

# Mechanical engineering



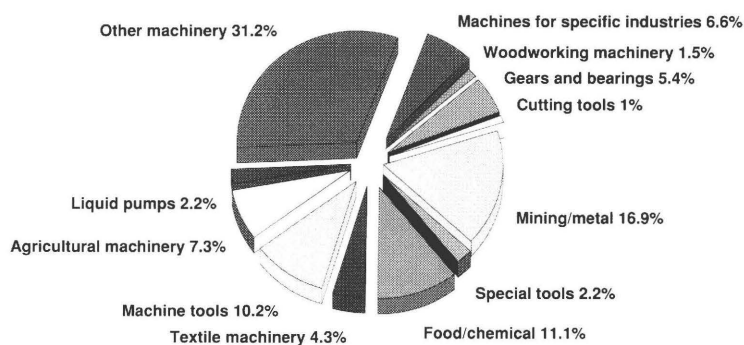
The European Community is by far the world's largest producer of mechanical engineering products. This sector proved to be competitive in the 1980's and is at the forefront of technology. The EC Member States concentrate more of their R&D capacities on mechanical engineering than any other country. The sector is a major supplier of capital goods and was hit by a severe crisis in the cyclical downswing at the beginning of the 1980's, which was mainly due to the poor investment climate. Subsequently the mechanical engineering industry was pushed forward by an investment boom during the remainder of the decade. The stimulus was the necessity to replace old machines and to use new opportunities for higher automation. In recent years, expansion of capacities has become increasingly important. However, this dynamic development has currently become more moderate and medium-term forecasted growth rates are 3.2% p.a. in real terms.

# Mechanical engineering

# 10



**Figure 1**  
**Mechanical engineering**  
**Composition of the industry, 1988**



Source: Eurostat

## Description of the industry

In general, the industry supplies traditional capital goods as well as preliminary products mostly used in capital goods industries. It comprises a broad spectrum of production: roller bearings, hydraulic components, combustion engines, cranes, lathes and robots. The fitting out of complex industrial installations, such as cement plants, is another area where the mechanical engineering sector is active. New hydraulic, pneumatic, microelectronic, laser technology as well as new materials have given renewed impetus to mechanical engineering, thereby fostering innovations in production. Moreover, there is a beneficial trend of combining machines and processes within increasingly larger systems. The term mechanical engineering is now being viewed as out-of-date in describing today's machine manufacturing sector.

Broadly speaking, machine firms have extensive expertise in adapting to the specific needs of their clients. For this reason, a number of machines with special capabilities have been developed. Small-scale and single-piece manufacturing are of major concern and large-scale manufacturing is the exception rather than the rule. As a result, small and medium-sized businesses make up a major share of the mechanical engineering sector, compared with other industrial sectors.

## Current situation

The sector's total production amounted to almost 226 billion ECU in 1990 and employed 2.4 million workers (Table 1). It is one of the largest sectors in the Community and accounts for more than 8% of total industry production. In light of the fact that the manufacturing of machines requires a large number of qualified workers, the sector has a relatively high level of

gross value-added compared with others. Value-added in 1989 reached 85 billion ECU.

In recent years, this sector has managed to secure a highly favourable position in terms of its use of high technology compared with non-EC competitors. The sector's success lies in the fact that it combines microelectronics and highly efficient and precise mechanics. A preference for coordinated machine systems and for the use of software and data processing techniques have also contributed significantly to the sector's strength.

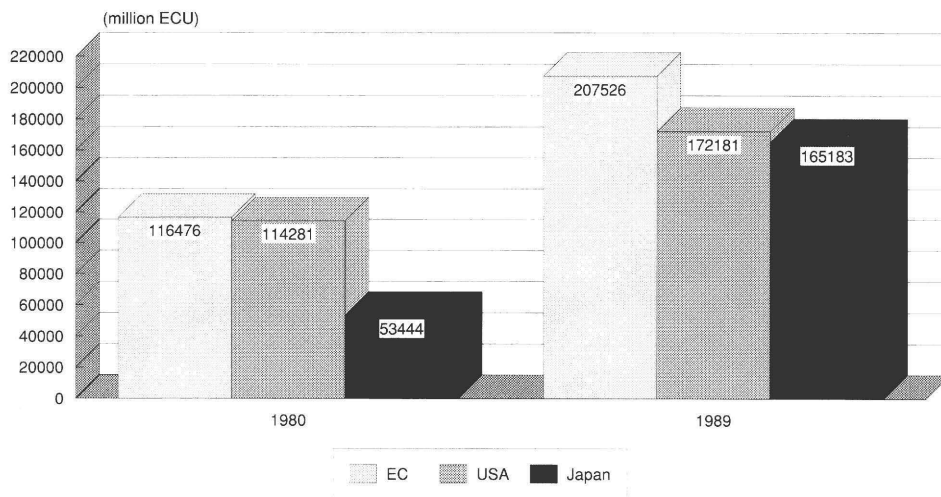
From both the quantity and quality standpoints, the EC's mechanical engineering industry is a worldwide leader. A comparison with two other major producers, the United States and Japan, will bear this out. In 1989, production in the Community reached 208 billion ECU; in the United States it amounted to 172 billion ECU; and in Japan, 165 billion ECU. Figure 2 compares production in 1980 and 1989 in ECU and current values. It shows strong Japanese gains in this period. This could have been partly induced by the appreciation of the Yen against the ECU, but also in national currencies and constant prices Japanese success in mechanical engineering can be seen: Japanese production rose by nearly 5% p.a. whereas the EC volume expanded by only 2% p.a. and that of the US decreased by some 1% p.a.

**Table 1**  
**Mechanical engineering**  
**Main indicators, 1980-90**

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990(*)
Apparent consumption	93 021	88 695	97 833	102 854	112 938	125 345	131 327	135 629	154 159	154 159	188 200
Net exports	23 455	29 722	30 217	29 593	31 407	35 369	35 127	30 987	30 361	33 774	37 381
Production	116 476	118 417	128 050	132 447	144 345	160 714	166 454	166 616	184 520	207 544	225 581
Employment (thousands)	2 858	2 725	2 597	2 456	2 379	2 377	2 385	2 281	2 307	2 363	2 401

(\*) Estimated by: Ifo Institute  
 Source: ORGALIME, Eurostat (Inde, Comext), Ifo Institute

**Figure 2**  
Mechanical engineering  
EC production compared to USA and Japan, 1980-89



Source: Eurostat

in this period. Machine production in all other Western industrialised countries amounted to some 60 billion ECU. Production in Western countries as a whole reached 600 billion ECU, of which the Community accounted for nearly 35%. The average size of the sector's firms is some 150 employees, similar to the mechanical engineering sector in the United States and Japan. The sector's extensive production diversity and its high degree of

specialisation in single-piece and small-scale series production give it a competitive advantage. Some changes have been observed in recent years as the mergers and acquisitions of Linde, O&K, Lancer-Boss etc. prove. But above all, a growing trend has been noticed on the part of non-EC firms buying a stake in EC firms in order to gain a foothold in post-1992 Europe.

## Production and consumption

Following the deep recession in 1982/83, production volume rose greatly until the end of the decade. Only in 1986 and 1987 did a short interruption take place. In 1989 EC machine manufacturers enjoyed a highly favourable investment climate. Investment took a turn for the better in almost all the EC Member States, which fuelled demand and led to a boost in real production of as much as 7%. Coupled with the even higher growth in 1988 this development brought an increase in capacity utilisation in this sector, close to its top limit. Further expansion of production is expected, however with a more moderate growth rate of nearly 5% in 1990. Between 1980 and 1987, investment in the services sector in most industrialised countries was the major driving force behind investment in capital goods. In 1988 and 1989, however, industrial investment staged a major recovery. This explains the recent growth in the mechanical

**Table 2**  
Mechanical engineering  
Production and external trade, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<b>Production in current prices</b>											
EC	116 476	118 417	128 050	132 447	144 345	160 714	166 454	166 616	184 520	207 544	225 581
Index	72	74	80	82	90	100	104	104	115	129	140
USA (1)	114 281	157 284	161 278	162 335	209 492	219 599	166 578	147 693	157 811	172 181	N/A
Index	52	72	73	74	95	100	76	67	72	78	N/A
Japan (1)	53 444	75 870	79 818	89 633	111 183	127 220	127 707	121 364	147 873	165 183	N/A
Index	42	60	63	70	87	100	100	95	116	130	N/A
<b>Production in constant prices</b>											
EC	160 014	150 012	148 961	146 026	151 002	160 714	159 102	155 024	166 607	177 791	186 071
Index	100	93	93	91	94	100	99	96	104	111	116
<b>EC trade in current prices</b>											
Exports extra-EC	35 308	42 268	44 178	43 937	48 796	54 113	53 292	51 581	54 768	62 671	68 711
Index	65	78	82	81	90	100	98	95	101	116	127
Imports extra-EC	11 145	12 399	13 462	13 963	15 825	17 912	18 250	20 692	24 407	28 897	31 330
Index	62	69	75	78	88	100	102	116	136	161	175
X/M	3.17	3.41	3.28	3.15	3.08	3.02	2.92	2.49	2.24	2.17	2.19
Imports intra-EC	23 385	23 501	25 918	26 413	29 449	34 095	37 257	41 668	47 990	55 341	60 150
Index	69	69	76	77	86	100	109	122	140	162	176

(1) Census of Manufactures and Eurostat estimates  
Source: ORGALIME, Eurostat (Inde, Comext), Ifo Institute



engineering sector.

In 1988 and 1989 the upswing in industrial investment was underpinned by a general economic expansion which was marked by greater utilisation of production capacity and improvements in profitability in most industrial sectors. The need to modernise, and preparation for the single market and new production technologies have all provided fresh impetus for investment. Automation of the manufacturing process is an obvious example of the use of new technologies. The introduction of high technology systems, robots, new testing equipment and transport systems have lead to complex, but none the less highly flexible, manufacturing systems.

This process was initiated on the basis of the computer aided manufacturing (CAM) system that has since been given wide-

spread application. It is designed eventually to lead to the universal computer integrated manufacturing (CIM) system. This developing trend will offer fresh opportunities to machine manufacturers and will completely overhaul their traditional image. Today, most machine manufacturing companies are able to offer their clients high-performance machines and a wide variety of services ranging from full consulting on systems and program design, to personalised client training.

However, this overall trend in the mechanical engineering sector masks, at least in part, widely varying movements. Despite the current upswing, some branches are still experiencing difficulties brought about by restructuring in their client industries. Manufacturers of agriculture machinery and tractors, mining equipment and com-

bustion engines for example, fall into this category. Pulp, paper, printing machinery, as well as rubber and plastics machinery, industrial robots and fluid technology and, more recently, machine tool manufacturers are currently undergoing expansion.

### Foreign trade

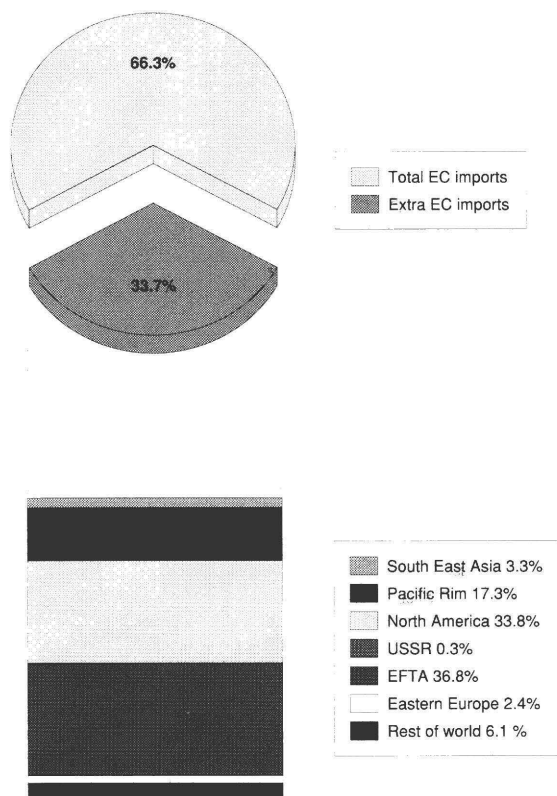
Since 1985, trade among the member states in the mechanical engineering sector has grown faster than consumption. This is partly due to the strong growth of demand in the Community. But this development indicates also an increasing division of labour among the Member States. In 1980 imports of machines from EC trading partners accounted for only 25% of the market's total volume. The 1990 figure is higher than 30%. But also extra-EC imports strongly expanded in this period. The market share of foreign suppliers increased from 12% to more than 15%.

Most important for the EC are imports from other Western European countries, followed by deliveries from North America. The US was able to regain market shares in the second half of the 1980's which had been lost before due to the overvalued dollar. The Asiatic competitors in the mechanical engineering market have not been very important by volume but high growth rates during the 1980's demonstrated their strength (Figure 3).

The US is the most important client of the EC mechanical engineering industry. In the first half of the 1980's exports were pushed by the overvaluation of the dollar. In the second half of this decade development reversed, but presently more than 30% of all EC exports are delivered to North America (Figure 4).

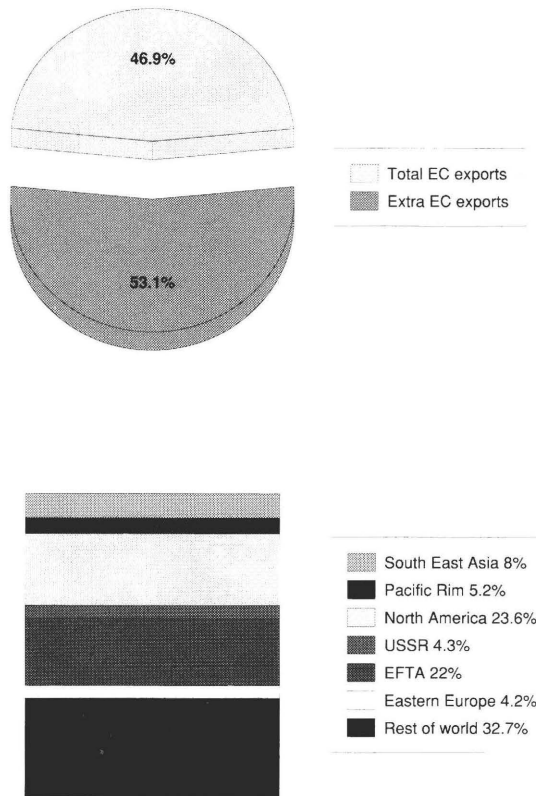
Demand from other Western European countries expanded during the 1980's due

**Figure 3**  
Mechanical engineering  
Breakdown of EC imports in 1988



Source: Eurostat

**Figure 4**  
**Mechanical engineering**  
**Breakdown of EC exports in 1988**



Source: Eurostat

to an economic situation similar to that in the EC, but nearly all other regions showed a poor demand. This is due to different factors such as the debt crisis of many Third World countries and the decrease in the prices for raw materials, including crude oil. But also the crisis of the Eastern Bloc countries has hampered demand.

Penetration of these markets has proved difficult partly caused by cultural differences and also by the Japanese predominance. In light of these factors it is a success that the export ratio as well as the world trade share did not change very much during the 1980's.

Foreign trade in the EC's mechanical engineering sector showed a considerable surplus as net exports represented about 16% of total production in 1990. But the

ratio has decreased in recent years. Simultaneously the export ratio declined from its peak of 34% in 1985 to 30% in 1990, the same level as in 1980.

The EC's trade balance in mechanical engineering displays a comfortable surplus, though the later has shrunk slightly in the second half of the eighties. The only re-

**Table 3**  
**Mechanical engineering**  
**Investment in the EC, 1980-89<sup>(1)</sup>**

(million ECU)	Investment
1980	4 165
1981	4 215
1982	4 184
1983	4 414
1984	4 914
1985	6 067
1986	6 857
1987	6 974
1988	7 225
1989	8 200

<sup>(1)</sup> 1987 estimated by Eurostat  
 Source: ORGALIME, Eurostat (Inde)

gion with which the EC now has a trade deficit is the Pacific Rim, the 0.5 billion ECU surplus that was observed in the early eighties having turned into a deficit towards the middle of the decade. The trade balance between the EC and the "rest of the world" deteriorated substantially between 1982 and 1988, reflecting losses in market shares. This was due to the increased competition from non-EC producers such as Japan and Far East Asia in these markets. However, the balance still showed a comfortable surplus of about 17 billion ECU at the end of the period considered.

The strongest improvement in the net trade balance was recorded with North America, with which the EC had a trade deficit in the early 1980's. The rapid growth of EC exports to North America during the early 1980's (thanks to strong demand for capital equipment from these markets), and slow growing imports in Europe due to the depressed investment climate, combined to turn the deficit into a 6 billion ECU surplus in 1986. Exchange rate movements and the increase of fixed investment growth in Europe thereafter reduced the surplus slightly. The latter now amounts to about 4 billion ECU. Finally, despite the rapid growth of imports penetration from the NIC's, the net trade balance with this region improved slightly, by 0.7 billion ECU.

### Employment trends

The cyclical economic development in the 1980's caused a sharp decrease of 600 000 jobs. This amounts to 20% of total employees in the industry in 1980. The time series in Table 1 shows a large time lag compared with production. Output volume reached its minimum in 1982/83,



**Table 4**  
Mechanical engineering  
Production by country, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Belgique/België	3 228	3 236	2 676	3 200	3 702	4 187	4 323	4 078	4 628	5 313	5 685
Danmark	2 005	2 051	2 217	2 461	2 755	3 206	3 366	3 178	3 500	3 671	3 800
BR Deutschland	47 740	49 942	54 919	56 442	60 787	68 120	75 805	73 465	81 249	90 927	100 474
Hellas	114	148	168	184	181	190	165	109	117	150	175
España	4 333	4 412	4 341	3 953	4 340	4 579	4 829	5 145	5 805	6 953	7 650
France	15 394	16 211	17 069	16 815	18 423	20 419	20 090	20 221	21 814	23 794	25 460
Italia	15 639	16 830	16 834	20 811	24 719	26 712	27 427	29 984	32 474	37 692	41 460
Portugal	262	345	386	353	341	366	372	387	425	480	545
United Kingdom	23 486	20 934	24 702	23 237	24 575	27 719	24 585	24 544	29 310	32 249	33 540

Source: ORGALIME, Eurostat (Inde)

whereas the lowest level of employment in the 1980's was not reached until 1987.

The strong upswing in the past three years has only induced an increase of a little more than 100 000 jobs. Therefore, output in prices in 1985 has markedly grown to 77 000 ECU per employee in 1990. This figure is 38% higher than 1980. It is also noteworthy that the level of hiring does not generally correspond to the present economic climate because adaptation to fluctuations in the capacity utilisation rates is ensured by reducing the working week or, if necessary, the amount of overtime.

This is particularly true for the machine production sector which is more reliant on highly-qualified personnel in order to meet production demands. Highly-qualified workers are very sought-after in times of renewed expansion and are increasingly

harder to find in the labour market. Today, nearly all machine production firms in the EC are seriously lacking in engineers and qualified personnel. Services are an expanding branch in the machine production sector and the production process is becoming increasingly automated.

These two phenomena have notably altered the structure of employment in the sector, and the number of manual workers is falling, while that of non-manual workers is on the rise. Among the latter group, technicians are playing a more predominant role. Jobs requiring little or no training are the ones most likely to be cut, while the number of highly-qualified jobs is expanding. Technological innovation is creating a demand for specially trained workers. Machine producers often encounter formidable difficulties on the labour market where there is a clear lack of

qualified workers in sufficient numbers.

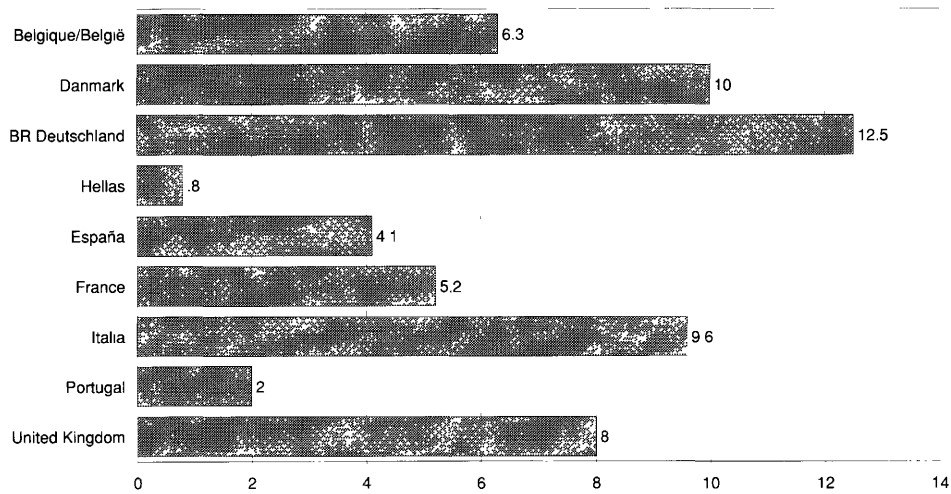
The only way to bridge the gap in the current transition period would be to organise ongoing training courses. The rise in permanent personnel in the machine manufacturing sector is expected to continue through 1990. If production grows as expected, employment will moderately increase in the medium term (see below). The deterioration in the personnel structure will probably continue. In the forthcoming years the number of engineers required by industry will increase. An opinion poll conducted with German firms confirmed this forecast. Nearly 70% of the firms questioned expect a rise in the number of engineers required: 28% of them estimate that demand for engineers will stabilise; and only 1% predict a fall. Those expressing no opinion made up a very small percentage of those queried.

**Table 5**  
Mechanical engineering  
Production at constant value by country, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990(*)
Belgique/België	3 810	3 651	2 943	3 415	3 838	4 187	4 081	3 784	4 226	4 677	4 817
Danmark	3 053	2 858	2 798	2 849	2 990	3 206	3 234	2 925	3 132	3 098	3 052
BR Deutschland	66 010	65 421	64 196	61 042	63 194	68 120	70 081	64 272	69 486	75 233	80 499
Hellas	152	163	172	184	176	190	169	84	81	92	95
España	5 593	5 196	4 833	4 635	4 608	4 579	4 849	5 036	5 185	5 593	5 873
France	20 455	19 604	19 714	18 741	19 580	20 419	19 321	20 584	21 986	22 880	24 024
Italia	21 951	22 246	20 769	23 718	25 577	26 712	24 991	26 070	28 306	30 431	32 257
Portugal	398	430	448	412	362	366	376	316	317	318	331
United Kingdom	32 963	25 075	27 719	25 675	25 968	27 719	26 825	26 963	28 836	30 023	29 423

(\*) Estimated  
Source: ORGALIME, Eurostat (Inde)

**Figure 5**  
**Mechanical engineering**  
**Share of mechanical engineering in total manufacturing production, 1989**



Source: Eurostat, IFO Institute

### Investment trends

Between 1981 and 1983, when a marked slowdown was registered, the EC's machine industry found itself entrenched behind a cautious attitude regarding investment. The share of gross fixed asset formation amounted to no more than 3.2% of the 1983 turnover.

In the second half of the 1980's, the share of gross fixed capital formation on production increased to a relatively high level of more than 4%. This trend reveals not only that investment in the mechanical engineering sector is dependent on the general business climate and profitability; but also that the rise in the rate of investment in the second half of the 1980's is a reflection of the spread of new technologies (Table 3). This trend should be considered in conjunction with the completion of the 1992 single market, whereby firms are seeking to step up their competitiveness. A further important explanation for investment growth lies in the necessity to expand capacities. For German industry this development is confirmed by an investment survey carried out by the Ifo Institute.

### Major geographical features

Since 1980, machine production in the EC has undergone a very distinct cyclical development. Nearly all the Member States took part in the period of expansion between 1988 and 1990, and the geographical breakdown of production has undergone no significant changes. However, it should be noted that between 1980 and 1990, growth rates of nominal production in Italy, Germany and Portugal were well above the EC average, whereas Greece and the United Kingdom were well below average (Table 4). In real terms the picture is quite similar for these countries with the exception of Portugal (Table 5). As regards turnover, the Federal Republic of Germany is indisputably the EC leader, accounting for 45% of EC production in 1990, followed by Italy at 18%, the United Kingdom at 15% and France at 11%. The remaining Member States recorded much lower shares; Spain, for example, accounting for 3-4% of EC production. The country breakdown obviously reflects, to a certain extent, the size of the individual Member States.

However, mechanical engineering production compared with total industrial output indicates the relative importance of this industry for the EC Member States. As shown in Figure 5, in Germany, Denmark and Italy production is above the EC average, whereas in Portugal and Greece its importance is well below. Until now the same can be stated for Spain. But in this country a growing importance can be expected.

Within the individual Member States there are special regional centres for machine production. In Germany, for instance, these are Nord Rhein-Westfalen and Baden-Württemberg; in the UK, the South-East region; in Italy, Lombardia; in France, the Bassin Parisien and Centre-Est; and in Spain, Catalonia is the leading region.

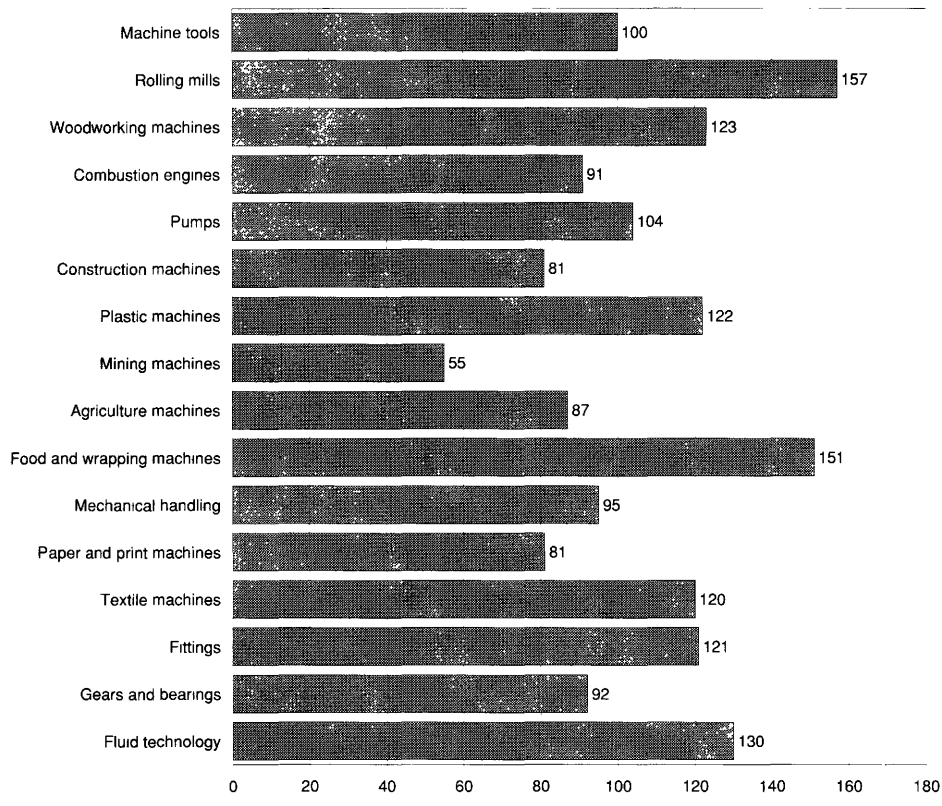
### Competitiveness

As this sector is a conglomeration of different subsectors, analysis of the competitiveness of the mechanical engineering industry is difficult. Therefore many important subsectors have been monitored and their performance in world exports in relation to the total mechanical engineering industry has been analysed.

EC companies were fairly successful in defending their share of the Western world's exports, which accounts for 40%. In Figure 6 this is defined as 100. Higher international market penetration of a subsector is indicated by a figure larger than 100 and vice versa. Figure 6 shows that rolling mills, food and wrapping machineries are in the lead. The poorest position is of mining machineries. This is due to oil exploration equipment which is mainly delivered by US firms. The EC position is much better concentrating on coal, iron, mining machines etc.

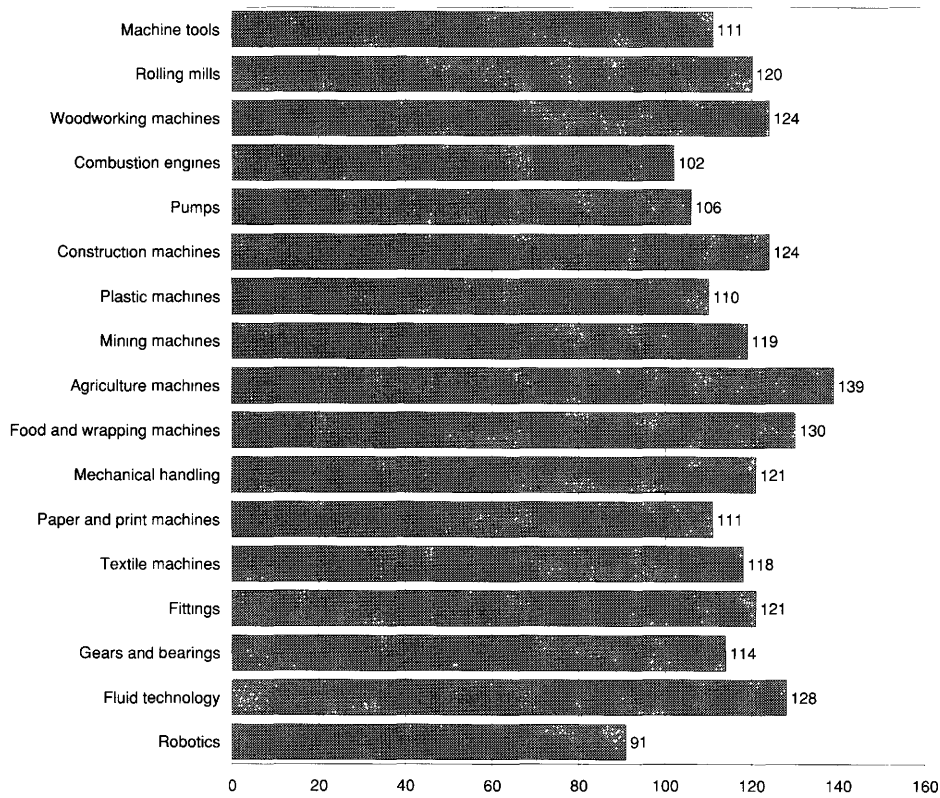


**Figure 6**  
**Mechanical engineering**  
**Importance of subsectors in world trade, 1988**  
**(EC share of western world's mechanical engineering exports = 100)**



Source: VDMA, Ifo Institute

**Figure 7**  
**Mechanical engineering**  
**R & D activity, 1982-88**  
**(Average EC inventions' activity in all technologies = 100)**



Source: INPADOC, Ifo institute patent statistics

Competition between industrialised nations is pushed forward by innovations. Due to its economic weight the EC is the world-wide leader in the volume of R&D carried out. The number of inventions is much higher than in the US or Japan. 45% of all important applications for a patent applied for in more than one country are from the EC, against 21% for the USA and 19% for Japan. The Federal Republic of Germany alone has applied for 24%. A further important indicator for technological progress lies in the concentration on technology fields related to mechanical engineering. An indicator is given by the share of total inventions made in these fields out of all inventions. Once more the EC is in the lead, with 32% of all important EC applications for patents having an impact on mechanical engineering. For the US and Japan the figures are 22% and 25% respectively.

The EC is concentrating its R&D efforts on mechanical engineering which amounts to more than the average of all countries in the world, their activity is 15% higher. This average of 115 for the EC industry is taken for comparison of the subsectors (Figure 7). There are some with even higher activity indices, such as the branches for agriculture machineries, food and wrapping machinery as well as fluid technology. Poor activity is indicated for robotics. It is even lower than the world average. In this field Japan proves to be by far the market leader.

## Threats and opportunities

**Environmental protection** Generally speaking, machine production does not seriously threaten the environment. Noise has traditionally been considered the sector's

most recurrent problem. Today, thanks to steady improvements in production techniques and processes, noise has been sharply reduced.

However, certain processes, such as hardening and galvanising, can cause serious harm to the environment. In the trend towards less vertical integration of production, these processes are increasingly carried out by experts outside the machine production sector. In general, costs arising from environmental protection in this sector are relatively low.

There is a strong demand for new capital goods for environmental protection, a trend which offers new possibilities for innovation and boosts yield. According to an analysis by the Ifo Institute, some 1% of mechanical engineering production is affected by environmental protection, primarily the subsectors of the industry working in the field of process technology.

### The 1992 single market

The 1992 single market will offer many attractive opportunities, and businesses hope to secure more outlets for their products. However, they can also expect stiffer competition. These two considerations should prompt them to invest more in new technologies. Preparations for the single market have already revived investment in recent years.

Spending on research and development in machine production has also been given greater priority in the run-up to 1992. The resulting production innovations are crucial for achieving greater competitiveness in this sector. Microelectronics and automation have radically altered a great many production methods. The machine production sector both supplies and acquires new production technologies which help to step

**Table 6**  
Mechanical engineering  
Forecast for EC and the major Member States, 1991-94

	1988 (mio. ECU)	1989 (mio. ECU)	1989/90 (%) var.	1990/91 (%) var.	1991/92 (%) var.	1989/94 Aagr (%)
<b>EC 12</b>						
Production	177 791	186 071	4.7	2.8	2.8	3.2
Consumption	148 874	155 255	4.3	3.1	3	3.5
<b>BR Deutschland</b>						
Production	75 233	60 499	7	3.4	3.1	3.7
Consumption	47 363	521 158	10.1	3.5	3.2	4.6
<b>France</b>						
Production	22 880	24 024	5	3.3	2.4	3.1
Consumption	25 359	26 822	5.8	4.1	2.8	3.7
<b>Italia</b>						
Production	30 431	32 257	6	3.7	2.9	3.6
Consumption	20 580	21 754	5.7	3.4	3.2	3.7
<b>United Kingdom</b>						
Production	30 023	29 423	-2.0	-1.0	2.7	1.3
Consumption	29 635	27 721	-6.5	0	3.5	0.9
<b>Others</b>						
Production	19 224	19 868	3.3	3.9	2.1	3.4
Consumption	25 937	26 800	3.3	4	3.1	3.1

Source: ORGALIME Eurostat (Inde), Ifo Institute

up productivity and strengthen competitiveness. In addition, supplementary investment in new technologies has a beneficial impact on employment. This is especially true for the machine production sector which, after an extended decline, has staged an impressive come-back that will continue in the medium term.

### Outlook

Trends emerging in 1990 indicate that production in the EC's machine production sector will enjoy a high rate of expansion, in real terms estimated at 4.7%. This growth is partly a result of increasing demand from inside the EC which, at constant prices, could be as much as 4.3%. Investment is expected to grow by only 5% in 1990, a slower pace than in 1989 (8.2%), but will not give rise to a decline in the short-term. Recent indices taken into account in evaluating demand for machines, reveal that the boom in machine orders is not expected to continue in 1991.

But several promising factors point to further growth of real production. These factors include the gradual dissemination of new generations of machines, the widespread need to make up for past drops in investment, and new investment in the run-up to the single market.

Further stimulation for the demand for mechanical engineering products is induced by the companies' preparation for the EC after 1992 and the unification of Germany. But as well as these promising factors, some threats emerged in 1990: the slowdown in some economies of the Western world, especially in the USA and the UK, the Gulf crisis with the expansion of crude oil prices and the high level of interest rates. A further threat especially for EC companies lies in the depreciation of the Yen and the US dollar. The latter reduces price competitiveness and hampers export growth.

Due to these different perceptions, fore-



casting is very difficult. In regard to the scenarios given as a framework for prognostic reasons real production should grow by 3.2% on average. In particular, Italian and German companies have good perspectives for growth due to their high competitiveness. The latter will have more profit from the unification of Germany than

others, but foreign competitors will gain market shares because of the strong growth of domestic demand.

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The agricultural machinery industry in the European Community plays a leading role in the world, based on its manufacturing know-how and its highly qualified personnel.

The decline in the importance of agriculture in industrialised countries has influenced the development of production of agricultural machinery, but it is still one of the large sectors of mechanical engineering.

The trend is likely to continue, both in developing and developed countries, and therefore the medium-term growth prospects are not very positive.

### Sector description

NACE 321 is defined as the "manufacture of agricultural machinery and tractors".

It covers the design, development and manufacture of tractors and all machinery necessary for production, preservation and first processing of animal and agricultural products. Tractors account for about 50% of the sectors' turnover.

The following list shows the main groups but is not comprehensive:

- ❖ tractors including two-wheel tractors;
- ❖ machinery and equipment for soil cultivation, sowing, planting, fertilising, irrigation;
- ❖ machinery for harvesting/threshing and first processing;
- ❖ equipment for handling, transport and storage;
- ❖ machinery and equipment for cattle breeding and the dairy sector.

### Current situation

In recent years problems caused by the surplus of agricultural production in the EC hampered farmers investment activities. As

a consequence, manufacturers interest shifted from internal demand to extra-EC markets.

Apparent consumption recovered in 1988 and 1989 after a lean period in 1984 and 1987. Since 1984 the development of employment showed a steady downward trend (Table 1).

In 1990 the development is regarded to be satisfactory.

The current situation is characterised, beyond the expected production growth in 1990, by the prospects offered by the liberalisation of Eastern European markets.

The potential demand for agricultural machinery in these countries (including the former GDR) is high but its realisation will depend on the availability of purchasing power. In a worldwide comparison the EC is the largest producer of agricultural machinery, the United States as a single country is in a leading position. This also applies to the large US companies and their subsidiaries in the EC.

**Table 1**  
Agricultural machinery  
Main indicators, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(*)</sup>
Apparent consumption	7 772	9 105	9 934	12 013	10 880	11 390	10 670	10 597	11 859	13 467	14 350
Net exports <sup>(1)</sup>	2 058	2 296	2 124	2 196	2 461	2 598	1 937	1 643	1 629	1 829	2 017
Production <sup>(2)</sup>	9 830	11 401	12 058	14 209	13 341	13 988	12 607	12 240	13 488	15 296	16 367
Employment (thousands) <sup>(2)(*)</sup>	197	177	165	181	183	177	167	154	148	144	140

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

(<sup>2</sup>) Excluding Ireland, 1986 and 1987 partly estimated, 1988 and 1989 estimated

(\*) Until 1983 excluding Netherlands

(\*) Estimated

Source: Eurostat (Inde, Comext)

**Table 2**  
Agricultural machinery  
Production, value added and investment, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(*)</sup>
Production in current prices <sup>(1)</sup>	9 830	11 401	12 058	14 209	13 341	13 988	12 607	12 240	13 488	15 296	16 367
Index	70.3	81.5	86.2	101.6	95.4	100.0	90.1	87.5	96.4	109.4	117.0
Production in constant prices <sup>(1)</sup>	13 458	14 492	14 049	15 520	13 910	13 988	11 992	11 369	12 149	13 146	13 803
Index	96.2	103.6	100.4	111.0	99.4	100.0	85.7	81.3	86.9	94.0	98.7
Value added in constant prices <sup>(2)</sup>	3 150	3 343	3 383	4 142	4 433	4 430	4 019	3 886	4 383	4 959	N/A
Index	71.1	75.5	76.4	93.5	100.1	100.0	90.7	87.7	98.9	111.9	N/A
Productivity <sup>(3)</sup>	22 132	24 231	24 334	25 450	26 169	25 921	23 780	24 372	28 144	31 197	N/A
Index	85.4	93.5	93.9	98.2	101.0	100.0	91.7	94.0	108.6	120.4	N/A
Investment in current prices <sup>(4)</sup>	326	274	248	338	354	389	464	381	400	420	N/A
Index	83.8	70.4	63.8	86.9	91.0	100.0	119.3	97.9	102.8	108.0	N/A

(<sup>1</sup>) Excluding Ireland, 1986 and 1987 partly estimated, 1988 and 1989 estimated

(<sup>2</sup>) Excluding Netherlands, Ireland, Portugal, 1986 and 1987 partly estimated, 1988 and 1989 estimated

(<sup>3</sup>) ECU value added in constant prices per capita employed, excluding Netherlands, Ireland, Portugal

(<sup>4</sup>) Excluding Spain, Ireland, Portugal, 1988 and 1989 estimated

(\*) Estimated

Source: Eurostat (Inde), estimates by Eurostat and Ifo-Institute.

**Table 3**  
Agricultural machinery  
Exports, 1989

(million ECU)	Total exports	Exports Intra-EC	Exports extra-EC
Belgique/België, Luxembourg	469.6	356.4	113.2
BR Deutschland	2 197.4	1 202.2	995.2
Danmark	238.4	130.6	107.8
Hellas	5.9	2.0	3.9
España	78.5	47.6	30.9
France	761.7	424.3	337.4
Ireland	27.8	26.0	1.8
Italia	1 396.5	869.1	527.4
Nederland	381.5	255.8	125.8
Portugal	4.8	2.3	2.5
United Kingdom	1 188.8	443.8	745.0
EC total	6 750.9	3 760.1	2 990.8
Austria <sup>(1)</sup>	190.4	115.2	75.2
Finland <sup>(1)(2)</sup>	110.2	26.4	83.8
Norway <sup>(1)(2)</sup>	88.9	52.3	36.6
Switzerland <sup>(1)</sup>	62.7	33.6	29.1

(<sup>1</sup>) Excluding parts and accessories of tractors.

(<sup>2</sup>) Division of total between intra and extra-EC is estimated

Source: Eurostat, CEMA

## Production and consumption

The production in real terms reached its peak in 1983. In 1989 production recovered again but at a lower level than in 1980 (Table 2). Apparent consumption showed the same pattern. This reflects EC agricultural policy which is orientated towards reducing the production surplus by reducing guaranteed prices, imposing quotas etc. The resulting decrease in income and the fading mechanisation of agriculture in the wealthier countries lead to a decline in investment.

In line with decreasing employment productivity increased during considerably the

eighties, although in 1986 and 1987 the trend was interrupted due to a slump in value added (Table 2).

Table 4 demonstrates that Italy and the Federal Republic of Germany were the largest European manufacturers in 1989. In 1989 Italy was ahead of Germany by a considerable margin whereas France and the United Kingdom had roughly the same turnover, with the UK concentrating on tractors, and France on agricultural machinery. In the last two years, Germany and France led the field with high growth rates. Italy and to a much greater extent the UK had a shrinking turnover (at current value).

The figures for EFTA countries in table 4 demonstrate the importance of the EC market and EC production compared to other countries. The US turnover of 6 billion ECU ranks ahead of single EC countries. Japan, the other big industrial competitor on the world market, has a turnover on the Italian or German level with an upward tendency.

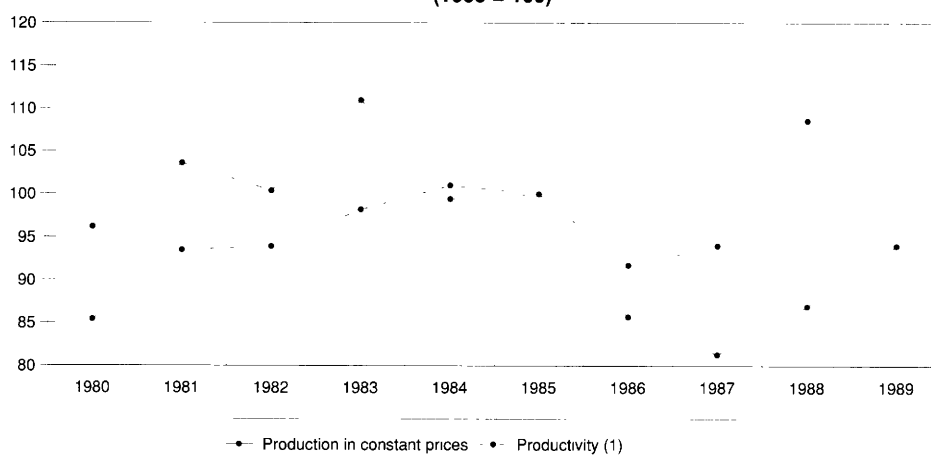
### Foreign trade

Forty four percent of production of agricultural machinery was exported in 1989.

The importance of exports (i.e. the share of exports on turnover) varies widely between the individual countries as does the share of intra-EC exports in total exports.

The United Kingdom is extra-EC orientated (63%). Germany, Denmark and France were exporting extra-EC roughly on EC average, whereas in all other countries intra exports significantly exceeded extra exports. Extra-EC exports have increased during the 1980s by 2% (current rate) with an all-time high in 1985. In constant prices this development would probably mean stagnation.

**Figure 1**  
Agricultural machinery  
Production in constant prices and productivity  
(1985 = 100)



(1) Excluding Netherlands, Ireland and Portugal  
Source: Eurostat (Inde), by Eurostat and Ifo-Institute

Extra-EC imports have increased to the contrary by high rates, especially in 1988 and 1989, thus reducing the rate by which extra exports exceeded extra imports (Table 5).

At the same time intra-EC trade grew substantially. The share on total trade volume soared from around 40% at the start of the 1980s to more than 55% at the end.

### Employment and industrial structure

The employment in the EC agricultural machinery industry decreased considerably in the 1980s. According to CEMA (European

Committee of Agricultural Machinery Manufacturers) the employment figures are generally higher than Eurostat's (probably due to a different selection of enterprises considered in the statistic) but they show the same development (Table 2).

### Industrial structure

The extreme diversity of equipment supplied to farmers by the European agricultural machinery industry makes it difficult to give a comprehensive view of the structure of the European industry.

The major companies with industrial plants in several Euro-pean countries and some-

**Table 4**  
Agricultural machinery  
Turnover by country, 1989

(million ECU)	Tractors	Other machinery	Total
BR Deutschland	2 014.4	1 668.9	3 683.3
Danmark <sup>(1)</sup>	0.0	638.5	638.5
España	264.0	150.3	414.3
France	878.0	1 335.5	2 213.5
Italia	1 905.4	1 682.6	3 588.0
Nederland	0.0	468.9	468.9
United Kingdom <sup>(1)</sup>	1 004.7	434.0	1 438.7
Total	4 052.1	4 709.8	8 761.9
Austria <sup>(1)</sup>	214.9	202.3	417.2
Finland <sup>(1)</sup>	107.2	156.8	264.0
Norway <sup>(1)</sup>	3.1	118.7	121.8
Sweden <sup>(1)</sup>	1.5	N/A	N/A
Switzerland <sup>(1)</sup>	22.7	83.8	106.5

<sup>(1)</sup> Excluding parts and accessories of tractors  
Source: CEMA





**Table 5**  
**Agricultural machinery**  
**EC trade in current prices, 1980-90**

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(1)</sup>
Exports extra-EC	2 532.5	2 835.5	2 730.8	2 822.4	3 129.6	3 244.9	2 618.4	2 393.2	2 623.0	2 990.8	3 094.6
Index	78.0	87.4	84.2	87.0	96.4	100.0	80.7	73.8	80.8	92.2	95.4
Imports extra-EC	482.5	549.6	613.9	632.4	677.4	656.9	689.8	757.3	1 008.4	1 181.7	1 077.6
Index	73.5	83.7	93.5	96.3	103.1	100.0	105.0	115.3	153.5	179.9	164.0
X/M	5.25	5.16	4.45	4.46	4.62	4.94	3.80	3.16	2.60	2.53	2.87
Trade intra-EC	1 737.3	1 776.0	2 309.8	2 439.4	2 659.0	2 919.1	3 033.8	2 990.0	3 400.3	3 728.8	N/A
Index	59.5	60.8	79.1	83.6	91.1	100.0	103.9	102.4	116.5	127.7	N/A
Share of total (%)	40.9	38.3	45.3	46.0	46.1	47.4	54.0	56.0	56.6	55.2	N/A

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

times in several continents, are well known. They specialise in the manufacturing of tractors and automotive harvesting equipment for cereals and fodder, as well as in the manufacture of trailed balers. There are ten such companies in Europe. In addition to the four American companies, Case International Harvester, John Deere, Ford-New Holland, Massey-Ferguson, there are six European companies: FIAT, Renault, KHD, Fendt, Claas and Same. Then come a few companies which specialise in the manufacture of tractors (five or six). Together, these manufacturers generate around 60% of the turnover in the industry.

The remainder, i.e. all agricultural equipment, is produced by 3000 to 4000 companies which are usually very specialised, either in one type of equipment, or in the equipment of a sector or elements of an agricultural sector (poultry farming, pig breeding, wine production, animal feeding, storage, drying, preservation).

The number of salaried staff in these companies varies from fewer than 10 to 1000, or even more.

The total number of European companies trading in the agricultural machinery sector is gradually diminishing.

Notably, recourse to subcontracting, a traditional feature of this industry, is constantly developing, whereas companies which specialise in the design and manufacture of components are becoming more and more numerous, particularly due to a general use of hydraulics, electronics, and integrated EDP.

In the former GDR agricultural machinery manufacturing was concentrated in one large company (VEB Fortschritt) which produced combine harvesters and other machinery and equipment for the other Comecon countries.

### Technological trends

Every year agricultural machinery producers invest 3-4% of their turnover in research for the improvement of quality, comfort and safety. Modern environmental standards and requirements are the main objectives of research and development projects. Considerable progress has already been made in the reduction in the noise level of powered equipment, the strict control of smoke emissions, the electronically controlled distribution of phytosanitary products and fertilizers, the computerised controlling of breeding methods.

Self-propelled balers are a new product line developed in recent years together

with the development of silage plants.

Generally, the concentration in agriculture and the increase in the size of farms brings about a trend for larger machinery and equipment with a higher capacity.

Apart from electronic and sensoric control of machinery it should be noted that the manufacturing of machinery is also continuously developing. Producers are investing in robotics and in machining centres, the flexibility of which facilitates the switching from one product to another while avoiding costly stock piling. This trend can only increase in the years to come.

### Outlook

Distribution is an area which may develop considerably in the future, especially after 1992. Changes will be brought about by the free movement of goods, by EC regulations and directives. This development will also exert its influence on production structures.

The foreseeable development of production will be the result of a variety of factors. First and foremost stands the income situation of the farmers in EC countries, all of Europe and worldwide. In EC countries agriculture is, apart from Greece, Portugal and Ireland, well developed with little need of modernisation programs, while at

the same time tending to produce surpluses. The need for investment growth in the EC countries is, therefore, on average limited, the conditions do not always allow this even when it is considered to be necessary. In well developed countries, such as North America, Australia and South Africa, the situation is similar, meaning that exports to these areas will hardly develop beyond the relatively high level already achieved. This is based on the high technological level of the European agricultural machinery production.

Strong competition will give exchange rates a decisive edge.

In Eastern Europe and in all developing countries there is a great demand for modern agricultural machinery and equipment, this would offer sufficient scope for high export growth rates. The problem in all these countries is the financing of such investment. In Eastern Europe the situation might gradually improve in the coming years.

After a relatively high production growth of about 5% (7% in current prices) in the Eu-

ropean Community in 1990 there will be a slowdown tendency in the coming years.

The production growth rates for 1991 and 1992 will be only marginally above stagnation, i.e. between 1 and 2%, a trend which is likely to continue throughout the first half of the 1990s.

**CEMA: European Committee of Agricultural Machinery Manufacturers. Address: 19, rue Jacques Bingen, F-75017 Paris; tel: (33 1) 47 66 02 20; telex: 60362 F; fax: (33 1) 40 54 95 60**  
**Revised by: Ifo-Institut für Wirtschaftsforschung**

Since 1984 the EC machine tool industry went through a strong upswing stimulated by domestic demand. It has not yet reached its peak, but growth rates are expected to slow down in the coming years. The EC industry is a conglomeration of national industries with varying structures and performances. In general, EC industry is on the leading edge of technology, but in some new technologies, competitors from Japan and even the USA are in the forefront. In international markets the EC machine tool industry represents 45% of the world production. Globalisation of competition driven by the maturing of certain markets and technologies, and Japanese strategies, represents a challenge for the EC industry in the 1990s.

### Description of the sector

The machine tool industry is one of the most strategically important industries as it supplies critical technology to the engineering industries and is responsible for efficient production in nearly all industries.

Machine tools are based on physical or chemical processes used to manufacture workpieces mainly consisting of metal, however new materials such as ceramics are also used.

Machine tools are categorised in two broad product groups. Cutting machinery accounts for 75% of production value while forming machines comprise the rest.

Machine tools may be classified by the type of machining they carry out. The turning lathe category includes all machine tools having a rotating part, the tool itself remaining stationary. In all other cutting machine tools (boring machines, drilling ma-

chines, milling machines, grinding machines and screw-cutting machines) and shaping tools (presses, forging machines, shearing tools, stamping machines, tools for machining metal bars, sections, tubes, sheets and strips), the rotating part is held stationary and the tool is mobile.

### Current situation

Since the recession 1982/83 the cyclical upswing has been pushed by investment, especially in machinery and equipment. This has been an advantage to EC machine tool suppliers who have strongly expanded their sales in domestic markets. Apparent consumption has doubled in 6 years, although performance in international markets has not been as good. The share of non-EC suppliers in the domestic markets has grown, whereas companies have lost market shares in non-EC markets. Thus net export have grown only

**Table 1**  
Machine tools for metal-work  
Main indicators, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 <sup>(*)</sup>
Apparent consumption	4 891	4 806	4 750	4 541	4 820	5 766	7 099	7 926	8 536	9 993	11 172
Net exports <sup>(1)</sup>	1 877	2 134	1 964	2 064	1 952	2 064	2 063	1 795	2 130	2 057	1 842
Production <sup>(1)</sup>	6 768	6 940	6 714	6 605	6 772	7 830	9 162	9 721	10 666	12 050	13 014
Employment (thousands) <sup>(2)</sup>	215	198	187	167	160	164	168	170	170	172	172

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

<sup>(2)</sup> Excluding Denmark, Greece and Ireland

<sup>(\*)</sup> Estimated

Source: CECIMO

slightly (Table 1).

## Production

The production of EC industry had a volume of 12 billion ECU in 1989 (Table 2). It is the world's most important machine tool supplier, with a 45% share of world production. Next to EC industry are Japanese suppliers with 24% of world production. They have markedly increased their share in the past decade, whereas the US companies have been the main losers. In 1980 the US contributed 18% to world production; in 1989 it was not more than 7%. In the machine tool market Swiss firms are important players. They operate in specialised markets and were very successful in the past. Their share of world production could reach 5% of the world total in the 1990s.

In real terms production volume increased by 4% compared with 1980 (Table 3). The strong cyclical upswing in the following years induced an increase in production, however the 1980s volume was not surpassed until 1989.

There are large differences in performance between the machine tool industry in each EC member country. German companies expanded their share of total EC production to more than 50%. Italy's presence has increased and its contribution to EC production accounts for 22%, whereas the other large EC countries, UK and France,

performed poorly. Their shares decreased to 12% and 7% respectively due to companies' low competitiveness. The smaller EC countries, Belgium and especially Spain, are also of increasing importance.

The mix of machine tools produced in the EC has remained stable during the 1980s. Product groups comprising of mature technology such as turning and drilling tools showed a slight decline, while machining centres and EDM (Electronic Discharge Machines) increased their importance.

## Consumption

The EC machine tool market is the largest with 30% of world demand. It is followed by Comecon (28%), Japan (17%) and the USA (11%). The German market for machine tools is as large as the US market. German demand for machine tools accounts for 40% of EC demand, Italy 20%, UK 16%, France 12% and Spain 5%.

In Germany and Italy demand for machine tools grew stronger than in other EC countries.

Foreign suppliers have increased their market shares in the EC in the past decade. They now provide 22% of domestic demand. Most important deliveries are from EFTA countries with 38% of all imports, especially Switzerland. Japan has sharply increased its importance and supplies 27% of imported machines.

Detailed figures are not available for the

demand by end user. Demand has grown strongly in the automotive industry, in aeronautics and in machine tools manufacturing itself.

The main sector where demand has declined is in heavy engineering due to weak demand for heavy engineering products.

The predominance of clients from capital goods industries implies a strong dependency on the investment climate. Indeed, ex-post analysis shows a stronger cyclical development of demand for the machine tool industry than for most other industries.

## Trade

The EC machine tool industry is until now the most important supplier in international markets. The industry contributes 41% to world trade, but its importance has been reduced in the 1980s. Ten years earlier 50% of all exported machine tools originated from the EC. In this period only a few industrialised countries could increase their shares in world trade. By far the most impressive, has been the expansion of Japanese suppliers: In 1980 their contribution to world trade accounted for 19% of all exported machines, in 1989 30%. In the USA they increased their market share from 9% to 26% in the past decade. Compared with this development the Japanese penetration in the EC was moderate. Their market share grew from 4% to about 7%



**Table 2**  
Machine tools for metal-work  
Production at current value by country, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total	6 768	6 940	6 714	6 605	6 772	7 830	9 162	9 670	10 665	12 050
Belgique/België	99	93	103	90	93	123	154	153	175	188
Danmark	35	37	36	38	43	55	55	51	53	51
BR Deutschland	3 390	3 554	3 580	3 950	3 978	4 189	5 289	5 555	5 564	6 238
España	254	287	265	207	255	333	404	449	594	732
France	687	728	636	600	561	660	599	605	669	737
Italia	1 245	1 385	1 178	1 114	1 196	1 472	1 657	1 938	2 363	2 730
Nederland	54	54	49	32	41	50	58	40	56	54
Portugal	13	17	16	12	12	14	13	12	16	22
United Kingdom	991	785	851	562	593	934	933	867	1 175	1 298

Source: CECIMO

**Table 3**  
Machine tools for metal-work  
Production at constant value by country, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total	9 503	9 019	8 022	7 449	7 135	7 830	8 559	8 563	9 231	9 918
Belgique/België	117	105	113	96	96	123	145	141	160	165
Danmark	53	52	45	44	47	55	53	47	48	43
BR Deutschland	4 716	4 661	4 203	4 327	4 170	4 189	4 804	4 700	4 602	5 019
España	336	353	305	250	275	333	404	435	520	577
France	913	880	735	669	596	660	603	615	674	709
Italia	1 885	1 939	1 593	1 394	1 269	1 472	1 477	1 635	2 023	2 140
Nederland	71	68	55	34	43	50	54	35	48	45
Portugal	20	21	19	14	13	14	13	12	14	17
United Kingdom	1 391	940	955	621	627	934	1 006	943	1 142	1 203

Source: CECIMO

**Table 4**  
Machine tools for metal-work  
Production, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990(*)
Production in current prices											
EC (*)	6 768	6 940	6 714	6 605	6 772	7 830	9 162	9 721	10 666	12 050	13 014
Index	86.4	88.6	85.7	84.4	86.5	100.0	117.0	124.2	136.2	153.9	166.2
USA											
Index	97.7	129.4	106.2	68.0	86.9	100.0	79.0	63.2	63.0	83.8	N/A
Japan											
Index	38.9	61.1	55.0	56.3	80.3	100.0	101.0	80.3	105.6	128.1	N/A
Production in constant prices											
EC (*)	9 503	9 019	8 022	7 449	7 135	7 830	8 559	8 563	9 231	9 918	10 900
Index	121.4	115.2	102.5	95.1	91.1	100.0	109.3	109.4	117.9	126.7	139.2

(\*) Excluding Greece and Ireland

(\*) Estimated

Source: CECIMO

in the 1980s.

The extra-EC exports have increased in the past decade by an average growth rate of 5.4% in current values to nearly 10 billion ECU, whereas production has grown by 6.6% (Table 5). The export ratio declined from 40% to 36% in this period.

For instance the EC share on US imports decreased from 37% to 31% in the 1980s.

This lower EC export performance was mainly due to the low competitiveness of the UK and France in the 1980s.

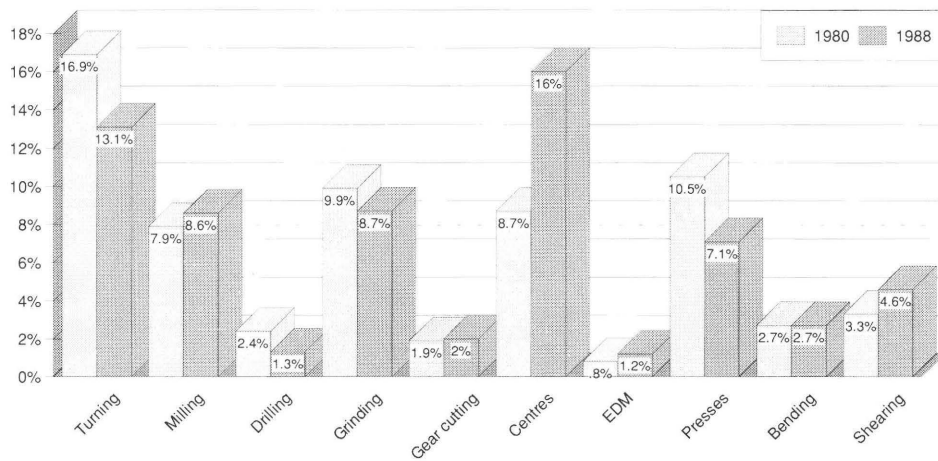
As a comparison, Table 5 shows the time series for production and trade for the

USA and Japan. The USA showed a poor development in foreign trade due to weak competitiveness and the high value of the dollar in the middle of the 1980s.

## Employment

In 1980 the EC machine tool industry employed a workforce of 215,000. It was re-

**Figure 1**  
Machines tools for metal-work  
Changes in EC production mix



Source: DG III study made in collaboration with CECIMO; Inpadoc; VDW Data base; IFO Institute

duced during the recession in 1982/83, with the number of employees falling to 160,000 in 1984. In the cyclical upswing employment increased once again, and in 1989 there were 172,000 employees (Table 6).

The industry is marked by small and medium sized companies and, on average,

they employ 124 people. Only a few companies have more than 1,000 employees.

Comparisons of EC member countries show significant differences. In Germany companies are by far the largest compared to other EC nations. Average size is twice as high as in the EC.

## Structure of EC industry

International comparisons show that EC machine tool companies are smaller than Japanese or US firms, which employ, on average, 240 and 172 people respectively. Further, it must be pointed out that Japanese companies in particular have, on average, a markedly higher output due to a different industry structure. Average production of a Japanese company is twice as high as that of a German one.

It must be kept in mind that the EC machine tool industry is a conglomeration of national industries with different structures.

Within each country, industry is concentrated in particular areas, often traditionally industrialised regions, such as Baden-Württemberg in Germany, West Midlands in the UK, Lombardia in Italy and Basque in Spain. In France and the UK regional concentration is lower than in the other important machine tool supplying countries of

**Table 5**  
Machine tools for metal-work  
EC, USA, Japan trade in current prices, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990(?)
Exports											
EC (¹)	2 695	2 951	2 824	2 703	2 855	3 243	3 636	3 309	3 842	4 312	4 325
Index	83.1	91.0	87.1	83.3	88.0	100.0	112.1	102.0	118.5	133.0	133.4
USA	863	1 373	1 128	539	1 058	1 158	1 039	982	1 176	859	N/A
Index	74.6	118.5	97.4	46.5	91.3	100.0	89.7	84.8	101.5	74.2	N/A
Japan	1 116	1 635	1 401	1 457	2 383	3 138	3 394	2 907	3 218	3 422	N/A
Index	35.6	52.1	44.6	46.4	75.9	100.0	108.1	92.6	102.5	109.1	N/A
Imports											
EC (¹)	984	971	971	877	1 066	1 414	1 811	1 670	1 948	2 232	2 483
Index	69.6	68.7	68.7	62.0	75.4	100.0	128.1	118.1	137.8	157.9	175.6
USA	1 106	1 567	1 620	1 225	1 986	2 779	2 721	2 056	1 837	2 222	N/A
Index	39.8	56.4	58.3	44.1	71.5	100.0	97.9	74.0	66.1	80.0	N/A
Japan	185	230	257	218	267	334	320	269	392	437	N/A
Index	55.3	68.9	76.7	65.2	79.9	100.0	95.7	80.5	117.3	130.7	N/A
Export-Import coverage (X/M)											
EC	2.74	3.04	2.91	3.08	2.68	2.29	2.01	1.98	1.97	1.93	1.70
USA	0.78	0.88	0.70	0.44	0.53	0.42	0.38	0.48	0.64	0.39	N/A
Japan	6.03	7.09	5.46	6.68	8.92	9.38	10.60	10.80	8.20	7.83	N/A
Trade intra-EC (¹)											
Index	1 112	1 195	1 157	943	1 050	1 259	1 600	1 781	2 044	2 712	N/A
	88.3	94.9	91.9	74.9	83.4	100.0	127.1	141.5	162.4	215.4	N/A

(¹) Excluding Greece and Ireland

(²) Estimated

Source: CECIMO, VDW, Ifo Institute

**Table 6**  
Machine tools for metal-work  
Structure of the industry, 1989

	Employment	Manufacturers	Employees per company	Production per company
Belgique/België	2 100	28	75	6.7
BR Deutschland	95 000	380	250	16.4
España	7 874	143	55	5.1
France	9 475	150	63	4.9
Italia	32 100	450	71	6.1
Nederland	960	20	48	2.7
Portugal	1 100	20	55	1.1
United Kingdom	23 700	200	119	6.5
<b>Total</b>	<b>172 309</b>	<b>1391</b>	<b>124</b>	<b>8.6</b>
Switzerland	13 915	115	121	14.2
USA	46 268	269	174	11
Japan	50 907	213	239	41.9

Source: CECIMO, VDW, Atkins/IFO

the EC (Table 7).

The typical German company is a medium-sized, privately owned company. In the past few years some of them have become publicly registered companies, such as MAHO, Traub, Hermle, Montanwerke Walter, and others. Foreign ownership has been the exception in the German machine tool industry. Only a few takeovers have taken place. Steinel, for example, was bought by Voest of Austria to facilitate EC market penetration. On the other hand some firms located in Germany were resold from foreign owners to German companies, e.g. Böhlinger, TBT, Wotan. In some cases Asian companies have transplants; South Korean Tong Il Co. took over Heyligenstaedt and two other companies; Japanese Makino Milling bought Heidenreich & Harbeck.

The structure of the Italian industry shows a large number of very small firms like Rovetta and Manzoni which are specialists, and operate mostly in regional markets. These companies have proved to be competitive, and the success of the Italian machine tool industry is partly attributable to them. Only some medium-sized and few

large companies like Comau and Mandelli exist. The German company Maho acquired Graziano for the completion of its product programme and better penetration of the Italian market.

In the UK, companies are often part of a group, sometimes working in the machine tool or the mechanical engineering markets. Foreign ownership is more significant than in any other European country.

Traditionally strong are US alliances and subsidiaries like Bridgeport, Cincinnati Milacron and Butler Newall.

The French industry, like the British, showed poor competitiveness in the 1980s. The 'plan-machine-outil' was not able to solve the problems.

After a phase of company closures and restructuring, performance has been revitalised. Some machine tool companies belong to the French automotive industry and were able to survive without a change in ownership, such as Renault automation and SCEMN. But in many cases new capital was necessary and often foreign machine tool companies invested in French industry, especially Japanese firms such as Mitsui Seiki and Toyoda. But European

companies also acquired French firms such as Comau, Trumpf and Traub, in preparation for the European market in 1992.

The structure of the Spanish industry is unique in that there is a high level of collaboration between companies in the sector, as well as with clients. The largest group which collaborates in product development is FATRONIC. It includes some of the most technically advanced Spanish machine tool manufacturers, such as Etxetar, Ona Electroerosion and Anayak. Another important collaboration is the MIL group bringing together four manufacturers: Sabi, Ibarria, Metosa and CME to undertake commercial and marketing joint ventures. In the Basque region where the machine tool industry is concentrated, companies are often set in the form of labour cooperatives. One of the largest is the Debako group belonging to the Mondragon group of cooperatives. One of the main questions will be whether these organisations succeed in strengthening their competitiveness because leading technicians and managers are attracted by higher salaries and better working condi-

**Table 7**  
Machine tools for metal-work  
Production breakdown by region

	Share on EC %	Share on Country %
BR Deutschland	51.8	
Baden-Württemberg		48
Nordhein Westfalen		22
Bayern		20
España	6.0	
Basque		60
France	6.1	
Ile-de-France		35
Rhone-Alpes		26
Italia:	22.7	
Lombardia		42
Piemonte		29
United Kingdom	10.8	
West Midlands		23
South East		20

Source: VDW, Atkins/IFO

**Table 8**  
Machine tools for metal-work  
Japanese machine-tool  
µtransplants in the EC

Company	Set up	Country
Mitsui Seiki	1975	France
Makino Milling	1978	BRD
Yamazaki Mazak	1980	UK
Toyoda Machine	1985	France
Fanuc	1986	Luxembourg

Source: JMTBA 1989

tions in competitors' companies.

### Investment and R&D

EC companies are investing roughly 5% to 6% of turnover. Germany is the only large EC country where this characteristic figure is higher. In the UK this could be partly due to Japanese activities.

Belgium and Denmark have strongly increased their investment expenditures since the end of the recession in 1982/83. Spanish figures show a strong investment activity: The share on production is higher than 10% (Table 9).

Mechanical manufacturing technologies are mature and R&D in these fields has lost some of its importance. Technological progress focuses increasingly on the peripheral equipment necessary to automate manufacturing, where the handling of tools and parts as well as the development of tools was intensified to optimise manufacturing at higher speeds and prolong the edge life of the tools.

In new manufacturing technologies such as wire EDM (Electronic Discharge Machines) - a variant of the traditional electrical discharge process - Swiss and Japanese companies are at the leading edge of technology. In laser manufacturing technology German and Japanese companies have the leading edge.

In control technology, Japan is in the forefront with Fanuc, the world's largest sup-

plier with a 40% market share. European companies such as Siemens, Philips, Heidenhain and others have strengthened their technological competitiveness but their prices are much too high compared with those of Fanuc.

A comparison of R&D activities shows that the EC is concentrating more of its research activities on machine tool related technologies than its competitors from the USA and Japan. In the EC 5.1% of all important inventions - these are inventions with patent applications in more than one

the position is worse, and it is a situation which could pose a threat to the EC industry in the future.

### Impact of the Single European Market

European machine tool companies tend to be national manufacturers and pan-European traders. This distinction is fundamental to the approach which many companies have taken towards integration, i.e. creating distribution subsidiaries in other Member States. Many companies who have not done so, intend to establish

**Table 9**  
Machine tools for metal-work  
Investment by machine tool industries, 1985-88

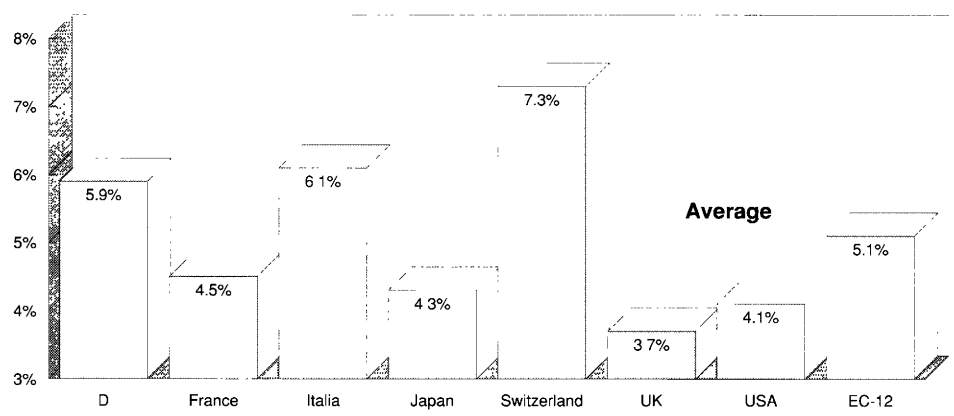
(million ECU)	1985	1986	1987	1988
BR Deutschland	256	390	372	372
España (*)	N/A	N/A	55	66
France	70	74	42	34
Italia	66	100	107	123
United Kingdom (*)	N/A	N/A	68	93

(\*) Estimated  
Source: Atkins/IFO

country - are machine tool related. Germany is the major contributor with an almost 6% share in national R&D activity in machine tools (Figure 2). However it must be mentioned that EC inventions are mainly in mature mechanical technologies. In other fields such as microelectronics, robotics, powder metallurgy, and ceramics

European distribution networks in the future. Manufacturers in all of the major EC countries do not consider there to be any significant technical barriers to intra-EC trade. Differences in national standards are not seen as a significant issue. Manufacturers usually ensure that they meet the toughest standards so that all

**Figure 2**  
R&D activity in machine tool industry



Source: Inpadoc; Ifo Institute



legal technical requirements are met.

However many large users determine their own specifications, and will continue to do so in spite of harmonisation (e.g. NUM controls in France).

Customs and administrative delays are not considered by any of the major EC countries to constitute barriers to intra-EC trade. The removal, however, of such delays is perceived to facilitate intra-EC trade. The one administrative hindrance most commonly cited is the requirement to conform to COCOM regulations, which however are being relaxed as a consequence of the East-West detente.

Manufacturers do not perceive substantial commercial barriers to intra-EC trade.

However the single European market developments to improve the provision of services and free movement of capital are welcomed as a means to facilitate intra-EC trade. Directives, like the machine directive, affecting the machine tool industry, are considered by most manufacturers and distributors to be a positive means of facilitating intra-European trade. Machine tool manufacturers do not perceive the Directive as removing barriers which formerly prevented trade because they are able to adapt their machines to differing requirements if need be.

However, it will reduce unnecessary administrations and ensure that duplication of safety requirements does not occur.

## Outlook

The investment climate had been very good for a couple of years. Forecasts indicate a continuous growth in spite of some regional threats (British and US economy, Gulf crisis).

The demand for machine tools has been stimulated by new technologies and fac-

### Western Company

Maho AG, Pfronten  
Schiess AG, Düsseldorf  
Trumpf GmbH & Co., Ditzingen  
Gebr. Hoffmann AG & Co. KG, Hilden

EX-CELL-O Holding AG,  
Geislingen  
Boehringer GmbH, Göppingen  
Pittler Maschinenfabrik AG,  
Langen

Source: IFO Institute

**Table 10**  
Machine tools for metal-work  
East-West German company affiliations

### Eastern Company

Maho Seebach GmbH  
Aschersleben  
Niles GmbH  
Unio Gera GmbH  
Union Sächsische Werkzeugmaschinen GmbH  
Niles GmbH  
BWF GmbH  
Werkzeugmaschinenfabrik  
Glauchau GmbH  
Leipziger Drehmaschinen GmbH  
Werkzeugmaschinenfabrik Vogtland GmbH  
Herrmann Matern Werkzeugmaschinenfabrik  
Neue Magdeburger Werkzeugmaschinen GmbH

**Table 11**  
Production forecast for EC machine tool industry, 1991-94

(million ECU)	1989 abs (1)	1990 abs (2)	1990 - 91 %var (3)	1991 - 92 %var (3)	1989 - 94 %var (3)
BR Deutschland	5 019	5 500	5	-	-
France	709	730	2	-	-
Italia	2 140	2 350	4	-	-
United Kingdom	1 203	1 300	-3	-	-
<b>Total</b>	<b>9 918</b>	<b>10 900</b>	<b>3.8</b>	<b>3.5</b>	<b>4.4</b>

(1) Constant prices 1985  
(2) Expected  
(3) Real growth rate  
Source: CECIMO, IFO Institute

tory automation, and this will also stimulate future development even if intensity decreases.

In the short term, French and British machine tool industries face some problems. In France, the automotive industry - one of the main customers - expects a worsening market situation and postponed investment. In the UK a reduction in investment activity must be seen for 1991. In all other important countries real production volume will increase with high growth rates in 1990. 1991 with probably show a slow reduction.

International price competition will increase because of the depreciation of the dollar and the yen. Due to this development and the slow down of the US economy, trade flows will change. Exports from Japan and the USA to the EC could become a threat.

Therefore, the production forecast for the EC machine tool industry is dependent on its ability to meet the challenge, to use the advantage of growing domestic markets, and to stop the erosion of world trade shares. Moreover it must be pointed out that it is presumed that the Gulf crisis and the frictions in the international financing system do not have a fundamental impact on the world economy. Under these circumstances production can be expanded at an average real rate of 4.4% p.a. and employment could expand until 1994.

Written by: IFO - Institut für Wirtschaftsforschung on the basis of a study work by W.S. Atkins management consultants for DG III of the EC who are also in colloration with CECIMO. The industry is represented at the EC level by: CECIMO: Comité Européen de Cooperation des Industries de la Machine-Outil. Address: Rue des Drapiers 21, B-1050 Brussels. tel: (322) 510 23 51; fax: (322) 510 23 01

Cutting tools are used in many industries, in particular the capital goods sector.

Demand, therefore followed cyclical developments in the 1980s.

Developing countries are becoming increasingly important as suppliers, whereas industrialised countries are concentrating production on high performance tools. EC companies are well established in tool technologies and are in a position to succeed in competition with Japan, the US and Sweden.

But Japan and the US have intensified R&D into new materials, which, if this results in the development of basically improved tools, could pose a threat to the EC producers.

### Description of the sector

The industry supplies tools for machining operations, such as drilling, threading, tapping, turning, gear-cutting, broaching and sawing. The different processes need cutting tools adapted to the specific requirements of geometric form and material.

In both fields technological progress has created high performance products, and the edge life of tools as well as cutting speed can be markedly improved.

R&D in new materials has affected cutting tools, but ceramics and polycrystalline materials have so far only achieved a 6%

market share.

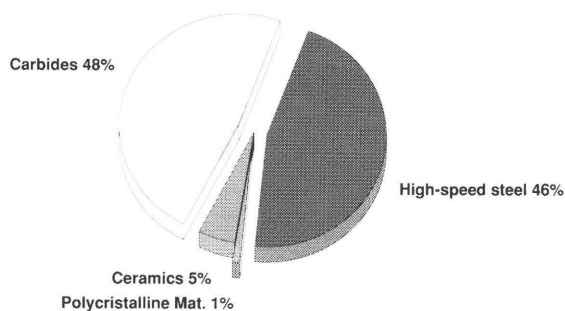
The most important change in volume business is the substitution of high speed steel (HSS) by carbides, which have gained a share of nearly 50%.

The remaining tool market volume comprises HSS tools (see figure 1).

### Production and consumption

In 1989 EC production of cutting tools accounted for some 2 billion ECU. This is roughly 30% of world market volume. The most important EC producing country is Germany which increased its share of EC

**Figure 1**  
Cutting tool materials  
World demand 1988



Source: Krupp Widia

production to more than 50% (table 1). Krupp Widia and Hertel are the largest German suppliers. Most of the industry's production is used in machine tools. A relationship therefore exists between the cutting-tool and machine-tool industry. Their customers are from the same industries, the most important being the automotive, mechanical engineering and electrical products industries. The cyclical upswing after the recession of 1982/83 stimulated demand for cutting tools as for most capital goods. The apparent demand in the EC grew between 1984 and 1989 by 10% p.a. and induced a strong expansion of production. But in the past few years growth rates decreased. In real terms the 1980 volume of cutting tools was not regained until 1989 (see table 2). Improved performance and the extended

edge life of tools has been accompanied by a strong growth in the demand for cutting tools. This is stimulated by tougher specifications from customers as well as factory automation requiring large tool magazines for flexible production and low lead times. A further change in demand lies in the growing customisation, i.e. the specification of a tool for a defined manufacturing process.

### Trade

The EC is a net-importer for cutting tools. This is mainly due to the imports. The import penetration rate (imports extra-EC/production) has increased in the 1980s, up to 25% in 1989 and lies well above the 15% for the total mechanical engineering industry. EC imports of cutting tools are affected by two developments. Imports from Japan, Sweden, Switzerland and also the US are

at a high level because these countries are at the leading edge of technology. Japan is the predominant supplying country of cermets with a share of some 25% on its cutting tool production whereas important suppliers of carbide tools include, Kenna Metal (US) and Sandvik (Sweden). On the other hand simple tools made of high speed steel and other standard materials are increasingly supplied by the newly industrialised countries, especially from the Far East.

### Structure of EC industry

The cutting tool industry is dominated by medium-sized enterprises. Only a few large companies exist worldwide such as Sandvik, Kenna Metal, Valenite, Sumitomo Toshiba, Krupp Widia and Hertel. Only the last two are from the EC. Another large cutting tool company has just been created: Cutting Tool Technology (CTT), a merger of Swedish SKF Tools and German Günther & Co. (Titex). The coating of tools is a sophisticated process for improving cutting attributes, and the necessary machinery and equipment are delivered only by a few companies. The two major suppliers are European companies, Balzers and Multi-Arc, with a high level of penetration in the EC. This is an advantage to the EC cutting tool industry because of the possibility of

**Table 1**  
Cutting tools  
Production by country, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989 (*)
EC (*)	1 243	891	874	1 298	1 436	1 662	1 812	1 852	1 924	2 010
BR Deutschland	570	319	324	729	828	998	1109	1138	1096	1098
France	100	104	106	96	98	113	120	117	190	190
Italia	166	169	151	130	138	148	162	170	177	233
United Kingdom	275	139	131	198	220	219	225	240	267	286

(\*) Estimated by Eurostat  
(\*) Estimated by ECTA  
Source: ECTA

**Table 2**  
Cutting tools  
Production at constant value by country, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
EC (1)	1 735	1 142	1 037	1 452	1 513	1 662	1 709	1 663	1 671	1 663
BR Deutschland	793	418	380	799	868	998	1013	972	913	885
France	133	126	122	107	104	113	115	109	173	183
Italia	251	237	204	163	146	148	144	143	147	183
United Kingdom	386	166	147	219	232	219	245	264	262	266

(1) Estimated by Eurostat.  
Source: ECTA

**Table 3**  
Cutting tools  
EC trade in current value, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Exports extra-EC (1)	169	198	213	217	289	338	330	324	431	480
Index (2)	53	62	67	68	86	100	98	96	127	142
Imports extra-EC (1)	239	254	254	245	313	388	433	429	448	499
Index (2)	64	67	67	65	81	100	112	110	116	129
X/M	0.71	0.78	0.84	0.88	0.92	0.87	0.76	0.76	0.96	0.96
Trade intra-EC (1)	221	234	264	247	293	349	375	383	484	583
Index (2)	67	70	79	74	84	100	108	110	139	167

(1) 1980 EC9; 1981-83 EC10

(2) Taking into account changes in EC membership  
Source: ECTA, Eurostat (Comext)

intensified communication and support in the diffusion of the improved technology. Japan has direct investment in the EC cutting tool industry with Toshiba Tungaloy and Sumitomo, both with production sites in Germany. Asahi Diamond Industrial has acquired a share of Triefus France with plants in France and the UK.

New opportunities for the improvement of the industry's structure have been provided by the unification of Germany.

Affiliations have been launched by some companies, e.g. Montan-werke Walter and Krupp Widia. The latter has announced a joint venture with VEB Schmalkalden.

## Research and development

Technological progress in cutting tools is due to development in various fields. In the forefront are innovations affecting the design of cutting tools for a specific manufacturing process like milling or sawing.

Most important variables are the tool's shape and its surface. Innovations in material technologies also create progress in cutting tools, and developments in materials such as ceramics were dynamic during the 1980s.

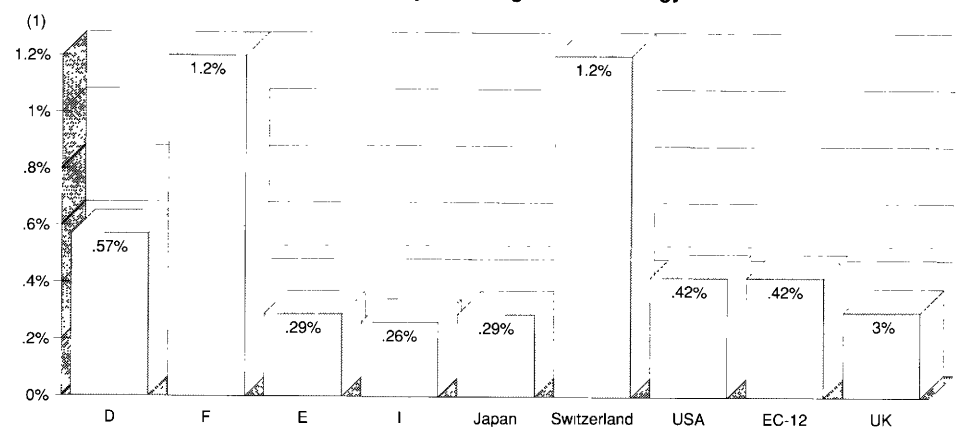
A comparison of inventions in cutting tool technologies indicates a strong position for the EC, from which 38% of all important

applications for patent come. This is mostly due to companies from Germany who currently apply for one patent in four. Only the US has as many patent applications on cutting tool technologies.

Some countries concentrate their R&D efforts on tool technologies, including Germany, Switzerland and Sweden.

In these countries the ratio of applications

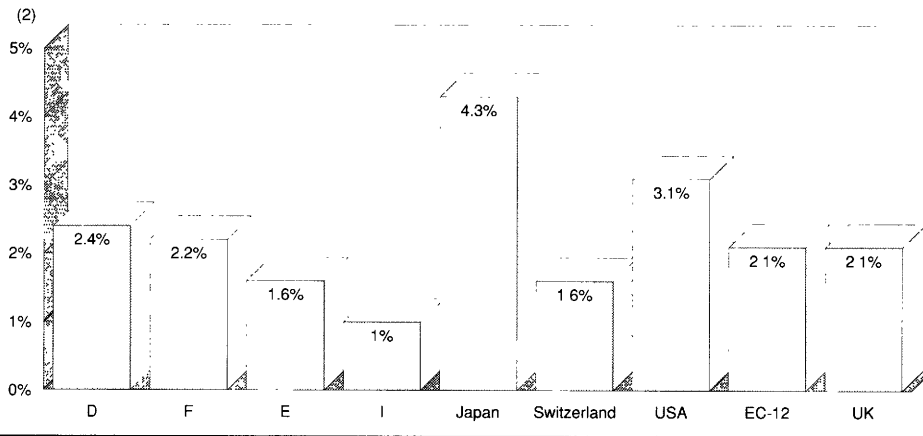
**Figure 2**  
Cutting-Tools  
R&D activity in cutting-tool technology



(1) Calculations based only on patent application in more than one country  
Source: Inpadoc; IFO Institute



**Figure 3**  
**Cutting-Tools**  
**R&D activity in cutting-tool related technology 1988 (1)**



(1) Metal coating, powder metallurgy, ceramics, alloys

(2) Calculations based only on patent application in more than one country

Source: Inpadoc; IFO Institute

for a cutting tool patent is markedly higher than the world average, and shows that Western European countries are at the leading edge in this field (see figure 2). By contrast, Japan and the US concentrate on new materials technology (see figure 3).

This situation poses a threat to the European tool industry because newly developed materials and surface refining technologies can provide tools with an extremely improved cutting performance.

Since the early 1970s, for instance, Japanese companies sell cermets.

The Japanese are amongst the market leaders and are the most important suppliers of this technology. European companies are behind and have problems overcoming the gap. In Japan cermets have strong market penetration and have gained about a 25% share of cutting tool demand. Until now in Europe the share of cermets in tool demand is less than 5%, but market penetration will increase.

Changes in manufacturing technologies impose higher requirements on tools.

They have to be stiffer to allow higher cutting speeds, which are now possible with the new generation of machine tools. Addi-

tionally the growing capital costs in an automated factory must be met by a higher utilisation. Therefore customers require more and more durable tools with an increased edge life.

Increased flexibility of automated production lines has been achieved by the installation of programmable machines, for instance equipped with NC controls.

A hindrance to the fast change from the manufacturing of one part to another was the handling of tools.

To reduce set up times tool fixture systems were developed and supplied by tool manufacturers.

This has induced additional demand from customers.

Latest developments towards an improved use of the flexibility of programmable machines is the standardisation of cutting tools. Norms for the shape and the accuracy of a tool, e.g. an NC milling tool, will be set. The application makes set up times obsolete, even if new tools are used. In particular large customers are interested in this development.

However, it requires a high input of R&D in tool producing companies. Some of the smaller ones perhaps cannot afford the ex-

penditures and are facing a threat.

With the help of thin film technology, for example, tool performance could be further improved. A cutting tool coated with a film of diamond could achieve greater cutting speeds and less resistance than even the most advanced coatings.

Besides some Japanese companies, like Asahi Diamond, EC companies are also working in this field and some governments are funding R&D in this technology.

## Outlook

The importance of R&D on new materials for the development of new cutting tools will grow further. Technological progress is expected to continue to be dynamic and the key success factor for competition between industrialised countries.

The EC is in a good position, but R&D on new materials should be intensified.

The international division of labour will be increased and low wage countries will become more important as suppliers.

Therefore EC tool manufacturers will have to increasingly concentrate on high performance products. Markets for these cutting tools are strongly expanding, which is mainly due to changes in customer industries. The automotive and aircraft industries, for example, require more and more sophisticated manufacturing processes; the use of light and highly durable materials is increasing and high accuracy is necessary, and the development of adequate tools is the basis for success in these markets.

The short-term prospects for the EC cutting tool industry have worsened mainly because of the expectations of the most important user industries, the automotive industry, mechanical engineering and electrical products industry. EC demand for

cutting tools is expected to grow in 1990. EC companies should be able to stabilise their share of the domestic market and to increase their exports.

Due to this development a real growth of production of 3 to 4% in 1990 will be reached.

Demand for capital goods is expected to

slow down in 1991 stimulated by a reduced investment climate. Moreover the depreciation of the Dollar and the Yen gives an important advantage to foreign competitors.

To improve long-term prospects, the technological position of EC manufacturers should be strengthened, otherwise market

shares could be lost.

**Written by: IFO - Institut für  
Wirtschaftsforschung**

**The industry is represented at the EC level by:**

**ECTA - European Cutting Tool Association.**

**Address: Light Trade House 3 Melbourne  
Avenue, Sheffield S10 2QJ, United Kingdom**

**tel.: (44-742) 663 084; fax: (44-742) 670 91**

The companies in this sector are mostly small and medium sized and supply the intermediary products necessary as tools in other industries.

Such high-performance, exclusively customised products require engineering skills and qualified workers. At present, firms are facing challenges from rapid technological change and emerging competition, mainly caused by the increasing international sourcing of large clients. In the past years industry has experienced strong growth in demand, but currently expectations have worsened. Nineteen-ninety one will see moderate growth in comparison with that of 1990.

#### Description of the sector

The manufacturing range can be divided into major groups: dies for pressing, stamping, punching and forming, (including car-body dies and tools for deep drawing and bending), moulds and die castings, jigs and fixtures, standard parts and components for moulds and dies, and special machines manufactured by tool makers.

The industrial production of items with identical measurements in quantities of as many as one million, requires tools and moulds with the greatest precision, excellent durability and a long life.

These include stamping tools for the production of metal and sheet metal work pieces in forming processes; moulds for the precise and rational production of complex parts made from plastics and caoutchouc or for the production of work pieces from non-ferrous metals; jigs and fixtures for clamping and processing work pieces with machine tools as well as welding lines and similar production facilities.

Single purpose machines are designed and produced for very specific applications, e.g. for assembling light bulbs or television tubes.

#### Current situation

Companies in this industry are mainly regional players and are dependent on the development of domestic markets.

The EC market is fragmented and trade relations are weak. Extra-EC exports account for only 12% of production (table 2), whereas extra-EC imports' share of domestic demand is only 7%. This is due to the products manufactured, which require a strong interaction between manufacturer and customer.

Enterprises in this industry are small, with less than 100 employees per company on average. The dynamic technological evolution as well as the single European market present important challenges.

High investment and the improvement of employees' skills are necessary to ensure success in the future.

**Table 1**  
Special tools  
Main Indicators, 1982-89 (1)

(million ECU)	1982	1983	1984	1985	1986	1987	1988	1989(*)
Apparent consumption	2 001	2 030	2 299	2 924	3 418	3 818	3 793	N/A
Net exports (2)	138	151	154	214	182	242	295	N/A
Production (3)	2 139	2 181	2 453	3 138	3 600	4 060	4 088	4 354

(1) Portugal not available for 1982/83.

(2) Excluding Greece, Ireland and Luxembourg

(3) Excluding Denmark, Greece, Ireland and Luxembourg

(\*) Estimated

Source: ISTA

Since 1982 demand for special tools has been booming. However in 1988 this dynamic expansion resulted in an almost stagnant market. In the EC, production volume in the sector was circa 4.1 billion ECU in 1988 (table 1).

In 1989 the market recovered, output increased by 7% and further growth is expected in 1990.

### Production

Figure 1 shows the share of EC production in "special tools" by individual Member States. The leading position was held by West Germany with 37.9% in 1988, followed by Italy, France, Spain and the

United Kingdom. Differences when compared with 1984 are notable, especially the growth of Spain's share of EC production from 4.8% to 12.9% and the losses of the UK (-1.9%), Italy (-3.7%), and West Germany (-1.8%).

German companies concentrate on dies for pressing stamping, punching and forming as well as jigs and fixtures with some 60% of EC production, whereas France has a strong position in moulds for plastics (table 3).

In 1988, volumes are highest for the production of dies (1.34 billion ECU) followed by moulds for rubber and plastics (approx-

mately 1.32 billion ECU).

### Consumption

Apparent consumption indicates that Germany has the largest market with a 35% share of EC demand. France follows with less than half the volume (table 4). Comparison with table 3 shows that there are only two net-exporting countries in the EC, Germany and Italy. Figures for Belgium and the Netherlands have a bias because of internal deliveries of large groups, especially from the automotive industry.

The most important client industries include the automobile industry (26%), the electrical industry (25%), iron, sheet and

**Table 2**  
Special tools  
Production and external trade, 1982-89 (1)

(million ECU)	1982	1983	1984	1985	1986	1987	1988	1989(*)
<b>Production in current prices</b>								
EC (2)	2 139	2 181	2 453	3 138	3 600	4 060	4 088	4 354
Index	68	70	78	100	115	129	130	138
<b>Production in constant prices</b>								
EC (2)	2 467	2 485	2 588	3 138	3 474	3 800	3 692	3 840
Index	79	79	82	100	111	121	118	123
<b>EC trade in current prices</b>								
Total exports (3)	690	697	797	991	1 191	1 306	1 238	N/A
Index	70	70	80	100	120	132	125	N/A
Extra-EC as a % of total (4)	N/A	48	47	46	44	44	40	N/A
Total exports (3)	559	546	643	777	1 009	1 064	1 024	N/A
Index	72	70	83	100	130	137	132	N/A
Extra-EC as a % of total (4)	N/A	30	33	27	26	27	26	N/A
X/M	1.23	1.28	1.24	1.28	1.18	1.23	1.2	N/A

(1) Portugal not available for 1982/83.

(2) Excluding Denmark, Greece, Ireland and Luxembourg

(3) Excluding Greece, Ireland and Luxembourg

(4) Estimated

Source: ISTA

**Table 3**  
Special tools  
Production by main product category, 1988

(million ECU)	Stamping tools	Moulds for plastics	Die casting dies	Jigs and fixtures	Standard parts	Total
(Total ) <sup>(1)</sup>	1 341	1 319	209	349	176	4 088
Belgique/België	15	70	20	1	N/A	106
BR Deutschland	770	368	63	222	127	1550
España	254	217	38	N/A	19	528
France	165	386	51	N/A	N/A	602
Italia	N/A	N/A	N/A	N/A	N/A	696
Nederland	42	21	N/A	N/A	N/A	63
Portugal	4	79	10	3	2	98
United Kingdom	90	177	27	123	28	445

<sup>(1)</sup> Excluding Denmark, Greece, Ireland, Luxembourg  
Source: ISTA

metal goods manufacturing (17%), toys, sports goods and plastics (13%), food and packaging industries (7%), aerospace and aeronautics (4%). The structure of deliveries shows that there is a high dependency of companies producing special tools in the capital goods industries.

Large accounts from the automotive and electrical industries help to keep prices down. The spread of 'global sourcing' increases the competition amongst tool suppliers themselves and also leads to a rise in the number of tenders for an order. As a result of this development, cost increases as well as price pressure have led to a permanent erosion of the tool manufacturers' profit margin. Smaller companies are particularly exposed to this stronger competition.

## Trade

**Export** In EC countries, die, jig and fixture, and mould exports totalled 690 million ECU in 1982 and 1,233 million ECU in 1988.

This is an average growth rate of 10% p.a., whereas extra-EC deliveries only increased by 8% p.a.

As can be seen from figure 2, Germany is the major exporting country.

It has gained approximately a further

1 point share since 1984. Export shares have shrunk for the UK (-5 points) and Belgium (-4 points), whilst Spain has shown a marked growth. Italy has stabilised its position. The data for Belgium and the Netherlands, however, must be considered in light of the above bias.

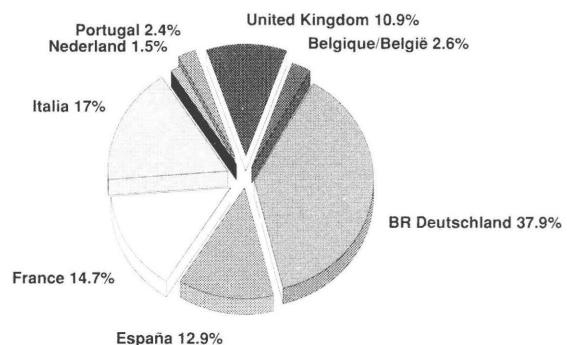
When exports are subdivided by product types, it can be noted that moulds have a share of almost 60%.

Germany's strong export orientation is significant.

The data for Portugal are for moulds only (except for the 1988 figures).

Approximately 60% of the EC's total

**Figure 1**  
Special tools  
EC production by country, 1988



Source: ISTA

**Table 4**  
Special tools  
Consumption by country, 1985-1988

(million ECU)	1985	1986	1987	1988	88/85(%)
Total	2907	3405	3786	3793 <sup>(1)</sup>	30
Belgique/België	162	236	261	127	-22
BR Deutschland	988	1160	1385	1320	34
España	294	337	417	546	86
France	456	493	526	648	42
Italia	456	470	502	581	27
Nederland	N/A	265	318	N/A	N/A
United Kingdom	463	444	377	535	16

<sup>(1)</sup> Including Portugal with 36 million ECU  
Source: ISTA

**Table 5**  
Special tools  
Salaries and wages, 1988

(ECU)	Quality mould or tool maker ( <sup>1</sup> )	T/M designer ( <sup>1</sup> )	Foreman ( <sup>2</sup> )
Belgique/België	8.68	11.37	1969
Danmark	13.59	N/A	N/A
BR Deutschland	4.89	2254( <sup>3</sup> )	2415
España	7.94	9.88	1643
France	7.25	8.06	29008( <sup>4</sup> )
Portugal ( <sup>3</sup> )	2.66	2.99	667
United Kingdom	8.78	11.99	2054

(<sup>1</sup>) Effective wages per hour  
(<sup>2</sup>) Salary per month  
(<sup>3</sup>) Calculated on basis of 168 working hours per month  
(<sup>4</sup>) Per year  
Source: ISTA

exports in 1988 represented intra-EC exports. Countries with particularly high levels of intra-EC deliveries were Belgium (85%), the Netherlands (75%), Spain (72%), and France (69%). The following countries reported lower intra-EC exports; Germany (54%), Italy (52%), and the UK (48%).

**Import** The EC countries total imports of dies, jigs and fixtures and moulds which represented 559 million ECU in 1982, reached 1,024 million ECU in 1988, indicating an average growth rate of 11% p.a.

A country-by-country breakdown shows that Germany has the highest import share (figure 2). In the case of Belgium and the Netherlands, cross-border

deliveries within multinational concerns can be involved, which may alter the picture.

According to the member states' 1988 foreign trade statistics, 74% of the EC Member States' total imports came from other EC countries. This means that the share due to intra-community trade was high. The countries with high intra-EC import levels were the Netherlands (91%), Belgium (86%), France (84%), Italy (75%), Spain (71%), and the UK (63%). Germany was below average at 58%.

### Employment and labour costs

Table 5 shows that nominal wages are very high in Germany and in Denmark.

At the opposite end of the scale is Portugal, where skilled workers' salaries are extremely low. Even when differences in productivity are taken into account, Germany remains one of the countries with the most expensive workforce in this sector.

Total labour costs include wages, social security, pensions, etc.

They are summarised in table 6 and underline the sector's sensitivity to such costs.

Compared with labour costs, the addition of social security contributions seem relatively low in the UK (28%), Denmark (25%), and Spain (33%), whilst the burden of social costs in Italy is well above average (110% of salaries).

The importance of labour costs - as a share of total turnover - has declined in the EC since 1982. As a percentage of net turnover, labour costs have reached 44% in 1988. This development was mainly induced by the increasing use of capacity in the cyclical upswing. In contrast to the general tendency, development in Germany was worse.

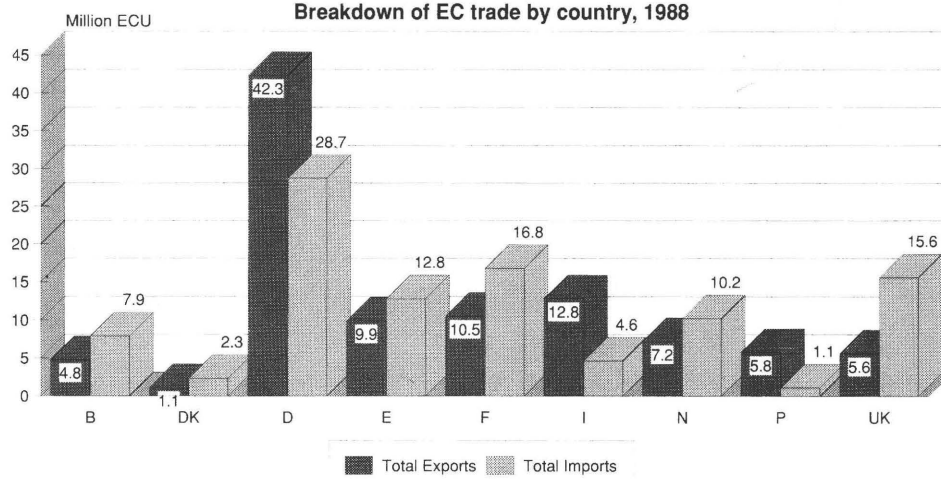
The share of labour costs increased in 1988, partly due to a specific economic development: The effective working hours were less than planned because of a lack in demand in the second half of 1988.

In contrast to this, overtime in the United Kingdom and Spain reached very high levels (table 7).

### Structure of the industry

According to a 1978 study by the International Special Tooling Association (ISTA), the average company size in this sector is 53 employees. In Germany, for example, 63% of the companies employ less than 100 people. In the meantime the structure has not changed a great deal, which is

**Figure 2**  
Specials tools  
Breakdown of EC trade by country, 1988



Source: ISTA



**Table 6**  
Special tools  
Personnel and social costs, 1982-1988

	Total personnel cost as a % of net-turnover				Social contribution as a % of paid remuneration			
	1982	1984	1986	1988	1982	1984	1986	1988
Total	54.7	51.4	45.8	43.8	64.5	61.7	61.2	64.4
Belgique/België	62	60	43	48	69.1	69.1	83	87.5
Danmark	65	N/A	N/A	N/A	25.6	27.7	28	25
BR Deutschland	49.9	50.1	43.7	52.2	77.9	79.6	83.1	83.6
España	43.9	46.8	40.1	42.2	45.5	40.3	32.6	32.6
France	62.9	57.3	50.6	43.8	83.7	88	88	82
Italia	47	42	43	36	110	110	110	110
Nederland	53	54	40	44.8	63.7	63.5	N/A	86
Portugal <sup>(1)</sup>	N/A	47.5	50	37	N/A	51.2	41.5	45
United Kingdom	54.1	53.2	55.6	46.7	40.2	25.8	23	28

<sup>(1)</sup> Moulds only  
Source: ISTA

why the number of production firms remains relatively high. Within the EC approximately 10,000 companies are involved in the manufacture of these products.

The introduction of modern technologies such as digitally controlled machines and CAD/CAM or CIM have helped the industry to maintain its competitiveness by short-

Böhler of Austria, Thyssen Edelstahl and Krupp of Germany, Ilva of Italy, Usimor Sacilor of France and Hitachi of Japan. The announced merger in 1991 of Uddeholm and Böhler should create the world's largest special tool manufacturer and could put pressure on medium-sized EC manufacturers as the group has a strong presence in the EC and a strong customer base in Eastern Europe.

### Outlook

As a result of higher than average labour costs in this industry, the EC countries which operate with a moderate wage level and longer working hours, such as Portugal and Spain, for example, have a bright future. Germany has to compensate for its high salaries with the high quality of its products and the productivity of its specialised workers. Like Germany, the UK, France and Italy must strengthen their technical competitiveness to continue to succeed in the market.

Competitive pressure by newly industrialised countries who have relatively low salary costs (e.g. Korea, Singapore, Taiwan, etc.) could become increasingly important as the EC countries' technological

lead over those potential suppliers diminishes. However this threat seems to be limited as close contact with the customer is an important competitive advantage in this market.

A negative impact may result from the replacement of mechanical by electronic parts - e.g. in office machines, machine tools, etc. - and from a shortage in the supply of a highly qualified workforce.

For 1990 EC production should grow by 3 to 5% in real terms. In spite of this the medium-term outlook is favourable.

The production of tools and moulds is expected to expand in the coming years, although probably at lower growth rates than in the past.

This prospect is based on the expectation of a reduced investment climate in most of the EC countries. The growth of the EC capital goods market will be much lower in 1991 and affect the demand for tools and moulds as capital goods suppliers are the most important clients for this industry.

**ISTA: International Special Tooling Association.**  
**Address: Lyoner Strasse 8, Postbox 71 08 64, D-6000 Frankfurt; Tel: (069) 66 03 251; fax: (069) 66 03 511 Updated by: IFO - Institut für Wirtschaftsforschung**

**Table 7**  
Special tools  
Total number of working hours, 1988

	Hours per year actually worked	Comparison against normal hours (%)
Belgique/België	1697	100
Danmark	N/A	N/A
BR Deutschland	1659	90
España	2012	111
France	1794	103
Portugal <sup>(*)</sup>	2140	107
United Kingdom	2200	123

Source: ISTA

tening delivery times, reducing costs and meeting clients sophisticated requirements. However, this places a heavy financial burden on the SME's that make up the bulk of this sector as it requires increased investment and more highly qualified personnel.

Only a few large companies exist worldwide such as Uddeholm of Sweden,

Production automation is a heterogeneous market which includes, besides physical goods, software and services. Companies working in this field throughout the 1980s experienced a strong growth in demand. New efficient production technologies stimulated development. In the forthcoming years market growth is expected to become more moderate, but expansion will continue. A threat must be expected from foreign competitors, especially Japanese companies which have a price advantage and a leading technical position. EC companies will have to use all their resources to compete successfully.

## Description of the sector

The sector's product range includes hardware (computerised numerical controls (CNC), control motors, modems, robots, sensors and instruments), software (Computer Aided Design (CAD), NC applications, production management programmes, interface software, integration software), systems (flexible cells, flexible systems (FMS), large systems such as FIM) and services (analysis of automation needs, design and run-in of systems, training, maintenance), etc.. The new technology of mechatronics has been developed to adapt electronics to machine based production systems.

Besides production, other company activities such as production planning, administration of stocks as well as research and development can be the subject of automation. Besides manufacturing and assembly of pieces and parts, process technology is also included here.

An overview of the market for production

automation is given in Table 1. It illustrates the heterogeneous structure, comprising of hardware, software and preliminary products for the different tasks, although the list of products is far from complete.

A shift in the demand affected by growing automation is in progress from stand-alone machines towards systems. Until now this has not been very significant; in EC countries with a sizeable machine industry an average of not more than 3-4% demand is accounted for by Flexible Manufacturing Systems (FMS), although increasing demand is expected. This will require an additional supply not only in transporting and handling equipment but still further in software to control complex processes and engineering to design a system to a customer's specific requirement. Therefore companies working in the field of production automation are no longer suppliers of hardware only; they are becoming increasingly suppliers of manifold services.

**Table 1**  
Production automation  
Frame of the market for production automation

Tasks	Hardware	Preliminary Products	Application Software
Research and Development	Computers, Workstations, PCs		CAD, CAE
Factory-, Process Guiding Systems	Master Computers, Workstations, PCs, LANs		PPS
Execution - Production - Handling - Transport - Stockpiling	Machinery, Robots, Industrial Trucks, Aisle Stackers	NC Controls, LPCs, Sensors, Instrum., Step Motors, Drives, Pneumatic, Fluid T.	NC Program

Source: IFO Institute

Most of the goods and services production automation offers are included in other industry reports in the EC Panorama. Machine tools for instance are presented in a specific chapter. For other markets, figures are not available as neither Eurostat nor other bodies have reliable statistics. Only for robotics, was information gathered from

the International Federation of Robotics and from national associations.

To gain a picture of the development in production automation market, robotics are used as an example in this chapter. An extensive definition of a robot is given by ISO TR 8373: "The industrial robot is an automatic position-controlled repro-

grammable, multi-functional manipulator having several degrees of freedom capable of handling materials, parts, tools, or specialised devices through variable programmed motions for the performance of a variety of tasks. It often has the appearance of one or several arms ending in a wrist. Its control unit uses a memorising device and sometimes it can use sensing and adaptation appliances that take account of environment and circumstances. These multi-purpose machines are generally designed to carry out repetitive functions and can be adapted to other functions without permanent alteration of the equipment."

Other definitions exist, and especially Japanese robot statistics are based on low level requirements. Even simple manipulators with only one or two axes of motion are included. This prevents proper comparison and is one explanation for the

**Table 2**  
Production automation  
Domestic demand for industrial robots 1982-88

(units)	1982	1983	1984	1985	1986	1987	1988	Aagr
Belgique/België	119	153	261	200	60	82	114	-0.7
Danmark	11	14	38	50	46	77	62	33.4
BR Deutschland	1 200	1 300	1 800	2 200	3 600	2 500	2 800	15.2
España	50	83	92	163	171	290	233	29.2
France	595	535	830	1 400	1 120	1 307	1 449	16.0
Italia	550	510	1 090	1 400	1 000	1 600	1 700	20.7
Nederland	30	20	93	137	280	117	98	21.8
United Kingdom	439	601	870	585	475	620	731	8.9
Total EC-8	2 994	3 216	5 074	6 135	6 752	6 593	7 187	15.7
Austria	15	25	35	55	80	55	141	45.3
Finland	37	37	71	67	89	88	121	21.8
Norway	N/A	50	50	73	73	35	93	13.2
Sweden	148	179	293	301	337	367	292	12.0
Switzerland	N/A	37	81	99	92	93	308	52.8
Japan	11 000	15 000	20 000	26 000	23 000	25 000	35 000	21.3
USA	1 000	1 000	5 000	7 000	5 000	4 000	3 600	23.8
Australia	69	150	128	172	100	125	275	25.9
New Zealand	N/A	N/A	14	17	11	23	15	N/A
Singapore	N/A	3	N/A	2	25	37	10	N/A
Taiwan	19	58	70	79	65	165	225	51.0
Czechoslovakia	N/A	N/A	N/A	N/A	N/A	N/A	5 961	N/A
Hungary	N/A	N/A	N/A	N/A	N/A	N/A	89	N/A
Poland	N/A	N/A	N/A	N/A	N/A	30	61	N/A
USSR	N/A	N/A	N/A	N/A	10 003	9 044	6 133	N/A
Total	15 505	19 755	30 816	74 068	46 007	45 655	59 511	25.1

Source: International Federation of Robotics

high number of installed robots in Japan.

### Current situation

Production automation has become a major objective in companies' investment decisions. After the recession of 1982/83 certain factors induced a booming demand for the total market. These factors

has not been uniform. Demand for new automation products has boomed, with average growth rates of 10 to 15% in real terms. Expansion for traditional manufacturing machines was much lower, even if they were equipped with controls necessary for automation. In some cases substitution pro-

concerned, their supply is cheaper and in some cases technologically more advanced. For instance Fanuc, the world's largest supplier of NC controls, is expanding its production capacities in Luxembourg. EC companies will therefore be forced to improve their competitiveness to succeed in the market.

**Table 3**  
Production automation  
Application of industrial robots in most important industries, 1988

(units)	United Kingdom	Italia	France	Total EC-3 Units	Shares
Automotive Industry	1 540	3 594	2 643	7 777	36.4
Electronics,					
Electrical Products	543	697	799	2 039	9.5
Mechanical Engineering	363	2 548	1 679	4 590	21.5
Rubber & Plastics Products	980	465	1 210	2 655	12.4
Other Industries	1 608	996	1 695	4 299	20.1
<b>Total EC-3</b>	<b>5 034</b>	<b>8 300</b>	<b>8 026</b>	<b>21 360</b>	<b>100.0</b>

Source: International Federation of Robotics, IFO Institute

are the replacement of old machinery and equipment (delayed due to the poor investment climate in preceding years), the supply of new efficient production technologies and the preparation for the single European market.

The cyclical upswing was first induced by investment activity during 1984 and 1985. In 1986 and 1987 a short stagnation period occurred. Thereafter there has been sustained growth until 1989, which was an exceptionally favourable year for the automation industry. The latest trend in the second half of 1990 is a slow-down in sales which reflects the stand-by reaction among end-users in face of the Gulf crisis. For 1991 and 1992, prospects are less favourable, with sluggish growth rates. A clear recovery is not expected before 1993.

The production automation market is heterogeneous and development in the sector

cesses could be found, with negative affects on the demand for these products, and high growth rates on the one hand caused low ones on the other. In the past decade EC companies had the advantage of expanding domestic markets. But Japanese competitors, in particular, have penetrated the EC and become increasingly important. As far as standard components for production automation are

### Production and consumption

**General development** The Ifo Institute carried out an analysis of production automation in Germany some years ago. It was focused on data processing, controls, sensors, drives, software and engineering excluding manufacturing machines and transporting equipment. German market volume in 1988 was some 12 billion ECU and roughly 30 billion ECU for the total EC.

This market segment has expanded more dynamically in the past than, for instance, the market for manufacturing machines, strongly influenced by the progress in microelectronics.

Average growth rate in real production reached 10% in Germany between 1982 and 1990. The market for Language Programmable Controls (LPCs) was most dynamic. It grew by more than 20% p.a.

This strong development was partly in-

**Table 4**  
Production automation  
Most important application areas for robotics, 1988

(units)	United Kingdom	Italia (*)	France	BR Deutschland	Total EC-4 (Units)	(%)
Spot Welding	591	2 268	1 414	3 717	7 990	20.5
Arc Welding	679	N/A	1 015	3 255	4 949	12.7
Other Machining Operations	1 743	716	718	1 940	5 117	13.1
Assembly	493	1 076	799	3 370	5 738	14.7
Machine Loading	915	2 455	2 714	4 887	10 971	28.1
Miscellaneous	613	1 785	1 366	531	4 295	11.0
<b>Total EC-4</b>	<b>5 034</b>	<b>8 300</b>	<b>8 026</b>	<b>17 700</b>	<b>39 060</b>	<b>100.0</b>

(\*) Spot and arc welding are merged into one group  
Source: International Federation of Robotics, IFO Institute

duced by the substitution of old fashioned fixed programmed controls.

In other EC member countries development of production automation markets should have been similar, although influenced by country-specific economic situations and the investment climate.

### Developments in the robot market

The demand for robots in the EC was booming during the 1980s with an average rate of 15.7% p.a. in units delivered between 1982 and 1988; only in 1986 and 1987 did demand develop poorly (Table 2). In 1988, and according to information available in 1989, the market recovered and expanded strongly at 9% and 15% respectively. For some countries information is available on client industries. The statistics for Italy, France and the UK show that most demand is from the capital goods industry, with the automotive industry in the lead at 36% on average for these three countries (Table 3). In Table 4, the distribution of robots in different application areas is given. On average for the large EC countries, 45% of robots are used in manufacturing processes in particular in welding.

Other important processing applications are painting and casting. Robots have also strongly penetrated in assembly, a sector which was not as highly automated at the beginning of the 1980s as other manufacturing units. Handling operations, moving tools and parts are necessary for the design of automated systems.

These applications include not only the loading and unloading of machines, but are also used to combine stand alone machines with flexible manufacturing cells.

### Structure of EC industry

As a result of the heterogeneous markets of production automation, the structure of industry is not uniform. There are large manufac-

**Table 5**  
Production automation  
Structure of the industry, 1988

	Italia	BR Deutschland
Total turnover (million ECU)	1 353	1 536
Production (million ECU)	176	300
Production (units)	1 994	3 155
Companies	50	125
Employees	12 775	21 500
Production/employees (thsd ECU)	14	14
Employees/company	256	172
Imports (units)	225	740
Exports (units)	519	1 095

Source: Europäischer Roboter Markt, IFO Institute

turers of components such as Siemens, supplying controls or large automobile manufacturers such as Renault which produces industrial robots. Other companies from the data processing industry are also working in this field, i.e. Digital Equipment, having specialised in information technology for production automation. Still others such as IBM have diversified their business from office automation to technical applications. Most of these companies are also working in the market for systems engineering to provide automated production units. But these large companies have some difficulties in the customisation of their supply and often collaborate with small and medium-sized companies, who have specialised in market niches with high engineering requirements. These companies concentrate on the design of a dedicated process as well as on the development of software applicable for a specified automated production process. In the field of other components such as drives, pneumatic equipment, motors, etc. the environment is similar. Large companies such as Bosch, Rexroth and Festo are supplying mainly standard products whereas at most small and medium-sized companies are providing their engineering knowledge for the design of a customised

automated production system.

As far as machinery is concerned, such as machine tools, textile machinery, industrial trucks, etc., the structure of the industry is different. These companies deliver capital goods for investment and are often working in the field of system engineering. They have the knowledge to supply automated customised systems. In general these companies are medium-sized. Large suppliers like Linde are the exception. The structure of industry in the robot market is marked by some large suppliers and a large number of small companies. The large ones are sometimes affiliated with the automotive industry such as Comau from Italy in respect to Fiat. In Italy for instance, the three largest suppliers provide as much as 56% of the national robot production. On average, the Italian robot makers such as Tecnomecc are the largest in the EC, reflecting their higher level of concentration (Table 5).

The structure of the EC robot industry has changed in recent years. Most important was the merger of BBC and ASEA, one of the world's leading suppliers of robots, with Swiss Brown Boveri into the new ABB. Investment from outside the EC is being undertaken in order to have a strong hold in the single European market,

**Table 6**  
Production automation  
Penetration of Computer Aided Design (CAD) in industry, 1986

	Employees (1000)	CAD (units)	CAD per million employees
BR Deutschland	10 688	26 000	2 432.6
France	6 243	16 000	2 491.0
Italia (*)	6 788	15 000	2 209.8
United Kingdom	7 607	23 000	3 023.5
EC4	31 506	80 000	2 539.2
USA	30 965	210 000	6 781.9
Japan	20 520	104 000	506.8

(\*) 1985 data  
Source: OECD, Labour Force Statistics, IIASA

for instance AFMA from the US in France as well as GMF, a US-Japanese joint venture. Sony is currently launching a robot production site near Stuttgart.

### Penetration of new automation technologies

R&D in manufacturing industries has been strongly altered by the development of computer sciences. Since the middle of the 1970s, hardware and software has been created for the specific application in companies' R&D departments. In the beginning, diffusion rates were low, and in the early 1980s a strong increase took place,

when equipment and programmes became more powerful.

Today many software packages are available to aid engineers in design, calculations (ie: FEM) etc. This has helped to increase the efficiency of the highly qualified personnel. But more important than cost reduction is the improvement of products being developed. Many high performance goods could not have been supplied without the help of Computer Aided Design (CAD). CAD has become an important factor in the international competition between indus-

trialised countries. Until now there existed large differences in the penetration of this technology, mostly due to the initial diffusion. In 1986 the highest penetration was achieved in the USA, whereas in Japan diffusion is less than 1/10 of the US figure. It is surprising that only about 500 CAD sets per 1 million employees are installed in the Japanese manufacturing industry.

Furthermore, time series show that Japan will not reach the high penetration of other industrialised countries, as the diffusion rates are too low. Within the EC, a comparable penetration of CAD is indicated by the figures. The UK is ahead, applying this engineering technology (Table 6).

In opposition to the penetration of CAD, analysis of the penetration of new production technologies shows that Japan is in the lead. The share of NC machines, machining centres and EDM machines in the domestic demand for machine tools is much higher than in any other country of the world. A study made by W.S. Atkins and the Ifo Institute also shows that pro-

**Table 7**  
Production automation  
Penetration of industrial robots, 1987-88

	1987		1988	
	Employees (1000)	Robots per million employees	Employees (1000)	Robots per million employees
Belgique/België	1 040	1 074.0	N/A	N/A
Danmark	736	389.9	N/A	N/A
BR Deutschland	10 317	1 444.2	10 340	1 711.8
España	3 681	312.1	3 830	360.8
France	6 461	1 018.0	6 420	1 250.2
Italia	6 716	982.7	6 790	1 222.4
Nederland	1 424	524.6	N/A	N/A
United Kingdom	7 449	577.7	7 610	661.5
EC 8	37 824	943.3	34 990	1 225.1
Austria	1 147	265.9	1 250	356.8
Finland	753	563.1	741	735.5
Norway	565	762.8	549	954.5
Sweden	1 291	2 130.1	1 300	2 340.0
Switzerland	1 225	387.8	1 220	641.8
Japan	19 970	7 060.6	20 052	8 777.2
USA	30 475	951.6	30 965	1 052.8

Source: OECD



**Table 8**  
**Production automation**  
**Penetration of flexible manufacturing systems**  
**(FMS) in industry, 1986**

	<b>Employees (1 000)</b>	<b>FMS (units)</b>	<b>FMS per million employees</b>
Belgique/Belgié/Luxembourg	1 077	6	5.6
BR Deutschland	10 688	85	8.0
España	3 829	2	0.5
France	6 423	72	11.2
Italia	6 788	40	5.9
Nederland	1 566	8	5.1
United Kingdom	7 607	97	12.6
<b>EC 8</b>	<b>37 978</b>	<b>310</b>	<b>8.2</b>
<b>USA</b>	<b>30 965</b>	<b>139</b>	<b>4.5</b>
<b>Japan</b>	<b>20 520</b>	<b>213</b>	<b>10.4</b>

Source: OECD, Labour Force Statistics, IIASA

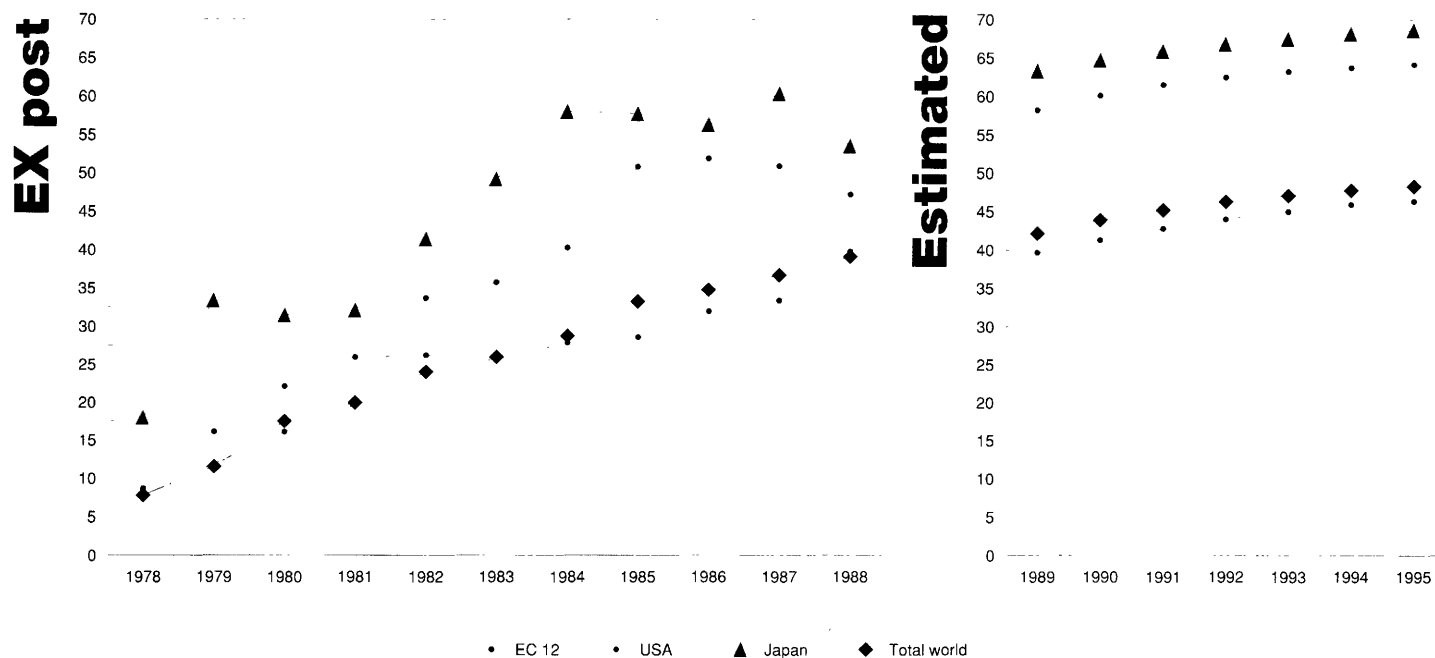
duction automation is not only a supply push but in some cases a demand pull. The interest of user industries in new technologies stimulates progress in production automation and the supply of advanced machinery and equipment. The application of robots shows a similar picture. Notwithstanding the low level of the Japanese definition of robots, penetration of robots is much higher there than in any other country. In 1988 nearly 8 800 units were installed per one million industrial workers. Second is Sweden with 2 340 robots (Table 7). Within the EC large differences in the penetration of robots exist. In the lead is Germany with 1 700 robots whereas Spain has less than 1/4 of the specific robot population. The level of penetration in the UK is surprisingly low. Flexible manufacturing systems (FMS) can be defined as manufacturing units which are automatically adapted to the production of a part. The change from one type of part to another is done without manual interference. In this view a machining centre equipped with a tool and part handling system which meets this requirement. But usually a FMS includes more than one machine, a transporting system and a mas-

ter computer. In general, a FMS is a small part of a production line for the manufacturing of a complete product, but it includes all functions necessary for a fully automated process. Therefore a FMS can be regarded as the nucleus for computer-integrated manufacturing (CIM). But until now the level of penetration is low and the information concerning the pace of diffusion is conflicting. Table 8 shows the differences in the penetration of FMS's between the EC, the USA and Japan, Japan being ahead whereas the US is far behind. Penetration of FMS in the EC is on a high level and in France and the UK, penetration is higher than in Japan. However, these figures can only be taken as a rough guideline as not only different national definitions are hidden behind these figures, but also a different structure of types of FMSs. NC technology is the broadest application of advanced manufacturing techniques. Analysis of diffusion is done by the figures for the domestic demand because data base is more reliable than the figures for the diffusion on NC technology in the parc. The penetration of NC machines began at the end of the 1970s and now represents

more than 40% of production value. NC controls give advantages, particularly for cutting processes. In forming, the opportunities are fewer but growing, particularly in turret presses and laser cutting. Therefore, significant differences in the share of NC controls exist between the two basic types of machine tool. In cutting machines it has reached 53% worldwide, and in forming machines it is about 10%, although there exists statistical problems in deriving a precise figure.

Japan is the most advanced market for NC machines, where penetration in cutting machines since the mid 1980s has fluctuated between 60 and 70%. This can be treated as an indication of the stabilisation of the mix, giving an estimate of about 75% of sales as the worldwide saturation point for cutting machines. It may be even lower, as the characteristics of production in other countries are different and less directed towards automation. If this proves to be the case, then the growth in EC demand for NC as opposed to conventional machine tools will decline. In the forming machines segment, the data is weak. Therefore a detailed analysis is not possible. As far as time series information is available, the use of NC technology is not as dynamic as in cutting. Production figures show that in the past 5 years, its share has not significantly increased. The penetration may stabilise between 20 and 30%. Figure 1 presents the level and forecasts of penetration by NC technology in terms of sales in the EC, US, Japanese domestic markets, and the world. NC total machine tool demand in the EC is expected to stabilise at 65%. NC technology accounts for less than 10% of the number of

**Figure 1**  
**Production automation**  
**Machine manufacturing, robotics and instruments.**  
**Penetration of EC technology**



Source: VDW Data base, IFO Institute

machines in use (the machine parc). This will change even though its share of demand may stabilise, as NC machines continue to replace conventional machines in the parc. It will be a gradual change as machine tools (particularly conventional ones) have long lives. There is a strong second-hand machine tool market in the EC and so replacement does not necessarily imply that the used machine leaves the parc. In dynamic end-user industries, there is already a demand to replace earlier generations of NC machines.

### R&D

Many technology fields are important for production automation. Some of them are analysed in other chapters of the EC Panorama, for instance in the report on machine tools.

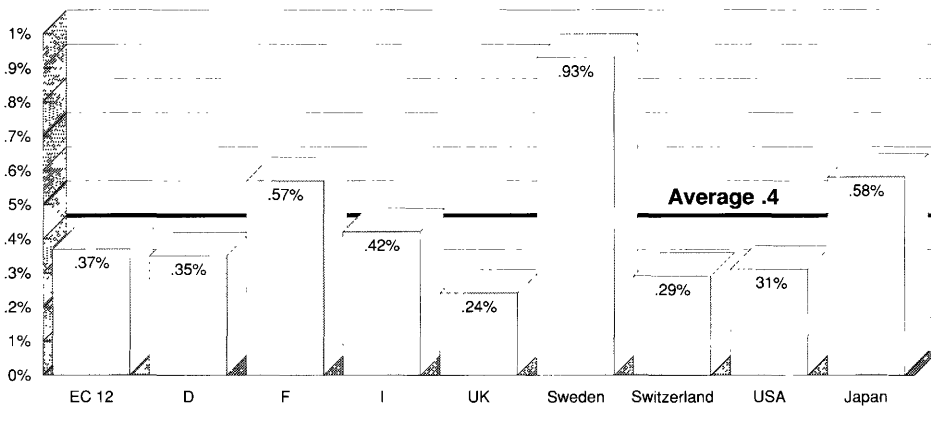
Much of the knowledge of production automation is engineering know-how, not generally understood as high technology, but rather the knowledge necessary to design

a specified production system. International competition in these technology fields is in many cases not very significant. Therefore this chapter concentrates on more general developments. Because of the heterogeneous structure of the production automation market the analysis is anything but a complete description of the state and pace of research and development. Only technologies relating to robotics and controls are regarded. Competition between industrialised countries is intensified by innovations. Inventions are an important indicator for technical progress. Therefore important inventions, i.e. inventions with a patent application in more than one country, are used to compare the technological competitiveness between different nations: 35% of all important inventions in robot technology are from the EC. This is only a little more than the patent applications by Japanese companies, 32%. The US companies are

third with 20%. A further important indicator for technological activity lies in the concentration on technology fields related to mechanical engineering. This focuses on the question of what share of total national R&D capacities is concentrated on robotic technologies. An indicator is given by the share of total inventions on all inventions made in these fields.

This indicator shows Sweden and Japan to be in the lead. In the case of Sweden this result is at most due to ASEA; nearly 1% of all Swedish inventions are made in the field of robotics. In Japan, a much larger economy, there are a lot of large companies working in this field, such as Matsushita, Fanuc, Fuji Machine, Yaskawa Electric etc. These four companies had a turnover of nearly 1 billion ECU in 1989. In Japan the R&D capacities are more concentrated on robotics than the world average. Similarly high activity is shown in France (Figure 2).

**Figure 2**  
**Production automation**  
**R&D activity in robotics (1)**



(1) Calculation based on patent applications in more than one country  
 Source: Inpadoc, IFO Institute

In control technology, the most important inventions have been made by EC companies, 36%. The Japanese are second with 29% before the US with 25%. Within the EC, Germany is in the lead with 19% of all inventions. But Germany is once more not concentrating its R&D efforts in this technology as much as in other fields. Japan and even France show a higher activity. These countries are working more intensively for the progress of controls (Figure 3).

This analysis shows that Japan as a single country is by far the leader in two technologies affecting the progress in production automation. The number of import-

ant inventions is higher in the EC, but R&D efforts are dispersed in many different nations. Therefore the picture given by the activity indicators is important; R&D input is not sufficient to compete with the Japanese challengers.

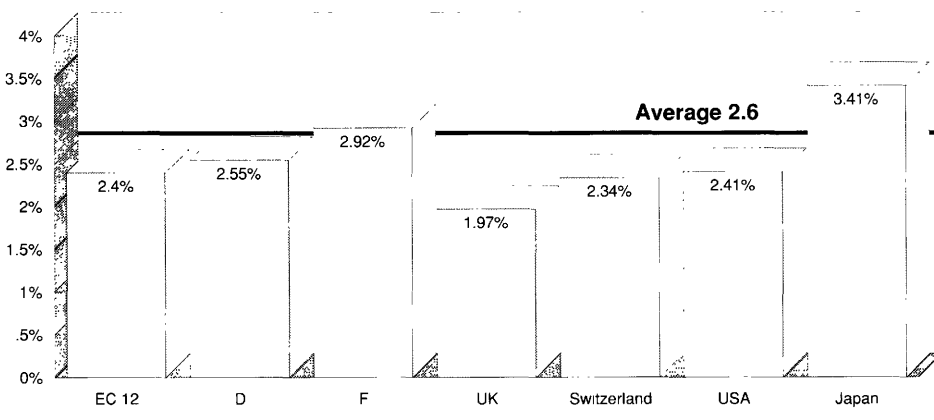
**Outlook**

EC companies working in the field of production automation had the advantage of a good investment climate over the past few years. In the forthcoming years market expansion will become more moderate which will create stronger competition. The decline of the yen and the dollar is an advantage for foreign competitors. Imports from Japan in particular could become a

threat for EC players in the automation market. The worsening of the investment climate in the USA will additionally increase the import pressure.

Some EC components for production automation have been too expensive to compete with Japanese products, i.e. controls, laser sources, etc. A leading position in technological progress is therefore essential, but a patent analysis showed only a low activity level. This situation will presumably induce losses in some market sectors. Only in sectors with a highly specified supply of machines and systems will competition not intensify as much. Insofar as production automation is dependent on engineering know-how, the market is fragmented and foreign competitors can hardly penetrate.

**Figure 3**  
**Production automation**  
**R&D Activity in control technologies (1)**



(1) Calculation based on patent applications in more than one country  
 Source: Inpadoc, IFO Institute

Written by: IFO - Institut für Wirtschaftsforschung.  
 The Robotics Industry is represented by the International Federation of Robotics, IFR, S-1148 Stockholm, Sweden, Box 5506; tel: 08/783-8000; fax: 08/6603378



The EC textile and clothing machinery industry is one of the most heavily export-oriented sectors in the Community. Export earnings have grown steadily over the 1980s although the value of output has declined, in real terms, during the first half of this period. Demand patterns, especially from developing countries, tend to be relatively volatile, being substantially influenced by exchange rate movements. In the EC countries, as well as in other industrialised textile producing countries, the emphasis is increasingly on the degree of automation and technological innovation, and this trend is likely to continue. In nominal terms, the value of Community exports has grown at an average annual rate of 9% per annum over the 1980-89 period. Net export earnings of the Community's industry were close to 3.5 billion ECU in 1989. Recent years have seen an increasing demand from the EC countries. Although world imports have been decreasing, extra-EC imports have been growing at a rapid rate (annual average of 10% from 1985 to 1989). A major factor for this trend is the strong position of the Swiss manufacturers who account for a large proportion of total textile machinery imports into the Community.

# Textile and clothing machinery

**Table 1**  
Textile and clothing machinery  
Main Indicators, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988 <sup>(1)</sup>	1989 <sup>(1)</sup>
Apparent consumption <sup>(2)</sup>	2402	2020	2215	2234	2852	3258	4293	4663	5819	5841
Net exports <sup>(2)</sup>	1789	1888	1795	1740	2188	2683	2794	2908	2911	3530
Production <sup>(2)</sup>	4191	3908	4010	3974	5040	5941	7087	7571	8730	9371
Employment (thousands)	131	118	108	99	98	101	102	104	109	110

<sup>(1)</sup> Estimated  
<sup>(2)</sup> 1980: ECG; 1981-85: EC10  
Source: Eurostat (Inde, Comext)

## Description of the sector

The major categories of textile machinery are used in the following processes: spinning, weaving, knitting, dyeing, printing and finishing.

No satisfactory unit of measurement can be meaningfully applied to the analysis of textile machinery, ancillary equipment and accessories. Even within a given class of machines (e.g. weaving machines or looms), the variety of specifications, the diversity of degree of automation and the range of production capacities are extensive. Moreover, the use of weight as a physical measure is both inaccurate and

seriously misleading, since the higher technology, electronically controlled machines are in many instances more compact and lighter. Therefore, it was decided to combine data for different European countries by comparing the actual monetary value in ECU of machinery and equipment produced and/or delivered.

## Current situation

The EC is a major producer of textile machinery and accounts for around 55% of the total exports of this product. Substantial restructuring occurred in the 1980s as the industry tried to remain competitive on both domestic and export markets.

In absolute terms, Japanese exports to the USA and to the EC have been relatively modest during this period, and have mainly depended on sales of weaving machines and ancillaries. With the exclusion of some smaller sectors, Japanese textile machinery sales represent a marginal, although fast growing competition for EC manufacturers in European and world markets, the main thrust of Japanese competition remaining in Asian markets. Japan's exports to neighbouring countries in the Far East accounted for nearly 50% of its total exports. Japanese exports to North America increased relatively rapidly

**Table 2**  
Textile and clothing machinery  
Production, value added and investment, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Production in current prices</b>										
EC <sup>(1)</sup>	4 472	4 198	4 308	4 225	5 287	6 241	7 087	7 571	8 730	9 371
Index	72	67	69	68	85	100	113	121	140	150
USA <sup>(2)</sup>	1 130	1 393	1 387	1 374	1 596	1 569	1 323	1 220	1 301	1 524
Index	72	89	88	88	102	100	84	78	83	97
Japan <sup>(2)</sup>	1 593	2 007	1 889	2 265	2 868	3 281	3 330	4 003	5 082	5 198
Index	49	61	58	69	87	100	101	122	155	158
<b>EC</b>										
<b>Production in constant prices</b>										
Index	6 314	5 542	5 151	4 745	5 555	6 241	6 566	6 682	7 522	7 771
	101	89	83	76	89	100	105	107	121	125
<b>Value added in constant prices</b>										
Index	2 946	2 512	2 384	2 256	2 474	2 748	2 813	2 834	3 238	3 339
	107	91	87	82	90	100	102	103	118	122
<b>Productivity</b>										
Index	22.5	21.3	22.1	22.8	25.2	27.2	27.6	27.3	29.7	30.4
	83	78	81	84	93	100	101	100	109	112
<b>Investment in current prices</b>										
Index	156	144	140	137	179	263	350	414	N/A	N/A
	59	55	53	52	68	100	133	157	N/A	N/A

<sup>(1)</sup> 1988 and 1989 estimated  
<sup>(2)</sup> Census of Manufactures and Eurostat estimates  
Source: Eurostat (Inde)

over the early part of the 1980s but have since shown a declining trend. However, exports to Europe have recently displayed steady growth. Japanese deliveries to Europe account for about one seventh of total exports.

Competition from developing countries has been confined to the production of more basic, low-technology machinery, which is often manufactured under licence from EC manufacturers; this mainly represents an import substitution policy. Exports of textile machinery from Third World countries are usually too small to figure in detailed international statistics. Nevertheless, a trend in the past few years has been the emergence of a growing number of indigenous textile machinery makers in the Far East and South East Asian countries. However, as yet, their production has been confined to domestic markets or geographically close markets.

The Swiss textile machinery industry is a key player in the world market. This highly efficient and technologically advanced producer is able to capture a large share of market demand even in countries with strong indigenous textile machine-making capacities.

## Consumption and production

About 50% of world-wide capacities for the manufacturing of textiles are in Asia, 15% in the CMEA countries. North America's share accounts for about 10% and is commensurate with the EC.

The EC is by far the world's largest producer of textile machinery, and therefore foreign markets are more important than the domestic market. Their weight will further increase because the textile industry in newly industrialising countries is expan-

**Table 3**  
Textile and clothing machinery  
World market for spinning machinery, 1989

(1000 units)	Spindles		
	Short staple	Long staple	Open-end rotors
Africa	177	32	17
North America	268	20	91
South America	299	10	17
Asia & Oceania	2 248	180	147
EC	469	150	45
EFTA	56	12	6
CMEA	134	81	395
Other European countries	150	4	7
<b>Total</b>	<b>3 801</b>	<b>489</b>	<b>725</b>

Source: ITMF

during much stronger than in the industrialised world. There are significant differences in the structure of demand by region. Asiatic countries are strongly investing in spinning machines with short staple spindles. In 1989, 60% of all shipments of this product group were destined for Asia. However, CMEA countries showed quite a different focus of investment activity. Above all they procured open-end spinning machines in the 1980s; a total in 1989 of about 55% of world production. Whereas EC demand for long staple spinning machines used for high quality yarns, was important. In 1989, the EC textile industry procured 30% of the world supply of this product group

(Table 3).

There exist significant differences in the structure of the demand for weaving machines. Nearly all shuttle looms are produced by Asiatic countries, whereas textile companies from industrialised countries are important clients for advanced shuttleless looms, especially rapier/projectile and air-jet spinning machines (Table 4). Within the EC, Italy is by far the most important market for textile machinery. More than 30% of all spinning and weaving machines of total EC demand is from Italy. Italian textile companies are focusing their investment activities on long-staple spindles and even invest 60% in these kinds of machines. Investment in open-end rotors is far

**Table 4**  
Textile and clothing machinery  
World market for weaving machinery, 1989

(1000 units)	Shuttle-less looms				Shuttle looms
	Rapier/ Projectile	Air-jet	Water-jet	Total	
Africa	754	384	6	1 144	58
North America	1 804	2 390	215	4 409	5
South America	1 455	358	16	1 829	419
Asia & Oceania	13 251	7 967	6 316	27 534	13 031
EC	8 253	3 153	703	12 109	16
EFTA	397	72		469	
CMEA	1 776	2 110	51	3 937	40
Other European countries	1 023	189		1 212	
<b>Total</b>	<b>28 713</b>	<b>166 623</b>	<b>7 307</b>	<b>52 643</b>	<b>13 569</b>

Source: ITMF



**Table 5**  
Textile and clothing machinery  
EC demand for spinning machinery, 1989

(% share)	Spindles			Average (°)
	Short staple	Long staple	Open-end rotors	
Belgique/België	1.1	4.5	9.1	3.7
Danmark	0.4	0.2	4.4	1.3
BR Deutschland	17.9	3.5	0.5	11.0
Hellas	12.2	1.5	23.4	13.0
España	10.5	5.9	3.8	8.0
France	5.3	5.6	17.1	8.3
Ireland	0.0	1.3	15.1	4.0
Italia	33.1	63.8	2.9	31.3
Nederland	0.0	0.2	11.8	2.9
Portugal	19.4	10.7	12.0	16.0
United Kingdom	0.0	2.8	0.0	0.5
Total	100.0	100.0	100.0	100.0

(°) 1 open-end rotor outbalances 4.5 spindles  
Source: ITMF, IFO Institute

more widespread in the EC. The Italian, German, French and Spanish textile industries were important customers for rotor spinning machines with shares of between 15 and 25% for each country in the 1980s. In 1989, the structure was different compared with the average of the decade: The smaller countries such as Ireland, Greece and Portugal were among the major clients (Table 5). EC demand for weaving is focused on shuttle-less looms. In 1989, the total share

of shuttle-less looms was 98.5% (counted in units). Only German textile companies procured some shuttle looms. For shuttle-less looms, Italy is by far the most important market (Table 6). Demand within the EC accounts for around 45% of total Community production. This percentage has fallen sharply over the early part of the 1980s indicating stagnant demand within the Community. A substantial volume of production has been re-directed to export markets. However,

**Table 6**  
Textile and clothing machinery  
EC demand for weaving machines, 1989

(% share)	Shuttle-less looms				Shuttle looms
	Rapier/Projectile	Air-jet	Water-jet	Total	
Belgique/België	8.2	9.5	58.0	14.9	0.0
Danmark	0.0	0.0	0.0	0.0	0.0
BR Deutschland	15.3	18.8	0.0	14.2	100.0
Hellas	0.9	0.2	0.0	0.6	0.0
España	13.9	5.1	0.0	10.0	0.0
France	8.4	25.3	20.2	14.0	0.0
Ireland	0.0	0.0	0.0	0.0	0.0
Italia	41.5	32.0	13.2	35.6	0.0
Nederland	0.6	0.0	0.0	0.4	0.0
Portugal	6.8	1.9	1.4	4.9	0.0
United Kingdom	4.3	7.4	7.2	5.4	0.0
Total	100.0	100.0	100.0	100.0	100.0

Source: ITMF, IFO Institute

despite the growing importance of exports, the value of production in real terms fell until 1984, when the recovery in production began once again.

The Federal Republic of Germany is by far the largest producer, with a share of 50% of total EC production. Since 1984, output in real terms increased in almost all the member countries (except Portugal). The highest growth rate was realised in Italy and France.

Export markets include the industrialised countries - the US is an important market - the NICs, and the developing countries.

However, the proportion of extra-Community exports destined for developing countries had fallen during the eighties. In particular, the importance of the Latin-American market has experienced a fall attributable almost entirely to severe liquidity problems and a consequent inability to generate capital investment funds to match the re-equipment needs of the textile industries in the region. Conversely, the picture in the Far East and South East Asia is very different: these regions have been a major buyer of EC textile machinery in more recent years, and the emergence of the People's Republic of China in this respect has been a key factor in explaining this trend.

### Structural changes

There are more than 1 100 companies in the EC engaged in the manufacture of textile machinery, many of which are either small or medium-sized. Of these companies 300 and 350 are located in the Federal Republic of Germany and Italy respectively.

Three main factors determine the overall structural features of the EC textile machinery industry. Firstly, the very high propor-

tion of exports sales of European companies outside the EC market, which indicates the global nature of the industry. This is exemplified by the fact that most major European textile machinery manufacturers have fully or majority-owned subsidiaries in the important United States market, from where they can also serve the Canadian and Latin American regions. Some have similar arrangements (or joint-ventures with 'local' companies) in other key regions such as the Far East. Secondly, as already stated, the high degree of specialisation which refers not merely to broad product categories such as spinning, fabric forming, etc., but also to specialisation within these categories, resulting from pressures on order volumes and profit margins and increased local competition in some developing countries. For example, some major manufacturers have adopted the strategy significantly reducing the number of variations of machine type within a particular product category or group - which meanwhile has enabled them to optimise the production of machine parts and to match production and orders.

Thirdly, the restructuring process involving close-downs, acquisitions, mergers and other forms of cooperation not only within Member States but also at the international level. One reason being the aim of specialised textile machinery companies to become completer suppliers in order to cope with a growing demand of customers for fully equipped, highly automated production plants. For example, French SACM and ARCT have merged their textile machinery activities in spinning machines and yarn processing machinery to form a new company SAMT. Rieter, a Swiss textile machine group has acquired 51% of Schubert & Salzer from Germany, a specialist in rotor spinning machines in 1989. Saurer, another Swiss firm, took over Volkman. Sclafhorst, a German supplier of spinning machines acquired Zinser.

### Employment

In 1989 approximately 110 000 people were employed in the manufacture of textile and clothing machinery in the EC-12. This compares with an employment level of 131 000 people in 1980. Even in the face of a tendency to 'consolidation' involving mergers and closures, the EC indus-

try has maintained a relatively constant position as a major provider of employment.

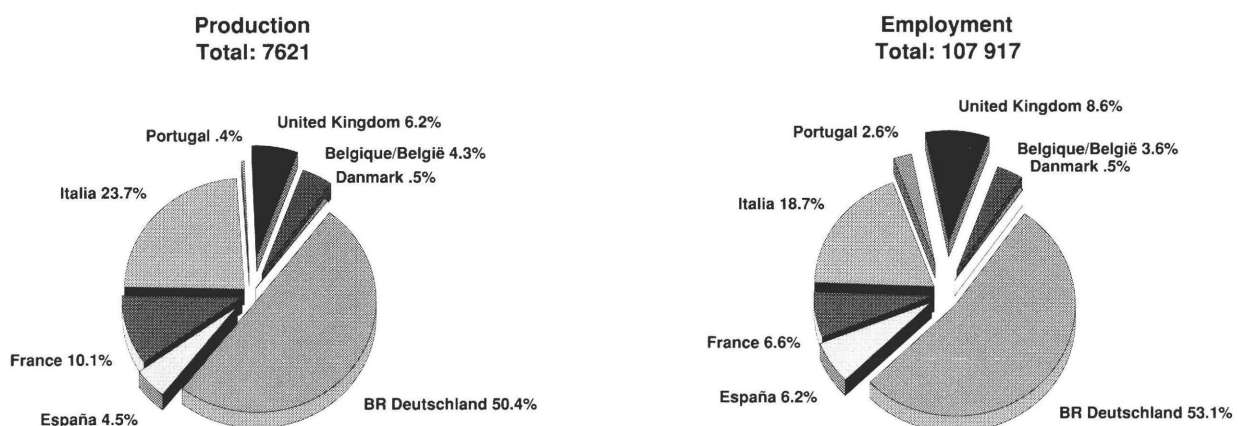
### Investment

It is a problem common to all European textile machinery manufacturers that price competition, made even more pronounced by a sometimes violent currency exchange rate fluctuations and pressure from many customers for 'soft' credit terms, has made depressed profit margins a permanent fact of life. Furthermore, fixed costs, whose relative importance can only be reduced by increasing sales, have exacerbated the situation. However, the traditionally high level of investment in research and development activities (often of the order of 5 to 10% of turnover) has been sustained to maximise the return from technical and product innovation. An additional non-negligible cost factor related to technical marketing activity has been the proliferation in recent years of 'international' textile machinery exhibitions, triggered by the growing influence of markets in recently developed and still developing markets for textile machinery.

### Geographic features

In the German textile machinery industry,

**Figure 1**  
Textile and clothing machinery  
Production and employment by country, 1989



(1) Estimated  
Source: Eurostat (Inde)

**Table 7**  
**Textile and clothing machinery**  
**EC trade in current value, 1980-89**

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Exports extra-EC (1)	2 401	2 546	2 482	2 450	3 083	3 736	3 999	4 198	4 454	5 121
Index (2)	63	68	66	66	83	100	110	115	122	140
Imports extra-EC (1)	616	663	694	749	891	1 063	1 217	1 341	1 533	1 548
Index (2)	58	62	65	70	84	100	110	121	139	140
X/M	3.89	3.84	3.58	3.27	3.46	3.51	3.28	3.14	3.04	3.31
Trade intra-EC (1)	940	873	950	1 048	1 215	1 352	1 958	2 260	2 445	2 491
Index (2)	69	65	70	78	90	100	139	161	174	177

(1) 1980 EC9, 1981-85 EC10  
(2) Taking into account changes in EC membership  
Source: Eurostat (Comext)

spinning and finishing machinery accounts for the largest portion of German exports. Incoming export orders have recently decreased, especially due to a recession in the American textile industry and the weakness of the Yen.

In 1989 the US market accounted for 20% of Germany's total extra-Community exports. Other main markets include the Republic of China (9.6%), Japan (4.5%), Taiwan (4.1%) and the USSR (4.0%). Intra-Community trade absorbed 28% of Germany's total exports. Recent growth of exports to the African market has been much better, rising by 22% in 1989, although from a comparatively low base. The Latin American market has declined.

Italy's textile machinery sector is extremely diverse, and highly labour-intensive, with some 350 firms employing over 20 000 people. Compared with its counterparts in other Member States, the Italian industry has relatively few large companies - a factor that tends to work to the industry's advantage, since in this way maximum specialisation and the essential close personal contact with customers can be accommodated.

Unlike most other textile-machinery-producing countries, Italy's total output and ex-

port profile is spread far more evenly across all the main subsectors. The main priorities of the industry are the increased use of advanced textile technology aided by the latest micro-electronics and robotics technology so that greater productivity and efficiency, reduced costs and shorter, more economical manufacturing cycle-times can be attained. Equally important is the Italian emphasis on after-sales service. Exports account for 77% of all French textile-machinery output and as much as two-thirds of this total is delivered to industrialised nations. Most exports are destined for countries that are economically and financially stable and able to maintain regular trade relations. Around 80 companies are involved in the French industry and they employ more than 7 000 people. This sector is characterised by a preponderance of medium-sized firms, and total production is shared between nine activity areas, led by the primary weaving and spinning machinery manufacturers.

With 'very high' current levels of activity and order books described as 'excellent', the British textile machinery sector is enjoying a booming demand from its home market and strong performance in world markets. The industry can claim world

leadership in several areas of technology, notably tufting, yarn spinning and processing and the manufacture of non-wovens. For the first time, the Republic of China topped the list of export markets for British machinery. The sector employs 9 000 people in around 180 firms. There is a relatively large number of small companies producing textile machinery in Spain. They cover the production of machinery equipment and accessories for the entire textile manufacturing and processing chain including spinning, weaving, knitting, dyeing, printing, finishing and making-up and laboratory and control devices and apparatus. In 1984-89, export sales increased substantially. Intra-Community trade accounts for around 18% of total sales and 33% of total exports. Of the different subsectors, knitting and finishing machines are the most prominent, followed by spinning and, trailing somewhat behind, weaving and making-up machinery. The industry is engaged in marketing efforts to increase its share of the US market. The Belgian textile machinery manufacturing sector is modest in size by world standards, but in the past five years has experienced remarkable growth in terms of both total deliveries and value of export

sales. Belgium has 24 textile machinery manufacturing plants and 12 accessories manufacturers, employing some 4 000 people. Many of these plants are vertically integrated, producing all components; Belgian textile machinery builders boast two of Europe's most modern factories.

The textile machinery manufacturing sector in the Netherlands has only eight companies, employing some 1900 people. However, it plays an important part in the overall infrastructure of the European textile machinery industry. The Stork group, an international leader in textile printing technology, is based in the Netherlands.

### **Sewing machines**

The world market is cornered by Japan, the Community, the United States and the newly industrialising Asian countries (and to a certain extent also by Sweden and Switzerland). In the Community, Germany is the dominant producer with some ten firms, followed by Italy and Spain with few specialised producers. Japan and Germany together account for more than 50% of world trade in sewing machines or the corresponding production technology. With a share of about 70%, the industrialised countries are the major customers of the European producers.

Japanese companies have increased efforts to penetrate EC markets in recent years. Yuki acquired the German company Union Special from a US group. Janome launched a joint venture with Pfaff from Germany. But this came to an end because of strong growth in imports of low-price machines from NICs.

Japan as a traditional supplier of simple technology, but at the same time a supplier of sophisticated automated equip-

ment, exports in roughly equal parts to developing and developed countries. The FR of Germany is a supplier of mature specialised technology. Three quarters of its exports are destined for the industrialised countries. Its one-quarter share of exports to the developing countries is thus below the world average of one third. The same is true of the other European world supplier, Italy. These figures are some proof of the notion that the industrialised countries demand high technology with an increasing tendency, while the developing and newly industrialising countries need standard technology with a slightly declining tendency. An excellent growth market, served primarily by Japan, is the Republic of China.

The big loser in the world trade of clothing technology is the United States. It lost its position in exports of sewing machines and accessories to the South East Asian NIC's. These countries are primarily expanding their exports to the industrialised countries. Taiwan, Hong Kong, Singapore, and South Korea are serious competitors as producers of sewing technology. They closely imitate the Japanese model.

### **Outlook**

The medium-term future looks favourable for European textile machinery. Overall growth is likely to continue. The expansion in demand for textile products owing to world population growth and the increasing prosperity of many regions, will ultimately provide a growth market for textile machinery. In particular, a great market for textile machinery will arise in Eastern countries, in the course of the modernisation of the textile industry. Besides this, Latin-America has also, in the medium-term, a great market potential, though this market is at pres-

ent 'dead' (because of lack of capital). In addition to the expected gradual rise in demand, the already apparent upward trend in requirements for speciality textiles, will continue. These trends will bring both opportunities and challenges for textile-machinery makers.

In great parts of the textile manufacturing sector the likelihood of significant downward pressure on prices and, therefore, on profit margins as a result of intensified global competition, means that textile producers will tend towards the production of standard items in more economical, cost-effective ways. This will shift demand for textile machinery to maximum automation and robotisation moving towards totally automated installations in which all, or most, processes are linked automatically. Meanwhile, other textile manufacturers will opt for greater specialisation where much higher value-added potential lies. In both cases, the challenge for the textile-machinery manufacturers will be the incorporation of further technological developments. These overall trends spell out a clear message for the future: the already impressive levels of R&D investment and activity on the part of the major machinery builders will, in many cases, need to be consolidated and sometimes extended. It is hoped that the recent strengthening of the European textile machinery industry will prove to be an important contributory factor in maintaining the leading worldwide position of European manufacturers. Moreover, the trend towards increasing high-technology development, in which computer control and electronics-based systems play a vital part, will provide the kind of challenge which will attract a substantial number of highly qualified people whose

energy and expertise will be increasingly required in the foreseeable future. Summarising one can expect that production of EC textile machinery will in the medium-term grow by about 3% per year. However, in 1990 and 1991 there will be a weakness in production due to keeping back investments before the International Textile Machinery Exhibition in 1991. The sewing machinery market is also a

growth market, especially regarding markets in developing and newly industrialising countries as well as in (former) centrally planned economies. But some special markets such as the USSR and the Republic of China have pent-up demand. In industrialised countries, the clothing industry at the moment keeps back investment partly due to the aforementioned International Clothing Machinery Ex-

hibition which will take place in 1991 in Cologne and which will show the newest technological developments. In 1991, a surge in demand for sewing machines is expected.

**Updated by: IFO-Institut für Wirtschaftsforschung**



The growth of the plastics and rubber machinery sector in the European Community has in recent years been above the industrial average. This was due to the high growth rates in the plastics processing industry and in the automobile sector, the latter being the main application for rubber products. Technologically there are two objectives: the continuation of the development towards automation, and the consideration of ecological necessities. Against this background the medium term prospects of the sector are reasonable and competitiveness against American and Japanese products appears to be guaranteed.

### Description of the sector

The plastics and rubber machinery sector (NACE 324.3) contains the following groups of products: extruders, injection moulding machines, compression/transfer presses and other presses, blow moulding machines, foam-manufacturing machines, thermoforming machines, calendaring machines, other machines, and parts.

This definition refers to the plastics processing machinery, but many of the machines listed can also be used, after minor modifications for rubber processing. Specialised machinery, such as tyreforming, vulcanisation machinery and plants are particular to rubber processing.

There is a wide variety of plastics to be processed, therefore machinery adjustments are necessary, according to the properties of the material.

### Current situation

Due to the considerable growth in the plastics processing industry and the automobile sector, the demand for plastics and

rubber processing machinery has risen sharply. Between 1983 and 1989 apparent consumption and production grew on average by more than 16% annually (at current prices).

The figures in the majority of the tables including table 1, cover the four principal EC countries, Federal Republic of Germany, France, Italy, and the United Kingdom, as statistics for the other EC countries are not available on a regular basis. The EC production value, including the "other countries" is estimated to be in the order of 6.5-7 billion ECU.

There are between 500 and 600 companies active within this sector employing around 80 000 people, with a long term tendency towards reduction.

### Consumption and production

The apparent consumption in the four principal EC countries rose by an annual average of 17.5% between 1983 and 1989.

Since there is no indication why the con-

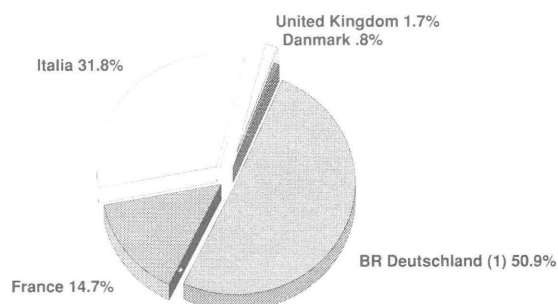


**Table 1**  
Plastics and rubber machinery  
Main indicators, 1983-89 (1)

(million ECU)	1983	1984	1985	1986	1987	1988	1989
Apparent consumption	1 099	1 399	1 632	1 890	2 631	2 850	2 737
Net exports	1 062	1 246	1 640	1 868	1 646	2 235	2 626
Production	2 161	2 645	3 271	3 758	4 277	5 085	5 363

(1) Germany, France, Italy and the United Kingdom. 1989 production is estimated.  
Source: EUROMAP, Eurostat (Comext)

**Figure 1**  
Plastics and rubber machinery  
Sales by country, 1989  
(6221.7 million ECU)



(1) Production  
Source: EUROMAP

sumption should have decreased between 1988 and 1989, a revision of the 1989 estimated production figure and the export figures may be necessary. Production has grown 16.4% at current prices, between 1983-89 and at 11.2% at constant prices which makes this sector

one of the fastest growing in the EC. This development was based on the strong investment growth in the plastics processing and other industries in the domestic market, and a large increase in extra-EC exports, as a result of the high competitiveness of the industry in the

**Table 2**  
Plastics and rubber machinery  
Production and external trade, 1983-89

(million ECU)	1983	1984	1985	1986	1987	1988	1989
Production in current prices							
EC (1)	2 161	2 645	3 271	3 758	4 277	5 085	5 363
Index	66	81	100	115	131	155	164
Production in constant prices							
Index	75	84	100	107	116	139	142
EC trade in current prices							
Exports extra-EC (2)	1 165	1 431	1 781	1 965	1 838	2 393	2 820
Index	65	80	100	110	103	134	158
Imports extra-EC (2)	254	322	376	406	504	641	749
Index	68	86	100	108	134	170	199
X/M	4.59	4.44	4.74	4.84	3.65	3.73	3.77
Trade intra-EC (2)							
Index	519	646	751	881	1 025	1 288	1 395
Index	69	86	100	117	137	172	186

(1) Germany, France, Italy, United Kingdom. 1989 estimated

(2) Reporting countries: Germany, France, Italy and the United Kingdom; Partner Country is extra-EC12 or intra-EC12  
Source: EUROMAP, Eurostat (Comext)

world market.

The contribution of the countries to the EC production of plastics and rubber machinery is shown in Table 3. Germany and Italy are the main producers having shares of almost one half and one third respectively of the EC total. For the Netherlands and Spain the 1987 figures (118 and 83 million ECU respectively) show the range of their production.

The breakdown of the production figures according to the type of machinery demonstrates the leading role which injection moulding machines and extruders play in the production program.

Besides the principle producing countries within the EC there are some other (EFTA) countries which supplement the European production capacities, notably Austria.

The major manufacturing companies in the EC are:

Krupp (D), Battenfeld (D), Klöckner (D), Mannesmann (D), (including DEMAG and Krauss-Maffei), Sandretto (I), Reifenhäuser (D), (in the plastics machinery sector only).

In the former German Democratic Republic there existed only one major industrial producer (Kombinat Umformtechnik) which was active in producing both plastic and rubber machinery and machinery for processing metal sheeting. These two fields of activity will be separated in the future. The main markets for this country were the GDR and the Soviet Union.

### Trade

Germany and Italy rank first and third respectively in world exports with Japan in second place with only half the value of German exports of plastics and rubber machinery (1989). The development of foreign trade in the 1980s reached very high growth rates (in current prices). As the figures in Table 2 show, the extra-EC imports grew faster than extra-EC exports though starting at a much lower level. The ratio by which exports exceed imports, therefore, declined during the eighties. Intra-EC trade has also continued growing at high rates and accounted for almost 35% of total exports in 1989 with France and the United Kingdom being the main outlets.

### Outlook

The single European Market already exists in the plastics and rubber machinery sector. Little direct impact can be expected from the completion of the single market. There may be indirect stimulating effects stemming from a general upswing of the EC economy after 1992 which in turn would motivate plastics and rubber processing. A considerable demand will develop in the coming years from the former GDR and the East European countries as soon as the necessary purchasing power is available. Demand and production in the plastics processing sector are still developing well. The investment climate and the investment activity are part of this development. The apparent consumption of machinery, therefore, will continue to grow although at a lower rate. Extra-EC exports, which play an important role in production (almost 50%), suffer from slow economic development in the United States and heavy Japanese competition in Asian markets. This will have some impact on EC production in 1990 which will grow, in real terms,

**Table 3**  
Plastics and rubber machinery  
Production by product category in the EC,  
1988 (\*)

(million ECU)	1988
Extruders	851
Injection moulding machines	1 092
Compression transfer presses	152
Other Presses	75
Blow moulding machines	317
Foam machines	132
Thermoforming machines	123
Other machines	1 639
Calendering machines	30
Parts	674
<b>Total</b>	<b>5 085</b>

(\*) Germany, France, Italy and the United Kingdom  
Source: EUROMAP

by about 5%. In the next two years there may be a further decline in production growth unless the development in Eastern Europe allows an increasing utilisation of its market potential.

**EUROMAP: Comité Européen des Constructeurs de Machines pour Plastiques et Caoutchouc.**  
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Industrial trucks are used in most sectors of industry.

Like most capital goods industrial trucks have experienced a strong cyclical development in the 1980s. Mergers and acquisitions have changed the structure of the supply side.

Large companies have expanded and set up plants in most important countries, and thus become global players. EC firms have participated in this development, attaining a size comparable to firms in Japan and the USA, and have succeeded in defending their world market share.

Technical change on the demand side has led to more sophisticated equipment for modern warehousing. Tendencies in automation of production, distribution and other services will further stimulate demand for industrial trucks.

### Description of the sector

According to Council Directive 86/663/EEC of 22 December 1986, self-propelled (powered) industrial trucks are defined as any wheeled vehicles, not running on rails, which are designed to carry, tow, push, lift, stack or tier in racks any kind of load. They are controlled by an operator, who walks with the truck or rides on a specially arranged driving platform which is fixed to the chassis or which can be raised.

Industrial trucks, as defined in the Council's Directive, can be subdivided into 4 broad product groups:

- ❖ counterbalanced fork-lift trucks, i.e. battery-powered counterbalanced trucks and diesel/petrol/LPG counterbalanced trucks, rough-terrain (cross country) and side loading trucks;

- ❖ other stacking lift trucks (narrow-aisle), i.e. reach trucks, saddle trucks, pallet stackers, lateral and front-stacking trucks, platform high-lift trucks with elevated operators, high and medium-lift order-pickers;
- ❖ low-lift non-stacking lift trucks, i.e. pallet trucks, platform trucks and horizontal order-pickers;
- ❖ non-lift trucks (non-lifting platforms), i.e. platform trucks, industrial tractors and shunting tractors.

### Production

In the EC, production of industrial trucks declined at the beginning of the 1980s and recovered in the cyclical upswing after 1982/83. In current values, 1988 production has doubled compared with 1981 and is about 65% higher than 1980 (Table 1). However, calculated in constant values, development proves to be poor: The produc-

**Table 1**  
Industrial trucks  
Main Indicators, 1980-89

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Apparent consumption	1 248	921	965	1 124	1 373	1 553	1 679	1 960	2 320	2 586
Net exports (1)	178	260	236	161	132	175	219	87	55	64
Production	1 426	1 181	1 221	1 285	1 505	1 728	1 898	2 047	2 650 (2)	2 650 (2)
Employment (thousands)	50.6	39.7	35.9	35.5	43.5	45.8	44.5	40.5	N/A	N/A

(1) 1980 EC9; 1981-83 EC10

(2) Fördermitteljournal

(\*) Estimated

Source: Eurostrategies, Eurostat (Comext)

tion volume of 1980 was not reached again until 1989, although final figures are not yet available (Table 2).

Worldwide development of production was similar. In current values it expanded by about 75% between 1980 and 1988. EC companies were able to defend their world market shares and they provide almost 30% of world supply if their production in foreign transplants is included.

But Japanese companies are the leaders, now commanding 23% of world production, whereas US companies have lost their position as the predominant suppliers (Figure 1).

## Consumption

The demand for industrial trucks in EC member countries is dependent on the

structure of the national economies.

In the large countries, services, distribution systems, and factory automation are far more important than in the smaller, less developed countries.

Therefore demand for industrial trucks and their penetration in the economy is not only higher in the large EC countries but the structure of demand is different.

Besides counterbalanced trucks increasingly specialised trucks, e.g. with high lift platforms etc., are needed.

Therefore the share of counterbalanced trucks of the total demand is lower than in countries such as Spain, Portugal and Greece. The only exception is Italy with a share of 74% for counterbalanced trucks

(Table 3).

The use of industrial trucks differs widely between the EC member countries.

The highest penetration is reached in Germany (Figure 2). In general the degree of saturation in the EC is high, so that demand becomes increasingly dependent on the necessity to replace old trucks and the application of trucks in new fields.

The latter requires an increasing sophistication of the product. It is apparent from Table 3 that the EC market is largely dominated by counterbalanced trucks. This is because they are very flexible and suitable for many different applications.

Over 60% of these counterbalanced trucks are powered by diesel, petrol or liquid pe-

**Table 2**  
Industrial trucks - Production and external trade

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Production in current prices</b>										
EC	1 426	1 181	1 221	1 285	1 505	1 728	1 898	2 047	2 375 (2)	2 650 (2)
Index	83	68	71	74	87	100	110	118	137	153
<b>Production in constant prices</b>										
EC	2 141	1 597	1 498	1 452	1 594	1 728	1 797	1 866	2 070 (2)	2 220 (2)
Index	124	92	87	84	92	100	104	108	120	129
<b>EC trade in current prices</b>										
Exports extra-EC (1)	294	374	351	300	375	459	533	406	534	615
Index (2)	65	82	77	66	82	100	116	88	116	134
Imports extra-EC (1)	158	148	151	159	233	282	310	328	479	551
Index (2)	61	56	57	60	83	100	110	116	170	195
X/M	1.86	2.53	2.32	1.89	1.61	1.63	1.72	1.24	1.11	1.12
<b>Trade intra-EC (1)</b>										
Index (2)	337	274	287	278	370	443	545	649	907	1 111
	83	67	70	66	84	100	123	146	205	251

(1) 1980 EC9; 1981-83 EC10

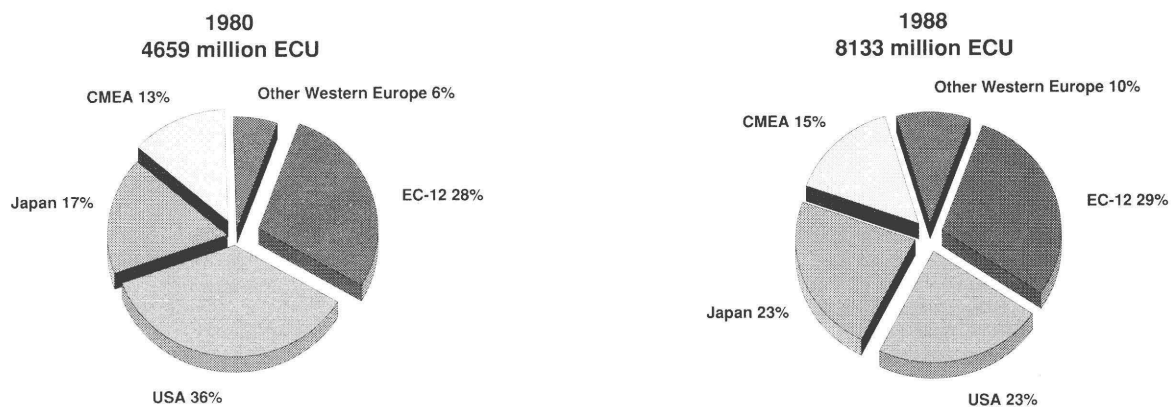
(2) Taking into account changes in EC membership

(\*) Fördermitteljournal, Ifo Institute

(\*) Estimated

Source: Eurostrategies, Eurostat (Comext)

**Figure 1**  
Industrial trucks  
World production



Source: Fördermitteljournal

proleum gas and thus may only be used in areas where pollution, exhaust fumes, cleanliness, noise, etc. are relatively unimportant, i.e. for outdoor rather than indoor use.

Because of saturation, the trend is away from the all-purpose counterbalanced truck towards a more specialist truck. This is a technical response to the factor of warehousing costs; the universal counterbalanced fork-lift truck requires too much space to be used in narrow aisles. Companies avoid extending or building new warehouses; instead, they try to make much better use of their existing warehouse space.

This explains the large increase in narrow-

aisle trucks which can be used in aisles 1.8 to 2.0 metres wide.

The price of narrow-aisle trucks has risen considerably, due to the increased use of modern hydraulics, mechanical and electrical components, which are inevitably more costly. In countries like Greece, Portugal, Spain and Ireland saturation is far from being reached. Demand has expanded markedly in the past years and will continue, but as in the larger EC countries, the share of counterbalanced trucks is declining. Demand for trucks shows some structural differences between the EC, US and Japan. The share of counterbalanced trucks is about 60% in these 3 markets, but the share of counterbalanced industrial

trucks driven by a combustion engine is highest in the US with about 50%, whereas in the EC it is only 30%.

### Trade

In the EC market, foreign suppliers have had a share of some 20% in 1988 for imports. At the beginning of the 1980s it was less than 15%. With the addition of the production of non-EC companies with transplants in the EC, the market share is much higher; non-EC players in the market for industrial trucks currently command a share of about 40% in the EC.

EC companies deliver 22% of their production to non-EC countries, and this has changed little since the mid-1980s. Germany and the UK are by far the most important

**Table 3**  
Industrial trucks  
Market structure by Member State, 1989

(number of trucks)	EC	B-L	DK	D	GR	E	F	IRL	I	NL	P	UK
Diesel/gas-powered counterbalanced	40 551	1 308	1 048	10 895	139	2 576	8 142	205	5 449	3 456	306	7 027
Battery-powered counterbalanced	32 033	937	615	7 447	91	2 464	5 334	92	8 496	1 985	179	4 391
Total counterbalanced	72 584	2 260	1 697	18 527	233	4 971	13 651	308	13 279	5 559	495	11 602
Narrow-aisle	22 175	538	745	8 220	41	1 350	3 704	24	2 891	795	60	3 807
Low-lift non-stacking	22 855	834	570	6 600	26	1 010	6 659	15	2 238	1 201	37	3 665
Non-lift	8 469	232	113	3 966	62	164	1 243		1 124	260	90	1 215
Total	126 083	3 890	3 194	35 857	335	7 831	25 540	376	19 874	8 129	656	20 401

Source: Eurostrategies, IFO Institute



exporters of the EC with a share of 19% and 16% respectively in world exports.

France and Italy are far less important. The world's largest exporting country is Japan with a share of 29%. Sweden is also important in the supply of heavy industrial trucks, and the Asiatic newly industrialising countries have strongly expanded their supply in international markets (Figure 3).

### Industry structure

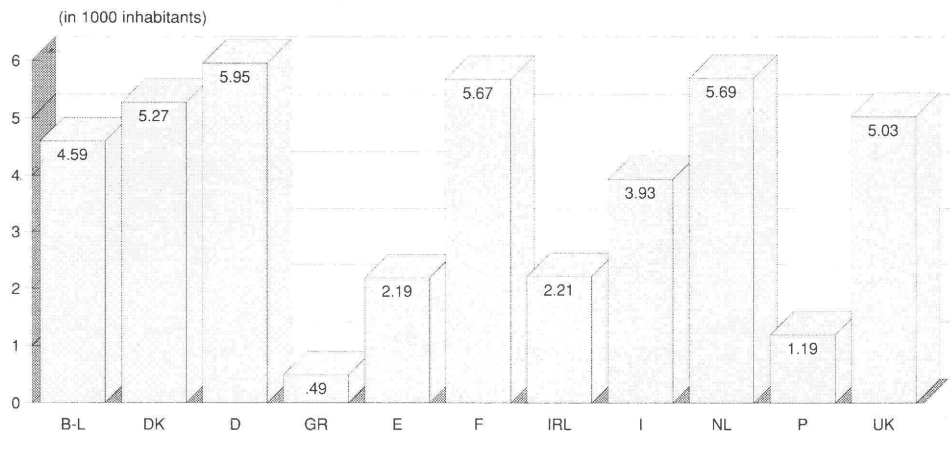
In the late 1970s and early 1980s, costs and salaries increased, and profits turned into losses. Steinbock nearly went bankrupt and was sold to Lancer Boss and in the process cut two-thirds of its personnel. Fenwick, Saxby, Lansing Bagnall, etc., all went through similar processes, resulting in lay-offs.

Although the industry went through a process of concentration, the actual number of production plants has remained stable over the past 10 years and accounts for about 110-120. Mergers and acquisitions continued in the industry even when the market recovered. Linde bought Fenwick, the former leading French supplier, as well as Wagner, Still and, in 1989, Lansing. With the help of these acquisitions Linde became the Western world's largest supplier of industrial trucks. In 1988 Linde supplied more than 51 000 units, some 10% more than Toyota, the second largest player in the market.

Jungheinrich, the second largest European supplier of industrial trucks, became a joint stock company in 1990.

This was partly due to the growth in the past few years and the necessity to fund further expansion. In order to complete its product range the company cooperates with Yale-Sumitomo and distributes its combustion-engine powered trucks. Compared

**Figure 2**  
Industrial trucks  
Penetration in EC countries 1988



Source: Fördermitteljournal

with these two German companies, other independent European suppliers of industrial trucks such as Boss, Manitou, Fiat, are far smaller.

Scandinavian suppliers of industrial trucks have a strong position in the EC as specialists. In general they are suppliers of heavy trucks like Kalmar. Japanese companies are penetrating the EC market, with production expanding within the EC in addition to imports. Nissan has set up a production line in Spain in 1989, whereas Toyota, Komatsu and Mitsubishi are cooperating with EC-sited companies.

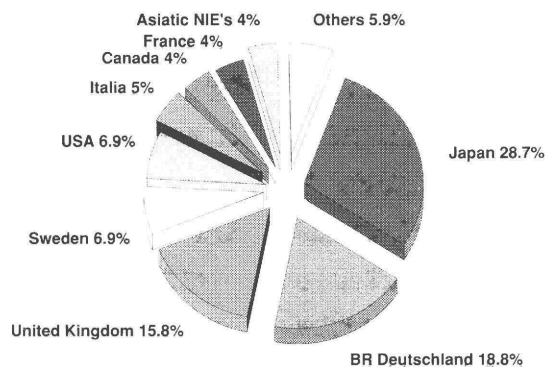
In general, the market became oligopolistic in the past decade. Supply is charac-

terised by global players with transplants in the most important markets to meet demand for standard products, but specialists were able to survive in niches.

### Opportunities and threats

The realisation of the single market creates new opportunities for the industrial trucks sector, procurement of intermediary products as well as the distribution of final products become more international, therefore stimulating new demand for transporting and warehousing equipment. As for example is the case with the food and beverage industry, which is one of the most important clients of industrial truck

**Figure 3**  
Industrial trucks  
World export, 1988



Source: OECD, IFO Institute



**Table 4**  
Industrial trucks  
Market structure, 1988

(number of trucks)	USA	Japan	EC
Counterbalanced	5 060	53 549	40 551
Diesel/gas-powered	17 286	9 700	32 033
Battery-powered	67 956	63 249	72 584
Total			
Other			
Battery-powered	40 044	12 139	53 499
Total	108 000	75 388	126 083

Source: IFO Institute

suppliers. Another opportunity for the industry lies in international sourcing.

Internationalisation will be easier after 1992 because of the abolishment of barriers and EC standardisation, consequently reducing external costs.

The industrial truck market is dominated by global players working in volume markets. Contrary to many other markets, European suppliers are very large and strongly focused on international distribution. They have the potential to compete in large volume markets with the leading suppliers from Japan (e.g.: Toyota, Komatsu) or the US (e.g.: Hyster, Clark). But nevertheless they have to face stronger competition, because foreign suppliers are intensifying their activity inside the EC.

In particular, Japanese suppliers are strengthening their position. Besides establishing distribution channels they cooperate with EC companies in the production of industrial trucks, for instance Toyota, Ko-

matsu, or they have launched their own production line like Nissan in Spain in 1989. Scandinavian companies, who are also important suppliers of special trucks, such as Valmet who have a world market share of 60% with straddle carriers, are building up footholds in the EC. Technological developments are being made in two main fields.

The first one, concerning all trucks, is the standardisation of parts, components and products. The design of common modules which can be used in a variety of products is necessary to reduce administrative tasks and to ease procurement.

Additionally it helps to meet the growing requirements of customisation if the product programme is built up in a modular design.

The second field of technological development is mostly stimulated by the progress in electronics. This has led to more sophisticated trucks equipped with advanced handling systems and in some cases has

led to fully automated vehicles. The demand for these products was pushed by the objectives of factory automation and automated warehousing. This development is concentrated on electrically driven trucks.

## Outlook

Existing trends in demand for industrial trucks will continue. In highly industrialised countries expansion will not be as dynamic as in others. In spite of this, demand will be stimulated more than that for other capital goods by structural changes. Warehousing and distribution are becoming increasingly important as well as factory automation and these induce demand for industrial trucks. Above all, growing demand can be expected from the smaller EC countries, the developing countries as well as Eastern European countries.

The demand from the latter is partly dependent on the question of whether Balcanar, the world's largest producer of industrial trucks, can defend its market shares in the former Eastern Bloc. Otherwise Western companies will expand their markets. In the former GDR, demand for trucks was about 5 000 units. Most of this demand will be met by Western companies in the future. Competition in the EC will increase, mostly due to direct Japanese investment. Especially in markets for standard products, economies of scale will become more important as a factor for success. The concentration process will therefore continue. Based on available information it can be presumed that real production of industrial trucks will grow in 1990, at a rate of 4 to 5%.

**Table 5**  
Industrial trucks  
Top five EC manufacturers, 1988

Companies	Headquarters (country)	Companies' total turnover (million ECU)	Industrial turnover (million ECU)	Total employees	Production/assembly (country)
Linde/Still	D	2 255	839	21 222	D,F
Lansing	UK	356	356	5 000	D,F,UK
Jungheinrich	D	544	446	5 634	D,F
Lancer-Boss	UK	200	197	1 990	D,E
Manitou	F	189	155	1 031	F

Source: Fördermitteljournal

Updated by: IFO - Institut für Wirtschaftsforschung

The EC wood-working machinery industry has displayed a rapid increase in production in recent years, benefiting from the strong recovery of construction and housing. This development is still continuing, with EC producers leading the world market in terms of supply and technology. This position ensures that the EC wood-working machinery manufacturers will play an important role also in future competition. The Japanese position is less important than in other mechanical engineering sub-sectors. Short-term prospects are good for the EC wood-working machinery industry, although growth rates are not expected to maintain the level of recent years.

### Description of the sector

NACE 327.1 covers all kinds of wood-working machinery, which are subdivided into two groups:

- ❖ Primary transformation machinery for saw mills (band saws, gate saws, circular saws), for particle board, fibre board, or plywood manufacturing (pressing and gluing), veneer slicing and peeling, production of pallets and packing crates; this group also includes non-portable chain saws used mainly in forestry;
- ❖ Secondary transformation machinery used in the manufacture of finished products such as furniture, timber work, wooden dwellings, toys, household appliances, also used in the craft industry and cabinet making, the main functions being drilling, milling, planing, and grinding.

There is a third group which contains all those machines and plants which do not belong to one of the categories described

above: specialised machines, parts, and accessories.

### Current situation

EC wood-working machinery production covers about half the world production. Based on high technological standards the position of the EC producers/exporters in world markets is very strong. This is probably the result of the high quality of housing and furnishing in Europe which has led to a diversified and sophisticated programme of wood-working machinery to satisfy demand. In Japan, to the contrary, there existed no forestry and there was no market for furniture. But wood-working machinery manufacturing very much depends on the development of construction. The strong recovery of the construction sector in several EC countries in recent years increased the demand in the fields of application of wood-working machinery. The manufacturers in the European Community, therefore, are

**Table 1**  
Wood-working machinery  
Main indicators, 1980-89 <sup>(1)</sup>

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Apparent consumption <sup>(2)</sup>	801	767	764	844	819	1 132	1 175	1 395	1 220	1 568
Net exports <sup>(3)</sup>	469	565	522	503	642	752	833	766	1 257	1 339
Production <sup>(4)</sup>	1 268	1 334	1 286	1 346	1 461	1 884	2 008	2 161	2 477	2 907
Employment (thousands) <sup>(5)</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	41.1	42.1	43.7

<sup>(1)</sup> Excluding Greece, Ireland, Luxembourg and Netherlands

<sup>(2)</sup> 1980-83 estimated

<sup>(3)</sup> 1980-83 excluding Spain and Portugal as well

<sup>(4)</sup> 1980-83 Spain estimated; 1983-86 Portugal estimated; 1989 estimated.

<sup>(5)</sup> Excluding Greece, Ireland, and Luxembourg. 1987 United Kingdom estimated. 1988 Belgium, and the Netherlands estimated; 1989 estimated.

Source: EUMABOIS, Eurostat (Comext)

experiencing a good business climate.

After a very high production growth in the Federal Republic of Germany and Italy in 1988 and 1989, good results are expected for 1990, and there are some indications that this development will last to some extent until 1991.

Production in recent years has developed so well, that in spite of the long-term tendency of rationalisation and employment reduction, the number of employees increased between 1987 and 1989 and, according to estimates, also in 1990 (Table 1).

### Consumption and production

Apparent consumption of wood-working machinery in the EC rose almost by an 8% annual average between 1980 and 1989 (Table 1). In real terms, growth was around 3% on average. These figures are somewhat misleading as between 1980 and 1984 consumption remained stagnant, and from 1985 onwards it fluctuated between strong years (1985, 1987, 1989) and weaker years. This development was mainly the result of the strong recovery of construction in the middle of the 1980s and of the accompanying increase in hous-

ing and furnishing expenditure.

Production development was more balanced but 1985 saw a sharp increase. The annual average growth rate reached almost 10% in current prices and 4.4% in constant prices between 1980 and 1989 (Table 2). Calculated for the period 1985-89 only, the rates were 11.5% and 6.9% respectively.

In 1988, little more than half the world production of 4.7 billion ECU came from EC countries, of which the Federal Republic of Germany and Italy are the outstanding manufacturers. These two countries produced 45% of the world total (Table 3).

**Table 2**  
Wood-working machinery  
Production and external trade

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Production in current prices</b>										
EC <sup>(1)</sup>	1 268	1 334	1 286	1 346	1 461	1 884	2 008	2 161	2 477	2 907
Index	67	71	68	71	78	100	107	115	131	154
<b>Production in constant prices</b>										
EC <sup>(1)</sup>	1 666	1 669	1 490	1 456	1 499	1 884	1 881	1 945	2 199	2 450
Index	88	88	79	77	80	100	100	103	117	130
<b>EC trade in current prices</b>										
Exports extra-EC <sup>(2)</sup>	494	578	542	535	706	823	901	865	1 756	2 052
Index <sup>(3)</sup>	61	72	67	66	86	100	109	105	213	249
Imports extra-EC <sup>(2)</sup>	77	71	77	87	112	115	136	156	560	754
Index <sup>(3)</sup>	69	63	68	77	97	100	118	135	487	657
X/M	6.37	8.11	7.04	6.15	6.31	7.14	6.64	5.56	3.14	2.72
Imports intra-EC <sup>(2)</sup>	280	246	261	283	349	407	454	590	1 284	1 571
Index <sup>(3)</sup>	73	64	68	74	86	100	111	145	315	386

<sup>(1)</sup> Excluding Greece, Ireland, Luxembourg and Netherlands. 1980-83 Spain estimated; 1983-86 Portugal estimated; 1989 estimated

<sup>(2)</sup> 1980-83 excluding Spain and Portugal as well

<sup>(3)</sup> Taking into account changes in EC membership

Source: EUMABOIS, Eurostat (Comext)

EC production, especially in Germany, has surpassed the production of other countries/regions due to high innovative and technical standards. Japanese production so far has concentrated on low-cost machinery with limited outfitting. This applies, although to a lesser degree, to Italian machines as well.

### Foreign trade

The major producers in the world are also the major exporters although with differing export quotas. Italy, for example, exported two thirds of its production in 1988, Germany almost half (Table 4).

The US market is large enough to make net imports necessary (Table 5). US imports greatly exceed other countries' imports. Canada is also a major importer (Table 5). The North American market, therefore, adds up to more than 1 200 million ECU (1988) compared with the German market of some 800 million ECU. It should be noted that the high exports of second-hand machinery result in an exaggerated export quota and consumption figures which are too low.

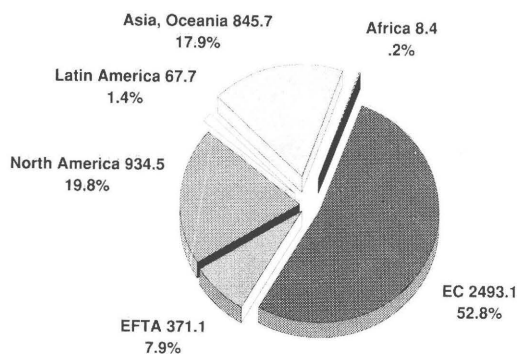
The list of importing countries also shows that France is a major importer, one of the main markets of Italian products, as well as the United Kingdom.

**Table 3**  
Wood-working machinery  
EC production by country, 1988

(million ECU)	
EC	2 493.1
Belgique/België	28.6
Danmark	9.1
BR Deutschland	1 288.5
España	90.4
France	123.0
Italia	848.8
Nederland	8.1
Portugal	14.6
United Kingdom	73.9
Other EC countries	8.1

Source: EUMABOIS

**Figure 1**  
Wood-working machinery  
World production, 1988  
Total World 4720.5 (million ECU)



Source: EUMABOIS

### Industry structure and employment

A little less than half the total number of producers in the world (about 1 700) manufacture in the European Community, which employed 42 126 people in 1988 (Table 6) out of an estimated world total of 60 000. In the United Kingdom and Belgium. Factories employ more than 100 people on average, in Germany 94 people (in 1989 an average of 100 was reached), whereas in the other countries, the factories are significantly smaller. In the United States there are about 300 factories with a total workforce of 9 000. These figures show that generally the branch consists of small and medium-sized firms. In some countries in the last decade, a concentration movement took place. This applies mainly to the United Kingdom, Germany, and Italy (which started from a lower initial level).

Some of the major groups/companies now active in the sector are: SCM Group (Italy, comprising of 27 manufacturers employing around 2 000 people), HOMAG Group (Federal Republic of Germany), DELMAO Group (Italy), IMA Norte Klessman (Germany), A.Cremona & F., Colombo & Cremona, OMGA Group (all in Italy), Stihl,

Weinig, and Siempelkamp (all in Germany).

### Technological development

The technological trend towards automation and centralised control systems which have become commonplace in most sectors of mechanical engineering is also evident in the wood-working machinery field. The general objectives of this development are, higher productivity and work optimisation, reduced consumption of material and energy, and higher safety standards. The automation development is taking place particularly in most of the larger industrial plants for producing particle board, fibre board, plywood, veneer, and furniture. But even equipment for hand use in forestry, in do-it-yourself, or in handicraft,

**Table 4**  
Wood-working machinery  
Major exporting countries, 1988 (1)

(million ECU)	
BR Deutschland	602
Italia	568
Japan	233
USA	138
Austria	93
Switzerland	62
France	54
Finland	54
United Kingdom	49
Sweden	42

(1) Excluding accessories and spare parts  
Source: UNSO (Comtrade)



is equipped with electronic control systems. This does not rule out that there is still a large market in developing countries for less sophisticated equipment and machinery.

The production and processing of new or modified material requires the development of specialised machinery. Almost three fourths of German production is machinery adapted to the customers' requirements. A problem which has already arisen in this context and one which will become more important in the future, is the inability of workers to handle the increasingly sophisticated machinery. If the respective training of workers on the level of machinery application is not strengthened, it may become the limiting factor for technological development in the future.

An international comparison of the technological position of certain countries was made on the basis of patent applications in the 1982-1986 period. In the field of wood-working machinery the German share in inventions worldwide was 31%. The United States (17%), Japan (8%), and Italy (3%) trailed behind at a clear distance. Since today's innovations are tomorrow's sales, the prospects for the EC wood-working machinery industry are bright.

**Table 5**  
Wood-working machinery  
Major importing countries, 1988 (\*)

(million ECU)

USA	307
France	141
BR Deutschland	126
United Kingdom	125
Canada	118
España	89
Switzerland	81
Austria	69
Belgique/België, Luxembourg	63
Singapore	54

(\*) Excluding accessories and spare parts  
Source: UNSO (Comtrade)

## Outlook

The production (and consumption) development in the 1980s demonstrates that forecasts, which are unavoidably based on past performance, are difficult. There is a high dependence of wood-working machinery production on the development of construction, housing, and furnishing, which in turn are results of the general economic development.

One cannot assume that the exploding development of the recent years will continue, but there are nevertheless positive influences which will bring about stable growth. First and foremost the liberalisation of Eastern European countries and the unification of Germany will open up markets which are characterised, not only by unsatisfied demand, but also by technical backlog. The realisation of this market potential depends on the availability of financial means, as it does in the case of most developing countries. This is the reason why the market impact from Eastern Europe will be felt only in the medium-term.

The short-term prospects have worsened as construction activities are still expanding, but at a much lower rate hit by the high level of interest rates. The investment growth rate for housing will be 0.9% in 1991 and 1.2% in 1992. In 1990 the production growth rate of the wood-working machinery industry is estimated to be 8%.

The Federal Republic of Germany alone, which accounts for more than half of the EC production, will have a growth rate of about 12%.

For the years 1991 and 1992 slightly decreasing growth rates can be expected, construction being at the capacity and/or interest limits, and the Eastern European

**Table 6**  
Wood-working machinery  
Structure of the industry, 1988

	Manufacturers	Employment
<b>Total</b>	<b>776</b>	<b>42 126</b>
Belgique/België(*)	8	844
Danmark	35	650
BR Deutschland	240	22 500
España	102	2 630
France	48	2 080
Italia	296	9 889
Nederland(*)	10	295
Portugal	23	1 338
United Kingdom	14	1 900

(\*) Employment estimated  
Source: EUMABOIS

markets' exploitation just starting. Against this background last year's forecast of a 4% annual growth rate can be considered to be reasonable, though probably a bit on the low side. On the basis of the situation in autumn 1990, the forecast for 1991 should read 5% with a further decline to 3 to 4% in 1992.

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Except for a marginal slowdown in 1987, EC pump production has maintained a steady course towards recovery since 1984.

Growth in demand has come mainly from within the Community itself.

Despite production recovery, however, net export earnings have been relatively stable throughout the 1980s.

The fastest growing market segments are the reciprocating and rotary pump sectors.

### Description of the sector

The manufacture of liquid pumps comes under the NACE code 328.3. There are other items included in this NACE category but the information and statistics below exclusively cover the manufacture of liquid pumps. This includes six broad classes of pump products, as follows:

- ❖ Hand pumps;
- ❖ Plunger pumps;
- ❖ Rotary displacement pumps;
- ❖ Centrifugal pumps;
- ❖ Other pumps (not elsewhere specified);
- ❖ Parts for pumps.

### Current Situation

Nineteen eighty-nine was another good year for the European liquid pump industry. Pump production rose a strong 11% against 1988 level (6% in constant prices) and registered an annual average growth of 5.1% between 1981-89. In real terms, as pump price inflation averaged around 5% per annum during the 1980s, the sector only just recovered its production level of 1981 in 1989.

This overall trend has been triggered by a combination of factors:

- ❖ the effects of changes in the international financial and foreign exchange markets and the associated adjustments which have created uncertainty among both pump investors and consumers;
- ❖ the sensitivity of pump production in particular to economic cycles;
- ❖ sharp rises in input prices (materials as well as labour) and the prohibitive cost of borrowing that weakened an already sluggish market and also dampened investment in the European pump industry;
- ❖ the stiff competition for external markets with the USA and Japan, especially in the wake of the strong appreciation of European currencies in foreign exchange markets.

### Production and consumption

Between 1981 and 1983, real consumption and production of pumps in the EC fell by 11%. Additionally, real exports also fell by about 5%.

The stabilisation of oil prices, the easing of monetary policies worldwide together with the post 1983 upward adjustments in the value of the US dollar, gave European



**Table 1**  
Liquid pumps  
Main indicators, 1981-89 (1)

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989
Apparent consumption	2 457	2 580	2 495	2 732	3 198	3 171	3 289	3 642	4 032
Net exports	994	1 032	1 064	1 061	1 127	1 175	994	1 004	1 120
Production	3 451	3 612	3 559	3 793	4 325	4 346	4 283	4 646	5 152

(1) Excluding Ireland and Portugal  
Source: EUROPUMP

exports a competitive edge. When expressed in current prices, pump demand in the Community increased almost continuously between 1983 and 1989, interrupted only by a marginal decrease in 1986.

When expressed in current prices, pump production increased by 6% annually, between 1984 and 1989, conditioned mainly by the 8% per annum rise in demand within the EC, and the 6% yearly increase in exports.

During most of 1989, the strong demand for pumps has been influenced by the following sectoral developments:

- ❖ The healthy situation in the process industry (particularly in its export business). This has led to an increase in pump sales to the sector;
- ❖ The extensive investments in the chemical industry. This has spilled over into a strong demand for chemical pumps;
- ❖ Strong activity in the construction industry. This had the effect of increasing the

demand for heating pumps as well as pumps for water supply and treatment.

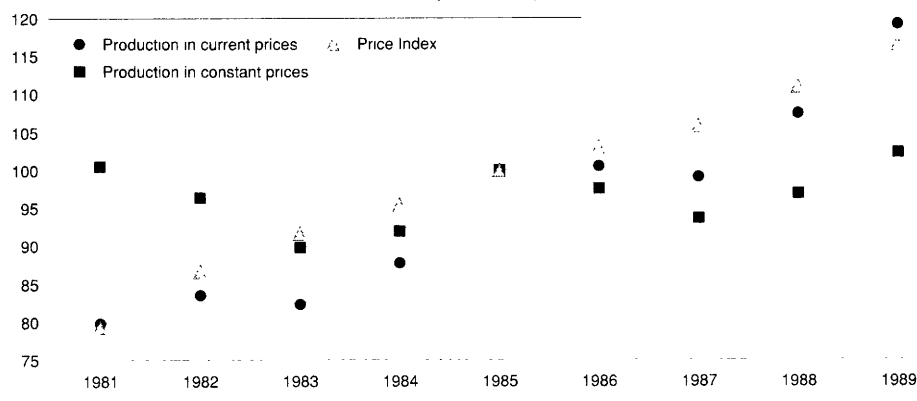
- ❖ Stringent environmental programmes. Stricter enforcement of air pollution standards bolstered the demand for pumps used in flue gas desulphurisation facilities. At the same time, tighter water protection standards increased the requirements for pumps for the treatment of effluents;
- ❖ Unusually hot weather conditions worldwide. This has led to greater demand for irrigation pumps;
- ❖ Improvement in pump orders from the power generating industry, mainly from the developing (LDCs) and the newly industrialised countries (NICs). The prospects for growth here can be significant but at present, financial and infrastructure problems in these countries are the major stumbling blocks;
- ❖ Improvement in the water supply industry. As in power generation, there has been

a rise in pump demand for projects involving water procurement and supply in LDCs and NICs. However, potential demand remains constrained because of lack of funds.

Although centrifugal pumps represent close to 50% of the pump industry's turnover, it is one of the sector's worst performing product lines. Over the 1981-89 period, real production of centrifugal pumps decreased by 1%. Even during the so-called "recovery period" (1984-89), centrifugal pumps sales managed to post only a token 1% rise. By contrast, although plunger and rotary displacement pumps account for less than 25% of sectoral turnover, both lines managed to register average annual rates of increase exceeding 4% in real terms. Currently, these two lines represent the pump sector's fastest growing market segments (Table 3).

Within the Community, the Federal Republic of Germany remains the largest pump producer. In 1989, Germany accounted for close to a third of the EC's pump production. The United Kingdom trails behind with a 15% share, followed closely by Italy with 13%. German leadership is mainly explained by its very strong position. It leads the rest of the Community in the production of all pump product lines, except "Other Pumps", which is dominated by the UK (Table 4).

**Figure 1**  
Liquid pumps  
Production and price trends in the EC, 1981-89  
(1985=100)



Source: Europump

## Trade

Whilst the European Community remains a

**Table 2**  
**Liquid pumps**  
**Production and external trade, 1981-89 (1)**

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Production in current prices</b>									
EC	3 451	3 612	3 559	3 793	4 325	4 346	4 283	4 646	5 152
Index	80	84	82	88	100	100	99	107	119
USA	N/A	N/A	N/A	N/A	4 245	2 958	2 454	2 604	2 883
Index					100	70	58	61	68
Japan (2)	N/A	N/A	N/A	N/A	1 321	1 410	1 364	1 743	1 839
Index					100	107	103	132	139
<b>Production in constant prices</b>									
EC	4 346	4 168	3 883	3 974	4 325	4 219	4 048	4 189	4 423
Index	100	96	90	92	100	98	94	97	102
<b>EC trade in current prices</b>									
Exports extra-EC	1 493	1 572	1 603	1 685	1 875	1 699	1 538	1 624	1 890
Index	80	84	85	90	100	91	82	87	101
Imports extra-EC	398	451	428	494	594	484	624	673	754
Index	67	76	72	83	100	81	105	113	127
X/M	3.8	3.5	3.7	3.4	3.2	3.5	2.5	2.4	2.5
Imports intra-EC	784	897	893	1 004	1 139	1 192	1 181	1 331	1 570
Index	69	79	78	88	100	105	104	117	138

(1) Excluding Ireland and Portugal

(2) Excluding pump parts

Source: EUROPUMP

net exporter of liquid pumps, its trade surplus has decreased between 1986 and 1988. This was partly the result of the second-round depreciation of the US dollar after 1986, which made European pump exports more expensive and imports more attractive. This resulted in a fall in export volumes in 1986 and 1987, and the continued rise in imports after 1987. Although exports recovered slightly in 1988, pump imports far outweighed export demand, resulting on balance in the further erosion of the Community's pump trade surplus at the end of 1988. Whilst this condition has been partially redressed in 1989, net export figures by the end of the decade still stood a fair way away from its 1981 reference level. The markets for the Community's pump exports had traditionally been the countries outside the EC. However, since 1981, there has been a gradual shift in export volumes towards the EC market,

as a result of slower growth in demand elsewhere. Between 1981 and 1989, trade between Member States grew at an average annual rate of 5% (as against a 2% fall in extra-EC exports). Particularly affected are export markets in the Middle East and the rest of the developing world. Exports to the Middle East fell as a result of the slump in oil prices; exports to LDCs declined on the other hand because demand in those countries has, for the most part been constrained by severe foreign exchange difficulties.

### **Technological developments**

Continuing previous initiatives, investment directions have been geared towards modernisation of production machinery, processes and methods. Since the early 1980s, the deployment of CAD/CAM/CIM (computer-aided design, computer-aided manufacturing, computer-integrated manu-

facturing) as well as NC and CNC controlled machine tools, have progressed appreciably. These labour saving technologies have been put in place to address both increasing labour costs and fierce competition for markets. In such business environments, better and more efficient technologies hold the key to sustained market dominance. To what extent the increasing use of computer controlled machinery will be accompanied by a decline in the industry's employment levels is still uncertain. What is clear however is that this development will require changes in the composition of the industry's labour force. There will be a corresponding strong and growing requirement for skilled and computer-literate workers within the industry and, this has implications for training and re-training policies both within the industry and in the Member States of the Community as a whole.

**Table 3**  
Liquid pump production by market segment, 1989

(%)	Hand pumps	Recip- rocating pumps	Rotary pumps	Centrifugal pumps	Other pumps	Total original equipment	Parts	Total production
Belgique/Belgie	0	0.2	0.4	1.0	2.3	0.9	2.0	1.2
Danmark	2.4	0.9	3.7	3.6	1.8	3	6.7	3.9
BR Deutschland	55.9	83	55.1	34.5	27.5	45.8	30.9	42.2
Hellas	23.6	0	0	0	2.8	0.6	0	0.5
Espana	0	0.1	0.4	2.7	1.8	1.8	1.5	1.7
France	2.6	3.9	9.5	16.9	2.1	12.3	10.6	11.9
Italia	0	5.1	14.5	21.0	0	15.5	8.6	13.8
Nederland	0	0	0	1.4	15.0	1.9	4.6	2.5
United Kingdom	15.5	6.8	16.4	18.9	46.7	18.2	35.1	22.3
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
EC production (million ECU)	66.5	694.3	540.8	2 336.8	272.4	3 910.8	1 240.5	5 151.3
Share by market segment (%)	1.3	13.5	10.5	45.3	5.3	75.9	24.1	100.0
USA production (million ECU)	0	168.0	150.2	1 350.7	293.2	1 962.1	921.0	2 883.1
Share by market segment (%)	0	5.8	5.2	46.9	10.2	68.1	31.9	100.0
Japan production (million ECU)	0	65.9	57.8	1 524.5	190.9	1 839.2	N/A	N/A
Share by market segment (%)	0	8.6	7.7	68.8	14.9	100.0	N/A	N/A

Source: EUROPUMP

In addition to plant automation, cost-effectiveness has also been realised through the use of better and more durable materials. In this respect, the pump industry has moved increasingly towards the use of more plastics and steels instead of castings. Also, greater development emphasis is now being given to the manufacture of control pump systems. The introduction of such systems has increased added value in the pump sector. Variable speed control systems are also being introduced. Whilst this is still expensive, it does hold strong growth potentials in the short term.

### Outlook

The completion of the single market will bring some changes in the structure of the pump sector. Already, in the last few years, there have been a number of buy-outs and mergers within the industry, in an attempt to form pan-European companies who can compete more aggressively within the framework of the European market after 1992. There are now a few such company groupings, including KSB,

SIHI, ABS-SCANPUMP, DRESSER, and GRUNDFOS. However, coexisting operationally alongside these big firms, are many small companies - in fact, the majority of pump manufacturers in Europe. To them, size may not be as critical to maintaining financial viability within a single market scenario. Their operations have, after all, been traditionally confined to smaller market niches. In fact, there is likely to be little change here. Some realignments are however expected from medium-sized companies. It is these rather than the smaller businesses which may feel the impact of the single market the most. To remain competitive after 1992, medium-sized firms will need to seek out joint ventures in other EC countries.

Despite close coordination among national associations in the European pump-producing countries, certain barriers to intra-Community trade still persist. It is hoped that such barriers will be removed as a result of the harmonisation of trade rules by 1992. The completion of the internal mar-

ket should enhance the ability of manufacturers to adjust to an expanded domestic demand base, as well as to compete successfully in world markets.

In terms of industry performance, the outlook for the 1990s is mixed. On the one hand, capacity constraints and production bottlenecks, already manifested in some countries (Germany in particular) during most of 1989, continued to pose problems for the industry during 1990. Unless these are addressed by increased investments, the EC pump industry may not be able to take full advantage of the potential for growth in both its domestic and export markets. Internally, there is the prospect of expanded demand within the Community which comes with the continued buoyancy of most European economies and, last but not least, the opening of the European market. Externally, there are promising opportunities for extending the European export base with the opening-up of Eastern Europe to a new market economy.

**Table 4**  
**Liquid pumps**  
**Production by country, 1981-89 (1)**

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total	3 451	3 612	3 559	3 793	4 325	4 346	4 283	4 646	5 152
Belgique/België	62	59	57	56	65	60	54	52	59
Danmark	143	145	153	161	171	182	186	191	201
BR Deutschland	1 306	1 378	1 400	1 510	1 643	1 801	1 834	1 949	2 177
Hellas	24	25	19	21	23	21	20	22	23
España	54	65	59	67	61	69	72	70	90
France	412	439	457	484	609	508	497	572	611
Italia	358	378	432	483	584	597	621	640	711
Nederland	157	163	135	146	145	166	126	112	130
United Kingdom	935	960	847	865	1 044	942	873	1 038	1 150

(1) Including parts  
 Source: EUROPUMP

Apart from production constraints within the industry, other economic pressures such as increased inflationary tendencies and excessive current account deficits in Member States may result in a slow-down in economic activity, leading to downward

pressures on pump growth. Despite these restrictions the real production growth rate for 1990 is expected in the order of not less than 7%. In 1991 and 1992 the development of production may to some extent slow down.

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