plastics  
Evolution of plastic composites' consumption by market between 1986 and 1989

MARKET (thousand tonnes)	1986	1987	1988	1989 <sup>(1)</sup>
Western Europe	858	963	1 095	1 200 <sup>(2)</sup>
United States	1 032	1 149	1 207	1 300
Japan	380	457	533	600

<sup>(1)</sup> Sema estimated figures  
<sup>(2)</sup> Greece excluded  
Source: Vétrotex

sectors represent roughly 80% of the total

European market of plastic composites:

- electrical and electronics equipment;

### Production trends

While reinforced plastic components include carbon fibre/epoxy used in such ap-

plications as the aerospace industry, the greater bulk of the tonnage and turnover in the EC involves the use of unsaturated polyester, reinforced with long glass fibres or glass mats to make large parts such as hulls for boats, industrial storage tanks and panelling for the construction and transport industries. An increasing number of manufacturers in the EC are replacing such conventional materials as metal and wood with reinforced plastics to achieve greater design freedom, weight-saving, and improved mechanical strength/weight ratios.

Table 5 shows an outline of the 12 EC member nations' output, country-by-country contributions for 1988.

Composites processing technologies are numerous and are well mastered by end users. Injection (mainly for thermoplastics based composites), as well as SMC and BMC, are the two major technologies.

### Consumption trends

The average annual growth of the composites market depends on two major factors:

- the penetration of composites in various applications (both replacement of traditional materials by composites and manufacture of novel articles with composites),
- the growth of the industrial production of concerned applications, taking into account some foreseeable delocalisation (for example, in electronical equipment areas).

**Table 3**  
Fibre-reinforced plastics  
Main indicators, 1980-91

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(1)</sup>	1991 <sup>(2)</sup>
Apparent consumption <sup>(1)</sup>	4 572	4 651	6 141	7 406	8 608	10 322	11 590	13 808	16 524	18 500	19 055	19 627
Production	4 572	4 651	6 141	7 406	8 608	10 322	11 590	13 808	16 524	18 500	19 055	19 627
Employment (thousands)	55.8	48.2	51.9	61.2	65.1	67.6	71.1	77.2	81.6	83.6	89.1	95.5

<sup>(1)</sup> There is no significant external trade  
<sup>(2)</sup> Estimates  
Source: Panorama 1990

## Employment trends

In the past few years, employment has increased in the Community, to around 80 000 employees. Sales per employee have increased greatly and are sufficient to meet rising demand.

The reinforced plastics industry is rapidly changing from labour-intensive to more highly automated production. For example, compression and injection moulding accounted for only 18% of the tonnage in 1970, rising to 36% in 1980, and to 59% in 1988. Industry estimates are that it will top 65% by the end of 1990. Automotive manufacturers are using the process for making grilles, opening panels and truck hoods, while appliance and electrical manufacturers find it an effective low-cost method for producing housings.

By contrast, the hand lay-up and spray-up market share has dropped sharply, from 43% in 1970 to 28% in 1988.

Some reasons for this drop can be discerned by examining the market share of sports and leisure in the reinforced plastics market, now only 7%. Meanwhile, the market share of transportation, mainly automotive, has risen to 22%. In addition, with faster cycling compression and injection moulding equipment, processors of reinforced plastics are more inclined to invest in expensive dyes and processing equipment for increased production efficiency.

91% of the companies in the EC have five or less executives, 64% have five or less technicians, and 76% have five or less administrators. Some 50% of the companies have 15 or less skilled workers, and 30% have 40 or less. Only 10% of companies have more than 40 skilled workers. Some 69% of all companies employ up to 15 unskilled workers, 21% employ from 16 to

40 unskilled workers, and only 10% employ more than 41.

## Structural changes

The reinforced plastics industry is composed of small companies with relatively low turnover. According to a survey of North American and Western European processors, typical North American reinforced plastics processing companies have about 80 employees, while in the EC companies employ an average of 25 people. Industry concentration is low in the fibre-reinforced plastics industry. Annual turnover per company rarely exceeds 2 million ECU and the annual sales figure per employee averages 180 000 ECU. The approximate 40 000 establishments in the industry de-

pend on a relatively small number of very large chemical companies for their supplies of raw materials: large producers of plastic compounds, such as Atochem, BASF, BP, ICI, Bayer, and DSM;

– large producers of mineral fibres, such as St Gobain (Vétrotex), Owens Corning.

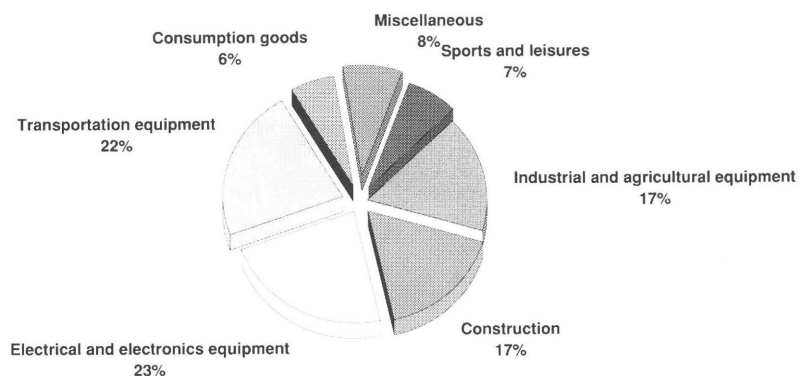
There is an increasing tendency for these large chemical companies to either acquire a composite company (and retain its "small" character), or set up an in-house operation. However, although the EC industry continues to grow and develop, there is little change in either the number of people employed, approximately 80 000, or in the number of companies involved. The distribution of the establishments and num-

**Table 4**  
Fibre-reinforced plastics  
Classification of major types of composite

Major Characteristics	Standard Commodities	Type of composite composites Engineering	GP composites
Price (Ecu/kg)	1.5-3	3-30	>30
Current market share in the EC (%)	70	25	5
Major Composites	polyester resin + glass fibre	polyamide resin + glass fibre or epoxy resin + glass fibre	epoxy resin + carbon fibre

Note: GP means great performance  
Source: Sema Group Managements Consultants

**Figure 1**  
Fibre-reinforced plastics  
Breakdown of EC market of plastic composites by main application, 1988



Source: Vetrotex

**Table 5**  
Fibre-reinforced plastics  
Production by country, 1988

	(thousand tonnes)
Benelux	105
Danmark	37
BR Deutschland	268
Hellas	15
España	73
France	176
Ireland	5
Italia	177
Portugal	13
United Kingdom	129
EC	997

Source: Panorama 1990

ber has stayed fairly constant over the years, with the United Kingdom at approximately 1 100, France at 700, and the Federal Republic of Germany and Italy at around 650 each.

To date, two factors have inhibited the growth of reinforced plastics in the automotive parts sector: the difficulty in obtaining the quality demanded by the user, and the low output rates compared with injection moulding of thermoplastics of traditional metal stamping.

Both these difficulties are being overcome. The advantages of compression moulding over other processes make it an ideal system for medium-scale production. The cost

**Table 6**  
Fibre-reinforced plastics  
Annual sales per employee, 1980-91

	(thousand ECU)
1980	81.9
1981	96.5
1982	118.3
1983	121.0
1984	132.2
1985	152.7
1986	170.4
1987	178.8
1988	202.5
1989	221.3
1990	( <sup>1</sup> ) 227.1
1991	( <sup>1</sup> ) 233.4

(<sup>1</sup>) Estimates  
Source: Panorama 1990

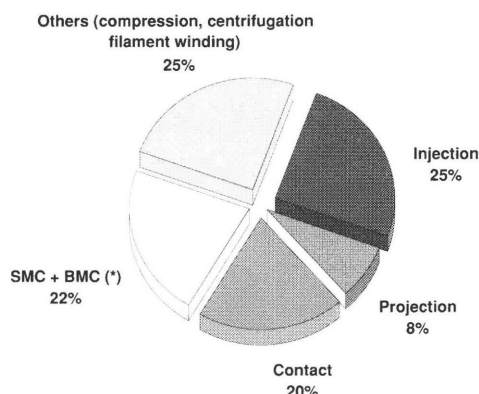
of dies capable of producing such parts as automobile fenders is relatively modest. The cost of investment in equipment is considerably less than would be required for an injection moulding machine. Since SMC involves the use of long reinforcement fibres, the parts are also stronger. Today, SMC is widely used in truck components. All of the major automobile manufacturers within the EC are developing SMC components, first for specialised vehicles, then for small and medium-scale produc-

investment to enter the field. Few of the traditional hand lay-up shops are likely to take this step. They will rather stay in specialised niche markets, while this need for major investment will trigger a concentration of the rest of the market.

### Geographical variance

While no figures are available for the EC as a whole, average annual sales per company in 1985 for France, the Federal Republic of Germany and the United Kingdom provide an idea of the typical

**Figure 2**  
Fibre-reinforced plastics  
Breakdown of EC market of plastic composites, by process, 1988



(\*) Notes:  
SMC= Sheet Moulding Compound  
BMC= Bulk Moulding Compound  
Source: Vetrotex

tion. Eventually, probably within a decade, these components will be used in mass production.

While compression and injection moulding as well as other automated and semi-automated processes will account for an increasing share of the reinforced plastics market, the small craftsman who relies on hand lay-up and spray-up will have some difficulties to stay in business. Little is expected in the way of technical developments, and production rates will remain unchanged.

The shift to compression moulding, however, involves much more than merely upgrading equipment. It requires large capital

company size. Germany has the highest EC average, with 3.5 million ECU, followed by France with 3 million ECU. This compares with an average company turnover of 4.3 million ECU in the USA. The growth of the plastic composites industry has remained positive throughout the EC for the major part of this decade. Given that the European composites industry now accounts for nearly 30% of the world total, if present trends continue, this EC sector will soon challenge the current supremacy of the USA as the principal supplier.

### Outlook

The EC composites industry is currently

**Table 7**  
Fibre-reinforced plastics  
Production trend, 1980-91

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(1)</sup>	1991 <sup>(1)</sup>
<b>Production</b>												
Value	4 572	4 651	6 141	7 406	8 608	10 322	11 590	13 808	16 524	18 500	20 800	21 700
Index	44	45	59	72	83	100	112	134	160	179	202	210
Quantity (thousand tonnes)	558	520	580	649	705	747	787	883	997	1 070	1 100	1 135
Index	75	70	78	87	94	100	105	118	134	143	147	152

<sup>(1)</sup> Estimates  
Source: Panorama 1990

growing fast, a marked change from the early 1980s. Growth is expected to continue rapidly, supported by a general improvement in GNP, the availability of increased and improved reinforcements and matrix materials which in turn promote low investment cost fabrication techniques, such as resin-injection which offers enhanced productivity, lower scrap rates, and better economics: Between 1990 and 1995, the EC market is expected to vary between 3 and 10% per year, according to each end use sector. Profitability is slowly improving. At the same time the cost of many of the less energy-consuming competitive materials is rising faster, as a result of a rapidly diminishing supply. All these fac-

**Table 8**  
Fibre-reinforced plastics  
Growth rates of the EC market in plastic composites for the period of 1990-1995

End-use sector	Aver.annual growth rate of the production of plastic composites (%)	Average annual growth rate of the production of the industrial activities (%)
Transportation equipment	5-6	3
Electrical and electronics equipment	2-2.5	3.5-4
Construction	7-8	1.5-2
Industrial and agricultural equipment	1-1.5	1.5-5
Others	1-2	2-3

Source: SEMA Group Management Consultants

tors suggest that the reinforced plastics industry is in a strong position to meet the increasing competition and to take advantage of growth opportunities.

Reviewed by: Sema Group Management Consultants on the basis of Panorama 1990  
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