

Electronic engineering



The electronics industry is a particularly vital and dynamic sector. Data-processing and communications are crucial for the competitiveness and growth of the whole economy, and the penetration of information technology in all sectors including households is steadily increasing, although in current values this is not always perceptible owing to the decrease in relative prices of electronics.

The coming period may be a turning point for the European industry, which must adapt to a less institutional and more competitive market, in the face of very aggressive competition from the USA and Asia. Issues may be the survival of European suppliers and technology in such critical fields as components, data-processing, HDTV. The steady degradation of the now heavily negative trade balance is a sign of the unfavourable position of the European industry.

Description of the industry

The electronics industry comprises computers and office equipment (NACE 33), telecommunications, radiocommunications and radar, medical equipment and measuring equipment (NACE 344), and consumer electronics, professional audiovideo equipment, and components (NACE 345).

NACE 345 also includes records and pre-recorded tapes (345.2), which are generally not considered part of the electronics industry.

The subchapters within Chapter 12 are organised as follows:

- ❖ electronic components (semiconductors, tubes and valves, passive components such as resistors, capacitors, printed cir-

cuit boards, etc.), mostly included in NACE 345.1;

- ❖ computers and office equipment (NACE 33);
- ❖ telecommunications equipment, included in NACE 344. Discussion of this segment excludes measuring and medical equipment, and radiocommunications are only included for civilian mobile communications, microwave links, and space communications. The rest of radiocommunications (e.g. radar, military applications, etc.) are excluded;
- ❖ consumer electronics, included in NACE 345.1, excluding records and pre-recorded tapes (NACE 345.2).

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Table 1
Electronic engineering
Trends in EC production in current prices, 1981-90

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 (?)
Electronic components	7 777	8 576	9 762	12 368	13 228	13 615	13 772	14 406	15 413	15 969
Active components	3 282	3 712	4 385	5 858	5 973	6 218	6 289	6 598	7 344	7 601
Passive components	1 568	1 691	1 787	2 060	2 121	2 187	2 193	2 261	2 349	2 419
E-mechanical components	2 927	3 173	3 590	4 450	5 134	5 210	5 290	5 547	5 720	5 949
Computers and office equipment(1)	14 746	19 580	23 961	29 365	35 388	35 326	36 053	41 553	45 663	49 090
Telecommunications equipment	16 379	17 593	18 543	20 601	22 390	22 226	22 584	22 939	24 328	25 798
Consumer electronics	8 671	9 850	8 064	7 808	8 895	12 111	12 526	12 906	12 243	13 020
Total	47 573	55 599	60 330	70 142	79 901	83 278	84 935	91 804	97 647	103 877

(1) Excluding Greece, Portugal and Spain
 (?) Bipe estimates
 Source: Panorama '91 - individual chapters

The statistics in the following tables and figures are based on the above definition as not all sectors are covered in Panorama.

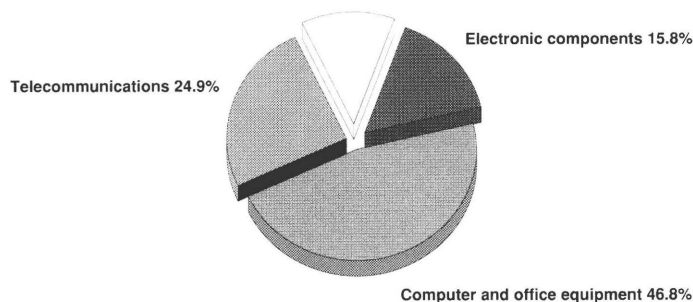
Importance of the electronics industry in the EC economy

Production Production of the electronics industry in the EC was 97.6 billion ECU in 1989, nearly 6% more than in 1988 and employment 855 thousand. Growth of production since 1981 has averaged at 9.4% per year at current prices.

Growth has been highest in computers and office equipment with over 15% per year between 1981 and 1989; components were close to the average for the industry with a growth rate a little less than 9%, and consumer electronics and telecommunications equipment grew at around 5% per year. This lower growth rate in consumer electronics was probably due in part to the decrease in prices.

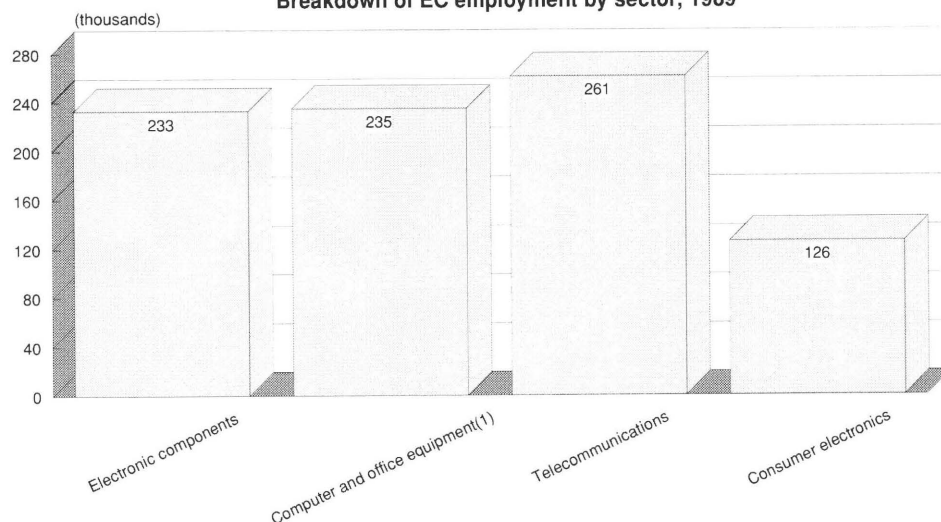
The industry remains mostly concentrated in the four larger countries (France, Germany, Italy and the UK) which account for 89% of production and 88% of R&D, a significantly higher ratio than their 72% share in EC population.

Figure 1
Electronic engineering
Breakdown of EC production by sector, 1989
 Consumer electronics 12.5%



Source: Panorama 1991 - individual chapters

Figure 2
Electronic engineering
Breakdown of EC employment by sector, 1989



(1) Excluding Greece, Portugal and Spain
 Source: Panorama 1991 - individual chapters

The electronics industry as a whole, including measurement instruments, industrial automation, electro-medical equipment and software and information services accounts

for 5% of GDP and is expected to reach 10% by the year 2000. The share of the electronics industry - without software and information services - in overall industrial

Table 2
Electronic engineering
Trends in EC consumption in current prices, 1981-90

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 (*)
Electronic components	7 101	7 760	9 279	13 197	13 992	14 023	14 487	15 832	17 276	18 237
Active components	4 153	4 754	5 715	8 115	8 303	8 159	8 287	9 206	10 310	10 825
Passive components	1 561	1 713	1 842	2 243	2 338	2 412	2 417	2 608	2 764	2 916
E-mechanical components	1 387	1 293	1 722	2 839	3 351	3 452	3 783	4 018	4 202	4 496
Computers and office equipment ⁽¹⁾	17 272	22 572	27 791	35 048	40 543	40 630	42 784	51 221	56 494	60 987
Telecommunications equipment	14 113	15 136	16 302	18 250	20 184	20 307	21 555	22 848	24 219	25 672
Consumer electronics	12 200	13 487	13 318	12 925	14 304	18 550	19 201	21 055	20 978	22 020
Total	50 686	58 955	66 690	79 420	89 023	93 510	98 027	110 956	118 967	126 916

(1) Excluding Greece, Portugal and Spain

(2) Bipe estimates

Source: Panorama '91 - individual chapters

production in the EC is approximately 8%, with significant variations according to the member states (from a maximum of 17% in Ireland to a minimum of 3% in Spain). The importance of the electronics industry is, however, much greater than its measurable share in production. Electronic technology is increasingly a key factor in the competitiveness of other sectors, in particular because of its widespread applications in factory automation, and because it enables the development of data-processing and communications. A large number of products of other industries increasingly use electronic technologies, as for

example the aerospace industry, the automobile industry, domestic appliances. In business services, banking and insurance the improved communications and data-processing lead to new products and increased productivity gains.

The electronics industry has two important characteristics, which are closely related.

The first is a high rate of innovation, which is the main reason for the rapid growth of the electronics industry. New technologies and products are continuously opening up new markets, as for example personal computers, portable computers, videorecorders, fax terminals, digi-

tal switching, mobilophones. The rate of innovation shows no signs of slowing down in the future, in particular with the booming growth of mobile communications, and the introduction of ISDN and HDTV.

This is the result of a high level of R&D expenditure, which was estimated at nearly 18 billion ECU in 1989 for the whole of the EC electronics industry. In order to improve R&D coordination and efficiency, a number of European programmes have been implemented, such as ESPRIT, RACE, or JESSI for semiconductors.

The second characteristic, a natural conse-

Table 3
Electronic engineering
Trends in EC trade balance in current prices, 1981-90

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 (*)
All components ⁽¹⁾	676	816	483	- 829	- 764	- 408	- 715	- 1 426	- 1 863	- 2 268
Active components ⁽¹⁾	- 871	- 1 042	- 1 330	- 2 257	- 2 330	- 1 941	- 1 998	- 2 607	- 2 966	- 3 224
Passive components ⁽¹⁾	7	- 22	- 55	- 183	- 217	- 225	- 224	- 348	- 415	- 497
E-Mech components ⁽¹⁾	1 540	1 880	1 868	1 611	1 783	1 758	1 507	1 529	1 518	1 453
Computers and office equipment ⁽²⁾	- 2 526	- 2 992	- 3 830	- 5 683	- 5 155	- 5 304	- 6 731	- 9 668	- 10 831	- 11 897
Telecommunications equipment ⁽⁴⁾	1 759	1 949	1 949	1 745	1 570	1 233	1 029	91	109	125
Consumer electronics	- 3 529	- 3 637	- 5 254	- 5 117	- 5 409	- 6 439	- 6 675	- 8 149	- 8 735	- 9 000
Total	- 3 620	- 3 864	- 6 652	- 9 884	- 9 758	- 10 918	- 13 092	- 19 152	- 21 320	- 23 040

(1) 1981-83 EC10

(2) Excluding Greece, Portugal and Spain

(3) Bipe estimates

(4) A change of trade nomenclature in 1988 makes a comparison of pre-1987 and post 1988 figures hazardous

Source: Panorama '91 - individual chapters

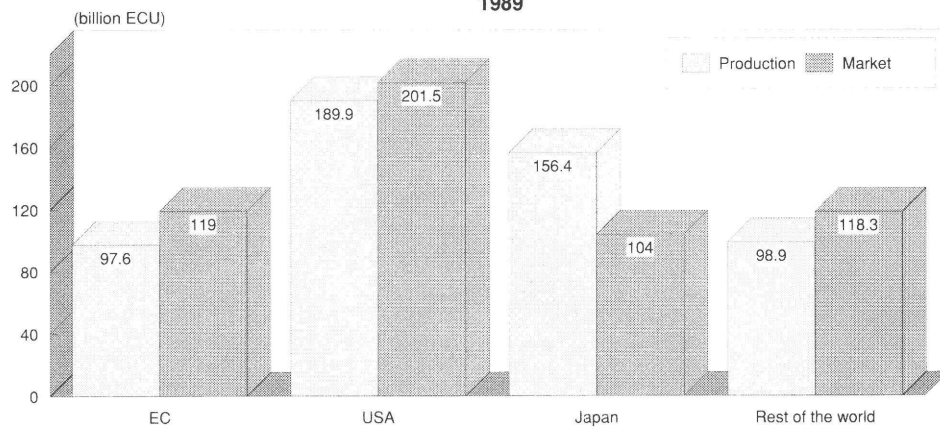
quence of the first one, is the dramatic decrease in the price of electronic functions. This means that the relative price of electronics decreases, at the same time as the level of performance increases. The implication is that companies entering markets too late will find it difficult to make sufficient profit to finance R&D for developing the next generation of innovations.

Foreign trade and the international context

The EC accounts for 18% of world production of around 540 billion ECU. The European electronics industry ranks third, behind the USA (35%) and Japan (29%). Comparison with market shares shows the unfavourable position of the EC; whereas the USA has roughly the same share of world production as of world markets, the EC with 22% of world markets can only boast of 18% of world production. Japan on the other hand with respectively 19% and 29% is in the opposite situation. This is naturally reflected in trade figures. The EC trade balance in electronics has continuously deteriorated over the past ten years: in 1981 EC electronic trade balance was -3.6 billion ECU. In 1989, the EC had a negative trade balance in electronics of 21 billion ECU, whereas Japan boasted a trade surplus of 53 billion ECU and the USA showed a negative balance of 11.6 billion ECU.

This is because European industry has not succeeded in capitalising on its strong points (e.g. public telecommunications network equipment, radiocommunications and detection) in order to develop in new directions. In particular the European data-processing or component industries have never really succeeded in competing with their American or Japanese rivals. And

Figure 3
Electronic Engineering
Comparison of production and market EC, USA, Japan and rest of the world, 1989



Source: Panorama 1990, EIC 1990

more generally European industry has mostly let its Japanese competitors take the lead in developing new products (e.g. HiFi, CD, Videorecorders, fax terminals). Whether HDTV will enable Europe to impose its own technology remains an open question.

The opening of Eastern European markets is a new factor, but trade flows between the EC and Eastern Europe in electronics are still very small: EC imports from Eastern Europe were less than 1% of total EC imports in 1988, and exports to Eastern Eu-

rope were about 3% of total exports.

These figures are underestimated because they do not include trade flows between Federal Germany and the GDR, but the order of magnitude remains correct.

The question is how these trade flows may develop in the future. It seems highly likely that they will substantially increase, and that the balance will remain positive because of the technological lead in Western Europe. However, most European suppliers are setting up joint manufacturing units in Eastern Europe, and this will re-

Table 4
Electronic engineering
The top 15 world electronics suppliers, 1989

	Total sales 1989 (million ECU)	Total employment 1988 (thousands)	World electronics sales 1989 (million ECU)	EC electronics sales 1989 (million ECU)
IBM	57 010	387	57 010	17 840
NEC	19 820	104	19 820	910
Matsushita	34 400	193	19 775	1 790
Hitachi	40 700	264	18 790	1 900
Siemens	31 770	353	16 830	10 050
Fujitsu	16 910	104	16 910	830
Toshiba	24 460	125	15 080	1 360
Philips	25 000	310	14 760	6 960
DEC	11 590	121	11 590	3 950
General Motors	115 392	766	12 570	940
CGE Alcatel	24 500	204	12 000	8 000
Hewlett Packard	10 820	87	10 820	3 350
AT&T	32 830	N/A	11 210	500
Thomson	10 930	104	10 040	5 400
Sony	16 650	79	10 020	1 560

Source: Bipe

duce the need for imports from the West, as well as providing opportunities for exporting into the EC.

Industry structure

The European electronics industry remains dominated by European companies, although the presence of foreign (mainly American) suppliers is strong. Seven of the top ten suppliers in the EC electronics market are European, but this ratio falls to only one half of the top 50, the other half comprising 18 American companies and 7 Japanese. On the world market the situation is somewhat different: only two Europeans are among the top ten (5 Japanese and 3 Americans), and 13 among the top 50 (24 Americans and 13 Japanese).

This is in part the result of the major restructuring of the industry which has taken place over the last few years. In the past the European electronics industry was often characterised by protected national markets which encouraged the development of "national champions". The prospect of the single European market has led to a large number of mergers and acquisitions across the national borders, and thus to the emergence of truly European suppliers.

Examples of such acquisitions are CGE-ITT, CGE-Telettra, CGE-GEC, Siemens-GTE, Siemens/GEC-Plessey, SGS-Thomson, Asea-Brown Boveri, Nokia-SEL consumer, as well as the acquisitions of Thomson Consumer Electronics in Germany (Nordmende, Telefunken, Saba) and the UK (Thorn Ferguson).

This restructuring is not yet completed, and it does not only involve European companies. AT&T for example has gained a foothold on the European market through agreements with Philips and Italtel, and

Table 5
Electronic engineering
The top 15 European electronics suppliers, 1989

	Total sales 1989 (million ECU)	Total employment 1988 (thousands)	World electronics sales 1989 (million ECU)	EC electronics sales 1989 (million ECU)
Siemens	31 770	353	16 830	10 050
Philips	25 000	310	14 760	6 960
CGE Alcatel	24 500	204	12 000	8 000
Thomson	10 930	104	10 040	5 400
Olivetti	6 320	58	5 880	3 570
Bull	5 820	46	5 820	3 190
GEC	10 660	145	4 790	3 570
Ericsson	4 430	65	3 700	1 480
Bosch (*)	13 360	165	3 360	2 530
Plessey (*)	2 470	26	2 960	1 250
Nixdorf	2 835	31	2 835	2 420
STC	4 480	34	2 830	2 020
Nokia (*)	4 420	45	2 620	1 410
STET (*)	10 600	N/A	2 040	1 790
Daimler-AEG	36 900	339	1 560	1 190

(*) Total sales 1988
Source: Bipe

the Fujitsu-ICL acquisition shows that the Japanese do not intend to remain on the side. However, the Japanese and Asian presence in Europe has mainly developed in a first stage through gaining market shares in specific high-growth product segments, and in a second stage through direct investment in European manufacturing plants. These are for the moment relatively small, with an average employment of 250 in about 110 plants in operation at the beginning of 1989. Total employment in Asian subsidiaries was around 30 000, i.e. about 3.5% of employment in the EC electronics industry. The UK comes first with over 10 000, followed by Germany, France and Spain; together these four countries account for 90% of employment in Asian subsidiaries in Europe.

Risks and opportunities

The electronics industry is a fairly mobile industry; innovation leads to a rapidly changing product mix, and this in turn enables new players to enter the scene. However, the European industry has not al-

ways been quick enough to grasp the opportunities afforded by innovation. This is particularly true in consumer electronics where Japanese industry has virtually monopolised innovation (HiFi, VCR, camcorders, and even CD players although they were originally developed by Philips). To a certain extent the same can be said of data-processing. The main innovations (mini-computers, micro-computers, workstations), which have been accompanied by the entry of major new players on the world market, have been grasped by American, and lately Japanese companies, but very little by European ones, with the possible exception of Olivetti in micro-computers.

In telecommunications the major European manufacturers have been more active in promoting innovation, but this is mostly true of public network equipment (digital switching, ISDN) and less so of terminal equipment, which has enabled Japanese industry to corner the fax market. The development of mobile communications is a new opportunity in telecommunications,

and European companies are not in a bad position, even though Motorola seems keen to gain a large share of the promising European market. In this respect the high price policies practised in some EC countries may have a perverse effect, inasmuch as they do not encourage local companies to be competitive, whereas companies able to supply at lower prices on international markets make high profits. One of the major issues in the next few years is undoubtedly high definition TV (HDTV). The Japanese, who understandably do not wish to lose their leadership in consumer electronics, have been very active in this field over the past years, and have developed a large range of equipment and components. European industry, although it is trying hard to impose its D2Mac-Packet standard, is at a serious disadvantage from this point of view. This is particularly true in the component field, where Europe is far behind in LCD screens which are an important feature of future HDTVs. The difficulties of Philips will not help to make European industry ready in time, nor will the battle of standards between European broadcasters (D2Mac/Pal, satellite decoding systems). Satellite TV which was to be the privileged transmitter of D2Mac, is now developing strongly in the UK and Germany on the Astra/Pal standard.

Components are probably an issue which is related to the vitality of a supporting electronics industry. The Japanese have succeeded in becoming leaders in semiconductor supply mostly through a strategy of vertical integration supported by leading market shares on innovative consumer products. The American strategy of independent semiconductor suppliers which

(million ECU)	1989	1990 (*)	1991 (*)	1992 (*)
Electronic components:				
Apparent consumption	17 276	18 237	19 337	20 736
Production	15 413	15 969	16 697	17 630
Computers and office equipment(*):				
Apparent consumption	56 494	60 987	66 135	71 492
Production	45 663	49 090	53 017	57 259
Telecommunications equipment:				
Apparent consumption	24 219	25 672	28 240	30 216
Production	24 328	25 798	28 645	30 970
Consumer electronics:				
Apparent consumption	20 978	22 020	23 350	24 751
Production	12 243	13 020	14 150	15 211
Total:				
Apparent consumption	118 967	126 916	137 062	147 195
Production	97 647	103 877	112 509	121 070

(*) Excluding Greece, Portugal and Spain
 (*) Biipe estimates
 (*) Biipe forecasts
 Source: Panorama '91 - Individual chapters

had been successful in the past is now confronted with powerful groups with large resources for R&D and dynamic in-house markets.

European suppliers, in spite of their efforts, have not yet succeeded in climbing to the top world ranks. The JESSI programme was designed to help joint R&D efforts, but the partial withdrawal of Philips, one of the three major partners with Siemens and SGS-Thomson, makes its outcome more problematic.

Outlook

The growth outlook for the European electronics industry remains favourable in the short term.

Not taking into account the effect of the crisis, growth prospects over the period 1990-1992 are the following:

- ❖ components: market 6.6% per annum, production 5% per annum;
- ❖ telecommunications: market 8.5% per annum, production 9.5%;
- ❖ data-processing and office equipment: market 8.2% per annum, production 8%;

❖ consumer electronics: market 6% per annum, production 8.1% per annum. These figures do not tell the whole story, however. There seems no question that growth of the industry will continue; but how will European companies prosper, and will they be able to keep their technological independence? The present difficulties of Bull, Philips and Olivetti for example, together with the acquisition of ICL by Fujitsu, are not encouraging for the future of European data-processing; the difficulties of JESSI and of the HDTV programme are no less worrying.

Written by: Biipe

The European and worldwide components industries have seen strong growth in 1988 and 1989. In 1989, the market for electronic components in the EC (including active, passive and electromechanical components) amounted to 17.2 billion ECU, 9% up from 1988.

Production of components in the EC in 1989 accounted for 15.4 billion ECU an increase of 7% from 1988. Demand has grown faster for active components, especially semiconductors, than for passive and electromechanical components. Preliminary estimates for 1990 indicate a slowdown in demand and in production which should be attributed to the cyclical downturn in the semiconductor's industry.

The trade balance of electronic components showed a deficit of 1.8 billion ECU in 1989. Exports reached 9.3 billion ECU and imports accounted for 11.1 billion ECU. The trade deficit is mainly due to the trade in semiconductors, accounting for a negative balance of almost 3 billion ECU.

European manufacturers have managed to maintain their share of the market and even expand it slightly in 1990 helped by growth in demand for consumer electronics and telecommunications equipment, where Europeans are stronger.

In the field of semiconductors, growing investments and research and development costs are forcing manufacturers to rationalise their operations and cooperate on research and development. The need to acquire a critical size to maintain their posi-

tion on a highly competitive market should push European manufacturers to seek partners in the EC or abroad to share the risks and the costs for the development of the new generation of electronic components. The EC passive and electromechanical components industry consists mostly of small and medium-sized companies. Certain firms - especially in EC countries - are trying to capture the world market by consolidating their position in Europe.

Table 1
Electronic components
Main Indicators by Segment, 1981-90 (1)

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989 (2)	AAGR 89/88	1990 (3)	AAGR 90/89
All components												
Apparent consumption	7 101	7 760	9 279	13 197	13 992	14 023	14 487	15 832	17 276	9	18 237	5.6
Net exports (2)	676	816	483	- 829	- 764	- 408	- 715	- 1 426	- 1 863	31	- 2 268	21.7
Production	7 777	8 576	9 762	12 368	13 228	13 615	13 772	14 406	15 413	7	15 969	3.6
Active components												
Apparent consumption	4 153	4 754	5 715	8 115	8 303	8 159	8 287	9 206	10 310	12	10 825	5.0
Net exports (2)	- 871	- 1 042	- 1 330	- 2 257	- 2 330	- 1 941	- 1 998	- 2 607	- 2 966	14	- 3 224	8.7
Production	3 282	3 712	4 385	5 858	5 973	6 218	6 289	6 598	7 344	11	7 601	3.5
Passive components												
Apparent consumption	1 561	1 713	1 842	2 243	2 338	2 412	2 417	2 608	2 764	6	2 916	5.5
Net exports (2)	7	- 22	- 55	- 183	- 217	- 225	- 224	- 348	- 415	19	- 497	19.8
Production	1 568	1 691	1 787	2 060	2 121	2 187	2 193	2 261	2 349	4	2 419	3.0
E-Mech components												
Apparent consumption	1 387	1 293	1 722	2 839	3 351	3 452	3 783	4 018	4 202	5	4 496	7.0
Net exports (2)	1 540	1 880	1 868	1 611	1 783	1 758	1 507	1 529	1 518	- 1	1 453	-4.3
Production	2 927	3 173	3 590	4 450	5 134	5 210	5 290	5 547	5 720	3	5 949	4.0

(1) 1981-83 EC10
(2) 1988 Greece estimated
(3) Biipe estimates
Source: Eurostat (Comext), BIS Mackintosh

Definition of the sector

Electronic components are the basic building blocks in the manufacture of all electronic equipment including electronic data processing, telecommunications, and consumer, automotive and military/aerospace equipment. Electronic components encompass a vast catalogue of products which can, nonetheless, be classified into three main categories:

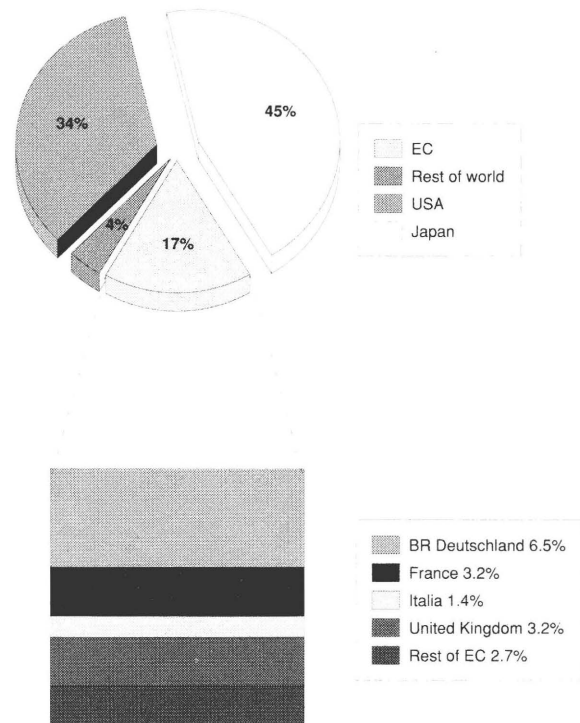
active components, passive components and electromechanical components.

Active components include semiconductors (integrated circuits and discrete semiconductors) and electronic valves and tubes.

Passive components include capacitors, resistors and wound components (small transformers, chokes, coils and other inductors). Electromechanical components include connectors, relays, switches and printed circuit boards.

The NACE coding system is insufficient to draw out the intricacies of this sector. Electronic components are classified together

Figure 1
Distribution of world production of electronic components



Source: BIPE

with consumer electronics under NACE code 345.1. Therefore, only trade statistics have been obtained from Eurostat using the Nimex and Combined Nomenclature

coding systems. In addition, other specialist and general sources (BIS Mackintosh, Dataquest, EIC, Elsevier Yearbook,) have been used. Employment figures have

been provided by EECA.

Current situation

The European component market accounted for an estimated 17.2 billion ECU in 1989, 9% up from 1988. Growth of the active component market (12%) was higher than that experienced by the passive component (6%) and electromechanical component (4.6%) markets.

In 1989, the production of electronic components in the EC was estimated to be 15.4 billion ECU, accounting for nearly 17% of world production, while Japan and the United States account for 45% and 34% respectively.

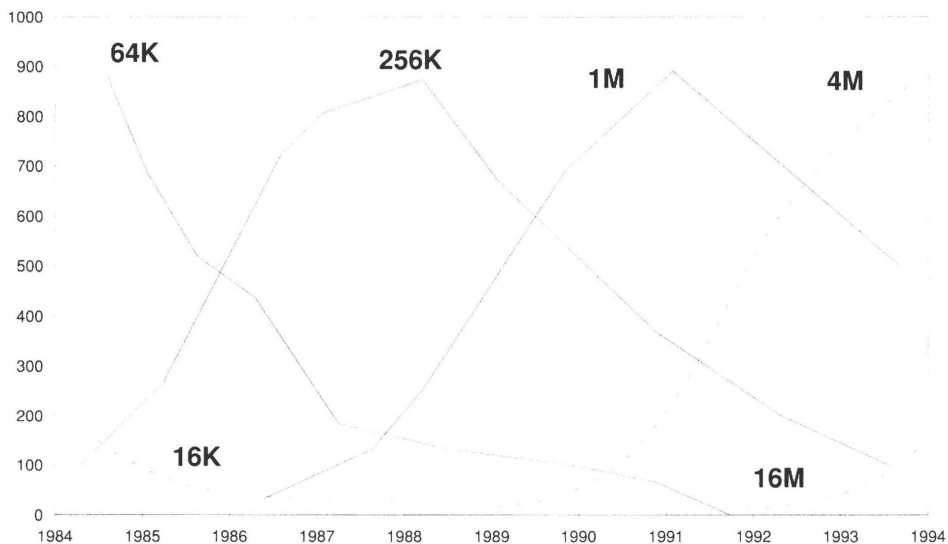
The Federal Republic of Germany, France, the United Kingdom and Italy together accounted for 84% of EC output, with shares of 38%, 19%, 19% and 8% respectively.

The manufacture of all types of components is increasing rapidly in Spain. On the other hand, overall British component production in 1989 rose little compared with the other European countries.

The electronic components industry suffers from large cyclical swings. These swings follow the development and application of subsequent technological leaps as illustrated in Figure 2 by the case of dynamic memory chips. This cyclical trend mainly affects the world semiconductor market and to a lesser extent the passive and electro-mechanical components market.

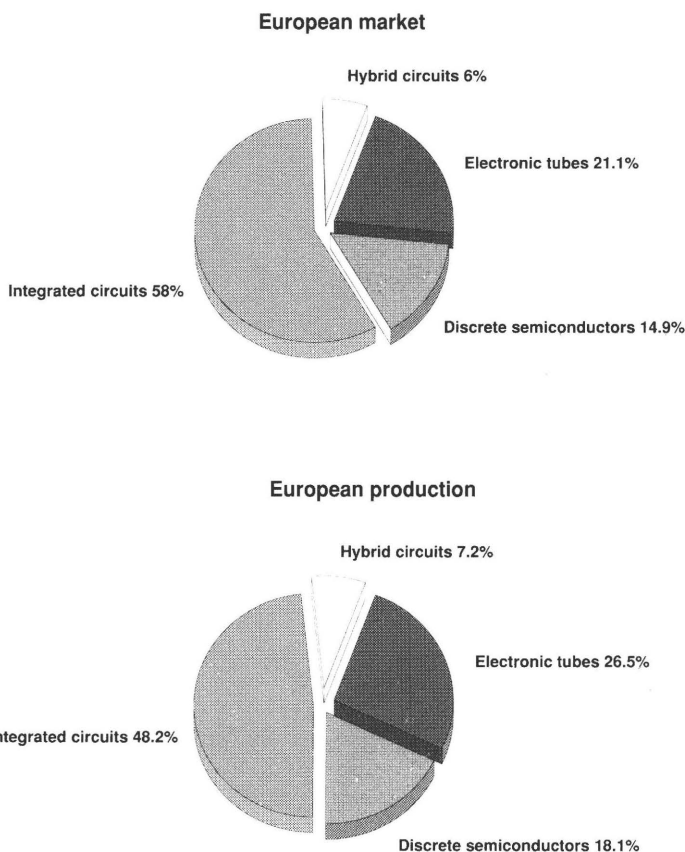
After a two-year crisis (1985 in the United States, 1986 in Europe), the world market of semiconductors entered the upswing of the cycle, marked by the stabilisation of prices and increasing demand. In Europe, this recovery began during the second half of 1987 and continued in 1988. In 1989 market growth continued because of a buoyant economic situation, strong de-

Figure 2
Electronic components
World demand for dynamic memory chips in million units per year



Source: NRC Handelsblad/Toshiba Corporation

Figure 3
Active components
Distribution of market and production by main product category, 1989



Source: EIC, 1990

mand and stable prices, especially on the memory market. The market stagnation towards the end of 1990 is expected to have a limited impact. As shown by recent market developments and 1990 to

1992 forecasts, the cyclical swings characterising the world market of semiconductors in the past are decreasing.

Production and consumption trends

Production of active components (semiconductors and tubes) was estimated at 7.3 billion ECU in 1989, an increase of 11% from 1988.

Integrated circuits (ICs) represent the major share output for the industry, followed by tubes and finally discrete components.

While the production of tubes is slowly rising, European production of integrated circuits rose sharply in 1989, especially in Germany 26% and France 12%. Discrete semiconductors enjoyed moderate but sustained growth: 8% in Germany and 18% in France.

The production of passive and electromechanical components accounted for an estimated 8 billion ECU in 1989, of which passive components represented 2.3 billion ECU and electromechanical components 5.7 billion ECU. Production rose 3.3% compared with 1988. The production of passive and electromechanical components accounts for 52% of total component output.

Germany takes care of 41% of European production, the United Kingdom 19%, France 16% and Italy 7%.

Production of passive components rose 7.5% in Germany, 4% in France and 6.2% in Italy. The output of electromechanical components rose 6.3% in Germany and 6% in France.

European semiconductor market and supply trends

In 1989 the EC semiconductor market rose to nearly 8 billion ECU.

The European market represents only 18% of the world market, far behind the United States 30% and Japan 40%. Other

South-East Asian countries account for 10% of the world market and their share is gradually increasing.

Germany is the largest European semiconductor market (28%), followed by the United Kingdom (25%). France (13%) and Italy (11%) account for a much smaller share.

The market is characterised by stiff competition, the gradual erosion of American shares and booming Japanese companies. Manufacturer strategies aim to focus their production (by mergers or acquisitions) or establish more extensive research and development partnerships (through agreements, licenses, etc.). Only European groups of world size can hope to maintain their position on the semiconductor market (the situation is different for certain specialists whose positioning strategies support a smaller size).

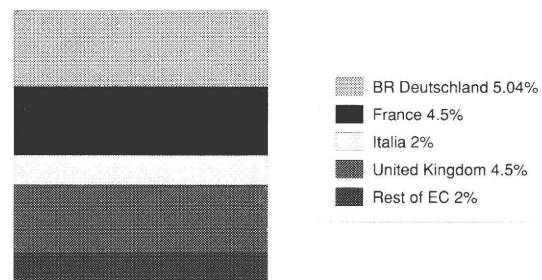
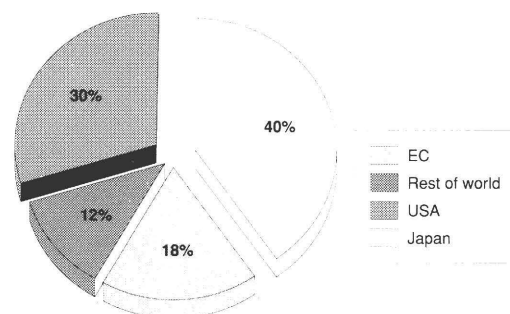
The main outlets for semiconductors are

computers, communications, military applications, industrial automation and transportation. Significant emerging markets for electronic components include ISDN (Integrated System Digital Network) in the telecommunications sector, HDTV (high definition television) in the consumer sector, and the increasing electronic content in automobiles.

Production of semiconductors in the EC is heavily biased towards the technologically simpler discrete units than is the case in the USA or Japan. In Europe the split is 27% discrete and 73% ICs in 1989 compared to 12% discrete for the USA and 21% for Japan. The main producers of ICs are Germany, the UK, France, the Netherlands and Italy.

The dependency of the Community on foreign suppliers for some key components is still strong. The restructuring efforts of European groups to adapt their production

Figure 4
Electronic components
Distribution of world market for semiconductors, 1989



Source: BIPE

to demand are resulting in a greater capacity to satisfy market requirements, especially as regards microprocessors and memories but European manufacturers are faced with great difficulties. Among European producers only Siemens is producing DRAMs (Dynamic Random Access Memory), and after a strong growth in 1989 its DRAM operations have gone into the red with an operational loss of 400 million DM. Philips, on the other hand, after having revealed an operational loss of F1125 million in 1989, decided to suspend its 1 Mbit SRAM (Static Random Access Memory) production operations. Thomson-SGS, the other large European manufacturer has not yet found a partner to enter the memory chips market (there are still negotiations between SGS-Thomson and Siemens to jointly develop 16 Mbit DRAMs).

In microprocessors "some European companies have entered licence agreements with Japanese companies or are producing their own microprocessor design but they are still far from achieving the degree of independence in the production and control of a widely accepted microprocessor family. In ASICs (Application-specific Integrated Circuits) the European IC suppliers have installed service and technical support throughout Europe and their production share is higher than in other segments, however, their current position may be threatened by the increasing complexity of circuits and the associated demands for leading-edge process knowledge".(CEC, SEC(90) 1032)

Since the formation of the SGS Thomson Microelectronics group, three European groups have ranked among the twenty largest semiconductor companies in the world: in 1989, Philips ranked tenth, SGS

Table 2
Electronic components
West European semiconductor market share ranking

Company	Sales 1989 (million ECU)	Rank 1989	Sales 1990 (*) (million ECU)	Rank 1990	European Market share 1990
Philips	875	1	867	1	10.3%
Siemens	850	2	758	2	9.0%
SGS-Thomson	681	3	713	3	8.5%
Motorola	597	4	606	4	7.2%
Texas Instruments	588	5	500	5	6.0%
Intel	481	6	487	6	5.8%
Toshiba	384	8	412	7	4.9%
NEC	389	7	342	8	4.1%
National Semiconductor	346	9	306	9	3.6%
AMD	260	11	220	10	2.6%
Hitachi	264	10	215	11	2.6%
ITT	227	12	190	12	2.3%
Telefunken	195	13	189	13	2.2%
GEC Plessey Semicond.	-	-	162	14	1.9%
Samsung	182	14	149	15	1.8%
Fujitsu	180	16	141	16	1.7%
Harris	132	17	130	17	1.6%
Mitsubishi	182	15	121	18	1.5%
Analog Devices	86	21	81	19	1.0%
LSI Logic	66	23	71	20	0.9%

(*) Provisional figures
Source: Dataquest/January 1991

Thomson 12th and Siemens 15th. Philips, Siemens and SGS Thomson are the leaders on the European market, respectively occupying 1st, 2nd and 3rd place (see table 2).

European tube market and supply trends

The stiffening of world competition is keenly felt on the cathode ray tubes market. The EC tube market accounted for an estimated 2 billion ECU in 1989. The demand for television cathode ray tubes is increasing at a moderate and more or less stable pace, although its value is hardly increasing due to the trend towards lower prices.

In the medium term, this trend is expected to recover owing to the introduction of products connected with the development of high definition television (HDTV). However, the gradual introduction of EDTV (Enhanced Definition Television) in 1991 and 1992 is expected to promote the wide-

spread use of a new generation of receivers adapted to new broadcasting standards (MAC standards). These receivers will incorporate a new generation of cathode ray tubes (size 16/9th).

A major challenge for Europe's producers will be the penetration of LCD (Liquid Crystal Display) technology screens market which is rapidly expanding and is dominated by Japanese companies.

The manufacture of tubes in Europe is dominated by two groups: Philips, operating two large tube plants in France and Germany, and Thomson, whose output is mainly manufactured in Italy. The Finnish group Nokia is the third major supplier operating a plant in Germany. Major Japanese firms include Matsushita, Toshiba, Hitachi and Sony, while the consumer operations of RCA (General Electric), the main American manufacturer, were taken over by Thomson.

After Europe-wide restructuring efforts, pro-

duction is concentrated in large automated plants. This, combined with the vertical integration of Europe's manufacturers should enable the industry to maintain its position on the European market, despite the increasing production of South-East Asian countries.

The market of cathode ray tubes for other applications (computer and video monitors) is expanding faster, but most of these tubes are produced in Japan and South-East Asia.

European passive and electromechanical components market and supply trends

The 1989 EC market of passive and electromechanical components was estimated to be almost 7 billion ECU.

Germany is the leading European market (29%), far ahead of the United Kingdom (17%), France (16%) and Italy (8%).

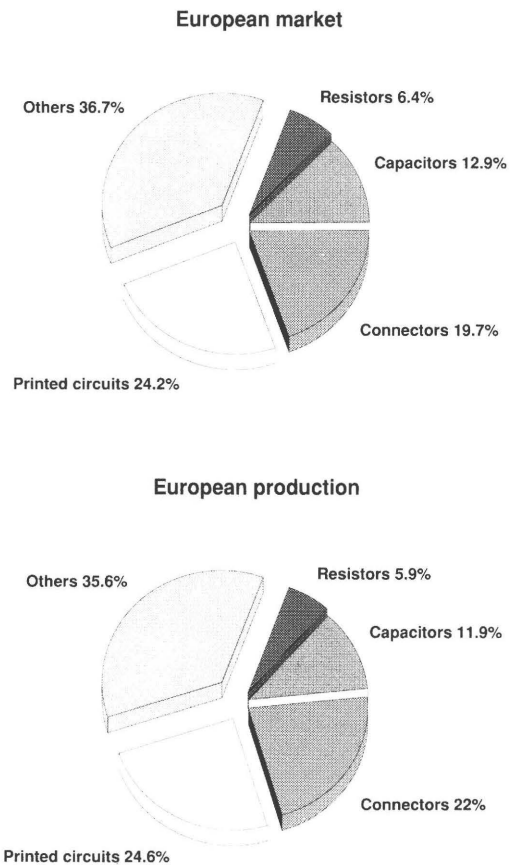
A market breakdown by product clearly reveals the large share of printed circuits (24%), connectors (20%) and, to a lesser degree, capacitors (13%) (see figure 5).

The demand for passive components is affected by the increasing integration of integrated circuits and hybrid circuits, making it possible to install new functions directly on circuits with the highest density and complexity. The impact of this trend is felt most on resistors, ferrites and coils, the prices of which are gradually going down. On the other hand, the development of integrated circuits is leading to a demand for components, mainly capacitors, connectors and printed circuits, whose share on the passive components market is expected to increase in the coming years. European production of passive and electromechanical components is mostly sup-

plied by small or medium-sized companies. A few major groups of European or world size occupy a stable position on the connectors and capacitors market: Philips, Siemens, Framatome and LCC of the Thomson Group (see tables 3 and 4). For the past few years, the passive component industry has been going through a major restructuring period, which is showing up in bankruptcy petitions, business suspensions, takeovers and mergers. The most recent and noteworthy of these actions include: AVX's purchase of STC's capacitor operations (United Kingdom) and Vishay's purchase of STC's resistor operations; the purchase of the two switch manufacturing divisions of the American Philips subsidiary by the British group Cambridge Electronics Industries; Vishay's takeover bid for Sfernice's resistor operations;

Framatome's entry into connector operations by acquiring the American group Burndy and the French companies Souriau

Figure 5
Passive components
Distribution of market and production by main product category, 1989



Source: EIC, 1990

Table 3
Electronic components
EC capacitor market share ranking, 1989

(%)	Market share
Philips	11
Siemens	9
AVX	9
Sprague	8
LCC (Thomson)	5
Roederstein	5

Source: Bipe (SIME)

Table 4
Electronic components
EC connector market share ranking, 1989

(%)	Market share
AMP	19
Framatome	10
Amphenol	7
ITT Cannon	6
Siemens	5

Source: Bipe (SIME)

and Jupiter; the partnership between Siemens and Matsushita for passive components; and, lastly, the acquisition of AVX by the Japanese company Kyocera. This trend is expected to continue in the future and lead to the constitution or reinforcement of entities of European or world size.

Employment

No precise data is available for employment in the electronic components industry on the Community level. According to EECA there were 233 391 people employed in the components industry in 1989 in the EC (without Belgium). Employment figures for 1988 and 1987 were respectively 229 080 and 233 810.

Trade trends

The trend in European components trade has been unfavourable since 1984.

In 1989, the overall trade deficit deteriorated to 1.8 billion ECU. The trade deficit for active components increased to 3 billion ECU.

These figures must be interpreted with

care because of nomenclature changes implemented in 1988. Furthermore, they conceal the fact that certain base components (e.g. wafers) are exported and, after further processing, reimported (e.g. as memories or microprocessors). The reasons for this include taking advantage of labour costs and/or customs duty differentials.

The negative trade balance is above all due to semiconductors, which are mainly imported from the United States (30%), Japan (25%), and the four main South-East Asian countries (almost 20%).

As regards imports of semiconductors, an increase of trade flows from Japan and the other Asian countries is to be noticed in 1989. Compared with the same period of 1988, the six first months of 1989 show a rise in imports from Japan (+48%) and from the four main Asian countries (+44%). The import of digital memories is the main cause of the trade deficit in semiconductors.

Despite the price fall, the imports of

DRAM during 1989 have strongly increased compared with 1988. The deficit is estimated to total approximately 900 million ECU in 1989.

A tariff of 14% has been placed by the EC on imports of semiconductors manufactured outside the EC. The tariff is subject of discussion at the Gatt negotiations. Regarding DRAM trade, a price agreement was concluded between EC and Japanese suppliers at the beginning of 1990, following the anti-dumping procedure submitted by the European suppliers. The EC Commission has terminated the anti-dumping procedure by accepting undertakings offered by eleven Japanese manufacturers and imposing a provisional anti-dumping duty of 60% on DRAMs from Japan. The undertaking will be in effect for a maximum period of five years. It establishes a framework for calculating reference prices (in effect for a three months period and adopted quarterly) below which sales must not be made. According to EC legislation, exporters can revoke their undertaking and re-

Table 5
Electronic components
EC trade in current prices, 1981-89

(million ECU)	1981	1982	1983	1984	1985	1986	1987	1988	1989
All components:									
Exports extra-EC	4 232	4 874	5 297	6 501	7 071	6 784	6 949	8 210	9 336
Index	60	69	75	92	100	96	99	116	132
Imports extra-EC	3 556	4 058	4 814	7 330	7 835	7 192	7 664	9 636	11 199
Index	45	52	61	94	100	92	98	123	143
X/M	1.19	1.20	1.10	0.89	0.90	0.94	0.91	0.85	0.83
Active components:									
Exports extra-EC	979	1 068	1 270	1 975	2 120	1 966	2 261	3 136	3 596
Imports extra-EC	1 850	2 110	2 600	4 232	4 450	3 907	4 259	5 743	6 562
X/M	0.53	0.51	0.49	0.47	0.48	0.5	0.53	0.55	0.55
Passive components:									
Exports extra-EC	526	602	650	794	835	818	862	931	1 048
Imports extra-EC	519	624	705	977	1 052	1 043	1 086	1 279	1 463
X/M	1.01	0.96	0.92	0.81	0.79	0.78	0.79	0.73	0.72
E-Mech components:									
Exports extra-EC	2 727	3 204	3 377	3 732	4 116	4 000	3 826	4 143	4 692
Imports extra-EC	1 187	1 324	1 509	2 121	2 333	2 242	2 319	2 614	3 174
X/M	2.3	2.42	2.24	1.76	1.76	1.78	1.65	1.58	1.48

Source: Eurostat (Comext)

quest a review by the Commission if it can be shown that the parameters on which the undertaking was based have changed significantly. In addition, the Commission has expressed its intention to re-view the situation in September 1991 when the US-Japan Semiconductor Agreement will lapse. Tubes also show a trade deficit, but to a lesser degree.

In 1989 exports of active components made up for little more than half the imports. However, exports rose steadily over the period from 1981 to 1988, reaching an average annual rate of 15.5%.

In passive components, the trade deficit has increased gradually since 1984 to reach 415 million ECU in 1989.

In electromechanical components, the Community has run a significant trade surplus since 1981. The surplus totalled 1.5 billion ECU in 1989.

Investment - Research and Development

Investment The manufacturing cost and investment structure for the semiconductor manufacturing process can be characterised as follows:

- ❖ Massive capital investment in wafer fabrication (front end) capacity;
- ❖ Considerable labour cost for test and assembly (back-end process);
- ❖ Materials costs associated with the procurement of the raw silicon wafers.

The ongoing refinement of production facilities to submicron technologies is placing an increasing burden on manufacturers. In order to remain competitive in the world market it is essential to keep pace in production technology. In 1985 a typical new semiconductor plant cost 145 million ECU; today this has risen to 225 million ECU.

Table 6
Electronic components
EC trade balance in semi-conductors, 1986-89

(million ECU)	1983	1985	1987	1989	1983-89
Discrete semi-conductors	-94	-133	-147	-195	12.9%
Integrated circuits	-967	-1 810	-1 293	-2 211	14.8%
Optoelectronics	-60	-103	-89	-64	1.1%
TOTAL semi-conductors	-1 122	-2 046	-1 529	-2 471	14.1%

Source: Eurostat (Comext), EC Commission

Table 7
Electronic components
EC trade balance in monolithic integrated digital circuits, 1986-89

(million ECU)	1986	1987	1988	1989 ⁽¹⁾	1986-89
Memory	-322	-340	-662	-893	40.5%
Micro-processors	-153	-229	-353	-362	33.3%
Other digital IC	-548	-613	-852	-876	16.9%
TOTAL digital IC	-1 022	-1 183	-1 868	-2 131	27.8%

⁽¹⁾ Greece estimated
Source: Eurostat (Comext), EC Commission

Table 8
Electronic components
Major investment plans in Europe by non-EC semiconductor manufacturers

Company	Location/ Date of operation	Investment cost (million ECU)	Activities
Motorola	East Kilbride (Scotland) 1989	119	Wafer fabrication (1 and 4 Mbit DRAMs)
Texas Instruments	Avezzano (Italy) 1990	1090	Wafer fabrication (4 Mbit DRAMs ASICs)
Fujitsu	Newton Aycliffe (UK) 1991	594	Wafer fabrication (4 Mbit DRAMs) 16 Mbit & ASICs
Mitsubishi	Aisdorf (NRW - Germany) 1991	207	Wafer fabrication (4 Mbit DRAMs ASICs)
NEC	Livingstone (Scotland) 1991	45	Wafer fabrication (4 Mbit DRAMs ASICs microcontrollers)
Hitachi	Landshut (Germany) 1992	114	Wafer fabrication (1 Mbit SRAMs, 4 Mbit DRAMs)
Intel	Dublin (Ireland) 1993	272	Wafer fabrication Board assembly
Harris	Devon (UK) 1994	204	Wafer fabrication (ASICs other)

Source: Dataquest and technical press reports

High production unit investment make it more and more necessary for manufacturers to rationalise their production. Such restructuring efforts are mainly undertaken by European companies (SGS Thomson, GEC Plessey Semiconductor) but American groups with units in Europe are also reorganising their operations (Texas Instruments).

The advantage of low labour costs in South-East Asia has encouraged manufacturers to move assembly units to this part of the world to maintain their position in an increasingly competitive environment.

At the same time foreign companies have stepped up direct investment in the Community, to strengthen their presence in the single European market but also in reaction to the modifications made in the rules of origin and the prospects of local content requirements in public procurement and new investment is expected from the Republic of Korea.

American companies, and Japanese in particular have announced large investment programmes.

Harris, the U.S. semiconductor company, has planned the investment of 85 million ECU into a European manufacturing plant aimed at strengthening its position in the EC. Inmos is getting a capital injection

from its new parent, SGS Thomson, in order to double wafer output at its Newport plant. Motorola is investing 50 million ECU to expand production of its UK memory production plant. Sprague intends to establish a new chip production facility in the UK. Similarly, Texas Instruments has announced a 1.1 billion ECU fabrication plant in Italy.

Arriving in Europe much later than the Americans, the Japanese are expected to make substantial investments over the next four years. The big four Japanese semiconductor companies - NEC, Hitachi, Toshiba and Fujitsu - will all establish wafer fabrication plants within the EC.

NEC has an existing facility in Livingston, Scotland, and Fujitsu has announced a 600 million ECU plant, also in the UK. As a whole, the EC has attracted some 3 billion ECU in investment from Japan.

Research and development The world electronic components industry is faced with an upward spiralling in research and development costs. It is estimated that research costs and investments for the development of the components for the years 1993-95, can reach up to 20% of turnover and a market share of 5-10% will be required to benefit from economies of scale in order to amortise research and investment costs. This, coupled with short product life-cycles, sometimes a matter of a few months for some consumer products, makes it clear that the components industry places itself in a precarious position between obtaining a healthy return on investment and making a loss.

So far, European manufacturers have tended to lag behind world developments and enter the market on the falling edge of the price curve after American and Japanese products have entered the mar-

ket. As a consequence, European manufacturers have failed to achieve payback on R&D investment and derive enough capital for the development of the next generation of components.

In order to assist the European semiconductor and IT industries to catch up with their Japanese and U.S. counterparts, a research programme known as JESSI (Joint European Submicron Silicon Initiative) has been launched at the initiative of various manufacturers led by Philips, Siemens and SGS-Thomson.

The overall budget for JESSI will be close to 3 800 million ECU over an 8-year period (1989-1996). Funding is shared between the participating companies (50%), their governments (25%) and EC contributions (25%).

The programme will cover four areas: process technology, end applications, production equipment and materials and basic research. JESSI involves many leading European high-tech companies: Philips, Siemens, ST, Nixdorf, Bosch, Telefunken and GEC Plessey among others. Within the framework of JESSI, ST has been entrusted with the mission of developing advanced Eproms while Philips will work on static RAMs (Random Access Memory) and Siemens on dynamic RAMs.

The announcement in January 1990 of the agreement between Siemens and IBM, the world's largest chip manufacturer, to develop jointly the next generation of memory chips of 64Mbits could provide substantial assistance to the JESSI programme. Costs that are estimated at around 450 million ECU will be shared equally by the two companies and production is scheduled to begin in the mid-1990's.

Table 9
Electronic components
European R&D expenditure, 1980-87

	R&D expenditure (million ECU)	% of sales
1980	86	5.6
1981	99	5.8
1982	112	5.7
1983	174	7.0
1984	285	7.0
1985	341	9.1
1986	320	9.1
1987	339	9.3

Source: Dataquest, March 1989, EC Commission

Philips' suspension of SRAM 1 Mbit memory production operations, announced as part of the group's restructuring plans, puts an end to the involvement of the Dutch group in one part of the JESSI program ("memories"). On the other hand, Philips will continue to contribute to the "logical" part of the same subprogramme, "process technology" as well as the "end applications" subprogramme. According to the latest available information, SGS Thomson, which is closely involved with SRAM, may decide to continue the JESSI SRAM programme alone or in collaboration with only one partner, such as Matra MHS.

Technology trends

The transistor of the 1950s was followed by the bipolar IC in the 1960s. The 1970s saw the semiconductor memory and microprocessor and by the 1980s there was CMOS (Complementary Metal Oxide Semiconductor) technology and the growth of semicustom application-specific ICs. These developments have supported the evolution of the semiconductor from discrete components to complex subsystems on silicon.

At the same time, material costs have remained virtually fixed. The more IC design elements can be shrunk, the more cost-effective complex ICs become. Density has increased from up to 2 000 transistors on a chip in the 1960s to today's upper reaches of several million transistor functions. Likewise, line widths of ICs have evolved from 5 microns in the early 1970s to today where the bulk of ICs have features in the 1.5 to 1.25 micron (1 micron = 10^{-6} metres) range and for leading-edge products the transition to 1 micron and below is underway.

The industry believes that line widths of

0.35 microns will be possible with optical lithography techniques by the late 1990s, following equipment refinements. The ability to go well into the submicron range without shifting to a new technique in the short-term is expected to offer a substantial cost saving. In optical lithography, ultraviolet light is used to transfer a circuit pattern on to the surface of a silicon wafer. Alternatively, lines smaller than 0.35 microns can be achieved using X-ray lithography. A further option is to use direct-write techniques where a directed energy draws the circuit pattern directly onto the wafer.

Lasers are now beginning to find use, as are X-rays. Key players in the major production regions have been supporting X-ray research programmes. In Europe the project is run by a consortium of semiconductor and production equipment companies, centred at the Fraunhofer Gesellschaft in West Berlin and funded by various European governments.

Japanese semiconductor manufacturing equipment suppliers now dominate the field, especially since Perkin-Elmer's exit from the business in April 1989.

The rate of product renewal is becoming faster and faster. This acceleration helps to push up research and development costs in the semiconductor industry.

This focus is demonstrated by the rapid pace of development in the semiconductor memory field where designs of 256 Kbit DRAMs (Dynamic Random Access Memory) have switched to 64 Mbit DRAMs. Silicon remains the most important basic material for the semiconductor industry, but regular progress is being made in the use of new materials, especially those based on gallium arsenide (GaAs). The

GaAs circuits market is likely to expand rapidly until 1994. GaAs and InP (indium phosphor) are increasingly used in optoelectronics.

The efficiency of MOS (Metal Oxide Semiconductor) technologies in terms of integration density per surface unit and signal propagation time contribute to their rapidly increasing use. The combination of MOS and bipolar technologies on a single circuit - accumulating the advantages of both (speed and lower power consumption) - offers promising prospects (BiMOS technology).

The technology of passive and electro-mechanical components is relatively mature. The most important technological change is the trend to surface mounting. This technique has penetrated all sectors of the market from surface mount capacitors and resistors to surface mount connectors and relays and, as a result, into printed circuit boards designed to accept these new components.

Eastern Europe

The trade of electronic components with Eastern Europe is modest. Exports to Eastern European countries totalled an estimated 270 million ECU in 1988 (source: Eurostat).

The Community's main partner is the Soviet Union, accounting for 43% of the exports of electronic components in 1988.

The economic liberation of the East is expected to encourage trade, especially in electronics. This trend can have a favourable impact on the EC industry and electronic components market. In the short term, Eastern European imports of consumer goods (TVs) and production equipment is expected to result in considerable expansion of the electronics industry and

Table 10
Electronic components
Production and market forecast, 1991-92

(million ECU)	1989	1990	1991	1991/90 (% var.)	1992	1992/91 (% var.)
All components						
Apparent consumption	17 276	18 237	19 337	6.0	20 736	7.2
Net exports	- 1 863	- 2 268	- 2 640	16.4	- 3 106	17.7
Production	15 413	15 969	16 697	4.6	17 630	5.6
Active components						
Apparent consumption	10 310	10 825	11 583	7.0	12 625	9.0
Net exports	- 2 966	- 3 224	- 3 564	10.5	- 4 045	13.5
Production	7 344	7 601	8 019	5.5	8 580	7.0
Passive components						
Apparent consumption	2 764	2 916	3 033	4.0	3 154	4.0
Net exports	- 415	- 497	- 542	9.1	- 538	-0.7
Production	2 349	2 419	2 491	3.0	2 616	5.0
E-Mech components						
Apparent consumption	4 202	4 496	4 721	5.0	4 957	5.0
Net exports	1 518	1 453	1 466	0.9	1 477	0.8
Production	5 720	5 949	6 187	4.0	6 434	4.0

Source: BIPE

therefore of the EC components market. In the medium term, the development of local electronics equipment production in the Eastern European countries will lead to more and more exports of components to these countries. Lastly, the construction of electronic component production units in Eastern Europe may be expected to result in cooperation, technology transfers and technical assistance.

Forecast and outlook

The EC electronic component market is predicted to grow by 6,6% per annum over the period 1989 to 1992. The strongest growth is forecast in the active components sector. Passive components and electromechanical components are ex-

pected to grow more slowly.

The active components market is forecast to increase at the rate of 7% in 1991, of 9% in 1992 reflecting the growth stage of the period. Within the semiconductor market, ICs will show the strongest growth, particularly in the Federal Republic of Germany, France and Italy. The slowest growth rate is expected in discrete components.

The passive components market will show some growth, forecast at 4% per annum over the period 1990-1992.

The electromechanical sector is projected to grow by about 5%.

During the same period, EC components production will continue to increase an

average of 5% per year. The production of active components will rise slightly faster than electromechanical components and passive components (6% compared with 3% and 4% respectively).

Written by: BIPE

The industry is represented at the EC level by:
EECA: European Electronic Components Association
Address: Rue d'Arlon 69-71, bte 8,
B-1040 Brussels; Tel: 230 96 30; Fax: 230 96 05

A new wide range of products and services is being offered in the telecommunications market. The process of market liberalisation in progress in the EC Member States is going to contribute to the growth of demand in the 1990s. High growth segments are mobile communications, space communications, optical transmission and some business communications products. Infrastructure disparities are wide between EC Member States and new opportunities are created from the unification of Germany and the opening of Eastern European countries. Increased business demand calls for advanced network infrastructure, while residential demand has a great potential as it still remains untapped. European suppliers appear to be in a strong position, but face strong competition from US and Japanese suppliers especially in data communication products and terminals for which the EC has a negative trade balance. Concentration has increased in recent years but new entrants exploiting niche markets are strengthening competition. In the future, the competitiveness of EC manufacturers in mobile communications will be a determining factor.

Description of the sector

The telecommunications equipment industry, which is part of the electronics industry, is mainly linked to the following sectors:

- ❖ Upstream - Electronic components (particularly optoelectronics and microwave), Software (e.g. Intelligent Networks, mobile communications), Aerospace (satellite communications);

- ❖ Downstream - Network Operators (public or private), Value Added Services Providers, Installers and Retailers.

In particular, telecommunications equipment cannot be treated in isolation from the telecommunications services sector, for which it provides the networks and terminals. As network operators represent more than half the total demand for equipment, any change in the telecommunications ser-

Table 1
Telecommunications Equipment
Main indicators, 1980-92

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Apparent consumption	12 734	14 113	15 136	16 302	18 250	20 184	20 307	21 555	22 848	24 219	25 672	28 240	30 216
Net exports (*)	1 500	1 759	1 949	1 949	1 745	1 570	1 233	1 029	91	109	125	405	754
Production	14 763	16 379	17 593	18 543	20 601	22 390	22 226	22 584	22 939	24 328	25 798	28 645	30 970
Employment (thousands)	380	351	340	329	315	294	286	279	270	261	255	250	250

(*) A change of trade nomenclature in 1988 makes a comparison of pre 1987 and post 1988 figures hazardous
Source: Eurostrategies ESTEL, Eurostat

vices sector (either economic or regulatory) will have a major influence on the equipment market, and vice versa.

Telecommunications equipment basically includes three types of products:

- ❖ Switching equipment, either public (inside the network) or private, representing nearly half of European production;
- ❖ Transmission equipment, including electronics to generate and receive signals, and cables to support it (when necessary);
- ❖ Terminal equipment, to send and receive either voice, data, text or image communications.

Definition of an appropriate nomenclature field It is always difficult to determine and maintain a nomenclature which would reflect as accurately as possible the importance and evolution of a sector.

As far as telecommunications equipment is concerned, NACE 344 presents two major drawbacks:

- ❖ It includes a large field of equipment which has nothing to do with telecommunications, mainly counting and measuring systems and electromedical systems;
- ❖ It does not include a number of telecommunications segments, particularly among those whose high growth rate is reflecting the revolution currently in progress in the field, e.g. mobile communications, data communications, satellite communications.

This is why a new nomenclature is proposed, which includes only telecommunications equipment, but in a broad enough

sense to take into account the major technological changes which have or will have a decisive impact on the sector, in terms of market size, trade balance and employment (see table 1).

In particular, this rather large nomenclature includes, in addition to NACE 344, the following equipment:

- ❖ All transmission systems, either by cable or microwave (including satellite and mobile communications), for all kinds of communications (telephony, data communications);
- ❖ All telecommunications cables (including copper and fibre), included in NACE 341.

Current situation

Telecommunications equipment is entirely electronic today, and almost entirely digital. For instance, the digitalisation rate of the public switching market was around 75% in 1989, and is expected to reach 100% by 1995.

Thanks to this major technological change, telecommunications have switched from a single-product telephone industry to the supply of a wide range of voice, data, text and image communications products and systems.

The EC telecommunications equipment market, which represents about a quarter of the world market, is growing, as the demand for its increasing range of systems from network operators and professional users is still on the rise. In addition, the liberalisation process currently in progress

in the Community will probably contribute to this increase in demand, with more open competition and lower prices, particularly in terminals and other Customer Premises Equipment (CPE).

Thus, the overall demand should grow by 7.7% in real terms up to 1992 (including Unified Germany from 1991) particularly due to segments such as mobile communications and space communications, optical transmission and some business communications products, whose growth over the period is expected to stay above 10%.

EC suppliers are in a rather good position, compared with the electronics industry on the whole. Indeed, the trade balance remains slightly positive, and thanks to a recent reorganisation of the EC industry, EC suppliers are well placed among the largest suppliers in the world, except for some particular segments in terminals (e.g. fax machines) and data communications (e.g. voice/data multiplexers).

But as the telecommunications industry was engaged in a switch from electromechanical to electronic equipment, employment decreased steadily, reflecting both the shift of value added upwards into the components of the systems, and large productivity gains.

The switch to digital electronics has been accompanied by a dramatic increase in R&D and manufacturing investments.

The telecommunications equipment industry is now one of the most R&D intensive

sectors (more than 10% of total turnover), a situation which should not change over the next period with the introduction of mobile communications, optical local loops, advanced switching techniques for broadband communications, and Intelligent Networks.

These new technological steps will contribute to extend the use of telecommunications equipment and services, provided that prices will decrease, whose respective markets are expected to go on increasing over the next ten years.

In addition, the unification of Germany should render the EC market (thanks to a 10% 90-91 growth rate) almost as large as the US market, and the opening of Eastern Europe markets should help EC suppliers reinforce their world position and strength.

Analysis of the demand: a major growth potential

The demand in telecommunications equipment can be broken down into two main types of final customers:

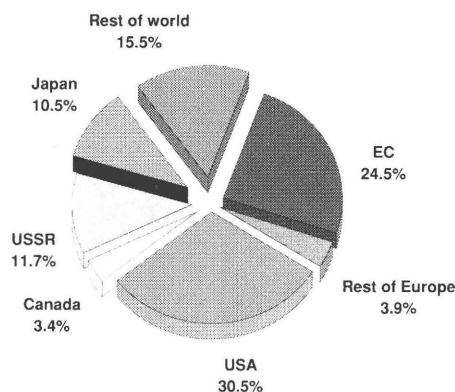
- ❖ Network operators, who have to build, update, maintain and manage their networks, and who mainly buy public switching and transmission equipment, represent over half the total market;

Table 2
Telecommunications equipment
Breakdown of the demand
by type of product 1989/1992

	1989 (%)	1992/89 AAGR (%)
Public switching	22	7
Transmission	20	6
Terminals	19	10
Private switching	13	6
Data communications	10	8
Mobile communications	5	15
Other	11	7
Total	100	7.7

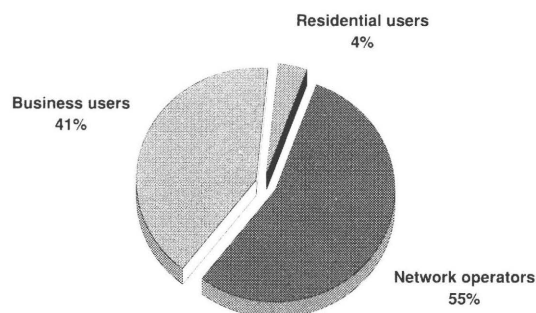
Source: Eurostrategies ESTEL

Figure 1
Telecommunications equipment
Breakdown of world market in 1989



Source: Eurostrategies (Estel)

Figure 2
Telecommunications equipment
Breakdown of the demand by final customer in 1989 (1)



(1) Network operators' purchases of CPE distribution are counted as user's equipment
Source: BIPE estimate

- ❖ Business users, who use public networks for their communications needs, and whose demand mainly concerns terminals, data communications and private switching, represent 41% of the total market.

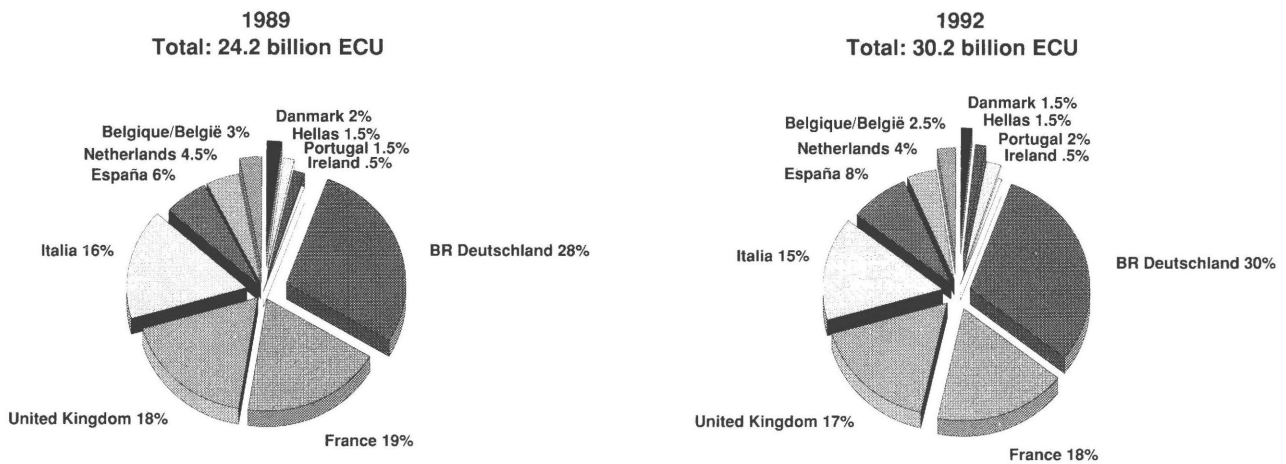
The rest of the market is covered by residential demand, which mainly concerns telephones, answering machines, and videotext terminals especially in France.

Increasing business demand calls for advanced network infrastructures

The growing diversity of telecommunications products and services (voice, data, text, image and value added services) answers the increasing demand of European business users, who are in the process of inter-

nationalising their structures and of seeking new ways of improving productivity. In such a context, telecommunications equipment is increasingly considered a strategic resource by business users, particularly in activities where it is used as a marketing tool (airlines, tourism, banking, etc.). Thus, business expenditure in telecommunications equipment is expected to continue growing over the coming years, with the development of integrated voice/data communications, and with the increasing use of fax and mobile communications. But this expected growth in users' needs will be possible only if public network infrastructures have the capacity to support the full range of advanced communications required by corporate users. There-

Figure 3
Telecommunications equipment
Breakdown of demand by country



Source: Eurostratégies (ESTEL), BIPE estimate

fore, building a modern, pan-European public network is a critical issue for the Community and its economic development.

This is the purpose of the Green Paper of the Commission of European Communities, in which the framework for a harmonised development of digital interconnected networks is defined, in terms of standards and time schedule.

The main steps of building a real Europe of Telecommunications are the following:

- ❖ The introduction of a pan-European ISDN (Integrated Services Digital Network) is already in progress, as are the interconnection possibilities between national networks: in 1990, the major ISDN nations (i.e. France and Germany within the EC, USA and Japan outside) carried out mutual interconnection tests, working towards a Worldwide Integrated Communications Network;
- ❖ The introduction of the GSM digital mobile network will begin in 1991; the joint development of this network throughout the Community should allow for pan-European car-phone communications;
- ❖ The introduction of the ERMES network (European Radio-paging MEssaging Sys-

tem) should allow, as early as the beginning of 1992, for alphanumeric messaging combined with electronic or voice mail throughout the Community;

- ❖ The introduction of Personal Communications, based on a pocket terminal which would allow individuals to send and/or receive calls from anywhere in the street or office, through a mobile infrastructure. The Telepoint service, already in operation in London, is the first commercial example of Personal Communications, though it provides only one-way communications;
- ❖ The progressive introduction of Broadband ISDN, in the 1995-2000 period, should allow for integrated text/moving image/voice communications over all the Community's Member States;
- ❖ The development of a single European market in satellite communications as set out in the Green Paper of the CEC in November 1990.

Such network developments, which are expected to give the EC the most modern network infrastructure, should generate a strong demand from network operators. This demand, together with the demand

from business users, will probably result in a constant growth of the market for telecommunications equipment, though partly tempered by decreasing unit prices, mainly because of the opening of the market in the EC.

Residential customers: untapped potential resources

Though until now new services have hardly penetrated the residential sector, and this demand remains mainly based on telephone terminals, the situation could well change over the next period, with the widespread use of personal mobile phones and text communication. The French Minitel is an example of the diffusion of new services among residential users, as are the so-called "Comfort services" which have extended over the major European countries.

Thus, thanks to the diffusion of ISDN, mobile or fax communications, the residential demand could become a major growth factor, particularly from 1995 on; this will be true mainly for terminals (but also for network equipment, since the network would have to handle extra traffic), provided users can buy them at reasonable prices.

Geographical breakdown of demand

The breakdown of the EC telecommunications market by country reveals that the size of each national market is not only related to population size, but also to the GDP of each country: the richer the country, the larger its market for telecommunications equipment, and the more advanced its network. Thus, developing new network infrastructures such as ISDN at a pan-European level appears to be difficult, taking into account the extreme disparity of infrastructures between countries such as Portugal or Greece on one side, and France, Germany or the UK on the other.

The purpose of the CEC's STAR programme is to help the least technologically advanced countries develop ISDN in time so as to meet the time-schedule for interconnection.

Three of the most advanced countries, should see their market grow significantly in the near future: Spain and Italy, where the network has to be seriously modernised to meet business requirements; and Unified Germany, where the infrastructure of the ex-Eastern Germany is obsolete and under-developed.

Supply and production

Among the 15 top suppliers in the EC market (who together represent 90% of the market), only two are not European (and 5 are not domestic).

Indeed, telecommunications equipment remains one of the few IT sectors where Europe still represents an important share in world production.

The switch to digital technology, and the tremendous increase in development costs which resulted (1 to 2 billion ECU to develop a new range of Central Office switches), has generated a vast restructuring movement. This process started at the beginning of the 1980, and is not yet complete, though both the announcement of Alcatel's takeover of Telettra (in October 1990) and the finalising of the Siemens-GEC deal significantly increase the concentration ratio in the EC.

In fact, the industry is very concentrated, both at world and EC level. The top twenty worldwide suppliers represent 62% of the total world market, while the top ten in the EC market (all domestic suppliers except Motorola) cover 81% of the market.

This last figure reveals how radical the restructuring has been within the EC, while

Table 3
Telecommunications equipment
Concentration ratio of telecom equipment supply in the EC and the world, 1989

(% of total market)	World	EC
TOP 5	32	65
TOP 10	49	81
TOP 20	62	92

Source: Eurostrategies (ESTEL)

the difference between EC and world figures shows how regional, the world market remains. In fact, telecommunications equipment is organised along three main manufacturing zones, each of which includes a few top suppliers who dominate their domestic market.

European suppliers today appear to be in a rather strong position: Alcatel has virtually become the world leader (taking into account Telettra's turnover), and seven European companies are among the fifteen top suppliers in the world, against four North American and four Japanese firms.

These major EC manufacturers, who have mainly attained a world size through a series of mergers and acquisitions, have become truly European, with production plants spread throughout the Community.

But these world leaders do not all have the same industrial structure, as is shown

Table 3
Telecommunications equipment
The top 15 telecom equipment suppliers of the EC market

Alcatel + Telettra	F	1	5 334	Public switching	Transmission	Business com
Siemens/GEC	D	2	4 644	Public switching	Transmission	Business com
Ericsson	S	3	1 610	Public switching	Business com	Mobile
Bosch	D	4	1 575	Business com	Transmission	Mobile
Italtel + AT&T NSI	I	5	1 456	Public switching	Business com	
Philips	NL	6	1 181	Transmission	Business com	
Motorola	USA	7	1 089	Mobile	Business com	
STC	UK	8	720	Transmission	Business com	
Matra	F	9	599	Public switching	Business com	Mobile
Sagem/Sat	F	10	471	Business com	Transmission	
IBM	USA	11	438	Business com		
Ascom	CH	12	400	Business com	Transmission	
Racal	UK	13	320	Business com	Mobile	
Pirelli	I	14	299	Transmission		
Nokia	FL	15	264	Mobile	Transmission	

Note: Business communications include private switching, terminals and data communications
Source: Eurostrategies (ESTEL), based on 1988 Company figures

Table 5
Telecommunications equipment
The top 15 world telecom suppliers

(million ECU)	Country	Rank	Telecom turnover	Main areas of activity		
Alcatel + Telettra	F	1	8 040	Public switching	Transmission	Business com
AT & T	USA	2	8 010	Public switching	Transmission	Business com
Siemens/GEC	D	3	7 990	Public switching	Transmission	Business com
NEC	J	4	4 680	Public switching	Transmission	Business com
Northern Telecom	USA	5	4 350	Public switching	Business com	
Motorola	USA	6	3 630	Mobile	Business com	
Ericsson	S	7	2 960	Public switching	Transmission	Mobile
Fujitsu	J	8	2 150	Public switching	Transmission	Business com
Bosch	D	9	1 750	Business com	Transmission	Mobile
IBM	USA	10	1 750	Business com		
Italtel + AT&T NSI	I	11	1 615	Public switching	Business com	
Philips	NL	12	1 440	Transmission	Business com	
Matsushita	J	13	1 200	Business com		
Hitachi	J	14	1 150	Public switching	Business com	
STC	UK	15	970	Transmission	Business com	

Note: Business communications include private switching, terminals and data communications
Source: Eurostratégies (ESTEL), based on 1988 Company figures

by the following breakdown into different categories:

- ❖ The telecommunications specialists (i.e. those for whom telecommunications equipment is the dominant activity), but which are rather generalists within the telecommunications equipment sector, like Alcatel, Ericsson (which can be considered an EC supplier though a Swedish firm) and Italtel, and like the North American suppliers AT&T and Northern Telecom;
- ❖ The electronics generalists, like Siemens, Bosch and Philips in the EC, and like the four Japanese firms;
- ❖ Apart from these two main categories, Motorola and IBM, who specialise in particu-

lar segments of telecommunications equipment (IBM in data communications, Motorola in both mobile and data communications), but whose dominant position in these segments allows them to be present among the leaders of the sector as a whole.

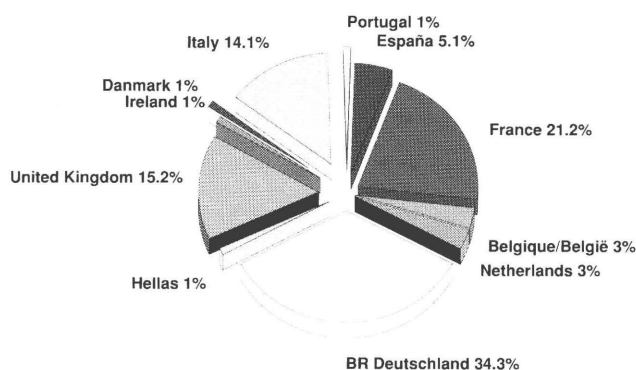
As for AT&T, the years 1989/1990 appear to be decisive in terms of its European strategy. In fact, the first US supplier has got a serious foothold in Italy (through its agreement with Italtel) and Spain (with the installation of a manufacturing centre in Madrid, and the participation of the Network operator in its European subsidiary AT&T-NSI), both countries representing

high-growth EC markets. AT&T could therefore succeed in penetrating the strategic EC market for public switching, which is still dominated by domestic companies. Behind these leaders stand a group of medium-sized players, such as Matra, STC, Sagem and Racal, who generally have a series of agreements between them, or with foreign suppliers. For instance, STC and SAT (Sagem group) are linked together in transmission, while Matra and Racal have close contacts in mobile communications. But Matra say they have not yet reached the necessary critical size to support the costs of developing the next generation of PBX, and are thus looking for partners outside the EC. Their recent acquisition of Intecom, a small US PBX supplier, should be part of this strategy.

Investment and competition

This high degree of concentration is probably due for the most part to the amount of investment required to develop and produce competitive telecommunications equipment, particularly in public network equipment, private switching and terminals. However, the nature of investment varies

Figure 4
Telecommunications equipment
Breakdown of EC production by country in 1989
(% in EC production)



Source: Eurostratégies (ESTEL)

according to the segment considered. Investment in telecommunications equipment can be broken down into two different classes, whose respective importance depends on the type of product:

- ❖ High manufacturing investment, particularly in terminals.

Terminals are characterised by the importance of the Sophistication/Price/Quantity equation, which can only be competitively solved through high investments in the manufacturing process. The experience of Japanese and Asian suppliers in this type of mass market, similar to hifi products, has helped them to gain market shares in the EC in such segments.

- ❖ R&D investment, which is particularly high in switching (both public and private), and network infrastructure in general. As an example, development costs for a new range of Central Office Switches represent a total of 1 to 2 billion ECU, so that any supplier would need to cover at least 15% of the world market to amortize its investments.

In fact, the telecommunications industry in its entirety (including equipment and services) has become among the most R&D intensive, with 5.4 billion ECU overall in 1988 for the EC, compared with 7.0 in the USA and 3.8 in Japan. Though these figures, which put together R&D in equipment and services, must be used carefully, they show the rather strong position of the EC compared with its main rivals. In fact, R&D in telecommunications is a point where operators and suppliers are more or less linked. Indeed, a significant share of R&D in equipment is financed by operators, who really play a key role in the equipment industry, as main customers but also as R&D contractors.

The European Commission is a major R&D contractor in telecommunications, through the RACE programme, which concerns all fields of telecommunications technologies.

New entrants Apart from those segments with a high level of investment, and consequently high barriers to entry, the telecommunications equipment industry includes a number of niche segments, especially in data communications (modems, multiplexers, communication add-on boards,...), which often correspond to emerging markets, characterised by their small size and high degree of innovation. Supply is then far less concentrated in this type of segment, in which there are a number of small, innovative firms, with many new entrants, so that the overall concentration of the telecommunications sector may not have increased, if not actually decreased, over the last ten years. But these small, specialised firms are not the only new entrants in the field. Thomson, for instance, which has been absent from the telecommunications field since its 1984 agreement with Alcatel, has had a limited activity in French video communications networks for two years, and is now looking with attention at the development of mobile communications, as a world leader of military applications in this area (Thomson is the supplier of RITA, a mobile system in use in the US army). The development of new technologies in telecommunications contributes to open the market either to small, high-tech players, or to larger corporations who can draw on their background in these technologies.

Vertical integration A number of recent events have shown signs of vertical integration from equipment suppliers, some of which are moving into network operating or to CPE distribution. Among the new mobile

operating consortia which have been created over the past three years, practically all include at least one equipment supplier as shareholder. Motorola, STC and Matra for instance, have made significant investments in the creation of Telepoint and PCN mobile networks in the UK.

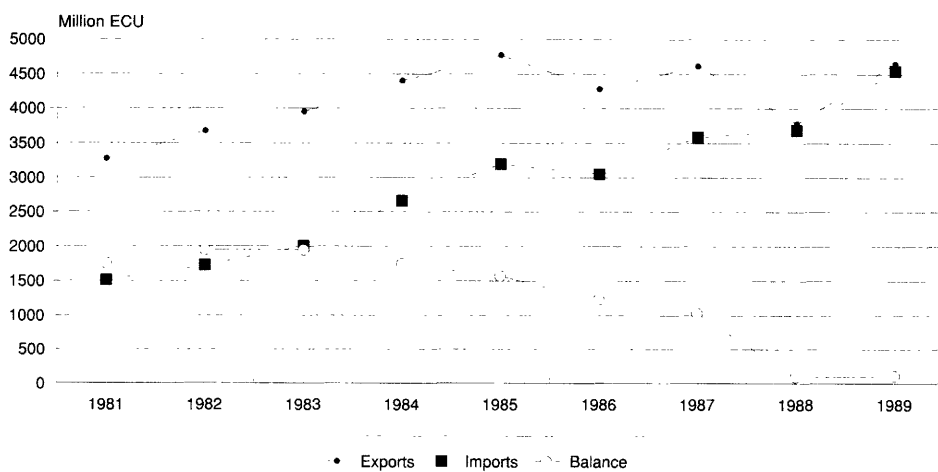
This type of operator/supplier association appears at the same time as an opportunity for the operator to share the initial investment for building the network, and as an opportunity for the supplier to share the expected operating profits. In a somewhat different way, Alcatel unveiled in 1990 its intention to become a VANS operator, based on its own corporate network, though its offer of services is for the moment limited to the companies inside the CGE group, to which Alcatel belongs. But for many years Alcatel has shown another type of vertical integration, since it possesses its own Business Communications distribution channel in France, as does its French competitor Matra. Controlling distribution ensures manufacturers that the right solution to increasingly complex corporate customers' requirements is proposed to them. But it could also represent a means for suppliers to accompany the shift in profits from hardware to sales and after sales services (maintenance, development of custom functionalities,...) which is taking place in the PABX field.

Do these signs of vertical integration prefigure a general trend or not? In all cases, they reveal the closeness and interpenetration of suppliers/operators relations.

Trade

The telecommunications equipment trade was in balance in 1989, and is expected to improve slightly over the next few years

Figure 5
Telecommunications equipment
The evolution of EC trade balance (1)



1981-1983: EC 10
1984-1989: EC 12 without Portugal and Spain
(1) Change in nomenclature from 1988 figures
Source: Eurostat (Comext)

to create a trade surplus of 750 million ECU in 1992.

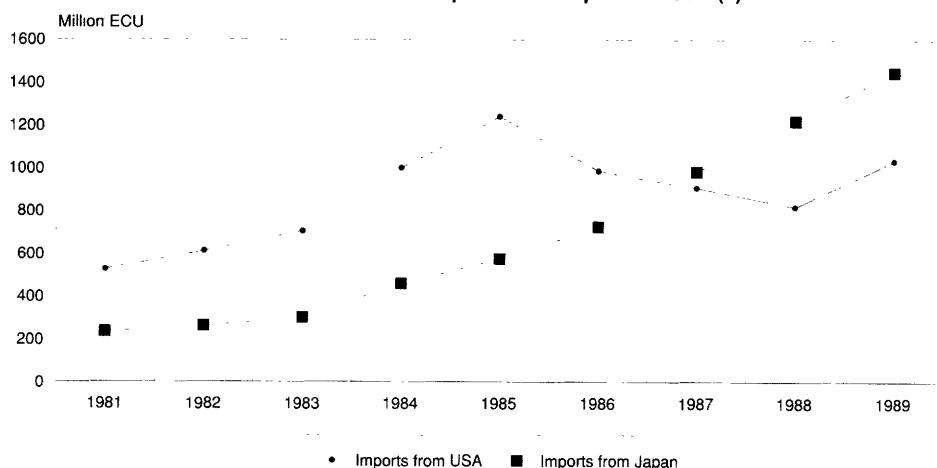
This positive trade figure, which is quite exceptional in IT industries, reflects the overall competitiveness of EC supply in the sector.

However, the balance has decreased on a regular basis from the 1983 level of nearly 2 billion ECU to near zero in 1988, showing the relative vulnerability of the EC, particularly in the face of its main rivals in the USA and Japan, with whom there is a trade deficit.

This progressive deterioration was mainly due to two types of products:

- ❖ Data communications products, where USA suppliers, benefiting from the earlier development of their domestic market and from their strength in data processing, appear as serious competitors;
- ❖ Terminals, where Asian suppliers have progressively gained important market shares in the EC, with their experience of mass market electronic products requiring high manufacturing investment and the development of large production series.

Figure 6
Telecommunications equipment
The evolution of imports from Japan and USA (1)



(1) Change in nomenclature from 1988 figures
Source: Eurostat (Comext)

As those two segments have grown significantly recently, with the need from business users for computer interconnection and text communication, they have had a dramatic impact on overall trade. In particular, the impact of fax machines, which have seen explosive growth in the EC, mostly through Japanese supply, has been the major factor in the overall decrease. In the recent period, the Community's net balance in equipment appears to have stabilised, the first half of 1990 seeing an improvement in the net deficit with Japan.

A more controversial segment as far as trade is concerned is mobile communications. Motorola's position among the top ten suppliers of the EC market for telecommunications equipment is mostly due to its mobile communications products, which demonstrates the relative weakness of leading EC suppliers in this area. But at the same time, Ericsson (if considered an EC supplier) and medium-size suppliers like Matra, Nokia or Racal have developed competitive products in mobile communications.

The competitiveness of EC supply in mobile communications is a very important issue in 1990, since mobile communications are expected to become one of the largest segments by 1995. Will the EC suppliers be able to increase their competitiveness in the field, benefiting from the introduction of digital cellular systems, as Alcatel is preparing to do? The answer to this question will probably have important consequences for trade figures, and for the competitiveness of EC suppliers in the world market.

Employment

The overall employment in the telecommunications equipment sector has steadily

decreased over the last 15 years. Indeed, whereas in 1980, there were 320,000 workers in the sector (according to our new nomenclature), there were 260,000 in 1987, with an expected 250 000 by 1992.

The switch to digital technology was the main reason for such a decrease in employment, since it generated two major changes in the industry structure:

- ❖ A shift of value added upwards to the electronic components sector;
- ❖ Dramatic productivity gains when passing from electromechanical generation to digital, and with the development of CAD/CAM;
- ❖ The diversification of applications and products in telecommunications has generated the need both for greater cooperation with related activities, and for more subcontracting, since developing a new product requires a larger range of skills.

In addition, the concentration and rationalisation process which took place at the same time contributed to this decrease in the level of employment, which would have been even higher if the demand for telecommunications equipment had not simultaneously significantly increased (even if this is only partly revealed by the figures, due to a price decrease that took place at the same time).

Thanks to the expected high level of the demand for public network and corporate equipment in the near future, the level of employment should stabilise, though the increasing interpenetration between telecommunications equipment and related sectors such as data processing, software services and broadcasting equipment and improved manufacturing technology, such as increased components' integration, makes it

hazardous to predict very accurately.

Main factors of change

Liberalisation of telecommunications

equipment and services Under the initiative of the Commission of the European Communities, telecommunications equipment is progressively passing from national, regulated contexts to a unique open and competitive market, following the guidelines of the 1987 Green Paper.

With the liberalisation of terminals distribution achieved throughout the EC, 1990 has been a turning point in this liberalisation process with the adoption of two important directives:

- The terminals directive, which contributes to the suppression of national boundaries for approvals procedures;
- The Public Procurement Market Directive, which should help open up EC markets for network equipment.

The Terminals Directive is based on mutual recognition of national Approvals tests, so that a terminal which has passed the tests in one EC country is considered approved in all EC countries. Such a directive should help to open national barriers, and to harmonise terminals prices, a domain where national variations are still considerable.

The Public Procurement Markets Directive establishes transparency and non discrimination for all Public markets in telecommunications worth over 600,000 million ECU (which represents 80% of the total value of such markets). It could then facilitate the introduction of competition into the network equipment segment, which still remains dominated by domestic and many national firms.

These regulation changes, together with the important work in the domain of tele-

communications services, should have considerable impact on the players in the field, in terms of number of players, inter-relations between them, and open competition.

The liberalisation of services, which is taking place in parallel, should in addition contribute to market growth, with the multiplication of service providers and network operators, and their needs in terms of infrastructure equipment

Wireless communications

The introduction of digital mobile communications as well as the progress in satellite communications will deeply change the traditional concept of a network. Apart from the revolution which mobile communications introduce in the usage of telecommunications, they also bring greater facility for potential new operators, who would no longer need any cables and ducts to create their own infrastructure. The recent example of the Motorola project is a good illustration of this: Motorola intends to create a worldwide mobile network based on 77 satellites covering most of the earth, for a total investment of less than 2 billion ECU. The liberalisation of two-way VSAT (a new generation of small, cheap satellite antennas) could encourage similar initiatives from other potential operators.

In the same way, the introduction of Personal Communications systems in the local loop (mobile pocket phones with a network made of microcells in which a small box manages communications) is likely to facilitate the emergence of new service providers, as happened in the UK with the launch of the Telepoint service: four operators are licensed, each with its own network.

Provided the regulatory and economic con-

Table 6
Telecommunications equipment
Development of networks and presence of EC suppliers in Eastern Europe

	Inhabitants (millions)	Main lines (millions)	Telephone density	Presence of Western suppliers
USSR	271	24.5	9.0	Alcatel (Public switching) Siemens (Public switching) Italtel (Public switching)
Poland	38	2.8	7.3	Alcatel (Public switching)
Yugoslavia	23	2.7	11.6	Alcatel (Public switching) Ericsson (Public switching) Siemens (Public switching)
Romania	22	1.5	6.7	
Czechoslovakia	16	2.0	13.0	Siemens (Public switching) Ericsson (Public switching)
Hungary	11	0.8	7.7	Alcatel (PABX) Ericsson (Public switching) Northern (Public switching) Siemens (Public switching)

Source: BIPE

ditions are favourable, the development of wireless communications equipment could endure an even faster growth, with the multiplication of network infrastructures they bring with them. In order to foster the development of such services, particularly on a pan-European basis the European Commission has undertaken a number of initiatives and adopted a number of Directives for GSM, DECT and paging (ERMES). To date, these initiatives have focused mainly on frequency reservation and coordination and the coordinated introduction of new services.

The opening of Eastern European

countries The opening of Eastern European economies has raised the problem of developing communications with Western countries. Thus, the current underdevelopment of telecommunications networks in these countries has become a crucial problem, for which Eastern European governments are looking for rapid solutions. EC suppliers have been active throughout 1990 working to gain positions in these promising countries through a number of joint-ventures with local suppliers.

After a first round, Alcatel and Siemens are both well placed in the three main countries (Hungary, Poland and Czechoslovakia), as well as in the ex East Germany; they have become the two leading German suppliers (Alcatel is a major German manufacturer through its SEL subsidiary), and also figures significantly in the large USSR market. The development of Eastern European markets could therefore allow the top EC suppliers to increase their world market shares, without being confronted by the difficult challenge of investing in the North-American and Japanese markets, which appear rather closed to them, except for Siemens, whose presence in the US market is far from negligible.

Outlook

The next five years for telecommunications equipment should be marked by the following major events:

- ❖ The opening of the Community markets for equipment, which should contribute to changing the rules of the game for domestic suppliers including the transition to Community-wide type approval for equip-

ment;

- ❖ The increasing importance of mobile communications, particularly through the development of the GSM network for digital cellular radio-telephones, and the development of Personal Communications, which has already begun in the UK;
- ❖ The development of business Communications as a strategic and marketing tool to win new market shares, at the regional, continental and international levels;
- ❖ The development of wireless communications networks, either by traditional public operators or new entrants.
- ❖ The opening of Eastern Europe markets, which should represent an opportunity for EC suppliers to develop their production. Remaining competitive in this double context of fast-growing markets and more open competition will require reinforced cooperation, particularly in R&D and Public Network developments, from EC players, who will be confronted by US and Japanese rivals eager to benefit from a newly liberalised environment. Thus, provided EC suppliers are able to complete the rationalisation they have undertaken, and to remain competitive on the critical segments (i.e. optical transmission, switching, mobile communications), they could benefit from the installation of modern pan-European infrastructures, and from the opening of neighbouring Eastern European markets with strong potential.

Written by: BIPE

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Computers and office equipment are increasingly becoming vital not only for economic activity, but also more generally for social life. This has largely been brought about by the diffusion of information technology through microprocessors, memories and personal computers into new applications and new categories of users.

The main growth factor during the 1980s has been the development of the personal computer market, whereas the mainframe segment is now more mature. In the coming period, networks and communications should be the principal growth areas.

This constant emergence of new and fast-growing product areas enables new players to enter the scene, and toughens competition.

European industry has experienced a global loss in market shares, in particular in the field of peripherals, but also because it was less present in personal computers. This shows up in the EC trade balance: the trade deficit increased sharply during the 1980s from about 10% of the market to almost 20%.

Sector definition

This chapter covers computing equipment and office machines (NACE 33). This statistical category includes all computer processors and peripheral equipment as well as office machines such as typewriters, accounting machines, cash registers; however photocopying, facsimile machines and data transmission equipment are not included. This definition is used for the data given throughout this chapter, except where otherwise stated.

The Eurostat NACE data presented here covers nine of the EC countries, excluding Greece, Portugal and Spain, for which comprehensive statistics were not available for inclusion.

The basic statistical data is from Eurostat; this however only gives fairly aggregated data. When no statistical data was available, estimates were made using national statistics or company reports, or other sources such as Datamation, Dataquest, IDC, Gartner Group, EIC, etc. This is be-

Table 1
Computer and office equipment
World Market for Information Technology, 1989

(billion ECU)	Computer equipment	Office machines (*)	Total	Share (%)
USA	64	11	75	39
Western Europe	54	5	59	31
Japan	32	4	36	19
Other	19	3	22	11
Total	169	23	192	100

(*) Including copiers and LANs
Source: Bipe

cause statistical data does not generally provide adequate breakdown by products, nor does it give company data. Moreover the comparison of production and foreign trade figures is often very difficult, in particular because of a large proportion of "parts" in computer equipment trade figures.

Production and consumption

Western Europe accounted for 31% of a total world market for computers and office equipment estimated at 192 billion ECU in 1989.

Office equipment is a very small segment (less than 5% of the total market worldwide); however if photocopying equipment were included (as it is in most definitions of office equipment, but not in NACE), the share of office equipment would be 12% of the total market of computers and office equipment.

Mainframe and minicomputers accounted for 38% of the European market, and per-

sonal computers for 22%, ratios which are very similar to the world average (37 and 21%) and the USA (35 and 25%). Japan however shows a significantly lower use of personal computers (only 14% of the market) which is probably partly due to the difficulty in dealing with ideograms.

The computer and office equipment sector remains very dynamic. The EC market grew at an average rate of 15,5% per annum at current prices during the 1980s.

Production also grew rapidly (at 14.3%), but slightly less so than the market, and this shows up in the increasing trade deficit. Growth has been fairly regular over the period, except for a slowdown in 1986. As a result, European production only covers 81% of the market in 1989, compared with 89% in 1980, according to Eurostat.

The situation is fairly different according to product categories. European industry remains strongest in mainframes and minicomputers (88% coverage), but shows its

weakness in peripherals (63% coverage) and more dramatically in personal computers (28% coverage only)(source: EIC). Whereas in the USA, production of data-processing equipment is roughly equivalent to the market, in Japan the coverage of the market by local production is 134%, with a particular strength in peripherals (183% coverage).

Personal computers and peripherals have been the most dynamic segments of the market, with growth rates worldwide of respectively 20% and 16% between 1984 and 1989. In 1989, the growth of the European systems market (mainframe, mid-range and mini computers) was 8% in value, whereas it was about 15% for personal computers (compared with 12% worldwide) and 13% for peripherals. In numbers, the growth of personal computer sales was even faster, but this was offset by decreasing unit prices.

As a result the share of PCs in the European market has risen to 22% in 1989 from very little in 1980, with mainframe and minicomputer growth slowing considerably during the 1980s.

An important event on the PC scene has been the rapid development of portable or "laptop" PCs. This market has grown very fast over the past few years and now accounts for nearly 20% of the total market in units, with no great difference between the USA and Europe in this respect.

Table 2
Computer and office equipment
Main indicators, 1980-90(*)

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Apparent consumption	15 467	17 272	22 572	27 791	35 048	40 543	40 630	42 784	51 221	56 494	60 987
Net exports	- 1 728	- 2 526	- 2 992	- 3 830	- 5 683	- 5 155	- 5 304	- 6 731	- 9 668	- 10 831	- 11 897
Production	13 739	14 746	19 580	23 961	29 365	35 388	35 326	36 053	41 553	45 663	49 090
Employment (1000)	214	200	206	212	227	248	247	242	239	235	N/A

(*) Excluding Greece, Portugal and Spain
Source: Eurostat (Inde, Comext)

Table 3
Computer and office equipment
Production, value added and Investment in current prices, 1980-90

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Production in current prices											
EC ⁽¹⁾	13 739	14 746	19 580	23 961	29 365	35 388	35 326	36 053	41 553	45 663	49 090
Index	39	42	55	68	83	100	100	102	117	129	139
USA ⁽²⁾	N/A	N/A	N/A	N/A	86 489	98 543	67 239	63 779	68 830	N/A	N/A
Index	N/A	N/A	N/A	N/A	88	100	68	65	70	N/A	N/A
Japan ⁽²⁾	N/A	N/A	N/A	N/A	29 253	34 741	38 204	43 387	50 205	N/A	N/A
Index	N/A	N/A	N/A	N/A	84	100	110	125	145	N/A	N/A
EC ⁽¹⁾ Productivity (1000 ECU/ per capita)	29.4	34.3	45.9	50.7	56.3	59.8	62.0	64.4	73.0	80.9	N/A
Value added	6 302	6 866	9 450	10 742	12 776	14 834	15 308	15 573	17 437	19 020	N/A
Index	42	46	64	72	86	100	103	105	118	128	N/A
Investment	1 424	1 556	1 559	1 668	1 639	2 077	1 942	1 822	N/A	N/A	N/A
Index	69	75	75	80	79	100	94	88	N/A	N/A	N/A

(¹) Excluding Greece, Portugal and Spain

(²) Census of Manufactures and Eurostat estimates

Source: Eurostat (Inde)

Growth of this segment should continue over the coming years; the American market is expected to be multiplied by three, between 1988 and 1992, from roughly one to three million units.

Local area networks (LANs) have been a particularly dynamic segment, showing growth of 36% in 1989 over 1988, reflecting increasing communications and systems integration.

Trade

Computer and office equipment in the EC show a heavy trade deficit. This deficit has worsened considerably during the 1980s, from 1.7 billion ECU in 1980 to 10.8 billion ECU in 1989, according to Eurostat figures.

EC exports, after a rapid growth between 1980 and 1985 have fallen back, and the figure for 1989 remains slightly lower than that for 1985. EC imports on the other hand have experienced a steady and rapid growth throughout the 1980s (18% per annum, compared with 14% for exports, and 15% for the market).

The share of EC production which is exported has risen from 20% in 1980 to 26% in 1985, but in 1989 it returned to the 1980 level (20%). The share of imports on the EC consumption has risen during the same period from 29% in 1980 to 35% in 1989. This reflects the relative weakness of European industry in the more dynamic fields of PCs and peripherals.

Half of the imports of computer and office equipment into the EC comes from the USA, reflecting the fact that the USA still retains a dominant position in this sector. Japan comes next with 22%, followed by the rest of South-East Asia with 19% and EFTA with 6%. There has been a shift in import growth from Japan to the rest of South-East Asia and EFTA.

EC exports were mainly destined to EFTA countries (40%) and the USA (28%).

Trade between EC countries has grown rapidly since 1980 (at 20% per annum) and in 1989 represented 50% of EC production and 40% of the EC market (compared with 32 and 29% respectively in 1980). This reflects the development of in-house trade by companies with plants in several EC countries, which is increasingly the case both with foreign companies (eg. IBM) and with European companies. These plants are generally specialised in certain products or sub-assemblies manufactured for the whole of the European market.

Table 4
Computer and office equipment
Market growth 1988-1989 by product and geographical area

(%)	EC12	USA	Japan	Total
Personal computers	14.7	9.9	11.9	12.3
Other computers	7.9	4.5	8.8	6.9
Peripherals	12.7	8.9	16.4	12.8
Office equipment ⁽¹⁾	9.2	7.9	11	10.3

(¹) Including copiers and LANs
Source: Bipe



Table 5
Computer and office equipment
EC trade in current value, 1980-90 (1)

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990(2)
Exports extra-EC	2 809	3 277	3 976	5 052	7 084	9 180	7 595	7 598	8 031	9 129	9 149
Index	31	36	43	55	77	100	83	83	87	99	100
Imports extra-EC	4 537	5 803	6 968	8 882	12 767	14 335	12 899	14 329	17 699	19 960	21 046
Index	32	40	49	62	89	100	90	100	123	139	147
Export rate	20.4	22.2	20.3	21.1	24.1	25.9	21.5	21.1	19.3	20.0	18.6
Trade intra-EC	4 441	5 432	6 818	8 970	11 449	14 502	15 082	16 337	18 943	22 853	24 680
Index	31	37	47	62	79	100	104	113	131	158	171

(1) Excluding Greece, Portugal and Spain
(2) Estimated
Source: Eurostat (Comext)

Employment and productivity

Employment in this sector has declined from its peak of 248 000 in 1985, to 235 000 in 1989.

This trend should continue as EC companies announced important staff lay-offs as part of a restructuring plan. Olivetti is going to shed 7 000 jobs - 4 000 in Italy; Bull Group another 5 000 - 1 200 in France; Nixdorf 3 500 and Philips 4 900. This is a worldwide trend, and US manufacturers are not in a better situation than the European ones. DEC has suppressed 2 500 jobs in 1990 and announces 3 500 more losses for 1991, Hewlett Packard 3 000 in 1990, Unisys 7 000 in 1990 and announces a further 5 000 for 1991, Data General 2 000 in 1990..

Productivity, measured by the production per employee ratio in current value, has grown very rapidly between 1980 and 1989, at an annual rate of 12%.

This is related to the evolution in the structure of employment in the sector. The share of non-manual workers in total employment has grown from 68% in 1980 to 85% in 1990.

Comparing computer manufacturers on the basis of sales per employee shows that

this ratio is generally between 100 000 and 200 000 ECU per employee. Newer companies which have risen with the PC market such as Apple or Compaq show ratios which are significantly higher.

Investment

Fixed capital investment in the EC computer and office equipment industry was nearly 2 billion ECU in 1987 (5% of the value of production in the sector). Investment has been relatively stable at that level since 1985; before that it had been at a significantly lower level (about 1.5 billion ECU) since 1980.

However, fixed "productive" investment is much less important in this field than investment in technology. Thus, computer manufacturers generally invest about 9 to 12% of their turnover in R&D, that is twice as much as in production facilities.

Traditionally American companies are well established in Europe, particularly in the United Kingdom (IBM, Apple and DEC).

Japanese companies seem to follow a different strategy: they are very well implanted in Europe for office equipment, particularly in photocopiers (eg. Canon, Seiko, Ricoh, Sharp) but have up to now preferred an OEM (original equipment manufacturers) strategy for computer equip-

ment, like Fujitsu with Amdahl and Siemens, Hitachi with Compaq, and NEC with Bull. However the recent acquisition of ICL by Fujitsu shows that this may be changing.

Structural changes and competition

The development of the computer and office equipment industry over the coming years will be governed by a number of factors:

Products and product-mix:

- communications in information technologies are becoming increasingly important, creating the need for a growing data communications segment; however in terms of manufacturers, communications and data processing still remain relatively separate, and a sign of this is the sale of IBM's telecommunications subsidiary Rolm to Siemens; however the takeover of NCR by AT&T shows how uncertain trends are in this field;
- the computer market has kept its vitality through new generations of equipment which have often brought new suppliers to the top. After mini-computers with DEC and HP, personal computers (with Olivetti, Apple, Compaq) are the new growth area, opening new fields to the diffusion

Table 6
Computer and office equipment
Market shares by major product category, Western Europe 1989 (1)

		Market share (%)
Personal computers	IBM	18
	Apple	8.5
	Compaq	8
	Olivetti	7.5
	Others	58
	Market (million ECU)	13 250
Workstations	Hewlett Packard	33
	DEC	30
	Sun	21
	Others	16
		Market (million ECU)
Computers (2)	IBM	24
	DEC	7
	Bull	6
	Siemens	5
	Others	58
		Market (million ECU)
Peripherals	IBM	15
	Siemens	4.2
	Olivetti	3.4
	Bull	3
	Others	74.4
		Market (million ECU)
Office equipment(3)	Xerox	16
	Olivetti	11.5
	IBM	10.5
	Canon	7
	Others	55
		Market (million ECU)

(1) Market figures are not additive (there are double counts)
(2) Mini, mid-range and mainframe computers
(3) Including copiers and LANs
Source: Bipe

of data-processing; not surprisingly the highest sales growth rates in 1989 were shown by Compaq (75%) and Apple (43%);

- the proportion of software and services in the sales of the industry is growing; these are supplied both by the computer makers, and by specialist software companies;

Systems :

- systems integration is becoming an increasingly important feature, in order to satisfy the growing need of the customers for strategic computer systems. At the same time however specialist suppliers are multiplying. Large suppliers such as IBM themselves find it necessary to collaborate with software houses and

"value-added resellers" (VARs) when penetrating particular markets (eg. the retail sector, banking etc.); even when these specialised suppliers have the experience that is required in a particular field (IBM and GSI in transportation, IBM and Steria in industrial software, IBM and CGS in banking...);

- the Unix operating system developed mainly for minis has been increasing its market penetration in the recent years. In 1989, 10% of computer systems were running Unix and this share could increase to over 20% of the total market by 1995. More generally, the growth of open systems makes it possible to connect equipment and to run software from a variety of suppliers, diminishing the market hold

of closed proprietary systems;

- decentralisation and distribution has led to downsizing expensive mainframe installations in central DP departments through replacement by smaller and cheaper systems, decentralised in the offices and departments. This decentralisation and the diffusion of the personal computer (mainly for word processing and spreadsheet work to date, although other applications are developing) has led to the rapid growth of computer networks, both wide-area (between sites) and local-area (within a site);

Technology :

- the power of personal computers is increasing dramatically, and this should continue over the next ten years at least;
- technology is rapidly emigrating from the computer itself to the components and the software. This is particularly true of PCs, and a sign of this is the increasing production of PCs by South-East Asian companies, particularly in Taiwan. This is an uncomfortable situation for European industry: the Japanese, and to a lesser extent the Americans dominate the component scene, and the Americans are very strong in software, particularly in the growing segment of package software for open systems;
- a lot of research is going into sophisticated fifth-generation computers, based on new architectures. Present machines are based on the sequential von Neumann architecture; a number of different architectures are being investigated (transputer or parallel, cellular, systolic, neuronal...) and this should lead to the development of new machines in the coming years.

The structure of the industry has been



Table 7
Computer and office equipment
Top 20 information systems companies by sales in Western Europe, 1989⁽¹⁾

Company	Rank '89	Rank '88	Origin	Revenue		AAGR (%)	Market share (%)
				1988 IS (million ECU)	1989 IS (million ECU)		
IBM	1	1	USA	17 357	19 348	11.5	32.8
Siemens	2	2	D	4 480	4 918	9.8	8.3
DEC	3	3	USA	3 741	4 469	19.5	7.6
Olivetti	4	4	I	3 719	4 104	10.4	7
Bull Group	5	5	F	3 405	3 703	8.8	6.3
Hewlett Packard	6	8	USA	1 972	2 624	33.1	4.4
Unisys	7	7	USA	2 232	2 476	10.9	4.2
Nixdorf ⁽²⁾	8	6	D	2 395	2 360	-1.5	4
STC-ICL ⁽³⁾	9	10	UK	1 744	1 970	13.0	3.3
Philips	10	9	NL	1 867	1 868	0.1	3.2
NCR	11	11	USA	1 486	1 547	4.1	2.6
Apple	12	14	USA	788	1 123	42.5	1.9
Nokia	13	12	SF	986	1 073	8.8	1.8
Compaq	14	20	USA	612	1 072	75.2	1.8
Canon	15	13	JAP	890	859	-3.5	1.5
Xerox	16	17	USA	673	812	20.7	1.4
Wang	17	15	USA	754	760	0.8	1.3
Mannesmann	18	-	D	606	685	13.0	1.2
Amdahl	19	-	USA	473	649	37.2	1.1
Memorex	20	-	NL	581	617	6.2	1

⁽¹⁾ Sales of some telecommunications equipment, facsimile equipment and digital PBXs are included in the figures. Sales of software and services are also included. Companies predominantly in the telecommunications or software fields have been excluded. Datamation figures were given in dollars and have been converted to ECU.
⁽²⁾ Now acquired by Siemens.
⁽³⁾ Now acquired by Fujitsu.
Source: Datamation, June 1989 and 1990

adapting to this new context. Extensive restructuring has taken place in the USA, new manufacturers have risen with the growth of PCs, Japanese industry is rising to the forefront with Fujitsu becoming the second world computer manufacturer behind IBM and NEC in fourth position behind DEC.

In Europe the structure of the industry is different from the worldwide picture, in particular because the European suppliers have succeeded in keeping a significant position on their market. Out of the top 20 suppliers of data-processing equipment to the Western European market in 1989, half were American, 9 were European, and only one was Japanese (or two if one considers that the partly Fujitsu-owned Amdahl sells a lot of Fujitsu equipment and technology). This shows the under-representation of the Japanese suppliers in Europe (at least under their own name):

among the top 20 manufacturers worldwide 6 were Japanese, of which 3 were in the top 10. This has of course changed in 1990: by the end of that year the 9 Europeans had shrunk to 7, ICL having become Japanese, and Siemens and Nixdorf having merged into a single unit.

The American companies present in the European market generally have large European manufacturing facilities. Thus IBM is not only market leader in Europe, but is also the largest manufacturer in Europe. However the increasingly large trade deficit shows that imports by foreign companies present in Europe remain very significantly higher than exports by European companies.

The industry has undergone severe restructuring over the past few years. However this restructuring has not led to the constitution of large trans-European suppliers. Most of the major mergers and acquisitions

in recent years have been international or American, rather than inter-European (eg. Bull-Honeywell, Bull-Zenith, Fujitsu-ICL, Memorex-Telex, or Burroughs-Sperry, AT&T-NCR, HP-Apollo). Exceptions to this are Siemens-Nixdorf and Nokia-Ericsson.

In 1989, there were few major acquisitions: the most worthy of mention are Bull-Zenith, HP-Apollo, Hitachi-NAS; in 1990 the acquisition of ICL by Fujitsu was a major event, as was (although to a lesser extent) the acquisition of Nixdorf by Siemens. Fujitsu passes DEC and becomes the second world computer manufacturer behind IBM, and Siemens becomes the first European. How European supply will develop over the coming years is an open question. Siemens is adapting to its acquisition of Nixdorf and does not seem very keen at the present moment to initiate further restructuring in Europe, preferring a looser

Table 8
Computer and office equipment
Main acquisitions and cooperation agreements in 1989

Companies	Date	Field	Operation
Siemens - IN2	1/89	Computer	A
Mips, NEC, Siemens, Sony (+ DEC, SGI)	2/89	Components	C
Sun, Fuji, Xerox—> Unisol	2/89	Software	C
Hitachi, NAS	4/89	Computer	A
HP, Apollo	5/89	Computer	A
IBM, DEC, HP, AMD, Intel	6/89	Components	C
NSC, LSI—> US Memories	6/89	Components	C
Whitney - Prime	7/89	Computer	A
Philips, Sun, Fujitsu, LSI, TI	8/89	Components	C
IBM, Toshiba—> Display Technologies	9/89	Components	C
Bull - Zénith	9/89	Computer	A
DEC, MDTV, Renault	10/89	Software	C
IBM, TI, Koyo	11/89	Process control	C
DEC, Cegelec, Allen Bradley, April	11/89	Process control	C
IBM - Cadam	11/89	Software	A

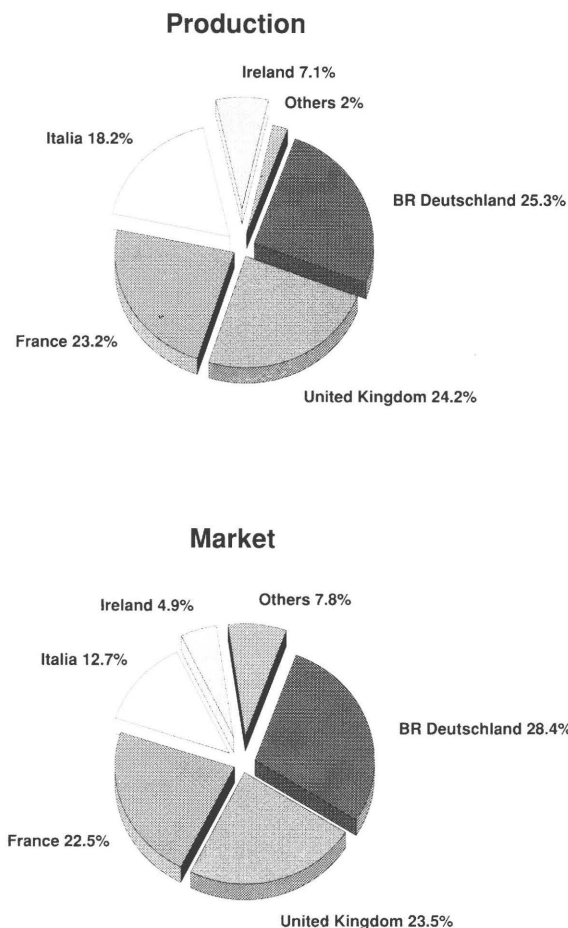
A: acquisition
C: cooperation

form of collaboration with Matsushita, whereby Matsushita will supply pocket computers to Siemens, and Siemens will supply office PCs to Matsushita which the Japanese company will sell in Europe under the Panasonic brand-name. Bull is in a bad period from the financial point of view, and will close a number of manufacturing sites. The acquisition of Zenith has given Bull a position in the booming laptop computer market, but Zenith has been losing market shares. Olivetti, faced with shrinking profits, is also cutting back employment and has been looking for a partner. Unfortunately there are not many possible European candidates, and an attempt with Phillips did not succeed. Phillips is in financial difficulty and has had to reduce employment, the company is reentering its activities and cutting back on R&D expenditure. After having dropped minis to concentrate on PC's, Phillips seems at least for the time being to want to hold on to its data-processing division, although it has been unprofitable in the past.

Geographical variance

The four larger EC countries (Germany, United Kingdom, France and Italy) account for 91% of EC production of computer and office equipment. Ireland is the only other significant manufacturing country with 7% of the total. Not surprisingly the four major EC countries are also the main markets and represent 87% of the total EC market. However the respective importance of the smaller countries is different, with Spain, the Netherlands and Belgium in the forefront. Production in Ireland and Spain has developed rapidly during the 1980s, mainly because of foreign investment in manufac-

Figure 1
Computer and office equipment
EC-9 production and market by country, 1989



Source: Eurostat, BIPE



turing facilities. This is particularly true of Ireland which is a manufacturing base rather than a market, whereas the Spanish market is growing rapidly to catch up with the other larger EC countries.

IBM comes before the national suppliers in the main European countries. Siemens is predominantly active on its own market whereas Bull and Olivetti are present in different countries.

EC trade with Eastern Europe

Official EC trade flows of data-processing equipment with Eastern Europe are very small in relation to total flows in this sector: less than 0,1% of total EC-9 imports and about 3% of EC-9 exports in 1988.

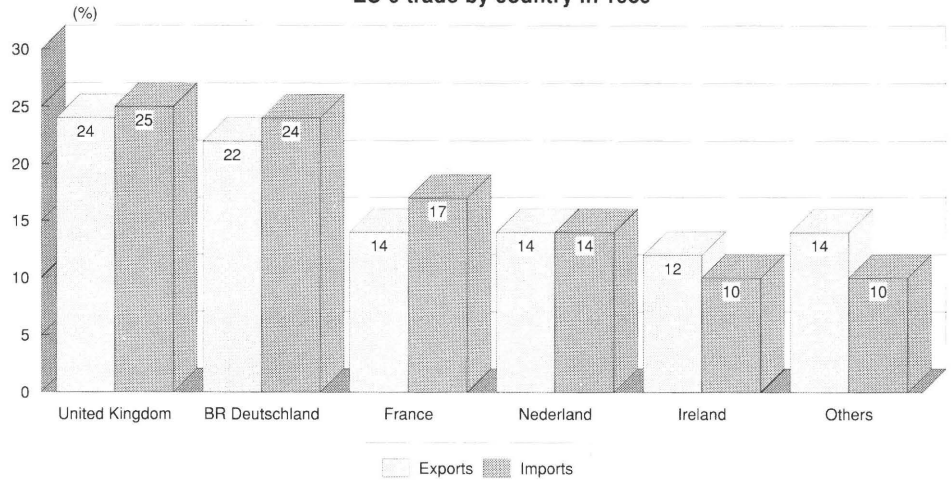
It should be noted however that these figures are underestimated, as trade flows between the Federal Republic of Germany and the former German Democratic Republic are not included in the Federal Republic's trade statistics, and are thus also excluded from EC statistics. The USSR, Czechoslovakia, Hungary and to a lesser extent Poland are the most important East-

Table 9
Computer and office equipment
Market shares by country, 1989

Country	Company	Share (%)
BR Deutcheland	IBM	18.1
	Siemens	11.7
	Nixdorf	7.3
	Olivetti	4.2
United Kingdom	IBM	17.8
	ICL	6.1
	DEC	4.4
	Unisys	3.8
France	IBM	17.6
	Bull	10.9
	DEC	3.8
	Unisys	3.2
Italia	IBM	18
	Olivetti	14.7
	DEC	4.6
	Bull	2.7

Source: Bipe

Figure 2
Computer and office equipment
EC-9 trade by country in 1989



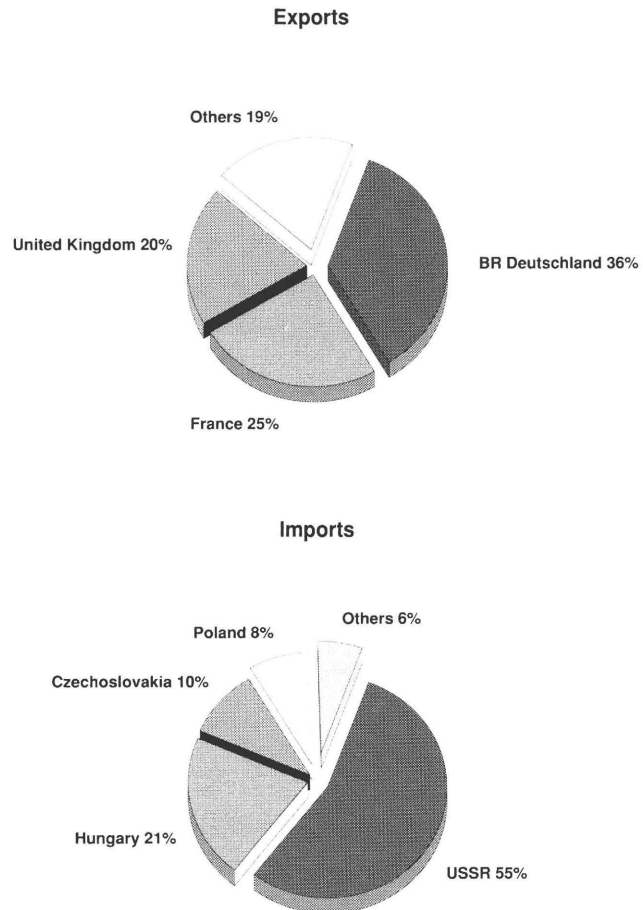
Source: Eurostat

ern European trade partners for the EC countries. Germany, France and the United-Kingdom are the main exporters.

Outlook

The current trends in the computer and office equipment sector are likely to continue for several years. The share of

Figure 3
Computer and office equipment
EC-9 trade with Eastern Europe, 1988



Source: Eurostat

Table 10
Computer and office equipment
Market forecast in EC9

(million ECU)	1989	1990 (*)	1990/91 (%)	1990/94 (%)
Apparent consumption	56 494	60 987	+8.4	+8.1

(*) Projected
 Source: BIPE

personal computers could reach half of the market some time in the mid-1990's; however the diffusion of PCs and their interconnection both together and to mainframe systems will affect the demand for larger systems both negatively (replacement of mainframe functions by PCs) and positively (mainframe demand for new functions).

The total Western European market is expected to reach 83 billion ECU in 1994 (56 billion in 1989). The average growth rate of 8% per annum includes much

higher growth rates for personal computers and workstations, of around 10-20% per annum.

The networking of computers will increase sharply (20% average growth).

Standards are an important issue for the industry; the development of open systems as against closed proprietary systems is likely to continue. With the shift to smaller, standard and more open systems, competition in the sector will continue to intensify, especially because entry costs are decreasing in some segments.

The computer market is a fairly open market: new actors appear with new concepts. DEC with mini-computers, Apple or Compaq with personal computers and Sun with distributed systems, have introduced new computer generations. Future systems will probably bring new players.

Technological change, driven by the rapidly increasing power of microprocessors and memories, is unlikely to slow down, and this will favour the continued diffusion of increasingly powerful and low-cost PCs, while R&D is continuing on fifth-generation computers.

Written by: BIPE

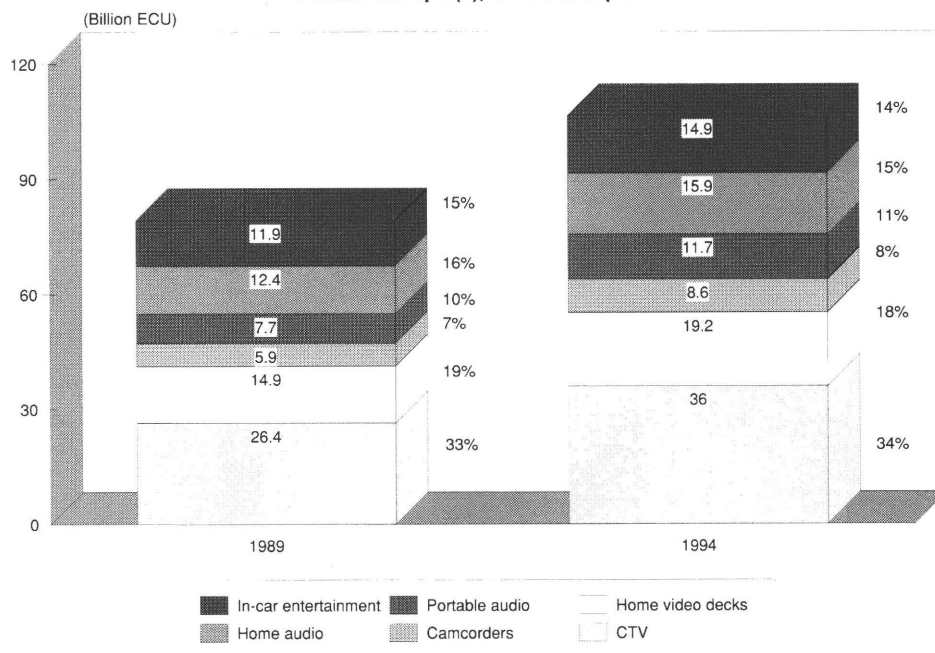
Audiovisual consumer electronics equipment provides the main vehicle of culture, education, information and entertainment. Together with electronic components and professional equipment, audiovisual consumer electronics constitutes one of the three virtually indissolubly linked key sectors of the electronics industry cluster.

In today's world, dominated by and critically dependent on electronics, the strategic importance for a society to maintain a competitive and sufficiently independent domestic electronics industry is generally recognised. Research and development, notably in the area of electronics components, are the lifeblood of this sector. Given the pace of technological innovations, products are upgraded and replaced more and more quickly. European industrialists have conceded a significant share of the European market, firstly to Japanese manufacturers, and more recently to manufacturers in the newly industrialised countries (NICs) of South East Asia. The large Japanese electronics manufacturers have stepped up their production of new consumer products sold on the world market. They also pursue the adoption of a production standard for High Definition Television (HDTV) which competes with and is different from the standard proposed by the European manufacturers.

The restructuring carried out by European manufacturers and the relocation of some of their production lines has enabled them to improve competitiveness in recent years. At the same time, the same companies launched a new compatible HDTV (HD MAC) collaborative R&D programme

which was selected as a Eureka project by the European Commission and by other specific EC R&D programmes such as Esprit and Race. The second phase of this programme is now starting with a financial input of over 400 million ECU for the three year period 1990-1993. A major com-

Figure 1
Consumer electronics
World consumer electronics market trends, 1989-1994
Western Europe (1), USA and Japan total



(converted at \$1 = 0.90 ECU)
 (1) EC and EFTA
 Source: BIS Mackintosh, Consumer Electronics Information Service

petitive advantage of the European HDTV system is its evolutive compatibility with the already installed base. 1995 is planned to be the time for operational and commercial introduction.

Fierce competition is now also developing from South East Asia, led by South Korea. European manufacturers are fully aware of the industrial and commercial stakes of this Far Eastern offensive, which, on some occasions, ran afoul of fair trade practices rules and resulted in the imposition of anti-dumping duties.

As regards technological innovations generated in Europe, it is worth mentioning that, besides the strategic European HDTV system, other new products or new applications have appeared, developed further or are about to appear such as the Compact Disc-Interactive, CD-ROM, wide-screen TV receivers, wide-screen High Definition projection displays, television digital stereo sound, D2-MAC satellite receivers and sat-

ellite aerials, optical technology applications, Radio Data Systems, Minitel, Teletext and the promising new Digital Compact Cassette. In addition to these innovating products, component and service technologies, manufacturing technologies have followed suit, more specifically in the field of factory automation.

It will be interesting to see how, in the future, home audiovisual consumer electronics products and services develop as a result of the gradual merge of telecommunication, computing and audiovisual technologies for home applications.

Description of the sector

This sector corresponds to NACE 345-1 (Manufacturers of radios and TV receivers). More specifically, this sector consists of audiovisual consumer electronics' manufacturers:

- ❖ video equipment: television sets, VCRs and video cameras, camcorders, specialised selectors and/or decoders and vi-

deographic terminals for receiving pictures transmitted by radio wave, cable or satellite networks, etc;

- ❖ audio equipment: the complete range of hi-fi equipment (stereos, compact disc players, analogue and digital tape players, radio receivers, car radios, etc);
- ❖ the complete range of accessories for both types of equipment (for example, microphones and head-phones) and blank audio and video magnetic media.

Some materials and equipment used in teaching and training programmes are also included in this product group.

PCs and home computers, electronic musical instruments and pre-recorded tapes, records and discs, have not been taken into account here.

Current situation

Given the steady stream of technological innovations (generalisation of digital technology, etc.), the development of new types of media (direct satellite broadcasting, cable networks, audio and video laser discs, etc.) and the boom in the number of new television stations, this sector is the scene of fierce competition between European firms and their Japanese and NIC challengers, especially those from South East Asia (South Korea, Hong Kong, Taiwan and Singapore).

The stakes are both economic (for example, control of the entire chain of electronic goods) and cultural, for audiovisual electronic equipment is an important vehicle of culture, education information and entertainment. The industry is primarily capital intensive. Direct and indirect employment represent approximately 200 000 people.

Table 1
Consumer electronics
Main indicators, 1980-91

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 (*)	1991*)
Apparent consumption	11 350	12 200	13 487	13 318	12 925	14 304	18 550	19 201	21 055	20 968	22 020	33 350
Net exports	- 3 468	- 3 529	- 3 637	- 5 254	- 5 117	- 5 409	- 6 439	- 6 675	- 8 149	- 8 725	- 9 000	- 9 200
Production	7 882	8 671	9 850	8 064	7 808	8 895	12 111	12 526	12 906	12 243	13 020	14 150
Employment (thousands)	160	151	147	146	134	134	131	127	123	126	126	130

Source: EACEM

Supply and demand

General trend Based on apparent consumption, the consumer electronics market rose by 10% in value between 1987 and 1988 after a downturn.

In 1989, the very strong pressure on prices led to a stagnation in market value in spite of a positive trend in volume. Apparent consumption decreased slightly from 21 055 million ECU in 1988 to 20 968 million ECU in 1989.

This growth rate in value terms does not show up as such in the European manufacturers' ledgers, even when given the concomitant sharp fall in retail prices, ranging from 6 to 10% for the equipment involved.

The value of the European manufacturers combined output decreased by 5% in 1989, from 12 906 million to 12 243 million ECU. The substantial loss of jobs in the in-

dustry, which employed 126 000 in 1989, should also be noted.

In 1989, the breakdown between video equipment, audio equipment and blank magnetic media was 55%, 35% and 10%, i.e. sales of slightly less than 11 600 million ECU, 7 400 and 2 030 million ECU, respectively.

Between 1988 and 1989, the video and audio visual markets declined by 2% and rose by 1% respectively.

Once more, the considerable drops in the average unit prices of these types of equipment must be borne in mind.

The video equipment market

Colour television Colour television sets, which account for 33% of the total consumer electronics market, remain the market's leading item.

The number of colour TV sets sold in 1989 was down 1% (in quantity) as compared to 1988 (18 161 000 sets in 1989 versus 18 424 000 in 1988) and 2% down in value over the same period. Once again, prices fell somewhat for these items, especially for small-screen sets (less than 42 cm measured diagonally).

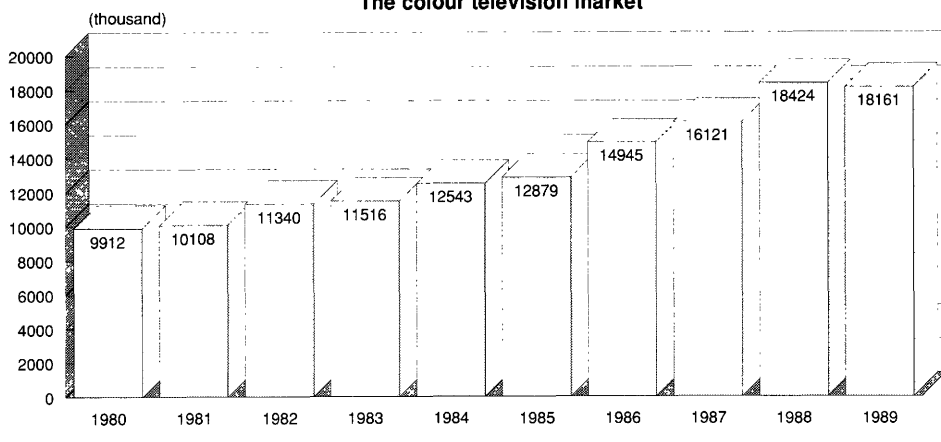
Indeed, this type of colour television set, sold at very low prices, is often imported from South East Asia and accounts for the surge in sales. During the 87/88 period, their share of the total sales of colour sets rose from 36 to 40%, reflecting a significant increase in the number of households with two colour sets.

But in 1989, the share of large screens became higher, increasing from 38% in 1988 to 46% in 1989.

It should be stressed that although large TV screens now account for a smaller share of the market, this is the category boosting development and sales of the most sophisticated equipment. The large majority of these are made in Europe, and equipped with new cathode ray tubes and give an excellent stereophonic reproduction of the broadcast's of those programmes which are produced with this type of modulation.

In addition, they can be equipped with the latest technical refinements such as decoders for D2-MAC/satellite broadcast re-

Figure 2
Consumer electronics
The colour television market



Source: EACM

Table 2
Consumer electronics
Breakdown of the colour television market by size of screen

(%)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Screen <= 42 cm	13.3	21	22.8	25	31.2	31.7	34.7	36.3	41.1	38.1
42 cm < screen <= 52 cm (*)	21	21	15.5	19.4	18	19.5	N/A	21	21.4	16.6
Screen > 52 cm (*)	65.7	58	61.7	55.6	50.8	48.8	65.3	42.7	37.5	46.2

(*) 1986: screen > 42 cm included in screen > 52 cm
Source: EACEM

ception.

Table 3 gives the ownership of the main types of consumer electronic equipment in households in the major European countries at the end of 1989.

Despite the gains made by small sets originating from South East Asia, most colour sets sold on the European market are made in Europe. Table 4 shows the trends in the leading supplier countries market shares.

As can be concluded from the above table, Europe held a 72% share of local

production in 1989, a figure well above imports from the Republic of Korea (4%), Hong-Kong (3%) and Japan (2%). However, Japanese brands control a larger share of the European market (of the order of 20%), as the natural result of Japanese industrial investments in Europe. Similarly, due to the relocation of some European plants in the Far East, European models account for a significant part of the imports from non-EC countries.

Video cassette recorders (VCR)

The surge seen in the market over the

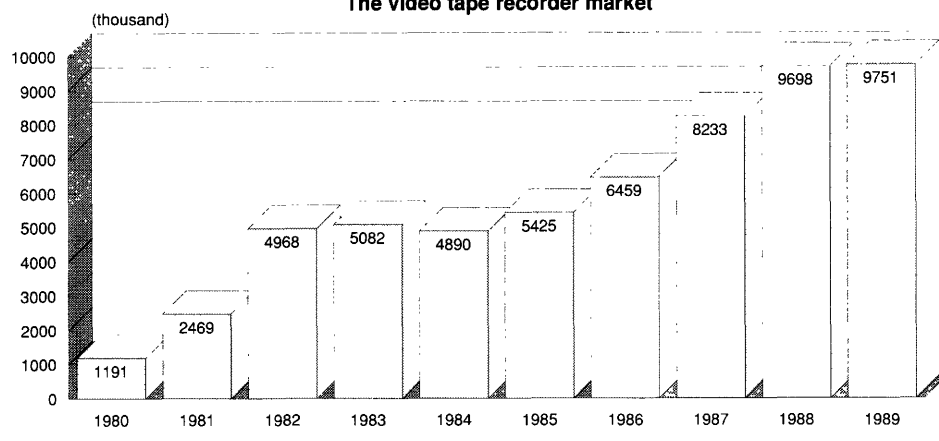
past few years continued to pick up speed in 1988. But in 1989, the growth in apparent consumption was 1% slower in terms of volume (9 751 000 units sold in 1989 versus 9 698 000 in 1988). However, the decrease in value over the same period amounted to 13%, from which it follows that prices fell an average of 14% over this period.

Almost all home VCRs are now built to the VHS standard following Sony's decision to abandon the BETA standard for consumer products. A noteworthy improvement in the VHS standard, S-VHS, giving greatly improved picture quality, was also introduced in 1988.

While Japanese competition in the early 1980s had practically outcompeted European manufacturers, the European industry however reacted successfully, in 1989, and regained part of the lost market share. As a result, the market share of Japanese products regressed compared to the high peaks in the past (also for reasons similar to those described for colour TV sets) and the share of Korean manufacturers has decreased after temporary anti-dumping duties adopted by the Commission at the end of 1988 were followed by a "price undertaking agreement".

Camcorders The market for the portable combined video camera and recorder (camcorder) is characterised by continued strong growth: 49% between 1988 and 1989, after

Figure 3
Consumer electronics
The video tape recorder market



Source: EACEM

Table 3
Consumer electronics
Equipment rate of European households at the end of 1989

(%)	B	DK	D	F	I	NL	UK
CTV	87	88	92	89	90	93	98
VTR	31	27	43	36	23	48	65
VCR	6	3	5	5	4	5	3
CD players	19	15	20	17	7	47	20

Source: EACEM

Table 4
Consumer electronics
Principal producers of colour televisions

(%)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
EC Production	84	90	80	87	81	85	82	74	72	72
Imports extra-EC	16	10	20	13	19	15	18	26	28	28
of which,										
South Korea	N/A	N/A	N/A	N/A	2	7	8	7	9	4
Hong Kong	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6	3
Japan	6	7	6	6	6	6	6	3	2	2
Total market	100	100	100	100	100	100	100	100	100	100

Source: EACEM

Table 5
Consumer electronics
Principal producers of video tape recorders

(%)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
EC Production	N/A	4	17	16	22	40	45	51	52	56
Imports extra-EC	17	96	83	84	78	60	55	49	48	44
of which,										
South Korea	N/A	N/A	N/A	N/A	N/A	2	6	16	13	5
Japan	94	94	80	82	74	58	51	43	33	32
Total market	100	100	100	100	100	100	100	100	100	100

Source: EACEM

a growth of 47% in the previous period.

The market is divided between the 8 mm camera launched by Sony and the VHS-C produced by Matsushita (now joined by S-VHS-C) standards.

Audio equipment market Measured by the trend in apparent consumption, the audio equipment market rose 1% in terms of value between 1988 and 1989, from 7 303 million ECU in 1988 to 7 376 million ECU in 1989. This slight growth was also accompanied by a noticeable fall in unit prices of about 6% per year.

We shall limit our discussion to analysing the market trends of two highly representative articles in this sector - the CD player and car radio, rather than an examination of the entire market product by product.

❖ The CD player, invented by Philips, has proved to be a major technological break-

through. Its diversification, primarily in sound, but also in the areas of the image (CD-V) and data processing (CD-ROM), has led to a great potential for a number of new products and services offered;

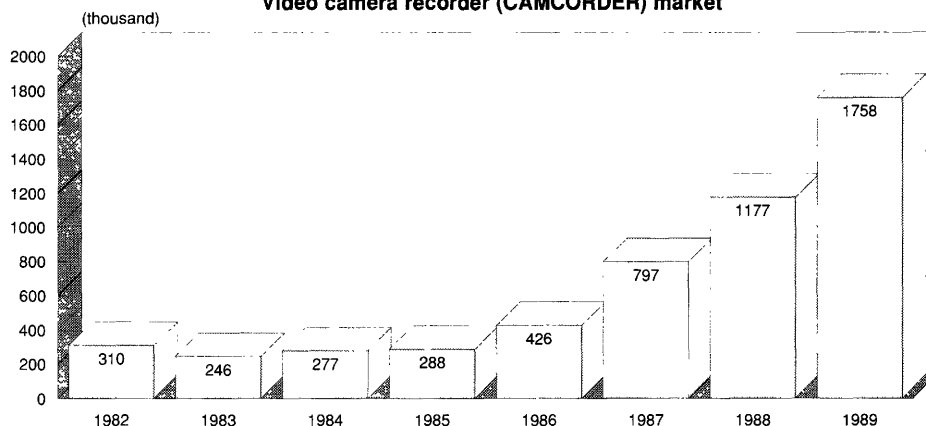
❖ The car radio is one of the elements of "mobile communications", an area that is booming as a consequence of the introduction of new services such as the RDS

(Radio Data System) for programme identification transmission, the transmission of traffic information, etc. Both these products are manufactured primarily by European concerns.

Foreign trade

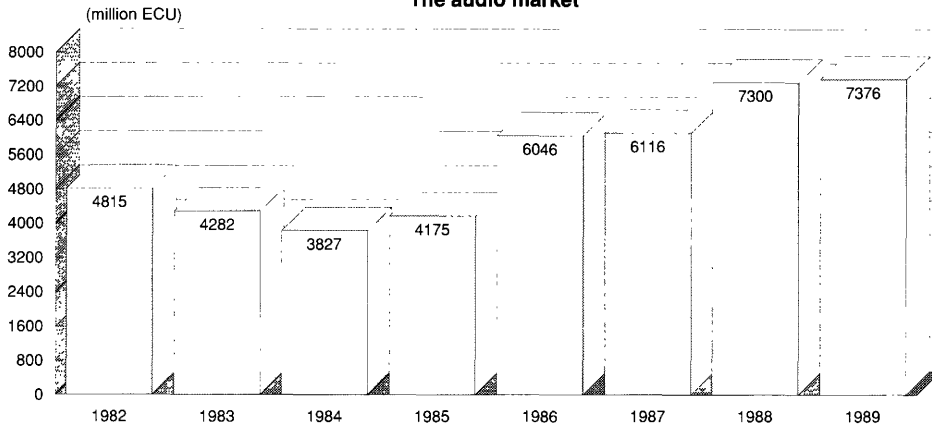
Intra-community trade The intra-Community trade figures do not accurately reflect the situation. Some companies involved in

Figure 4
Consumer electronics
Video camera recorder (CAMCORDER) market



Source: EACEM

Figure 5
Consumer electronics
The audio market



Source: EACEM

this market are European, but most are global concerns and have, in the last few years carried out a high speed restructuring of their manufacturing set ups, reducing the number of plants drastically.

For example, under the J2T joint venture, the Thomson group manufactures at its plant at Tonnerre, in Burgundy, the basic components of VCRs for assembly in West Berlin. The end products are distributed throughout Europe under the Thomson and JVC trademarks.

Other alliances between domestic European manufacturers and non European partners have a comparable effect on trade statistics.

In other words, intra-Community trade statistics reflect the results of restructuring decisions and certain industrial alliances between European and non European manufacturers rather than measuring trade movements based on the use of traditional criteria.

Trade with Eastern Europe

Developments in Eastern Europe may bring changes both in trade patterns and in the location of production units. Thomson for example is considering opening a VCR production unit in Hungary in a joint venture with the Hungarian company Videoton, and a colour TV assembly plant in Poland, in conjunction with the Polish company Unimix.

Nokia has signed a joint venture agreement with the East German TV manufacturer VEB Fernsehgerätewerk Stassfurt. EC manufacturers are not the only ones to be interested in Eastern Europe: major Japanese manufacturers such as Sanyo and Sony are reported to be pursuing investment plans in Eastern Europe. Samsung (Korea) is opening a colour TV factory in Hungary. Goldstar (Korea) entered into a major contract with the USSR for the building of a colour TV plant and

Samsung for the supply of VCRs.

Trade with non-EC countries

Both imports and exports decreased (-2% and -25%, respectively) between 1988 and 1989.

Imports accounted for nearly 52% of apparent consumption, while the export/import ratio was only about 20%. Europe's external trade deficit in this sector worsened in 1989 and amounted to 8 725 million ECU.

Table 8 shows that EC trade with EFTA countries is nearly balanced with a coverage rate of 88%.

The volume of trade with the USA is low and the export/import ratio close to 46%. The EC's largest supplier is Japan, with 49% of imports and 26% of the European market (without taking into account industrial investments in Europe). The Republic of Korea is close behind Japan, with 9% of the EC's total imports and 5% of the internal market (excluding industrial investments in Europe). European exports to these two countries are insignificant and the EC's trade deficit with Japan reached a record 5.3 billion ECU in 1989.

Employment

Employment in the sector declined from 250 000 in 1975 to 123 000 in 1988 and recorded a slight increase for the first time in 1989 to reach 126 000.

1980-88 was marked by two major phenomena - the closing of more than 100 plants and the disappearance of 50%

Table 6
Consumer electronics
Audio market products

(thousands)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CD players	N/A	N/A	N/A	138	272	655	2 095	3 951	6 203	7 766
Car radios	7 940	7 576	8 520	10 137	10 467	11 818	13 469	15 218	15 972	16 950

Source: EACEM



Table 7
Consumer electronics
Production and external trade

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Production in current prices										
EC	7 882	8 671	9 850	8 064	7 808	8 895	12 111	12 526	12 906	12 243
Index	88.6	97.5	110.7	90.7	87.8	100	136.2	140.8	145.1	137.6
USA (*)	N/A	N/A	N/A	N/A	N/A	11647	9515	8602	9023	N/A
Index	N/A	N/A	N/A	N/A	N/A	100	82	74	77	N/A
Production in constant prices										
EC	7 888	7 903	8 314	6 468	5 300	6 460	8 527	8 621	8 881	8 425
Index	122.1	122.3	128.7	100.1	82.1	100	132	133.5	137.5	130.4
EC trade in current prices (*)										
Imports extra-EC (*)	4 560	4 719	4 913	6 632	6 737	7 393	8 395	8 670	11 133	10 958
Index (%)	61.7	63.8	66.5	89.7	91.1	100	113.6	117.3	150.6	148.2
Exports extra-EC (*)	1 092	1 190	1 276	1 378	1 620	1 984	1 956	1 995	2 984	2 223
Index (%)	55.2	60.1	64.5	69.7	81.7	100	98.6	100.6	150.4	112.6
X/M	0,24	0,25	0,26	0,21	0,27	0,23	0,23	0,23	0,27	0,20

(*) Census of Manufactures and Eurostat estimates

(*) 1980 EC9; 1981-83 EC10

(*) Taking into account changes in EC membership

(*) It is possible that the worldwide change in nomenclature which came into effect on 1 January 1986 (switching from NIMEXE to the harmonised system, H.S.), may have had some perverse effects

Source: EACEM, Eurostat (Comext)

of the domestic European industry's jobs in the face of stiff competition and the two-way relocation of manufacturing facilities. The paradoxical phenomenon is that, whereas European companies are starting to set up facilities in the low-wage countries of South-East Asia, Japanese and Korean firms are investing in production and assembly units in Europe. To give a rough idea of the situation, the 68 Japanese and Korean plants located in Europe employ 21 226 people, while the 106 "native European" plants employ a total workforce of 105 000.

Investments

Research and development The consumer electronics industry is characterised by:

- ❖ rapid-pace innovation; 60-70% of its products become obsolete every 10 years;
- ❖ investment financing costs that are as high as 4% of turnover;
- ❖ an annual drop in prices of about 10%;
- ❖ R&D costs amounting to about 7% of

turnover. In conclusion, the industry has turned over to consumers almost all the benefits of the gains in productivity made over the past 30 years, without having collected any dividends on its investments.

Structural changes

Competitive pressure has forced the European industry to speed up its concentra-

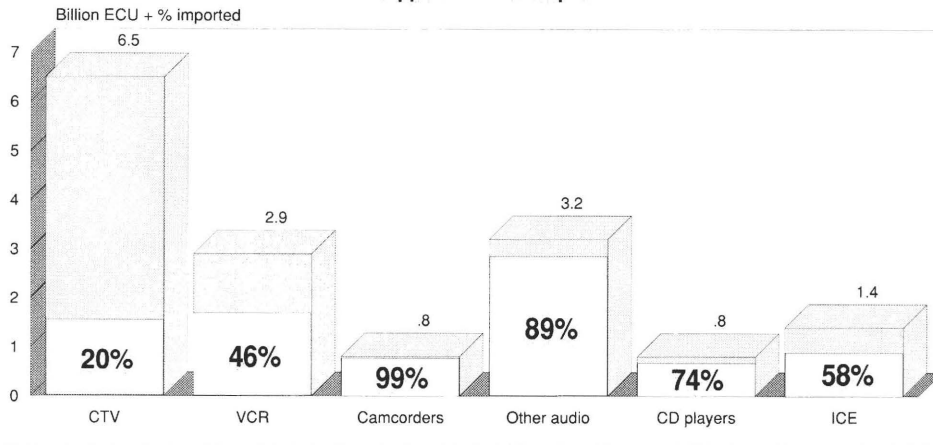
tion. Today, Europe is the home of two of the world's leading consumer electronics groups, Philips and Thomson (Thomson Consumer Electronics). In addition, the Finnish multinational Nokia has now created a third European consumer electronics company of a major size through a series of recent acquisitions in France and the Federal Republic of Germany.

Table 8
Consumer electronics
Structure of imports and exports, 1989

(million ECU)	Exports from EC	Imports to EC	X/M (%)
Japan	40	5 374	0.7
Republic of Korea	10	936	1.1
Austria	275	762	36.1
Singapore	31	709	4.4
USA	286	622	46.0
China	5	591	0.8
Taiwan	31	543	5.7
Malaysia	5	416	1.2
Hong Kong	31	298	10.4
Brazil	15	104	14.4
Thailand	5	103	4.9
Turkey	34	94	36.2
Total extra-EC	2 233	10 958	20.4
of which, from EFTA	886	1 006	88.1

Source: EACEM, Eurostat (Comext)

Figure 6
Consumer electronics
Imports by segment % by value 1989 - Ex factory level
Apparent consumption



Source: EACEM

Finally, a large share of the domestic market in many EC Member States continues to be held by highly skilled and innovating small and medium-sized enterprises, especially in hi-fi audio equipment.

Thomson's acquisition of General Electric's consumer electronics division has created a close tie between Europe and the United States. Philips is in a similar position vis-à-vis its American holdings.

Robert Bosch and its subsidiary, Blaupunkt are leaders in in-car entertainment electronics.

Finally, Japanese companies have decided to transfer production and assembly plants to Europe for products with a wide range of added value, depending on the products and companies involved.

Geographical distribution

The United Kingdom and, more recently,

Spain, France and Germany are the preferred countries for Japanese industrial infrastructure investments.

Environment

From the environmental standpoint, the development of the consumer electronics industry, a clean industry, can only be encouraged. Packaging and end-of-life recycling are important issues attended by the industry.

Impact of "1992"

The strategic importance of the consumer electronics industry in post-1992 Europe is twofold:

The EC Council Ministers responsible for cultural affairs have repeatedly asserted that audiovisual media are one of the main means of transmitting information and culture among the citizens of Europe and that there cannot be a European cultu-

ral policy without audiovisual support. This point has been strongly emphasised with the launching of the collaborative R&D programme "EUREKA - Audiovisual" and the EC's audiovisual policy proposals.

Strategic nature and single market issues

The electronic industry can be symbolised by a three legged stool with R&D as the floor. The three legs are: electronic components, consumer electronics and professional equipment. Each of the legs is necessary. If one of them breaks, the stool will collapse.

The interdependency of all links in the supply chain is the key characteristic of the electronics industry. The essential pre-requisite for the industry's global success in the future is the maintenance not only of strong European supply sources, but also of the necessary conditions to foster and strengthen the integrated functions of each link in such a chain. Despite the fast spread of electronics, Consumer Electronics products are still a major element and account for some 25% of the electronic component sales in Europe, a figure likely to increase in the future, as the range and complexity of Consumer Electronic products increases. Over and above its economic contribution in terms of turnover, employment and trade, the EC manufacturing sector plays a key strategic role

Table 9
Consumer electronics
Structure of industry

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Employment (thousands)	160.4	151.2	146.5	145.5	134.2	133.7	131	126.6	123	125.9
Number of factories (¹)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	224	165	174

(¹) More than 20 employees.
 Source: EACEM

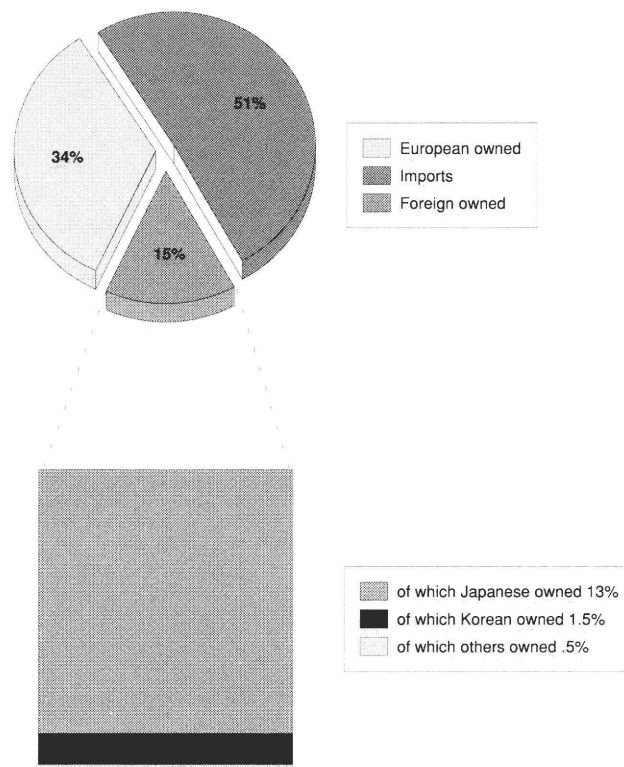
in the electronics industry as a whole. Its role as a volume purchaser of components allows for economies of scale in the production of key components such as screens (tubes, LCD's), semi-conductors, lasers, CD's, micromotors, magnetic heads etc. These then find their way into professional equipment and products which can subsequently be produced at lower cost and so eventually migrate to mass markets. The most visible example of such a process is the personal computer, but there are an increasing number of such "computerised" products such as: Camcorders, mobile phones and home faxes. Indeed, the EC plays an increasingly important part as technology leader in the electronics industry in addition to the market pull effect.

EC policy is to ensure that efforts are maximised to create and maintain the optimum business conditions for the European industry to compete successfully on world markets with its powerful third country competitors. The innovative technological and competitive potential of the European Consumer electronics manufacturing industry provides the necessary guarantee today that such policy measures will be beneficial to the EC in the future.

Important Single Market issues are:

- ❖ technical standardisation;
- ❖ satellite broadcasting standards: creation of a single standard environment to HDTV;
- ❖ facilitation of consumer electronics services development;
- ❖ measures to foster R&D and industrial cooperation;
- ❖ measures to provide support for EC small and medium-sized enterprises such as training, cooperation, tax incentives, parts and components specialisation;

Figure 7
Consumer electronics
European Audio/Visual consumer market share, 1988



Source: BIS Mackintosh

- ❖ equalisation and balancing of subsidies for investment and restructuring.

New technology

A key success factor in the 1990s for EC companies will be the successful development of the HDTV market, given the European strength in this product sector.

The launching in 1988 and 1989 of the TDF1-TVSAT2 Franco-German direct-to-home broadcasting satellites must be considered in this context. The first programmes broadcast using the new D2-MAC/Packet television standard pave the way for the future HDTV system, HD MAC. This system is being developed as a project in the EC's Eureka 95 project. It unites engineers from Philips, Thomson, Nokia and Robert Bosch, the skills and experience of such broadcasting companies as the BBC, IBA, TDF, RAI, Bundes-

post/FTZ, etc., universities and many private companies. The creation of the economic consortium "VISION 1250" in charge of the promotion of the European HDTV will be in time for the Olympic Games in Albertville and Barcelona in 1992 from where demonstration programmes will be broadcasted.

European consumer electronics firms are participating in many other European R&D programmes. These include Esprit II (especially in home automation), RACE, Media, Delta and Drive, in addition to a number of other Eureka projects.

Outlook

Supported by short and medium-term technological innovations as reported herein, the consumer electronics sector cannot but look forward to a promising future. However, fierce competition in the sector

and high market entry standards make it difficult for challengers to break into except in highly specialised niches. Cracking these obstacles is crucial for Europe. The demand can be expected to stay in 1990 at nearly the 1989 level, although volume growth will continue at a projected 4%.

Sales of major items are expected to in-

crease: 3% for colour television sets and 9% for VCRs. Strong growth can be expected in camcorder's (close to 30%) and, in audio equipment, CD player sales, DAT and portable music-centres.

1991 will also be marked by continued work to launch video CDs and television receivers for direct satellite reception, when satellites will have been put in orbit,

joining the TDF1, TVSAT2 and Astra satellites, which were launched previously.

Written by: EACEM

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