Demand for and applications of extra large EDP systems in the EEC Countries and the United Kingdom in the seventies

Vol. 4 - Current and future applications of extra large EDP systems per industry

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ANNEXES

This volume examines both present and future applications of electronic data processing systems, with particular attention to large EDP systems in the following Industries:

- Ch. VI - Manufacturing industries
- Ch. VII - Retail stores
- Ch. VIII - Banks and insurance companies
- Ch. IX - Public utilities
- Ch. X - Universities and service bureaus

Each chapter includes:

- a brief examination of the general features of the industry;
- a survey of the principal computer applications which are now being made and which it is foreseen will be made in the next ten years, if the principal problems of the different areas will be solved;
- a forecast of the applications which will be realized in the next ten years and of the consequent forecast of companies which will be using extra-large E.D.P. systems.

Each report is based mainly on the results of the direct inquiry, with the additional aid of a systematic study of existing literature.

CHAPTER VI

MANUFACTURING INDUSTRIES

1. Introduction

An analysis of present and foreseeable applications of EDP systems, high-performance systems especially, in the manufacturing industries of Common Market countries and the United Kingdom, must be divided into industries.
From the point of view of information processing, companies operating in different fields find that they must face partly different problems. The reason is that the sub-sectors which were the first to face problems of automation were the same who made greater progress in type, variety and quality of applications, as well as in the importance of their computer force.
The manufacturing industries already using large computers and which are therefore of most interest in a survey of the use of high-performance EDP systems are the following:

1. Steel
2. Oil
3. Chemical
4. Mechanical
5. Aeronautical
6. Electrical and electronics
7. Publishing and paper making

The users in these industries were interviewed personally; however, information was obtained only for five of the seven industries because it was impossible to interview users in the publishing and paper-making sectors and in the electronic and electro-mechanical sectors. Great difficulty was found in obtaining information on the structural and economic characteristics of each of the industries mentioned, because available statistics regarding the different Common Market countries do not always use the same classifications nor are they presented with the same degree of disaggregation as are the statistics on the number of computers.

2. Structure

2.1. Economic characteristics

The trend of the manufacturing industries in Common Market countries and in the United Kingdom between 1958 and 1966 can be summarized as in the following table by means of the average annual rate of increase of the added value of the manufacturing industries taken as a whole, and of the industries being considered:

TREND OF DEVELOPMENT OF ADDED VALUE OF THE MANUFACTURING INDUSTRIES
(Average annual rate 1958-1967)

	GERMANY	FRANCE (1)	ITALY	BELGIUM	NETHERLANDS	UNITED KINGDOM (1)
MANUFACTURING INDUSTRIES TOTAL	+6,3	+5,5	+8,4	+6,3	+7,0	+3.6
OF WHICH:						
STEEL	+4.3	+5.6	+9.9	+5.9	+10.7	+2,8
CHEMICAL	+10.3	+8.7	+13.7	+8,3	+8.2	+6.5
MECHANICAL	+7,2	+5.2	+9.1	+8.7	+7.2	+3.9
AERONAUTICAL (2)	+20,4	+ 12.2	+17,0	+ 17.0	+ 10.9	+3.4
ELECTRICAL & ELECTRONICS (3)	+ 5.5	+ 18.5	+ 7.9	+ 21.5	+ 7.4	+5.4
PUBLISHING & PAPER MAKING	+4.5	+5.4	+6,9	+7,6	+8.6	+4.7

SOURCE: CEE, COMPTES NATIONAUX, 1958-1967 E MINISTRY OF LABOUR, STATISTICS ON INCOMES, PRICES, EMPLOYMENT & PRODUCTION, MARCH 1968.

(1) 1958-1966
(2) 1960-1966, source: SORIS
(3) 1960-1964, source: BIPE

Development of the manufacturing sector has proceeded at a different rate in the various countries according to the different degrees of industrialization already achieved. Thus, the lowest rate is to be found in the United Kingdom, while the highest is to be found in Italy.

Of the industries treated in this survey, those which in all the Common Market countries most contributed to the overall industrial development are, in the following order: chemicals and petrochemicals, mechanics, electromechanics, steel and metallurgy.

In the mechanical sector, taken in the broadest sense of the word, production with a most dynamic development is to be found in electronics and aerospace which are the biggest users of computers.

Data on the changes in the situation of employment in various European countries in the various branches of the manufacturing industry are not available with a degree of disaggregation which permits comparison with data available on added value.

However, it is possible at least to give the number employed in 1967 so as to estimate the relative importance of each of the sectors surveyed in the overall picture of the manufacturing sector. The following results are thus obtained:

WORKERS EMPLOYED AT THE END OF 1967 IN EACH INDUSTRY

	GERMANY		FRANCE		ITALY		BELGIUM		NETHERLANDS		UNITED KINGDOM	
	(000)	%	(000)	%	(000)	%	(000)	%	(000)	%	(000)	%
MANUFACTURING INDUSTRIES TOTAL	8.955	100.0	5.115	100.0	4.179	100.0	1.095	100.0	1.210	100.0	9.224	100.0
OF WHICH:												
CHEMICAL	884	9.9	447	8.7	398	9.5	82	7.5	107	8.8	696	7.5
STEEL & MECHANICAL	3.099	34.6	1.737	40.0	1.491	35.7	417	38.1	491	40.6	3.574	38.7
AEROSPACE	35	0.4	101	2.0	17	0.4	5	0.5	6	0.5	291	3.2
ELECTRICAL AND ELECTRONICS	1.698	19.0	399	7.8	..		..		..		893	9.7
PUBLISHING & PAPER MAKING	140	1.0	318	6.2	(1)83	12.0	65	5.9	112	9.3	637	6.9

SOURCE: OCDE, LABOUR FORCE STATISTICS, 1956-1967, PARIS 1969

(1) Except publishing

In Common Market countries (Belgium excepted) and in the United Kingdom, state-owned enterprises have a part in the production in certain sectors of the manufacturing industry. The industries in which the presence of state-owned enterprises is more significant are also the most important from the viewpoint of the use of EDP. They are the steel, oil, chemical, mechanical (including aeronautics), electrical, electronic and publishing industries.

Except for the partial nationalization of the French mechanical industry (part of the automotive and aeronautical industries) and except too for that of British steel, the commonest form of public ownership in the manufacturing industry is represented by mixed enterprises (1).
In the industries being examined, besides a considerable presence of public enterprises there is also a strong tendency toward concentration. There have, in fact, been important concentrations in the steel industry in Germany and France in recent years.
In almost every country there have been important mergers in the chemical industry in recent years.
An important concentration in the mechanical industry of the United Kingdom is represented by the merging of British Motor Holdings and Leyland Motor Co. which were both the result of the concentration of about ten companies.
In France the main mergers since 1966 were that between Fives - Lille - Cail, later merged with Babcock - Wilcox and that of the shipyards: Chantiers de l'Atlantique - Plus de Méditerranée - La Ciotat.
Concentration in the German shipyards made a giant step forward with the merger of Deutsche Werft with Kill and Hamburg and in the aeronautics industry with the Messershmitt - Bölkow merger.
And finally, in the electrical and electronic industry there were the mergers of the German companies A.E.G. - Telefunken and Siemens - Zuse and a number of others in France and even more in England.

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(1) For further details see: Centre européen de l'entreprise publique - Les entreprises publiques dans la CEE - Dunod, 1967

In France, CSF joined the Thompson Houston - Hotchkiss - Brandt group. In the United Kingdom many important mergers were recently concluded.

The example represented by this overall view of some of the most recent mergers demonstrates the importance of the movement toward concentration organized or favoured by public enterprises as an element in the rationalization of productive structures (1).

The present tendency toward concentration will influence the productive structure of the industries in future years too, increasing the size of the companies on a national and even a multi-national basis. It is, however, very hard to forecast for the next decade the effects of the movement toward concentration on the structure of the different industrial industries, and therefore on the number and size of the existing companies.

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(1) In the United Kingdom the Industrial Reorganization Corporation restructures some of the industries of the manufacturing industry and provides an incentive through financial aid for other mergers which it feels useful to British industrial development.
In France a Bureau des Fusions was purposely created to intervene in favour of mergers by offering tax incentives.

2.2. EDP characteristics

The manufacturing sector does not have an application which by itself would justify the use of a large computer. This use is justified instead, if the smooth development of a mix of interdependent applications is to be achieved which should be automated at the same time in several projects and which must be integrated to avoid an uneconomical investment in data-processing.

An important characteristic of the sector is that it comprehends the applications typical of the other sectors, plus others relative to equipment and machinery: production programming, control of the equipment's operation, designing of equipment and machinery, applied research.

Fig.VI.1 shows the mix of applications typical of manufacturing companies, and the evolution of the mix itself on the basis of the percentual breakdown of EDP expenditure for U.S. industries.

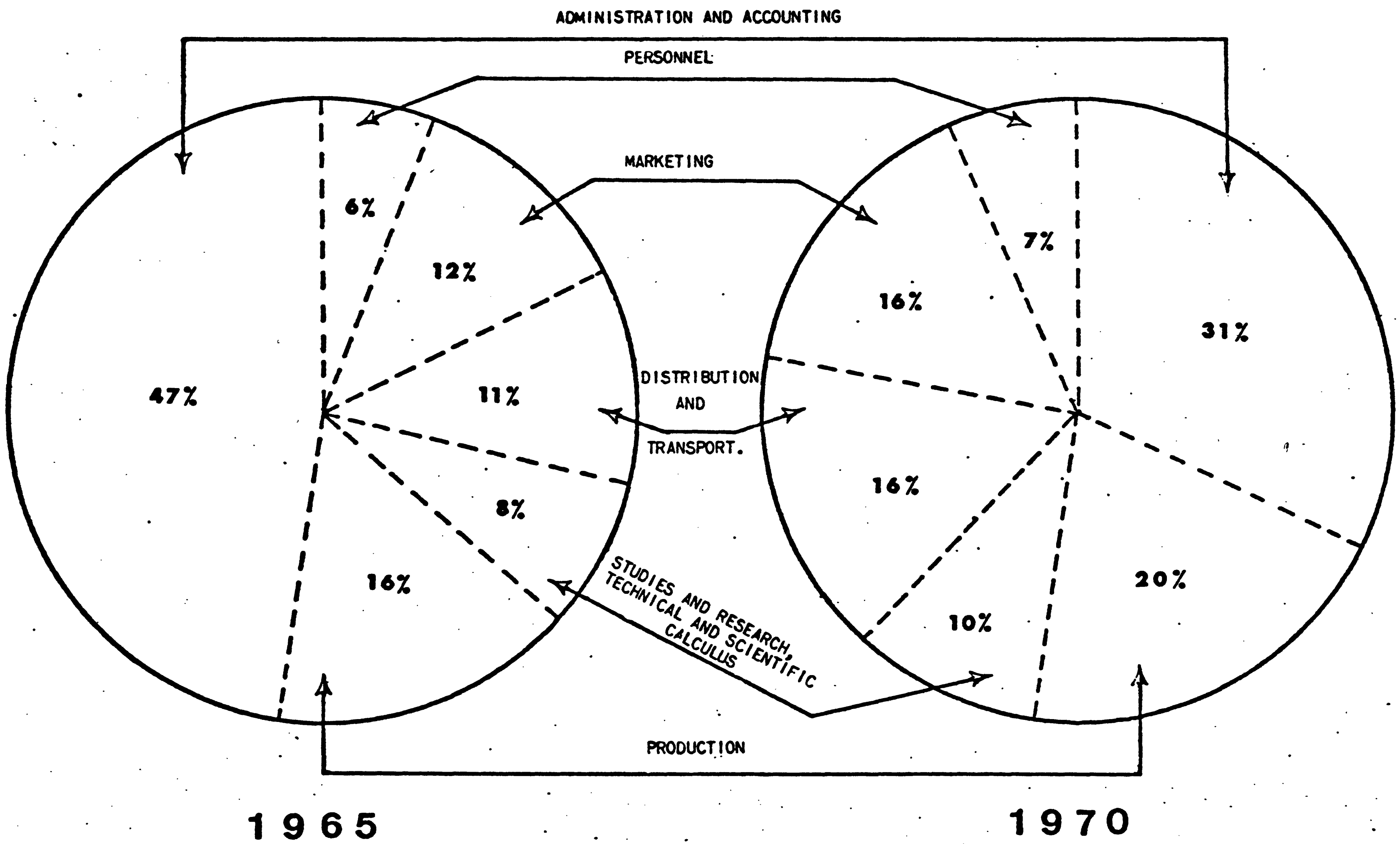
This sector's interest in the use of large computers stems from the integration of many applications of automatic data processing within a single information system.

This integration involves basic organizational changes (structures, procedures, delegation of responsabilities decisional processes) and an opportune program of executive training.

Both these steps toward integration are felt to be necessary, but they are not yet being taken with the needed degree of involvement.

FIG. VI.1

USA - BREAKDOWN OF EDP EXPENDITURE PER AREA OF APPLICATION



SOURCE: MANAGING TO MANAGE THE COMPUTER. HARVARD BUSINESS REVIEW, SEP.-OCT. 1966, PAR J. TAYLOR AND N. DEAN.

These difficulties within the industries under examination should be seen in the context of external difficulties : in fact, a rapid process of re-structuring of the size of companies is under way in Europe. Plans for realization of integrated and automated information systems, (operational, logistic and managerial) which require a 3 to 5 year period, are impedidos hindered by this process, which has been particularly traumatic for the entire manufacturing sector. However, the process should have achieved a stable rate of progress by the middle of the seventies and the second half of the decade should see the beginning of a boom in the use of large computers in the manufacturing sector.

Because of its heterogeneous composition, the sector should be broken down, for the purpose of this examination, into many industries: in fact, it includes such disparate manufacturing industries as metallurgy, electronics, food-processing, and paper-making.

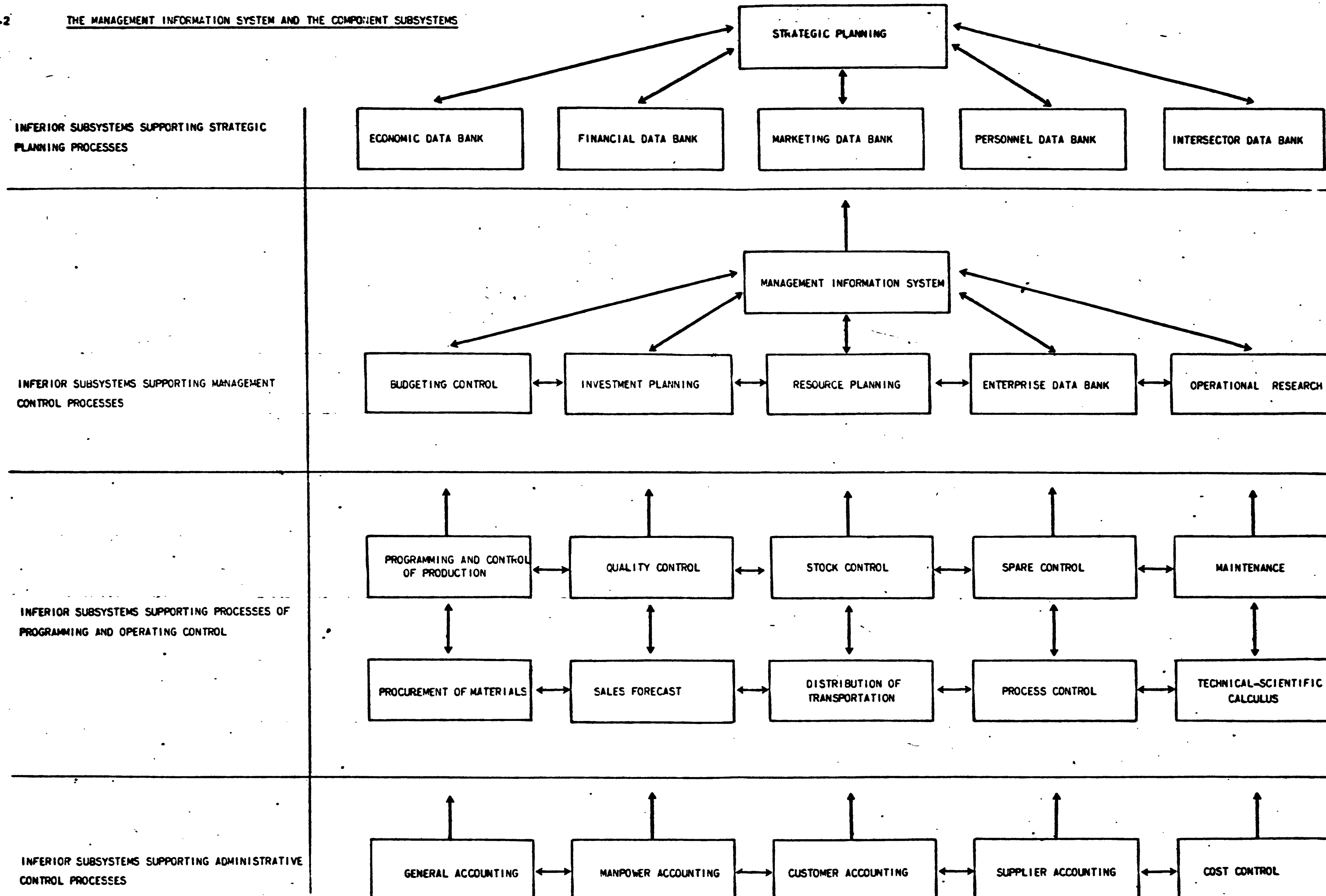
The composition of a typical information system of a manufacturing company and the points at which a computer can be introduced as a processing tool are to be seen in Fig.VI.2.

Naturally, the relative importance of the various sub-systems and the role of the computer can vary considerably in the different industries.

From the horizontal breakdown into sub-systems, it becomes clear that no typical applications are found to be prevalent, and that it is necessary, instead, to develop all the various sub-systems at the same time, since they are all conditioned by one another in the process of automation.

Fig.VI.2 shows that the manufacturing industry will find an

VI.2 THE MANAGEMENT INFORMATION SYSTEM AND THE COMPONENT SUBSYSTEMS



economical application of the large computer only with the introduction of automation into the integrated management system which need to be founded on operational and logistical sub-systems for programming and control.

In fact, the following average break-down into cost-items is to be found in the manufacturing sector's proceeds of sales:

- 15% administrative costs and overhead
- 50% production costs
- 15% sales and distribution costs.

(assuming gross profit to be about 20%).

It can thus be said that more widespread use of large computers will take place when they can significantly influence first the activities of an operative, tactical and logistic nature (production, sales and distribution) and later the process of management control, which corresponds, in monetary terms, to the management of 65% of the turnover.

3. Data Processing Equipment

The number and capacity of the computer equipment in the manufacturing industry undergoes a higher degree of development in comparison with the development of the overall economy.

This is evidenced by the increase of the percentage of computers in the sector in comparison with the national total of computer equipment both in Common Market countries and in the United Kingdom. In fact, the percentage rose from 29% to 38% in the Common Market countries between 1962 and 1965 (1) and from 40% to 48% between 1962 and 1968 in the United Kingdom (2).

It is difficult to present a complete picture of the computer equipment of the European manufacturing industry because, as in the other sectors of the economy, the only complete information available concerns German equipment of 1967 and English equipment from 1962 to 1968.

However, besides this information, De Bruijn's study of 1962 (1) already showed existing differences between the sum of computer equipment of the Common Market countries and of the United Kingdom, both in size and in the order of importance of the manufacturing industries using them.

In fact, the manufacturing industries of Common Market countries made use mainly of small computers while 15% of the computers used in the British manufacturing industries belonged to the large class.

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(1) De Bruijn: Development of the Computer Market in Europe (1963) and Computers in Europe in 1966.

(2) Computer Survey.

In addition, the most important industries in the Common Market countries were, in order of importance: steel, mechanical (including aeronautics), chemicals and electronics; while in the British manufacturing sector the order was as follows: mechanical (including aeronautics) electronics, chemicals and oil. Differences are apparent also from a simultaneous study of the tables VI.1 - VI.4 concerning the equipment in number and value for the German and British manufacturing industry in 1967, of the computers sub-divided by size and industry.
From this comparison, several points can be noted:

- the difference in order of importance of the industry by number of installations: in Germany the most important industry is steel; in the United Kingdom, chemicals;
- a lag in installation of high-performance computers in the British chemical and steel industries in respect to their German counterparts;
- the absence of high-performance computers in the German mechanical industry (including aeronautics);
- higher expenditures for extra-large equipment in the United Kingdom than in Germany; of total EDP expenditures in the manufacturing industry, the British share in the extra-large class is 5.6% against Germany's 2.4%;
- a proportionately larger investment by the German manufacturing industry in high-performance computers, in relation to the total national capacity.

TABLE VI.1 COMPUTER INSTALLATIONS IN THE GERMAN MANUFACTURING INDUSTRY IN 1967

INDUSTRIES	NUMBER OF COMPUTERS						% OF TOTAL ECONOMY					
	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL
STEEL	20	273	36	4	1	334	5,4	9,1	10,4	4,5	7,1	8,7
OIL	4	23	3	3	1	34	1,1	0,8	0,8	3,4	7,1	0,9
CHEMICAL	18	215	26	10	2	271	4,9	7,1	7,5	11,4	14,2	7,1
MECHANICAL AERONAUTICAL	20	275	42	10	-	347	5,4	9,1	12,2	11,4	-	9,1
ELECTRICAL AND ELECTRONICS	23	198	33	7	-	261	6,2	6,6	9,6	8,0	-	6,8
PUBLISHING & PAPER MAKING	20	49	3	-	-	72	5,4	1,6	0,9	-	-	1,9
OTHERS	31	342	16	4	-	393	8,3	11,4	4,6	4,5	-	10,3
MANUFACTURING INDUSTRY TOTAL	136	1.375	159	38	4	1.712	36,7	45,7	46,1	43,2	28,6	44,7

SOURCE: KERNFORSCHUNGSZENTRUM KARLSRUHE, UNTERSUCHUNG DES EINSATZES VON ELEKTRONISCHEN DATENVERARBEITUNGSANLAGEN IN DEUTSCHLAND, STAND UND ENTWICKLUNGSTENDENZEN, FEBRUAR 1969.

TABLE VI.2 VALUE OF COMPUTER INSTALLATIONS IN THE GERMAN MANUFACTURING INDUSTRY IN 1967 ACCORDING TO SIZE

INDUSTRIES	VALUE (purchase price 000 $)						% OF TOTAL ECONOMY					
	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL
STEEL	1.238	71.827	28.570	5.760	3.360	110.755	5,4	9,2	9,9	3,8	6,4	8,6
OIL	259	5.448	2.074	4.464	3.360	15.605	1,1	0,7	0,7	3,0	6,4	1,2
CHEMICAL	1.260	57.465	21.960	15.216	6.720	102.621	5,5	7,4	7,6	10,2	12,9	8,0
MECHANICAL AERONAUTICAL	1.220	74.957	34.545	14.976	-	125.698	5,3	9,6	12,0	10,0	-	9,7
ELECTRICAL AND ELECTRONICS	1.904	54.144	26.606	12.283	-	94.937	8,2	7,0	9,2	8,2	-	7,4
PUBLISHING & PAPER MAKING	1.310	11.136	2.736	-	-	15.182	5,7	1,4	1,0	-	-	1,2
OTHERS	1.866	81.749	13.599	5.760	-	102.974	8,1	10,5	4,7	3,8	-	8,0
MANUFACTURING INDUSTRY TOTAL	9.057	356.726	130.090	58.459	13.440	567.772	39,2	45,9	45,2	39,0	25,7	44,0

SOURCE: KERNFORSCHUNGSZENTRUM KARLSRUHE, UNTERSUCHUNG DES EINSATZES VON ELEKTRONISCHEN DATENVERARBEITUNGSANLAGEN IN DEUTSCHLAND STAND UND ENTWICKLUNGSTENDENZEN, FEBRUAR 1969.

TABLE VI.3 COMPUTER INSTALLATIONS IN THE BRITISH MANUFACTURING INDUSTRY IN 1967

INDUSTRIES	NUMBER OF COMPUTERS						% OF TOTAL ECONOMY					
	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL
STEEL	22	74	8	2	-	106	7,6	3,7	2,7	2,8	-	4,0
OIL	4	26	7	4	4	45	1,4	1,3	2,3	5,6	12,5	1,7
CHEMICAL	21	159	13	6	-	199	7,2	8,0	4,3	8,5	-	7,4
MECHANICAL	4	46	8	4	3	65	1,4	2,3	2,7	5,6	9,4	2,4
AERONAUTICAL	3	57	8	3	-	71	1,0	2,9	2,7	4,2	-	2,6
ELECTRICAL AND ELECTRONICS	25	110	16	2	-	153	8,6	5,6	5,4	2,8	-	5,7
PUBLISHING & PAPER MAKING	20	46	5	1	-	72	6,9	2,3	1,7	1,4	-	2,7
OTHERS	61	477	39	5	-	582	21,0	24,1	13,0	7,0	-	21,8
MANUFACTURING INDUSTRY TOTAL	160	995	104	27	7	1.293	55,0	50,3	34,8	38,0	21,9	48,4

SOURCE: COMPUTERS SURVEY

TABLE VI.4 VALUE OF THE COMPUTER INSTALLATIONS IN THE BRITISH MANUFACTURING INDUSTRY IN 1967

INDUSTRIE	VALUE (purchase price 000 $)						% OF TOTAL ECONOMY					
	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL	DESK	SMALL	MEDIUM	LARGE	EXTRA-LARGE	TOTAL
STEEL	1.030	20.097	5.981	2.880	-	29.988	0,8	4,9	3,0	2,7	-	3,5
OIL	198	6.452	5.472	5.472	13.440	31.034	1,5	1,6	2,7	5,0	11,3	3,7
CHEMICAL	774	43.757	9.211	10.291	-	64.033	5,9	10,7	4,6	9,5	-	7,5
MECHANICAL	187	13.790	5.822	6.336	10.080	36.215	1,4	3,4	2,9	5,8	8,5	4,3
AERONAUTICAL	129	14.000	5.160	6.216	-	25.505	1,0	3,4	2,6	5,7	-	3,0
ELECTRICAL AND ELECTRONICS	1.173	27.381	11.011	3.264	-	42.829	8,9	6,7	5,5	3,0	-	5,0
PUBLISHING & PAPER MAKING	939	13.891	3.610	1.584	-	20.024	7,1	3,4	1,8	1,5	-	2,4
OTHERS	3.335	128.456	27.744	8.218	-	167.753	25,3	31,4	13,8	7,6	-	19,7
MANUFACTURING INDUSTRY TOTAL	7.765	267.824	74.011	44.261	23.520	417.381	58,8	65,5	36,9	40,8	19,8	49,1

SOURCE: COMPUTERS SURVEY

The tables also show that the industries analyzed in the survey account for 100% of the extra-large installations; and, in Germany for 90% and in the United Kingdom for 81% of the value of large computers used in the manufacturing industry.

Altogether, the EDP value of the seven industries accounts for 60% in the United Kingdom and 80% in Germany of the total investments in computers in the manufacturing industry. Comparison with the computer capacity of the U.S. manufacturing industry is not very significant. For measuring the value, in fact, the only data available is the percentage of the manufacturing industry on the entire economy at the end of 1965: 34.5% (1) (the corresponding value for the United Kingdom was 43.4%) but this percentage is not broken down into industries.

Although the percent composition by industries of the number of computers in the American manufacturing industry in 1968 is known, its composition by class of computers is not known (2).

Therefore, the differences found in the U.S. and the United Kingdom do not shed any light on possible differences among the industries especially in the use of high-performance computers.

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(1) Computer Installation Data File of International Data Corporation.

(2) Computer and Automation, September 1969.

U.S.A. and United Kingdom - Percentage distribution of the computer equipment in the manufacturing industry to 1968 (number)

Industries	U.S.A.	United Kingdom
Steel	10,1	8.3
Oil	3.6	3.5
Chemical	10.1	14.6
Mechanical	21.7	5.4
Aeronautical		4.6
Electrical and Electronics	18.2	10.7
Publishing and paper	11.0	6.2
Others	25.3	46.7
MANUFACTURING INDUSTRIES TOTAL	100.0	100.0

4. The most widespread applications of EDP systems

The applications in the sector, on the basis of the inter - views included in the report, will be divided by the manufacturing industries and classified in terms of time according to whether they are already being implemented, being studied or simply being planned. The applications are also grouped according to the criteria mentioned in the chapter on structural characteristics of the sector from the point of view of data-processing.

The division of the sector into industries was carried out on the basis of information available about European users of large computers.

Based on the available data only 5 of the 7 industries of the survey could be examined in detail. This limitation is not serious owever, because the 5 industries with which the survey is concerned altogether make use of 100% in value of the very large computers installed in the United Kingdom and Germany, while total investment in 1967 in EDP for the 5 industries mentioned was 62% in the United Kingdom and 45% in Germany. The principal manufacturing industries which already use large computers and which are therefore potential users of large systems in the next ten years are:

1. Steel
2. Oil
3. Chemical
4. Mechanical
5. Aeronautical

TABLE VI.5 APPLICATIONS BEING PERFORMED, STUDIED AND PLANNED BY INTERVIEWS

STEEL	BEING PERFORMED	BEING STUDIED	BEING PLANNED
PROCESSES OF ADMINISTRATIVE CONTROL			
Financial accounting	M1 M2 M3 M4 M5		
Labor accounting	M1 M2 M3 M4 M5	M4	
Accounts receivable	M1 M2 M3 M4 M5		
Accounts payable	M1 M2 M3 M4 M5		
Cost control	M1 M2 M3 M4 M5		
PROCESSES OF PLANNING AND OPERATIONAL CONTROL			
Programming and production control	M1 M3 M4 M5	M3	
Quality control	M1		
Stock control management	M3 M5		
Spare parts control			
Maintenance	M5		
Supplies			
Sales forecasting			
Distribution, transportation			
Process control	M2 M3 M4 M5	M1 M3 M4 M5	
Technical-scientific calculus calculations	M1 M2 M3 M4 M5		
PROCESSES OF MANAGEMENT CONTROL			
Budgeting			
Investment planning	M3		
Resource planning			
Data bank		M1 M5	
Operations research	M3 M4 M5	M4 M5	
M.I.S.			M1 M2

Follow: VI.5

APPLICATIONS BEING PERFORMED, STUDIED AND PLANNED BY INTERVIEWS

OIL	BEING PERFORMED	BEING STUDIED	BEING PLANNED
PROCESSES OF ADMINISTRATIVE CONTROL			
Financial accounting	M6 M7 M8 M9 M10 M11		
Labor accounting	M6 M7 M8 M9 M10 M11		
Accounts receivable	M6 M7 M8 M9 M10 M11	M8	
Accounts payable	M6 M7 M8 M9 M10 M11		
Cost control	M6 M7 M8 M9 M10 M11		
PROCESSES OF PLANNING AND OPERATIONAL CONTROL			
Programming and production control	M6 M9	M6 M7 M9	
Quality control			
Stock control management	M6 M8 M9 M10 M11	M8 M10	
Spare parts control			
Maintenance	M10		
Supplies			
Sales forecasting	M6 M9	M7	
Distribution, transportation	M6 M7	M6 M7 M8 M9 M10	
Process control	M11	M6	
Technical-scientific calculus calculations	M7 M8 M9 M11		
PROCESSES OF MANAGEMENT CONTROL			
Budgeting			
Investment planning	M9		
Resource planning	M9		
Data bank		M6 M9	M7 M9
Operations research	M6 M7 M8 M9 M11	M6 M7 M10 M11	
M.I.S.		M10	M6 M7 M9

Follow: VI.5

APPLICATIONS BEING PERFORMED, STUDIED AND PLANNED BY INTERVIEWS

CHEMICAL	BEING PERFORMED	BEING STUDIED	BEING PLANNED
PROCESSES OF ADMINISTRATIVE CONTROL			
Financial accounting	M12 M13 M14 M15 M16 M21		
Labor accounting	M12 M13 M14 M15 M16 M21		
Accounts receivable	M12 M13 M14 M15 M16 M21	M15	
Accounts payable	M12 M13 M14 M15 M16 M21		
Cost control	M12 M13 M14 M15 M16 M21		
PROCESSES OF PLANNING AND OPERATIONAL CONTROL			
Programming and production control	M14 M15 M16	M13 M15 M16 M21	
Quality control			
Stock control management	M13 M15 M16 M21	M13 M14	
Spare parts control			
Maintenance			
Supplies			
Sales forecasting			
Distribution, transportation			M15
Process control	M16		M16
Technical-scientific calculus calculations	M12 M13 M14 M15 M16	M13 M21	
PROCESSES OF MANAGEMENT CONTROL			
Budgeting		M21	
Investment planning			
Resource planning			
Data bank		M14 M15	M14
Operations research		M13 M21	M15
M.I.S.		M13	M14 M15 M16 M21

Follow: VI.5

APPLICATIONS BEING PERFORMED, STUDIED AND PLANNED BY INTERVIEWS

MECHANICAL	BEING PERFORMED	BEING STUDIED	BEING PLANNED
PROCESSES OF ADMINISTRATIVE CONTROL			
Financial accounting	M17 M18 M20		
Labor accounting	M17 M18 M20		
Accounts receivable	M17 M18 M20		
Accounts payable	M17 M18 M20		
Cost control	M17 M18 M20		
PROCESSES OF PLANNING AND OPERATIONAL CONTROL			
Programming and production control	M17 M18 M20	M18	
Quality control	M20		
Stock control management	M17 M18 M20		
Spare parts control	M18	M20	
Maintenance			
Supplies			
Sales forecasting			
Distribution, transportation			
Process control	M17	M18	
Technical-scientific calculus calculations	M17 M18		
PROCESSES OF MANAGEMENT CONTROL			
Budgeting	M17		
Investment planning		M17	
Resource planning		M17	
Data bank		M20	
Operations research	M20	M18	M17 M20
M.I.S.		M18 M20	M17 M20

Follow: VI.5

APPLICATIONS BEING PERFORMED, STUDIED AND PLANNED BY INTERVIEWS

AERONAUTICAL	BEING PERFORMED	BEING STUDIED	BEING PLANNED
PROCESSES OF ADMINISTRATIVE CONTROL			
Financial accounting	M19		
Labor accounting	M19		
Accounts receivable	M19		
Accounts payable	M19		
Cost control	M19		
PROCESSES OF PLANNING AND OPERATIONAL CONTROL			
Programming and production control	M19		
Quality control		M19	
Stock control management	M19		
Spare parts control	M19		
Maintenance			
Supplies			
Sales forecasting			
Distribution, transportation			
Process control			
Technical-scientific calculus calculations	M19		
PROCESSES OF MANAGEMENT CONTROL			
Budgeting			
Investment planning			
Resource planning			M19
Data bank		M19	
Operations research	M19	M19	
M.I.S.			M19

6. Electrical
7. Publishing and paper

A survey carried out in the U.S. in 1969 of the 100 leading users of computers, classified 87% of the value of the computers then installed as being in the industries listed, while the first 5 industries for which the results of the interviews are available, accounted for 61.6% of the total.

In comparing the list of industries and their relative importance with the corresponding U.S. data, it should be pointed out that both the aeronautical and aero-space industries in Europe carry less weight than in the U.S. and that the electronics industry is still split into many separate companies.

The results obtained from interviews available for our research have been assembled in a series of tables organized by industries (Tables VI.5).

4.1. Present applications

With reference to the tables VI.5, it can be stated that the most modern manufacturing industries have definitively passed the stage of using computers for applications solely concerned with administrative and accounting procedures and that there is a greater tendency to use a computer as a new support for carrying out processes of programming and checking operational and logistic activities (see second band from bottom in fig. VI.2).

This tendency determines the introduction of computers into production departments (factories) or determines, at least in the case of the large multi-divisional or multi-national organizations, the installation of peripheral (district or national) data processing centres placed next to the operational and logistic activities (1). This presents a new problem in distribution of processing equipment between center and periphery, and at present there seems to be a preference for solving it with a network of medium and small computers connected to a large central data processing unit rather than with a very large central data processing unit with a vast network of terminals and Message Switching computers.

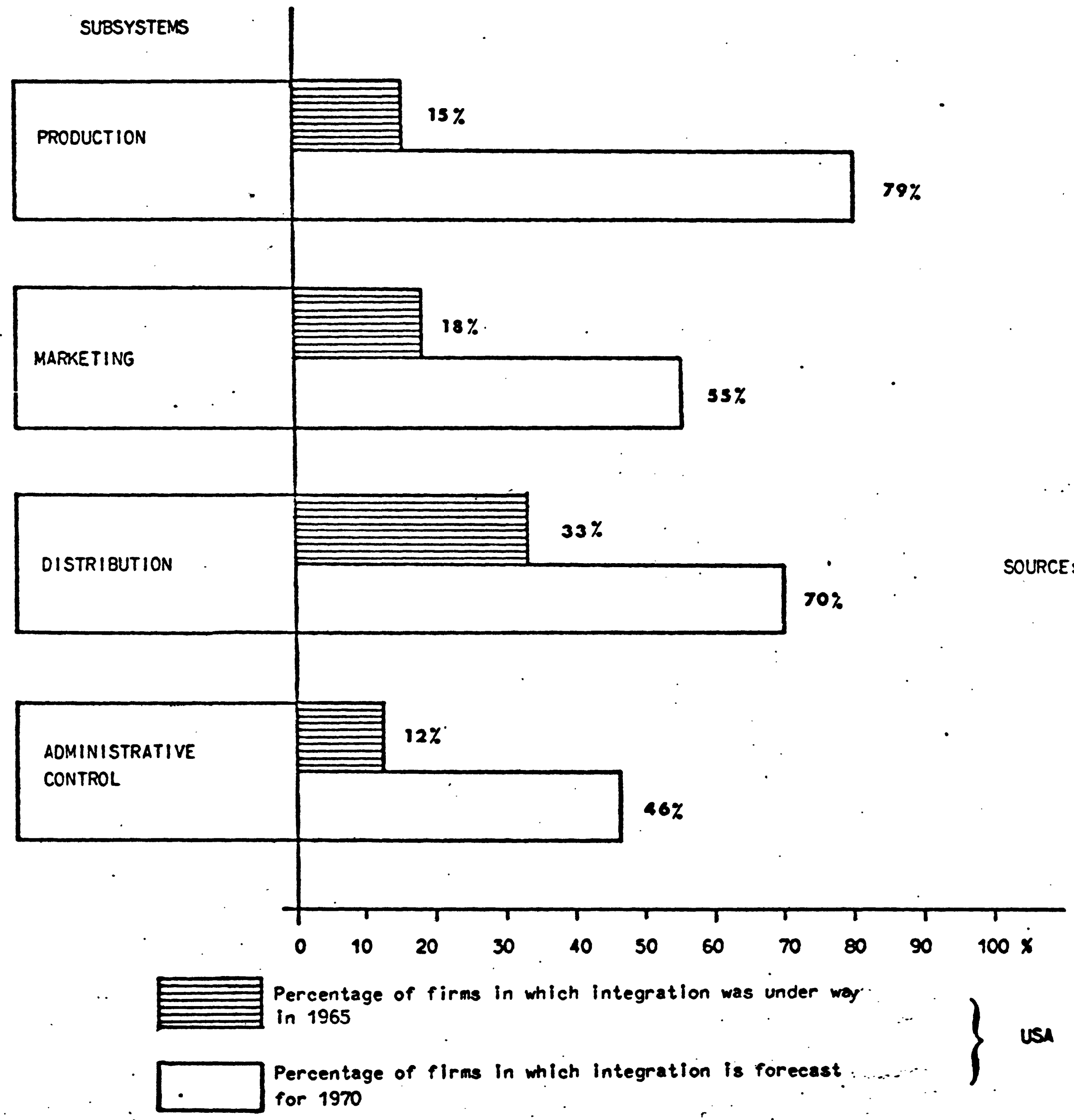
The stage reached by automation of operational and logistical systems is not yet an integration of its various sub-systems, but is limited mostly to automation of single sub-systems. This means that the effort being made by the companies is nothing more than an intermediate phase of only limited economic advantage, unless it is part of a long-term planning aiming at strict integration of the many sub-systems (see fig. VI.3).

At best, experimental applications are under way in Europe of systems that integrate groups of sub-systems with partial use of terminals, and limited processing in real time and on line.

The most typical examples are:

(1) Typical realizations of such an organizational structure of the hardware are to be found in a large Italian company interviewed in the chemical industry and in the multi-national oil companies.

FIG. VI. 3 TREND TOWARD INTEGRATION IN INFORMATIONAL SUBSYSTEMS



SOURCE: MANAGING TO MANAGE THE COMPUTER. HARVARD BUSINESS REVIEW, SEP.-OCT. 1966, BY : J. TAYLOR E N. DEAN.

- An automated system of "order-getting and order-filling" integrated with "peripheral stocks control", "planning of deliveries", "packaging material inventory control" for the petro-chemical and chemical sub-sector.
- An automated system of "Programming and control of maintenance activities", integrated with these sub-systems: "Inventory control and supply of technical materials and spare parts" and "Construction of new plants" for the mechanical and aeronautical sub-sectors.
- An automated system of "Programming and control of production" integrated with these sub-systems: "Quality control of finished product", inventory control and supply of raw materials, and "labor control" for the metallurgic and mechanical sub-sector.

To this group of operational and logistical applications of medium computers must be added other areas involving high capacity computers making up the Data Processing Centers of the headquarters of the large companies.

Administrative and accounting applications are always present in these centers (financial accounting, cost accounting, invoicing, accounts receivable and accounts payable administration, etc.).

But in addition to them, the most typical MIX of applications is as follows:

- cash flow control
- personnel administration
- sales forecasting
- technical-scientific calculus for engineering and research
- operational research applications or quantitative technical

applications for analysis in many different sectors
- capital investment analysis.

The present picture of the fields of application is shown graphically in fig.VI.4. It must be borne in mind that the applications listed of the various operational and logistical sub-systems are only partly integrated horizontally, while their process of vertical integration with the management information system has not yet begun. This integration will lead to more widespread use of large computers in the years from 1975 to 1980.

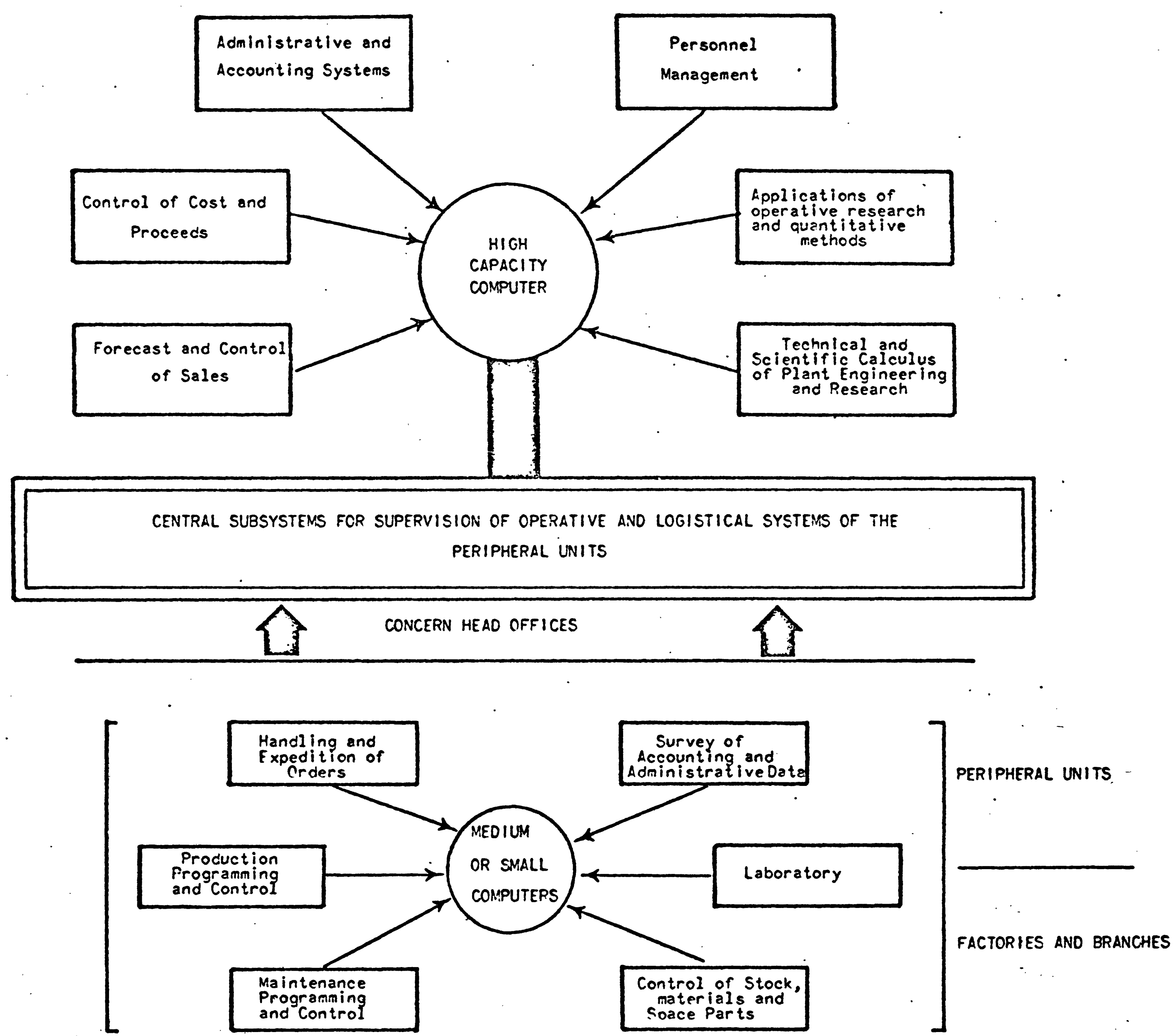
Among the present most advanced applications, the following should be pointed out, even though their integration involves only several projects in a sub-system , and not the system in its entirety:

- A large automobile factory, with headquarters in Great Britain, has achieved a high degree of integration of the four sub-systems into which the entire system has been divided, thus:
  a. Pre-production information system, involving the vehicle design area
  b. Material information system, involving the production area, in planning and control
  c. Vehicles information system, for the entire sales organization
  d. Employee information system, directed toward personnel management.

  Naturally, these sub-systems - especially type d. - are still evolving.

- A large Italian steel company, in addition to a complete,

FIG. VI. 4 ACTUAL PICTURE OF APPLICATIONS PER MULTIDIVISIONAL AND MULTINATIONAL CONCERNS



detailed layout of the entire information system based on sub-systems, has a series of Operational Research appli - cations based on the development of research groups at an operational level of factories. The methodologies most used are Linear Programming and Simulation.

The great strides in development of decisional techniques of this type, which require large computers and a great deal of time for calculations, have permitted the companies a technical-scientific utilization of a high percentage of processing time approximate to an American-type utilization for the particular sub-sector.

The present MIX for the oil and petrochimical sub-sector contains a vast range of applications. This sub-sector will be found to have the most up-to-date management, as can be seen from measuring the height of the points representing the applications.

All three bands contain applications typical of the information system for the manufacturing companies described in Fig. VI.2.

Not only does this represent integration of all the processes of administrative type; it also shows that a whole series of management tools have been prepared which will further the progress of the more advanced companies toward the first steps in scientific management of the entire activity of programming and control.

4.2. Applications being studied

The type of application to be found in the second previsional time band headed "being studied" involves a series of processes, most of them with sub-systems in the area of programming and control of production. Some cases of advanced applications in the area of administrative control can also be found, but they must be considered extensions or increased automation of existing procedures rather than innovative procedures.

From an examination of the topics mentioned by the interviewees as being viable in the near future, and by a study of the present applications, the great difference becomes clear between continuous process industries such as oil and steel, and those of discontinuous processes such as mechanics and aeronautics and some chemicals.

In industries of the first type, applications of programming of production must be considered as implementations and applications of models - built on the basis of O.R. techniques - for the study and optimization of production processes in the middle and long term.

Applications of production control are difficult to use on an operational basis, except in the rare cases where the company already uses process computers in direct connection with production plants. Instead, companies whose production cycle is discontinuous have already begun or in many cases are studying procedures of programming and control of production which are more directly related to data processing of a traditional type, and which can better be integrated with procedures of inventory control, quality control and cost control.

Listed are several applications typical of those being studied:

- Applications of process control for the steel industry (the oil and petro-chemical industry, which may be more suited to this sort of application, however does not seem decidedly oriented in this direction)
- Applications of planning and production control, for the chemical industry
- Applications in the area of analysis and planning distribution for the oil and petro-chemical sub-sectors
- Introduction of management applications, for the chemical and mechanical industries, which had previously been lacking in advanced techniques of planning and management.

4.3. Applications in project

The applications listed in the third time band are at present in a sufficiently definite project stage, and should therefore be realized between now and 1973/75. The distribution of these projects among the different types of processes examined here is evidently influenced by what has so far been said about applications being performed and applications being studied by the different industries.

The industries that group together companies with large-scale series productions and continuous-cycle production which are already more advanced in the quality and quantity of their applications, generally tend to set up data banks with high-speed access and try to integrate whatever has already been done into an organic whole which can really be called a Management Information System. (MIS)

The other industries instead try to realize the objectives of operational programming and decision-making which can only be achieved by the introduction and development of methods of quantitative analysis and calculation.

These are the principal tendencies that can be found:

- Extension of information sub-systems and their integration into the MIS, for the oil, petro-chemical, chemical and mechanical industries
- Applications of operational research, and their implementation, for the oil, petro-chemical, mechanical and chemical industries .
- Setting up of data banks for management purposes, for the oil, petro-chemical, aeronautical and chemical industries.

4.4. Some considerations on the comparison among industries

Analysis of the interviews conducted in the industries showed a degree of differentiation in terms of levels of application: the different aggregate groups are, in fact, in various phases of advancement from this point of view.

From a careful reading of the tables VI.5 in which the results are condensed, a pattern of points, representative of the applications in the companies interviewed, is evidenced. This pattern can be considered typical of the whole sector: a triangular repetitive trend can be observed in the shape of the whole.

The height of the triangle, measured on the ordinate, is in proportion with the level of applicative advancement, meaning by this the presence on the actual time band of EDP applications in the operative and management sub-systems.

As a consequence of the meaning attributed to the vertical dimension of the representation, the less advanced industries will be represented by triangles with very limited heights.

The horizontal dimension of the triangle represents the dynamic aspect of the integration. But this aspect too is connected with the number and with the quality of the applications already implemented and, consequently, with the height of the geometric representation.

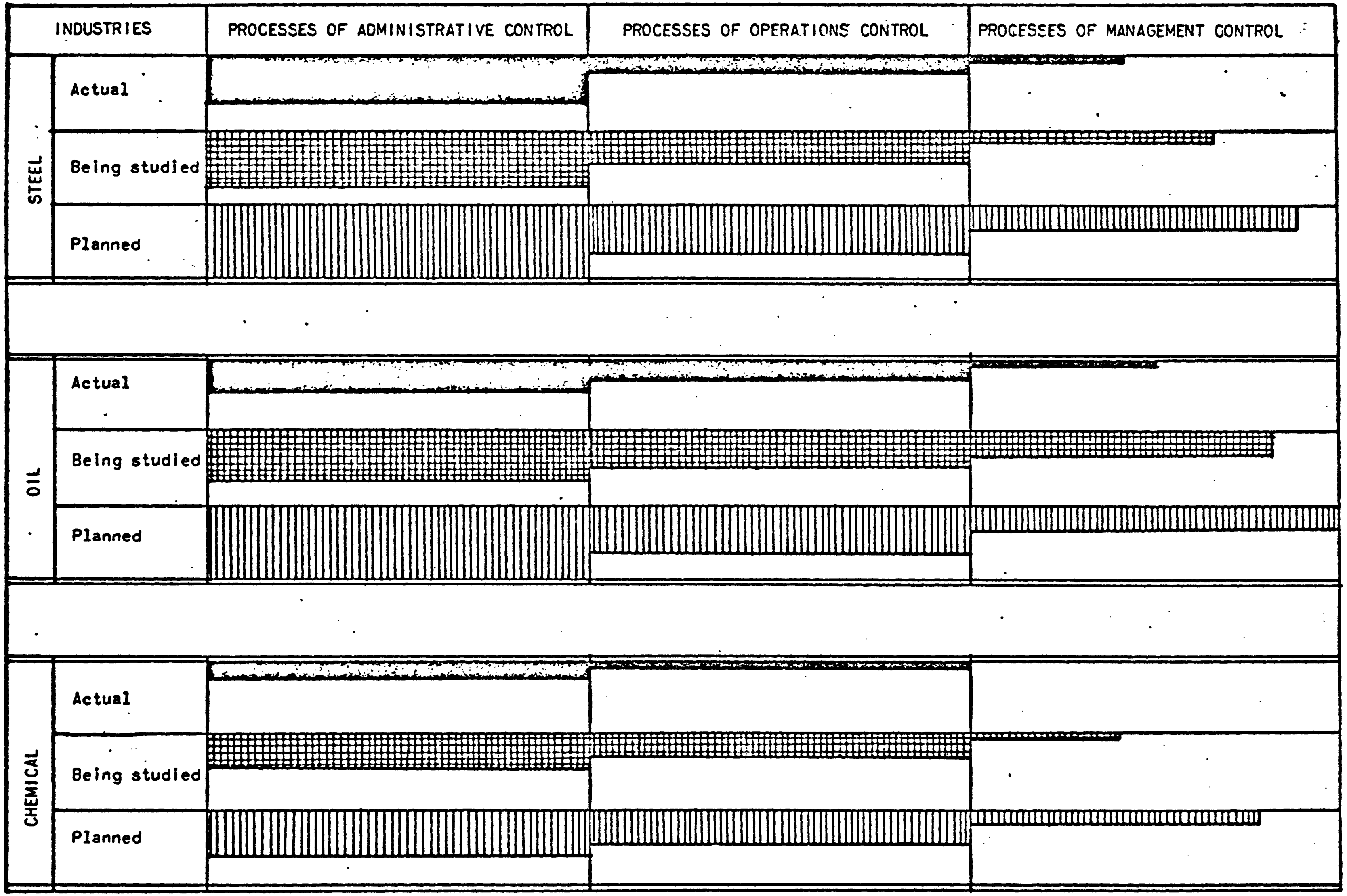
We have tried to synthesize graphically the quantitative and qualitative differences in fig. VI.5.

The criterion adopted to represent the phenomenon makes use of two fundamental parameters:
- the stage of advancement in applications
- the qualitative level of the applications.

The first parameter is to be read on the abscissa and accounts for the number of the applications, dividing them according to type. It must be remembered that the three bands are in sequence. This first parameter, therefore, is the expression of an evaluation of the degree of dynamic integration - from the point of view of information - of the industry taken into consideration. This evaluation, however, is not quantitative.

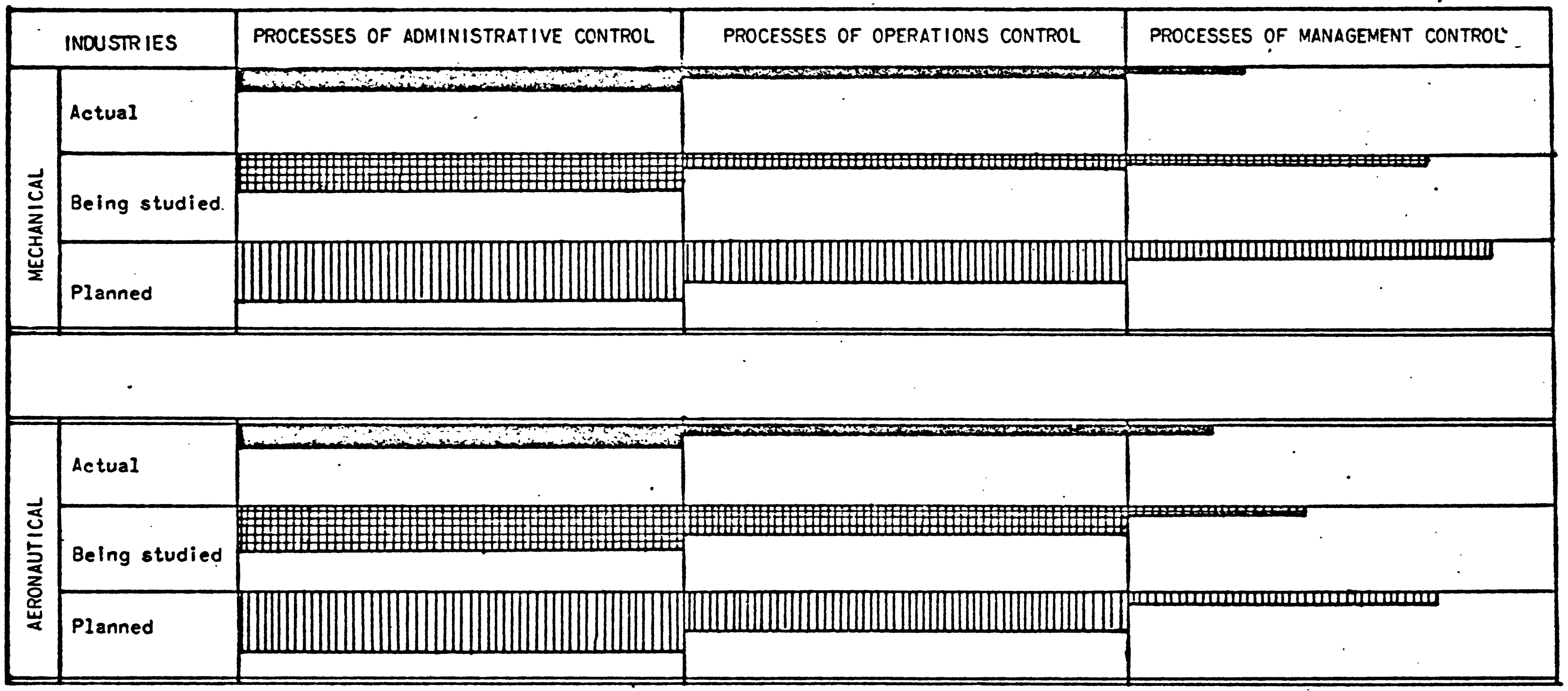
The second parameter, to be read on the ordinate axis, represents the level of horizontal integration in the sub-

FIG. VI.5 COMPARISON OF ADVANCEMENT OF APPLICATIONS BETWEEN THE VARIOUS MANUFACTURING INDUSTRIES



Follow: FIG. VI.5

COMPARISON OF ADVANCEMENT OF APPLICATIONS BETWEEN THE VARIOUS MANUFACTURING INDUSTRIES



systems in which data-processing was already used. The gradual decrease in the width of the band in the single divisions according to type, speaks not only of the different level of integration of applications, but also of the trend of the vertical integration among sub-systems belonging to different bands.

In this way it is possible to synthesize a certain order of priority (dynamics) among the industries we have been taking into consideration.

The ranking which results is in this order:

1) Oil and petro-chemicals
2) Steel, metallurgy and non-ferrous metals
3) Automobile and automotive mechanics
4) Aeronatics and Aerospace
5) Chemicals, pharmaceutics, synthetic fibers and rubber.

The dynamic sliding of the applications in the industries must be taken into consideration not only, as was seen before, in the evaluation of those applications under study and being planned in connection with others already implemented, but also when future applications are in project.

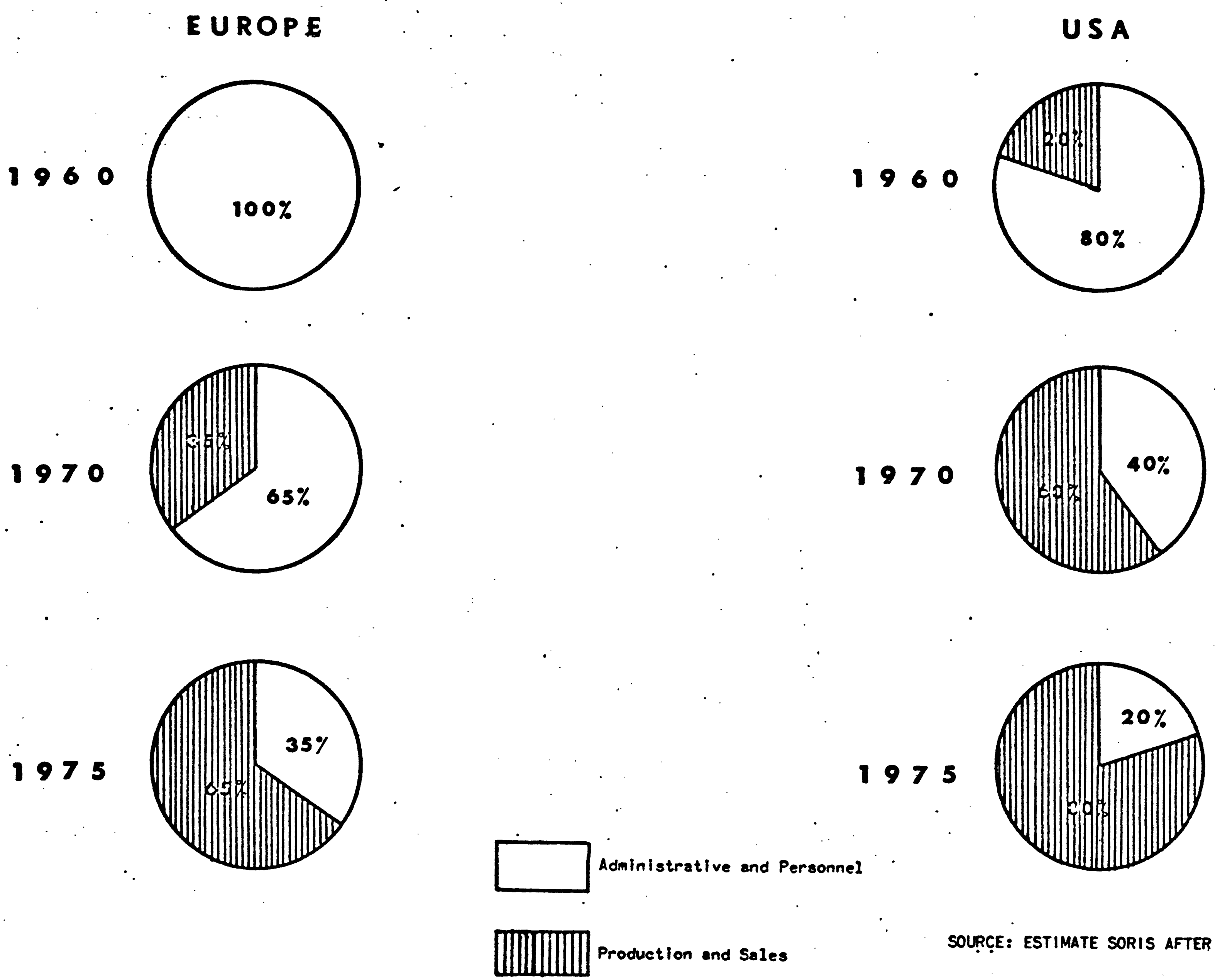
There is, in fact, a strong probability that the future applications which will be the targets of the less-advanced companies will already be the targets attained by the leading companies of the group. Nevertheless, it is possible to adopt the same forecasting logic in order to maintain the same ranking of priorities among the various industries.

In conclusion, it would seem that the appraisal of the informations collected in the interviews shows a trend toward an increase in the percentage of the costs in

EDP in the areas of production and distribution, with the timing represented in fig. VI.6 and VI.7 and corresponding to what had been observed in the United States.

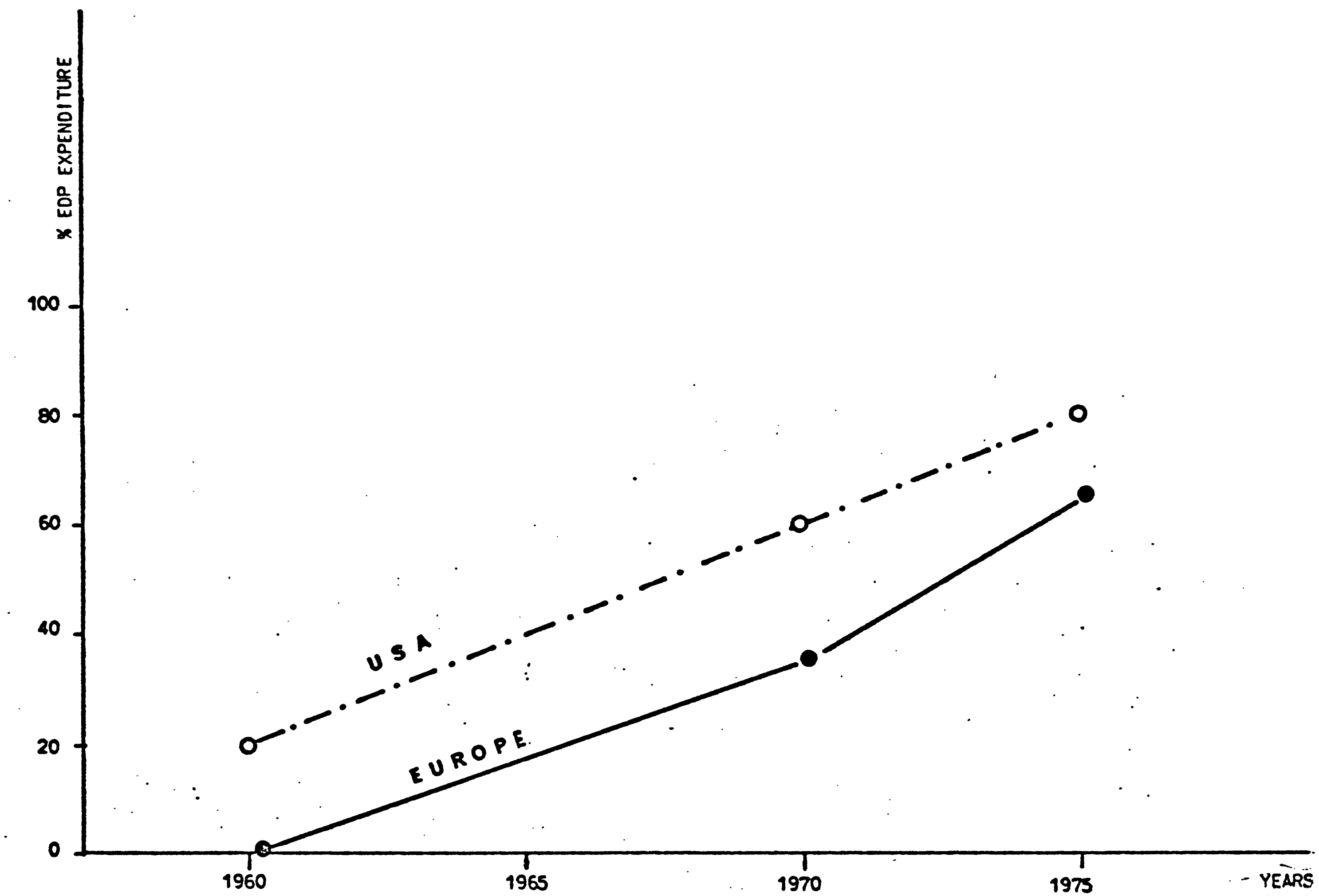
FIG. VI.6

BREAKDOWN OF EDP EXPENDITURES



SOURCE: ESTIMATE SORIS AFTER DATA FROM DIRECT SURVEY.

FIG. VI.7 PERCENTAGE OF EDP EXPENDITURE PER PRODUCTIVE-DISTRIBUTIVE AREAS



5. Future applications

5.1. Hypotheses of development

On the basis of the qualitative graphic chart used to summarize the situation, the future applications can be grouped as follows:

- foreseeable applications for the less advanced industries (mechanical, aeronautical, chemical)
- applications which are targets for industries with more up-to-date management (oil, steel).

In the first of these two groups will be represented all the projects typical of the band of integrated processes which are not yet included among the projects for 1973/75 for the industries in which EDP applications are at a lower quantitative and qualitative level. Obviously this "sliding" of the targets in terms of time among the industries will take place within the precise limit represented by the specific features of some of the applications for the different industries. In fact, if a common trend of development can be found among the industries, the evolutionary possibilities of certain typical applications must be taken into consideration: for example, planning in the electronics industry, or analysis of aerial photography in the oil-drilling and mining industries; that is, of applications which are in themselves definitely advanced, but are not representative of an overall modern management. Applications of this kind could be good reasons for adopting very large computers even in companies included in less advanced industries.

In the hypotheses of development of the more advanced in dustries' the trends which have already emerged play a prevailing role, and these same trends will become factors in favor of the use of very large computers in the following fields:

A. Completion of the process of integration of multiple information sub-systems (automated in mosaics) - operational, tactical and logistical - and the consequent creation, in company headquarters, of integrated sub-systems for supervision of operational and logistic activities, and of integrated data banks which would be accessible to the middle management in a flexible way.

B. Beginnings of the realization of management information sub-systems based on the sub-systems in point A.

C. Beginnings of studies of automated information sub-systems to support the strategic planning process of the company.

Special secondary sub-systems should accompany the above main trends; these secondary sub-systems, with different characteristics for each industry, tend to extend the use of operational research applications or, more generally speaking, of quantitative methods in:
- evaluation of investments;
- sales forecasting and market analysis;
- cash flow management;
- optimization of distribution network;
- optimization of distribution plans.

Large computers will also have an increasing use in Informa tion Retrieval applications (bibliographies, patents, national economic data etc.) and in technical-scientific calculations for planning and for operational research.

Both the preceding groups of applications will for the first time include a flow of external information (by computer) such as population figures, statistics on national and international economic and financial data, etc.

The typical scheme of the range of applications performed by a very large computer by the middle of the seventies should be those found in fig. VI.8.

What should also be kept in mind are:

- the degree of advancement of the studies and projects in the manufacturing industries by 1975;
- the simultaneous realization of automatic information systems in other public and private organizations which frequently interact with the companies of the sector being examined.

Granted the foregoing developments, which are particularly decisive in the public organizations, the following tendencies in applications can be foreseen in the chronological order given:

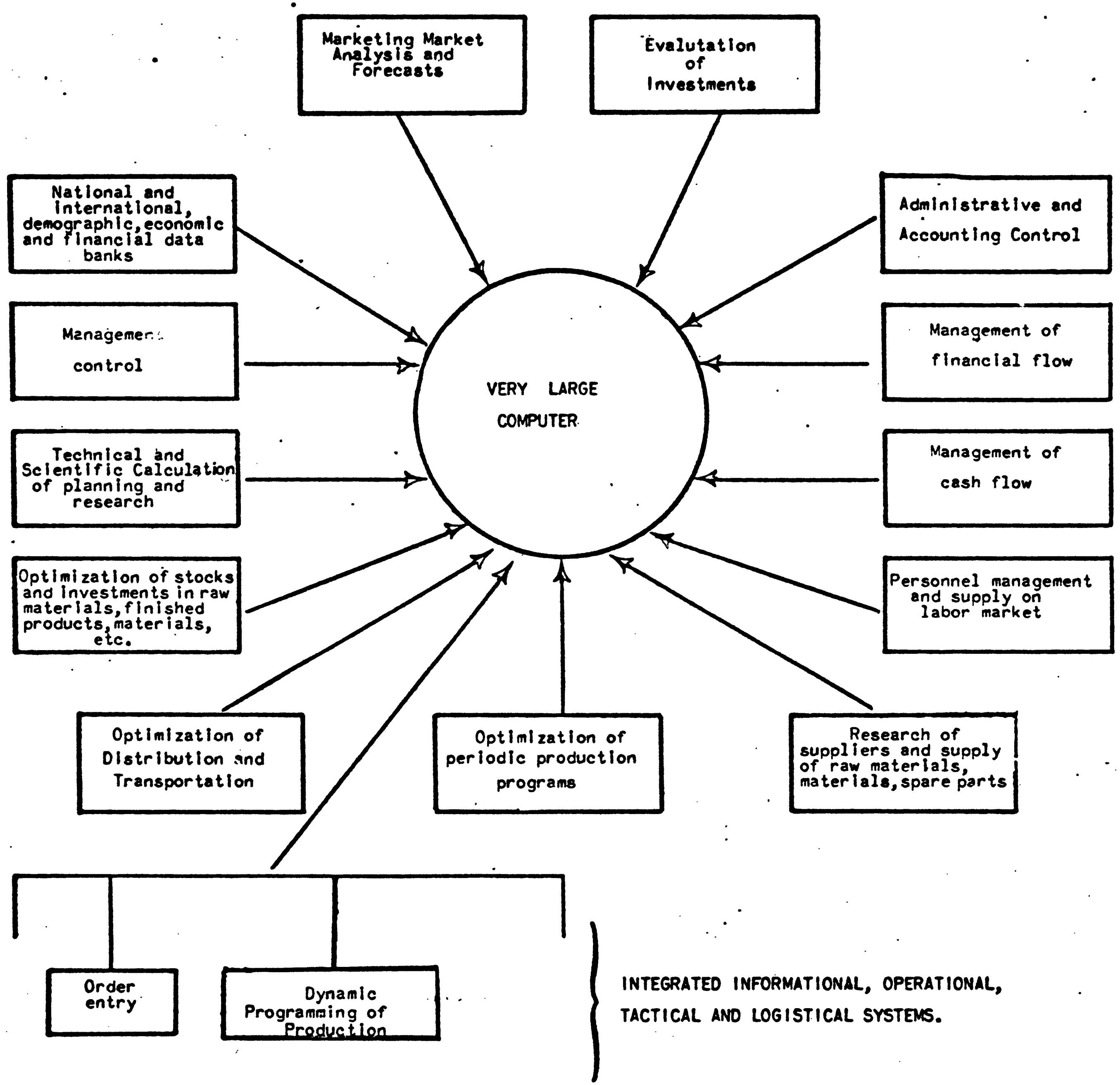
- automation of management control sub-systems based on information sub-systems realized and in normal use before 1975;

- beginnings of automation of information sub-systems in support of strategic planning procedures with a boom in use of national and international data-banks (Demographic, Economic , Financial, Personnel, etc.);

- beginnings of development of connections between inter-

FIG. VI.8

SPECTRUM OF FUTURE APPLICATIONS ON VERY LARGE COMPUTER



sectorial information systems, of which the following should probably be the most typical for the manufacturing industry:

- management of monetary and financial flow through direct connection with banking, insurance and stock market systems, with public administration systems (for social security and welfare, for tax collection etc.) and with the systems of the customers and suppliers (for payment and bill collecting);
- management of personnel flow with public corporations, schools and universities, and companies providing information service on the national and international labor market;
- management of the flow of raw material, finished products, materials etc. interchanged with the market via direct connections with the automated systems of the suppliers, the clients and transportation companies etc.
- management of information flow (Demographic, Economic , Financial, etc.) with public corporations and companies specialized in gathering such information,or with other companies in the same sector or in other sectors.

This range of additional applications could cause such a boom in the need for large computer systems as to bring about a significant increase in the speed of progress of less advanced industries , because such levels of automation of information systems depend for their realization on large computers, or at least on large systems. This in effect means multi-processor configurations of medium and large computers, which are in turn connected to networks of peripheral computers and terminals.

These considerations on the hypothetical development of data processing applications for the sector being examined are logical extrapolations made from the results of the interviews analysed in the preceding chapter. They are not, however, the only justifications for the use of large computers in the manufacturing industries.

The qualitative change that they implicate, with the approach to strategic planning and the immediate consequences on the dimensions of the computing equipment become clearer from an analysis made outside the company and therefore one does not always get from the person interviewed a precise overall view of this probable increase in the rate of development which is common in this day.

Instead, use is foreseen of large computers to cope with the increase in volume of applications which are not qualitatively advanced. These increases in volume are connected with the dimensions of the company phenomena which the computers can handle or simply find out.

This second factor, which encourages the use of large computers is even more quantifiable on the basis of parameters that express the dimensions of activity of the companies.

Tendencies in advanced applications and in the dimensions of the companies are therefore factors which will be taken into examination later, in order to obtain an overall quantification of the potential European users of large computers in the next ten years.

5.2. Comparison with the U.S.A.

There is no significant gap in the creative level of applications in the sector in comparison with the United States: automation of advanced sub-systems and the invention of sophisticated methodologies are already under way or in project in Europe.
Specific differences can instead be found in the reliability of the realizations already implemented and in the level of horizontal and vertical integration of the sub-systems because of the company organization's greater speed in adapting itself to the use of the computer.
In terms of time, this gap can be estimated at from 3 to 5 years.
On the basis of a report published by the NAA (National Association of Accountants) on the state and the trends in development of information systems in 12 leading companies in the various manufacturing industries (1), the following considerations can be made on the computer's impact on management in the U.S. manufacturing industry:

a) data processing covers almost all routine processes of administrative control, and the degree of integration between the various sub-systems is continually increasing; at the same time the needed changes in the internal communications networks are being completed to facilitate the integration of those applications which outgrow the traditional organizational divisions of functional character;

(1) Computer-Based Information Systems for Management - A Survey - NAA Research Study. March 1969.

b) among the operational processes, production planning is carried out by means of the computer and is generally done annually or semi-annually; the planning is done in conjunction with the inventory control sub-system which is the sub-system most frequently automated. Process control is growing in importance in many of the companies examined. Of the marketing-oriented operational activities, data processing of order-entry seems to be the most widespread, partly because of the very brief delivery time typical of the American market which does not permit stocks to be left with the suppliers.
An important part of total computer time is taken up by technical and scientific calculations for engineering, by calculus, by plant simulation and by applied research. However, the organizational aspects of these activities have not yet felt the impact of data processing;

c) the methodologies and procedures being used by the management areas are becoming more and more sophisticated. Many of the activities that once required man's intervention in the automated decisional process are now part of the computing program. The present tendency is toward determining the "rules of decision" followed by the manager in different phases of his activities, so as to transfer them to the machine level. Generally speaking, an increased understanding is expected of the decisional process and improved methodologies in operational research in order to take into consideration new projects in these subsystems;

d) little progress has been made in the field of assisting strategic decision-making. Preparation of information banks and retrieval systems necessary for making strategic plans has just begun;

e) most of the future applications involve typical management activities.
All those interviewed agreed that to achieve satisfying results from the use of these applications, the following organizational assumptions are needed:

1) A good informational base on which to make further plans.
2) Availability of analysts oriented toward understanding of managerial aspects of problems treated, and managers oriented toward and understanding new possibilities in methodology.
3) Strong support from top management to facilitate organizational changes required by the new procedures.

To this brief view of applications being made or being projected, in the U.S. manufacturing industry, some forecasts can be added about the American development of sub-systems requiring the installation of networks of terminals. The need for a radical evolution in this particular type of hardware was also underlined in the European interviews.
In general, applications of administrative and management type do not reveal any particular tendency to use data-transmission equipment.
Sub-systems of scientific calculation and design follow this course, while marketing-oriented applications show outstanding possibilities of development for data-transmission.

The aforementioned "order entry", which is the most typical of these applications, is being used by several large American companies such as Allied Chemical and Union Carbide, and is becoming ever more widespread for obvious reasons of competition, which is a very important motivation in marketing activity.
Data-transmission is not in itself a determining factor in future installations of extra-large processors, but it can become so in specific areas by changing from "off-line" as it is now, to "on-line"; which is to say changing the hardware structure from atomic systems to solar systems which involve extra-large processors connected to message-switching computers and to a network of terminals.
The forecast is that there will be a rapid increase in this type of configuration in the next few years, but as regards the quality of transmission and their cost, the present situation in the U.S. cannot be compared with that of Europe, where it is foreseen that these types of application will be extended necessarily much more slowly.

6. Expectations about hardware and software.

In the manufacturing industries, which present the most complete range of types of application and therefore the greatest diversification and differentiation of the characteristics of the machines, the most pressing needs in terms of hardware should be the following for each type:

A. Central Unit:

- multiprocessor-type configuration with central units possibly specialized in TP, Input/Output permitting a high level of data processing efficiency with a complex MIX of processing in BATCH, REAL TIME, ON LINE, COLLOQUIAL AND SCIENTIFIC CALCULATION;
- hardware which can take on with higher reliability more of the functions of present supervisors or executives of operational systems;
- much larger, much faster, low-cost central storage;
- non-numerical storage (IMAGE STORAGE);
- associative storage.

B. Input/Output a general tendency toward a more diversified and differentiated type characterization among remote units:

- optical reading of documents;
- facsimile input units;
- special terminals according to type of utilization;
- graphic input terminals;
- special terminals for programmers;
- output facsimile units;
- visual display units of figures and charts for

single work places or for meeting rooms (large visualizers)
- plotters.

C. Remote access transmission with increased speed and automatic control of data and as an example "processors" specialized in TP (RT and not) which can lighten the work-load of the central computer. And besides:
   - existence of a national network for data transmission without which the developments foreseen could not take place;
   - possibility of transmitting facsimiles;
   - differentiation in TP channels of the computers (for example, for communication between processors).

D. External storage:
   - increased diversification of the units of external storage both in performance and capacity, plus new units with very great storage capacity; this is needed to facilitate the configurations adaptability to the MIX of the applications;
   - optical files.

The needs most felt in terms of software appear to be the following:
- new languages and software to facilitate programming, plus specialized "terminal consoles" for programmers;
- hardware equipment for the main supervising functions and for compiling and assembling programs;
- language and software for control and management of processing systems which function in a network (ADAPTIVE MONITOR);
- special general language for handling files;
- languages centered on industry problems ;
- languages for image and chart processing.

TABLE VI.6

EXPECTATIONS ON HARDWARE AND SOFTWARE

INTERVIEWEE	SOFTWARE COMMENTS	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
M1		Large dimension Multijob management like hardware			Atomic system
M2				Very high cost of terminal networks	The group has 35 calculating centres
M3	Improvement of computer maintenance systems	Above 512 K	Mass memories above 300 M bytes		
M4			Mass memories > 300 M bytes Requirement for plotter, cathode screens,optical readers		Atomic system
M5	Software lacking for on-line, real time processings			Standardization of terminals of various manufacturers	Co-existence of solars and atomic systems
M6	Problems of scheduling computer operations	Storing capacity 512 K (directed toward twin computers and not toward extra-large computers)		Increase of data transmission speed	Atomic system
M7	Current application packages insufficient Improve software for data transmission	Capacity of around 1 million bytes	Mass memories > 300 M bytes		Atomic system

FOLLOWS TABLE VI.6

INTERVIEWEE	SOFTWARE COMMENTS	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
M8	Cost of software on the market too high	Increase st::ring capacity and decrease considerably cost	Reliability of tape units has to be increased Average access time of discpack units less than 10 msecs.		Extra-large central computer linked to medium computers and terminals
M9	Reliability and management of software have to be improved	Present CPU available on the market satisfactory	Management and organization of files still too complicated		Solar system
M10	Software complicated and cost too high	Greater capacity than at present	Greater reliability of peripherals also at the cost of low transmission speed	Too high transmission cost, particularly telephone lines	Central system
M11	Greater reliability of software and improved from the management view point	Capacity of 512 K words each with 32 bits	Prints usable for optical readers Units with cathode screens are requested	Standardized terminal apparatus	Solar system (but the choice depends from cost)
M12	Greater simplicity of languages Basic software not stabilized: it changes every 2/3 months	Hardware compatibility is a sales argument, but limits the possibilities of more powerful computers	Compatibility of informational supports		Central system (only one division of this group has been interviewed)
M13	Too long times of program compiling		Mass memories directly accessible by terminal units		Atomic system
M14	Simplify programming languages		Direct access to data banks must be possible, also by terminals		Co-existence of atomic and solar systems

FOLLOWS TABLE VI.6

INTERVIEWEE	SOFTWARE COMMENTS	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
M15	Major part of software integrated into hardware Simplify software for data transmission		Mass memories with capacity > 300 M bytes	Increase transmission speed from terminals	Atomic system
M16	Manufacturers must supply more basic software than at present		Lower cost of peripherals especially of auxiliary memories Faster printing	Increase data transmission speed	Solar system
M17	Weak point of third generation is programming connected with teleprocessing			Current teletransmission nets are considered satisfactory	Solar system with 1/2 extra-large computers at the centre
M18	Manufacturers must concentrate efforts to realize the requirements for reliability of software	Solutions presented by manufacturers today valid until 1980	Greater access speed to mass memories	Transmission speed of terminals must be equal to tape transmission speed	The group has 21 computer centres
M19	Requirement for simpler languages		Software must facilitate consultation of archives		
M20	Software for TP absolutely insufficient Different contracts for hardware and software	The present state reached in performance, access time, storing capacity is considered satisfactory			Solar system
M21	Less complicated operational system for management	Increase in capacity of CPU to around 1 M Bytes	Xerox printing	Decrease cost of terminals	Central system with twin computers

7. The Big Companies.

7.1. The European companies

To present a picture of each country's computer installations in number, value and size in the manufacturing sector, the same methodology was used as for the other sectors: a sample of companies was chosen which was felt to be representative of all users of large computers. For this reason, in each industry all companies taken into consideration had a turnover of more than 100 million dollars in 1968.

Below this limit, in fact, present investments in EDP mean almost exclusively desk and small computers and therefore the importance of companies using them would be negligible in a survey conducted to forecast the demand for high-performance computers. The list of companies for the Common Market countries was taken from the Enterprise survey (1) and for the British companies from The Times 500 (2); the value of the entire computer equipment was estimated on the basis of surveys published for the United Kingdom (Computer Survey) and France (O.1 Informatique Scope) and from direct surveys for the other countries concerned.

Because of many constraints much of the information on EDP is not available for all the companies considered; it is also felt that the French computer equipment is under-estimated; however, these limits are not prejudicial to the matter, since it is still possible to rank by size the EDP investments in the manufacturing sector.

The results are summarized in the following table:

---

(1) Les dossiers de l'entreprise / November 1969.

(2) Leading Companies in Britain and Overseas 1969-1970.

TABLE VI.7

SALES AND VALUE OF COMPUTERS INSTALLED IN LARGE EUROPEAN MANUFACTURING COMPANIES.

	NUMBER OF COMPANIES (1)	SALES (1)	VALUE OF COMPUTERS INSTALLED (2)	VALUE OF COMPUTERS PER 1,000 $ SALES	TYPE OF EXTRA-LARGE COMPUTER
STEEL					
UNITED KINGDOM	10	6,067	23,976	3.9	-
BELGIUM	5	2,004	7,427	3.7	-
NETHERLANDS	4	1,115	8,732	7.8	UNIVAC 1108
FRANCE	9	4,192	9,667	2.3	-
ITALY	3	1,265	12,201	9.6	-
GERMANY	22	11,977	28,506	2.4	IBM 360/65
OIL					
UNITED KINGDOM	7	4,531	14,807	3.3	UNIVAC 1108, IBM 360/65
BELGIUM	1	-	-	-	-
NETHERLANDS	2	294	446	1.5	IBM 360/65, IBM 360/75
FRANCE	10	6,591	16,862	2.5	UNIVAC 1108
ITALY	10	4,057	12,390	3.1	-
GERMANY	10	6,137	16,651	2.7	UNIVAC 1108, IBM 360/65
CHEMICAL					
UNITED KINGDOM	16	8,327	35,235	4.2	IBM 360/65
BELGIUM	2	875	858	1.0	-
NETHERLANDS	2	1,576	4,995	3.2	-
FRANCE	10	4,420	10,510	2.4	-

(1) EXCEPT THOSE WHOSE EDP INVESTMENT IS UNKNOWN.

(2) IN PURCHASE PRICE.

SALES AND VALUE OF COMPUTERS INSTALLED IN LARGE EUROPEAN MANUFACTURING COMPANIES

	NUMBER OF COMPANIES (1)	SALES (1)	VALUE OF COMPUTERS INSTALLED (2)	VALUE OF COMPUTERS PER 1,000 $ SALES	TYPE OF EXTRA-LARGE COMPUTER
(follow: CHEMICAL):					
ITALY	10	2,574	23,443	9.1	IBM 360/65
GERMANY	20	11,395	51,806	4.5	UNIVAC 1108, IBM 360/65/67
MECHANICAL					
UNITED KINGDOM	22	9,124	45,395	5.0	IBM 360/65
BELGIUM	-	-	-	-	-
NETHERLANDS	2	316	1,147	3.6	-
FRANCE	12	5,737	11,561	2.0	-
ITALY	7	3,671	29,804	8.0	IBM 360/65 UNIVAC 1108
GERMANY	25	11,747	33,923	2.9	-
AERONAUTICAL					
UNITED KINGDOM	4	2,614	48,244	18.5	IBM 360/65
BELGIUM	-	-	-	-	-
NETHERLANDS	-	-	-	-	-
FRANCE	3	876	24,283	27.7	IBM 360/65, CDC 6600
ITALY	-	-	-	-	-
GERMANY	2	419	8,395	20.0	-
ELECTRICAL & ELECTRONICS					
UNITED KINGDOM	9	2,615	12,447	4.8	-
BELGIUM	1	144	3,648	25.4	-
NETHERLANDS	1	3,013	17,933	5.9	IBM 360/75
FRANCE	9	3,875	4,622	1.2	-
ITALY	4	571	2,856	5.0	-
GERMANY	17	9,842	54,721	5.6	-
PUBLISHING & PAPER-MAKING					
UNITED KINGDOM	7	2,396	13,290	5.5	-
BELGIUM	-	-	-	-	-
NETHERLANDS	3	376	995	2.5	-
FRANCE	1	n.a.	7,720	-	2 IBM 360/75
ITALY	-	-	-	-	-
GERMANY	9	1,537	6,624	4.3	-

(1) EXCEPT THOSE WHOSE EDP INVESTMENT IS UNKNOWN.

(2) IN PURCHASE PRICE.

The quantitive differences by country and by class of turnover size are evident in synthesis in the fig. VI.9. The turnover value is given in the abscissa while the ordinate parameter expresses the value of computers installed, evaluated on the basis of the purchase price.
In several industries, particularly chemicals, electrical and electronics, mechanical and steel, it will be noted that there are still many companies with a turnover of less than 500 million dollars and an EDP investment of less than 2 million dollars.

7.2. Comparison with the U.S.

The annual survey of 100 leading U.S. companies (1), permits comparison between U.S. and European companies with a turnover of more than 600 million dollars (table VI.8).
By comparing value of computers installed per 1000 dollars turnover, the following observations can be made:

- all U.S. industries except aeronautics and electronics have a ratio of about 10;
- the Italian chemical and steel industries have almost reached the U.S. levels;
- the British gap vis-à-vis the U.S. is noteworthy; in almost all industries, the United Kingdom presents inferior values in more than 50% of the cases;
- the French gap is misleading; it has already been noted that the EDP value of the French manufacturing industry are underestimated.

A regression analysis on American data reveals a statistical law between the value of computers installed and turnover. The regression line is exponential negative, that is to say, the value of computers installed increases at a slower rate than turnover; especially in some industries.
In oil and the mechanical industry the following results were obtained:

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(1) EDP Industry Report, October 9, 1969.

Oil industry : $Y = 2.2 . 10^{4} X^{-0.358}$ $(r = -0.679)$

$(s_b = 0.111)$

Mechanical industry : $Y = 2.3 . 10^{2} X^{-0.137}$ $(r = -0.812)$

$(s_b = 0.049)$

Where:

Y: value of computers installed (in millions of Dollars)

X: turnover (in millions of Dollars)

TABLE VI.8

VALUE OF COMPUTERS INSTALLED PER 1000 $ TURNOVER IN MANUFACTURING COMPANIES WITH OVER 600 MILLION $ TURNOVER.
OF COMPANIES WITH OVER 600 MILLION DOLLAR TURNOVER AND EDP VALUE PER 1000 DOLLARS TURNOVER.

INDUSTRIES	USA		UNITED KINGDOM		FRANCE		ITALY		NETHERLANDS		BELGIUM		GERMANY	
	NUMBER COMPANIES	EDPx1000 $ TURNOVER	NUMBER COMPANIES	EDPx1000 $ TURNOVER	NUMBER COMPANIES	EDPx1000 $ TURNOVER	NUMBER COMPANIES	EDPx1000 $ TURNOVER	NUMBER COMPANIES	EDPx1000 $ TURNOVER	NUMBER COMPANIES	EDPx1000 $ TURNOVER	NUMBER COMPANIES	EDPx1000 $ TURNOVER
STEEL	6	10,8	3	4,9	3	1,8	1	8,8	-	-	2	1,6	7	1,7
OIL	15	9,1	2	3,6	4	1,2	3	3,2	1	1,0	-	-	5	2,7
CHEMICAL	16	11,7	2	4,5	2	1,6	1	10,8	1	3,3	1	0,6	4	3,7
MECHANICAL	6	10,1	4	4,5	3	1,5	2	6,9	-	-	-	-	4	1,6
AERONAUTICAL	10	30,2	2	14,9	-	-	-	-	-	-	-	-	-	-
ELECTRICAL & ELECTRONICS	16	22,0	1	1,5	2	1,0	-	-	1	5,9	-	-	4	5,0
PUBLISHING AND PAPER-MAKING	3	12,3	1	3,0	-	-	-	-	-	-	-	-	-	-

8. Quantitative hypotheses about the extra-large EDP systems by 1975 and 1980.

In the manufacturing industry, it was possible to use the entire forecasting procedure (1) because the information available for European and American companies was more complete.
Specifically, on the basis of U.S. data available, it was found that with an increase in turnover, there was a decrease in the ratio between the value of computers installed and turnover.
Naturally, most of the European companies do not reach turnovers which are comparable with the American ones and therefore sensitive to the decrease.
A more detailed examination of the different manufacturing industries yields the following summary of observations typical of the companies represented:

- in the oil and petrolchemical industry a comparison with the U.S. will show a gap which is mostly apparent because of the impossibility of comparing data concerning big company headquarters with applications and computer force of their European subsidiaries.
  The market share of the various oil competitors was kept in mind, because of the particular market structure of the oil industry.

(1) See the chart in the annexes.

Precautionary considerations were introduced in evaluating potential users in 1975, in view of the types of applications and the heavy costs and timing connected with substitutions which are to be made or are being made;

- the remarkable level of applications found in the steel industry was confirmed and is leading to large investments in hardware on the part of leading European companies. As the gap between them and the U.S. companies is smaller, the American companies can be used as points of reference for possible further rises in size;

- in the mechanical and automotive industries, a high number of potential users is foreseen; half of them should be automobile companies which, according to answers given by those interviewed, expect to significantly increase their applications. Comparison with the U.S. is also possible in this industry for the major European companies;

- in the aeronautics industry almost all the companies in the sample were considered potential users of extra-large computers because of the qualitative considerations connected with the highly technical content of their work;

- in the chemical industry the leading European companies reveal an operational dynamics which is on a level with their U.S. counterparts.
  Some of the companies examined even reached the highest levels of expenditures in data processing equipment, even if they were not yet oriented toward a specific choice in the structure of the unit system to be adopted;

- the electronic industry is still at a disadvantage in comparison with the U.S. especially in relation to size of single companies. This means that there are noteworthy differences in the average levels of investment in hardware for internal use.
  The lack of first-hand information on companies of this type has caused uncertainty in the basis for evaluation for the industry, in relation also to the possibility of future company concentrations;

- in the publishing and paper-making industry , no rapid developments were found in European companies in installing extra-large computers. The uncertainty of the forecast of future orientation was further aggravated by the lack of any interviews with the companies.

The number of potential users will be 31 by the end of 1975 and 75 by 1980 an estimated value of computers installed of 550 and 1230 million dollars.
The results disaggregated by industry are summarized in the table VI.8. which follows. Specifically , it should be noted that although the mechanical industry has a number of potential users almost equal to the oil industry, its estimated investments in EDP is one-third less because of the different stages of present applications in the two industries.

TABLE VI. 9 POTENTIAL USERS FOR EXTRA-LARGE COMPUTERS AND THEIR ESTIMATED VALUE OF EDP INSTALLATIONS UNTIL 1975 AND UNTIL 1980

INDUSTRY	1975		1980	
	Number	Estimated value of computers installed (M$)	Number	Estimated value of computers installed (M$)
STEEL	4	70	8	129
OIL	3	65	17	268
CHEMICAL	9	141	18	303
MECHANICAL	7	85	16	181
AERONAUTICAL	4	99	8	190
ELECTRICAL AND ELECTRONICS	4	93	7	153
PUBLISHING AND PAPER MAKING	-	-	1	6
TOTAL	31	553	75	1.230

TABLE VI.10-a

INTERVIEWES' FORECAST ON APPLICATIONS AND HARDWARE

BRANCH : STEEL

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN:		EVALUATION OF HARDWARE ON BASIS OF DEVELOPMENT OF APPLICATIONS		OPINIONS OF THOSE INTERVIEWED ON POSSIBLE EXTRA LARGE COMPUTER
	ADMINISTRATIVE PROCESSES 1	OPERATIONAL PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1970/71	BY 1975	1975	1980	
M1	Terminals for customer service	Process control on line (TP)	M.I.S.	1.000.000		1 + 2	3	Yes by 1980
M2			M.I.S. (TP)	500.000		3	3 (Development of TP)	Not before 1980
M3		Production control Process control		500.000	800.000	2	2	No
M4	Automated operations	Process control (TP)		1.200.000		1 + 2	2 (Development of TP)	Yes by 1980
M5		Process control (TP)	Data Bank (TP) M.I.S.	1.900.000	6.000.000 (24% TP)	1 + 2	3	Yes by 1980

TABLE VI. 10. b

INTERVIEWES' FORECAST ON APPLICATIONS AND HARDWARE

BRANCH: OIL

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN:		EVALUATION OF HARDWARE ON BASIS OF DEVELOPMENT OF APPLICATIONS		OPINIONS OF THOSE INTERVIEWED ON POSSIBLE EXTRA LARGE COMPUTER
	ADMINISTRATIVE PROCESSES 1	OPERATIONAL PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1970/71	BY 1975	1975	1980	
M6		Process control Production control (TP) Distribution and transportation (TP)	Data bank M.I.S. (TP)	900.000		2	3	Yes in 1980
M7		Production control (TP) Sales forecast (TP) Distribution and transportation (TP)	Data bank M.I.S. (TP)	950.000		2	2 + 3	Yes in 1980
M8 (Central head-quarters of a multi-national group)		Inventory control (TP) Distribution and transportation (TP)	Data bank M.I.S. (TP)	500.000	1.000.000		2 + 3 2.000.000	Yes in 1980
M9		Distribution and transportation (TP) Production control (TP)	Data bank M.I.S. (TP)	600.000	900.000/1.000.000		2 + 3 2.500.000	No
M10		Distribution and transportation (TP) Inventory control	Data bank M.I.S. (TP)	1.600.000		2	2 + 3	Yes in 1980
M11 (Central head-quarters of a multi-national group)		Process control	Data bank M.I.S. (TP)	2.400.000		2	3 7.000.000	Yes in 1975

TABLE VI. 10.c

INTERVIEWES' FORECAST ON APPLICATIONS AND HARDWARE

BRANCH: CHEMICAL

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN:		EVALUATION OF HARDWARE ON BASIS OF DEVELOPMENT OF APPLICATIONS		OPINIONS OF THOSE INTERVIEWED ON POSSIBLE EXTRA LARGE COMPUTER
	ADMINISTRATIVE PROCESSES 1	OPERATIONAL PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1970/71	BY 1975	1975	1980	
M12	(Information service recently set up)			650.000				No
M13		Production planning Technical-scientific calculations	Operations research	50.000		2 + 3		No
M14 (Central head-quarters of a multi-national group)		Production planning (TP) Quality control (TP) Inventory control	M.I.S. (TP) Operations research	500.000		2	3	No
M15		Production planning (TP) Distribution and transportation (TP)	Data bank (TP) Linear programming	350.000	700.000	2	3	Yes (depending very much on development)
M16		Production planning (TP) Process control (TP)	M.I.S. (TP)	2.500.000	7.000.000	2	3	Yes in 1975
M21		Production planning (TP) Process control (TP)	Data bank M.I.S. Linear programming	900.000	1.400.000	2	3	Yes in 1980

TABLE VI. 10. d

INTERVIEWES' FORECAST ON APPLICATIONS AND HARDWARE

BRANCH : CHEMICAL

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN:		EVALUATION OF HARDWARE ON BASIS OF DEVELOPMENT OF APPLICATIONS		OPINIONS OF THOSE INTERVIEWED ON POSSIBLE EXTRA LARGE COMPUTER
	ADMINISTRATIVE PROCESSES 1	OPERATIONAL PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1970/71	BY 1975	1975	1980	
M17			Investment planning Resource planning (TP) M.I.S.	2.500.000	4.000.000	3	3	Yes by 1975
M18		Production planning Distribution and transportation (TP)	Data bank Operations research	7.000.000		2	2 + 3	Yes by 1975
M20		Inventory control (TP)	Data bank TP integration for export Operations research	2.000.000	10.000.000	2	3	Yes by 1975

TABLE VI. 10.e

INTERVIEWES' FORECAST ON APPLICATIONS AND HARDWARE

BRANCH: AERONAUTICAL

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN:		EVALUATION OF HARDWARE ON BASIS OF DEVELOPMENT OF APPLICATIONS		OPINIONS OF THOSE INTERVIEWED ON POSSIBLE EXTRA LARGE COMPUTER
	ADMINISTRATIVE PROCESSES 1	OPERATIONAL PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1970/71	BY 1975	1975	1980	
M19		Quality control	Resource planning Data bank (TP) M.I.S.	5.000.000		2	3 15.000.000	Yes in 1975

FIG. VI.9.a. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: S T E E L

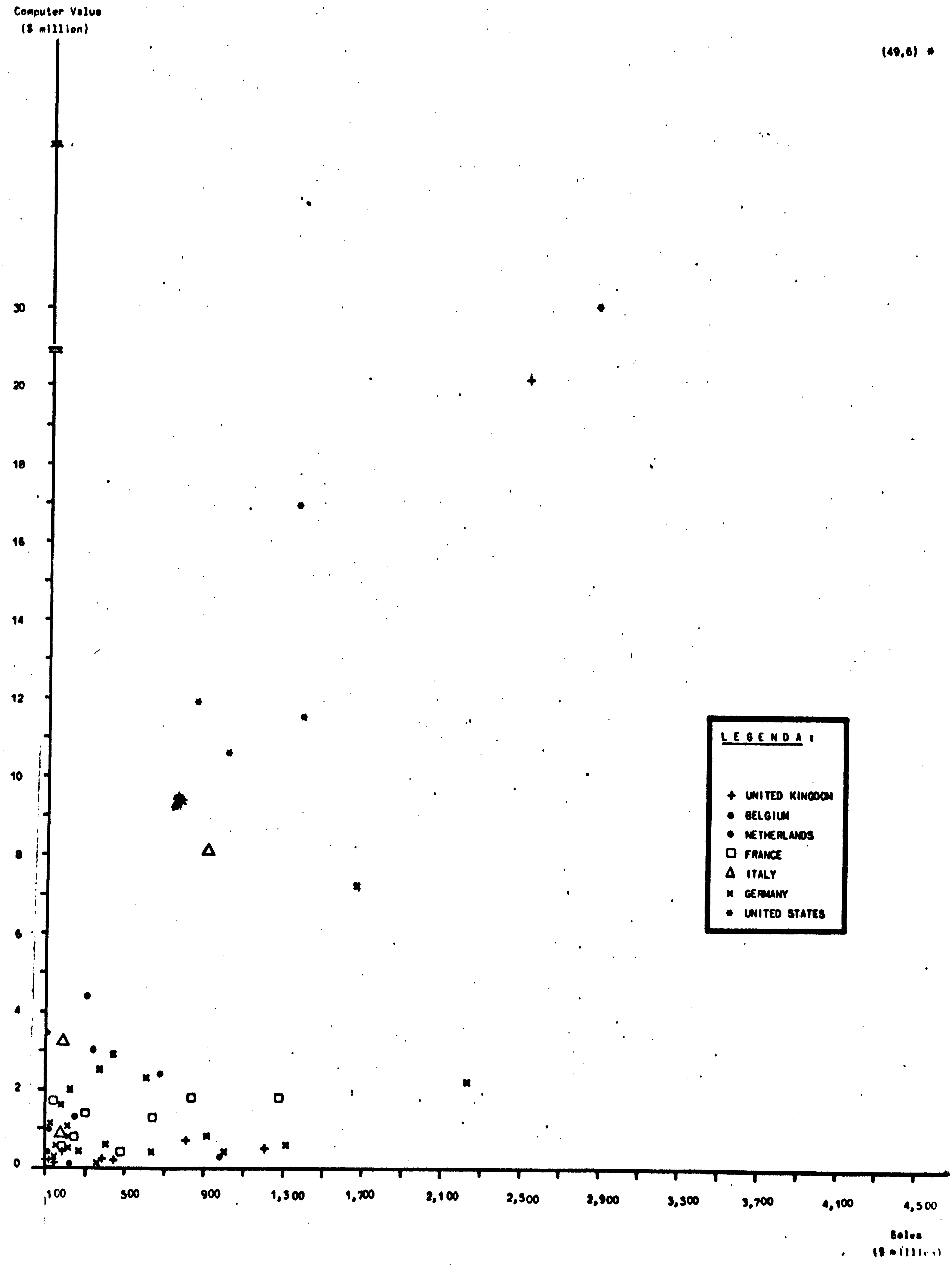


FIG. VI.3.o.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: OIL

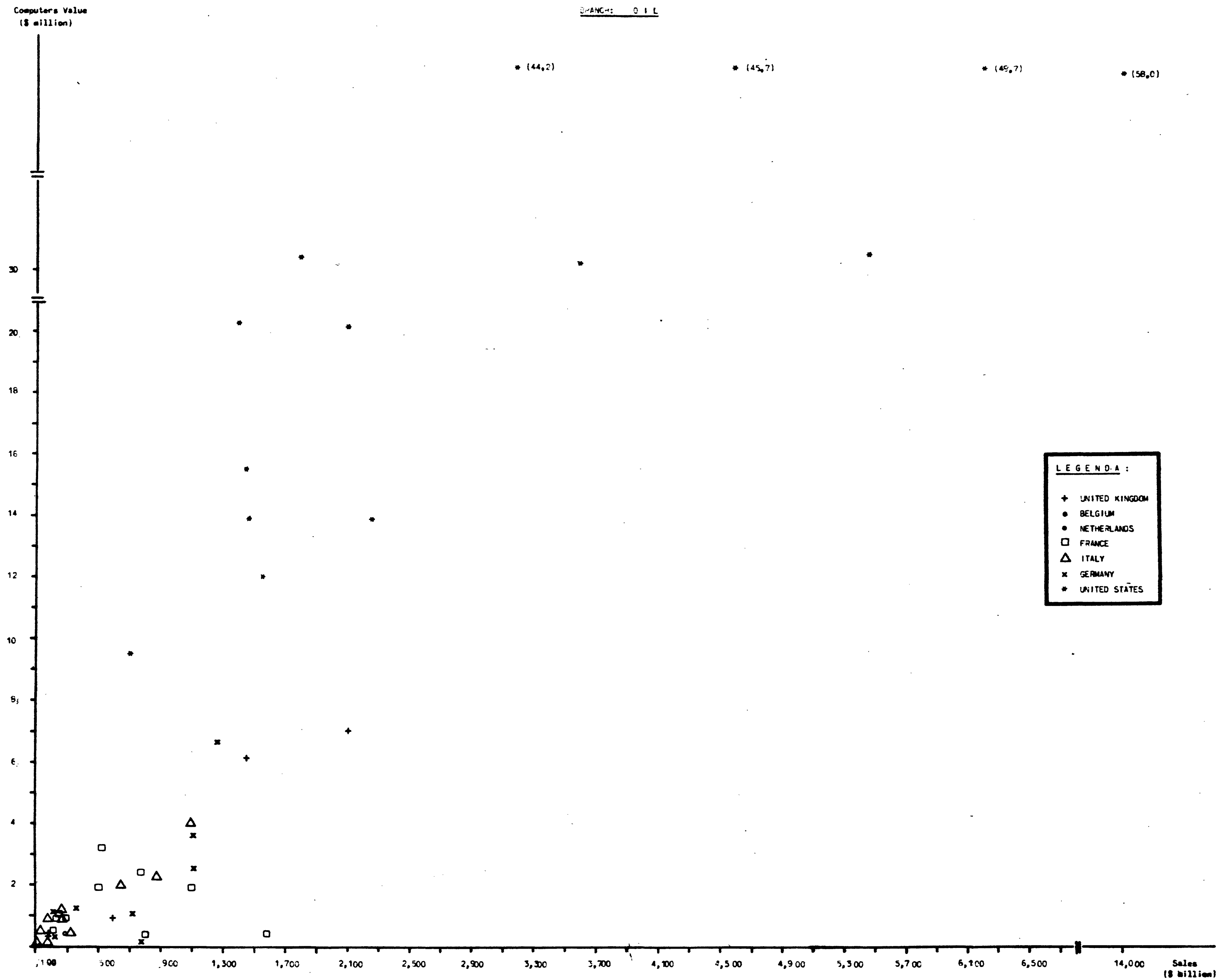


FIG. VI.9.e. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: CHEMICAL

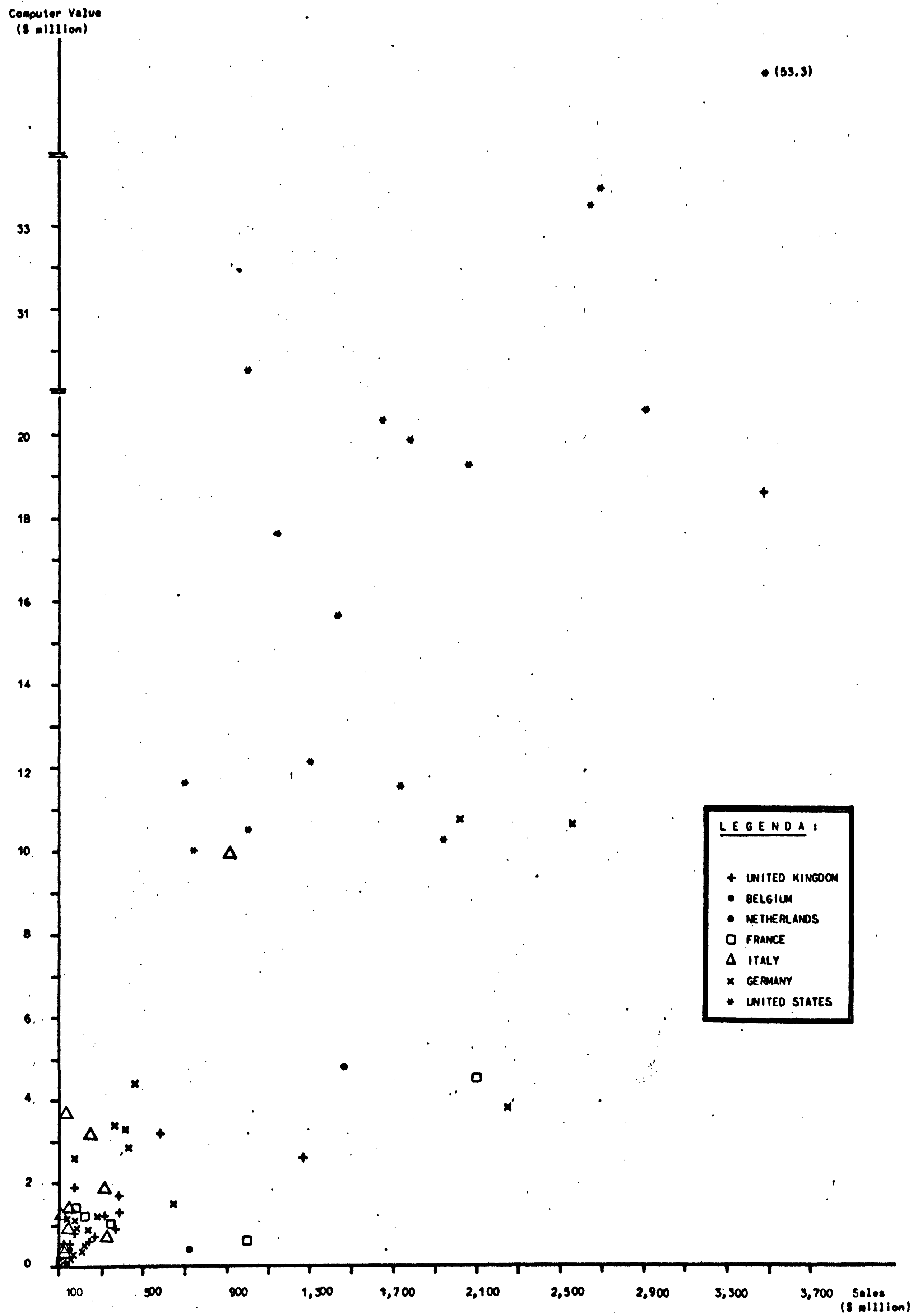


FIG. VI.?.?. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: MECHANICAL

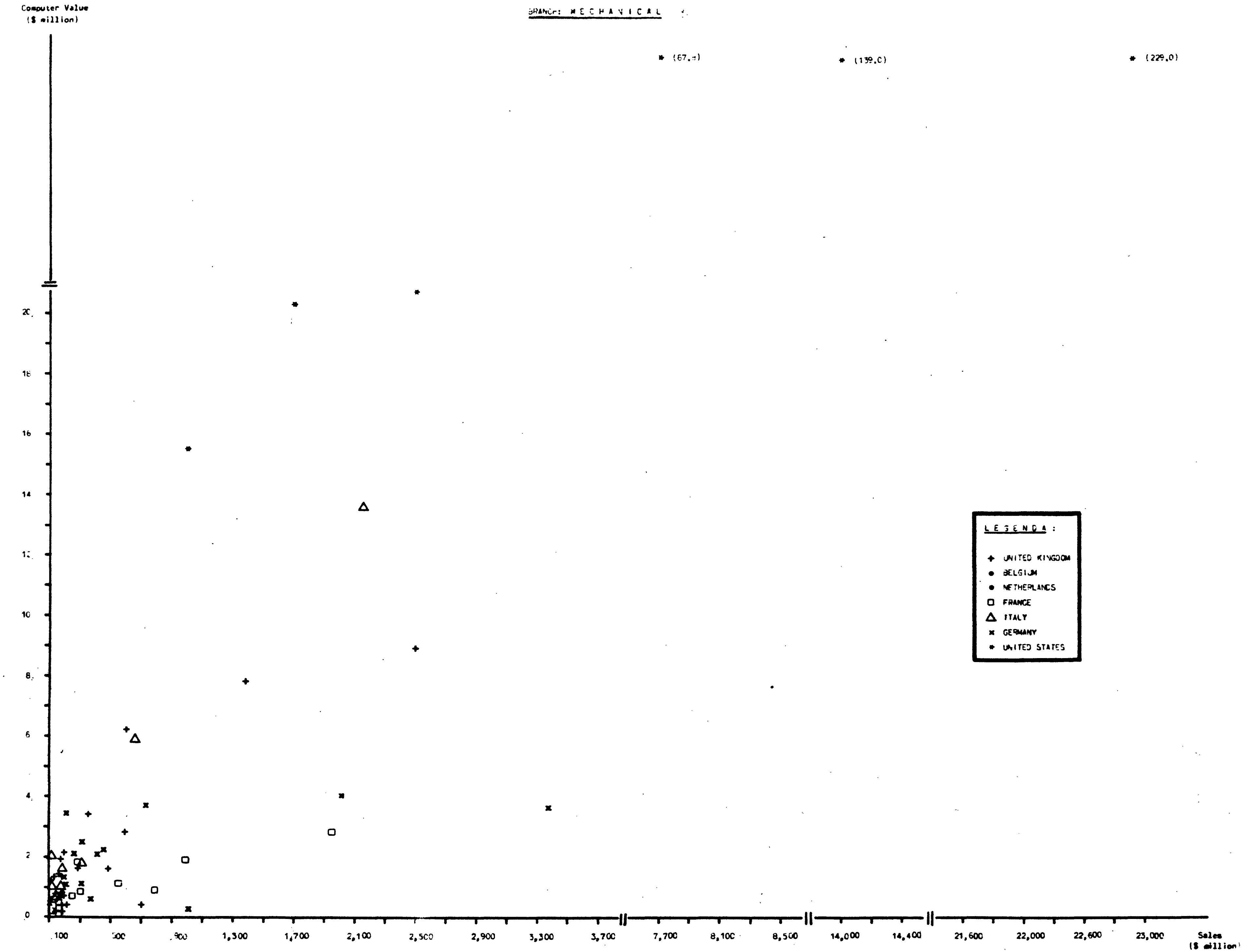


FIG. VI.9.e. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: AERONAUTICAL

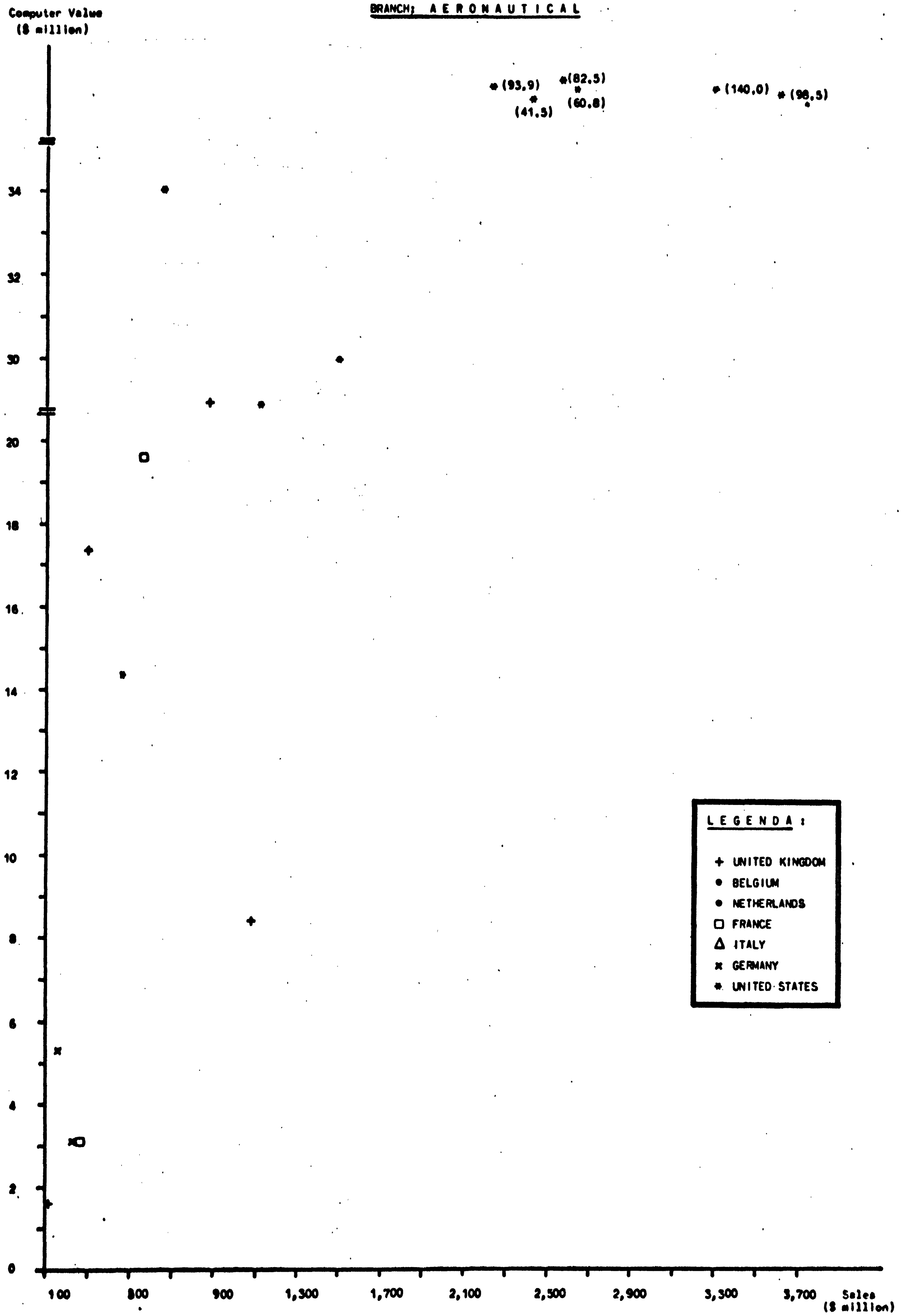


FIG. VI.9.f. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: ELECTRICAL AND ELECTRONICS

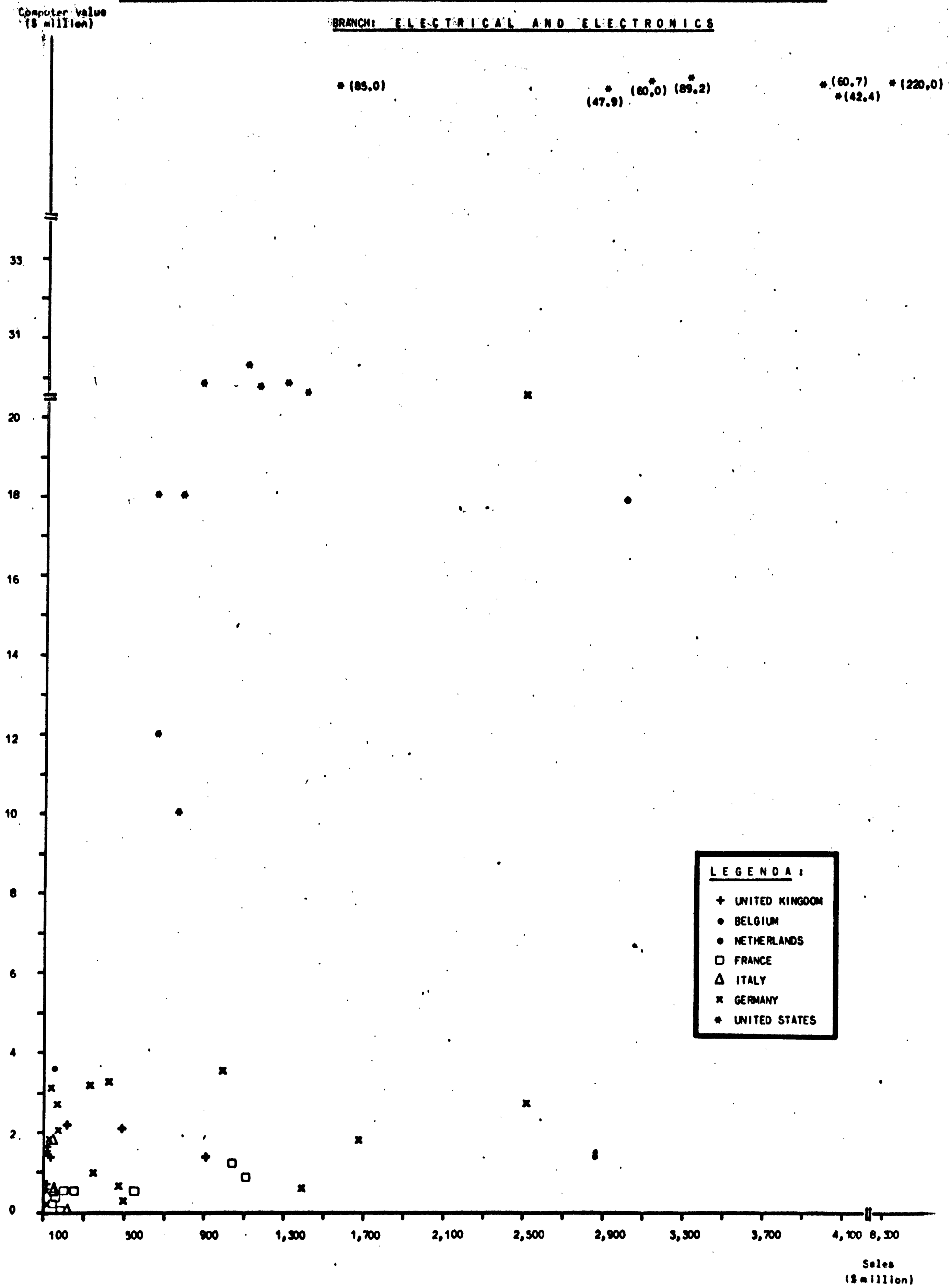
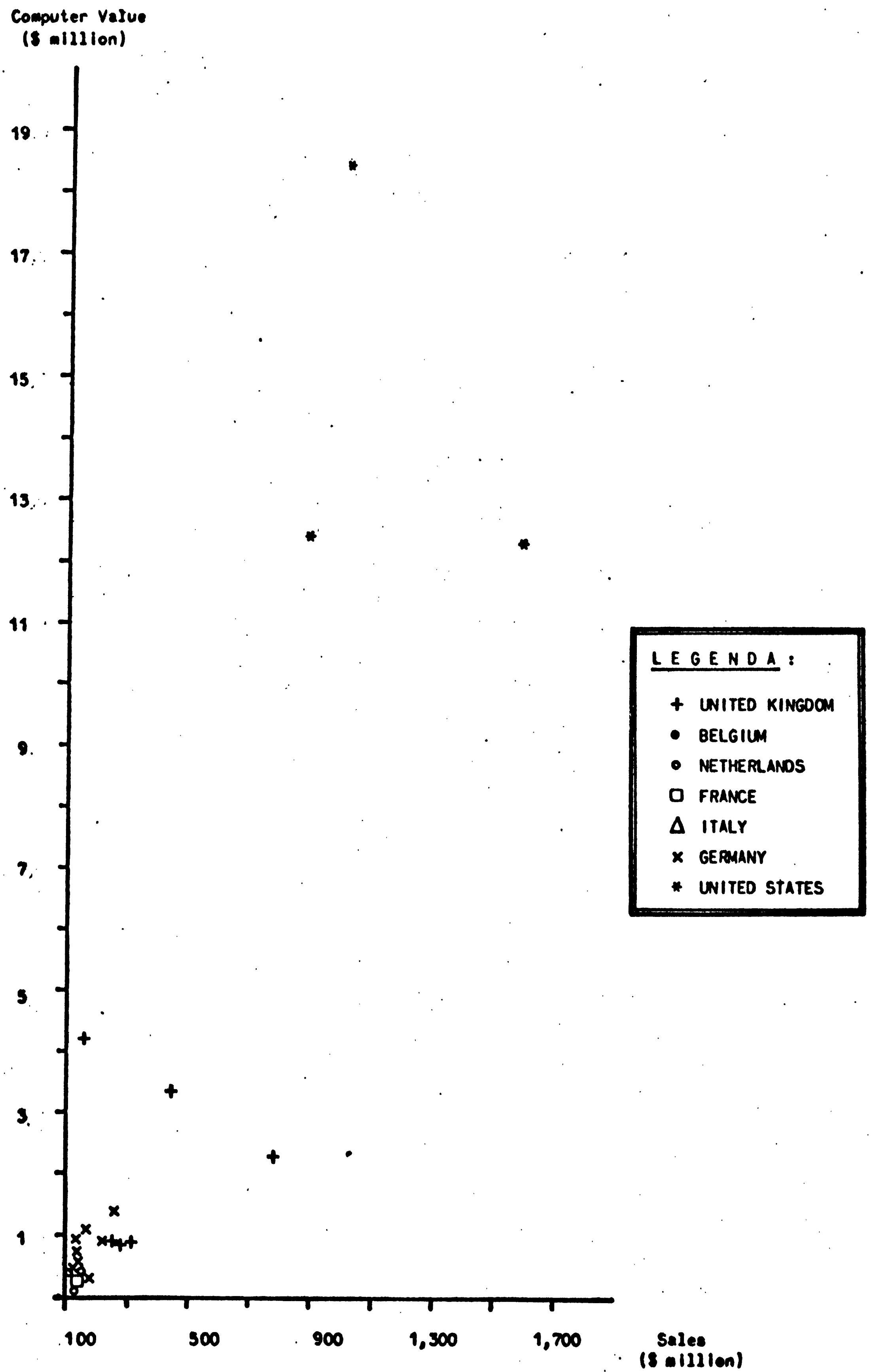


FIG. VI.9.g.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES, IN U.K. AND IN USA IN 1969

BRANCH: PUBLISHING AND PAPER MAKING



CHAPTER VII

RETAIL STORES

1. Introduction

In this survey the actual and projected applications of computer systems will be examined with special reference to large scale systems among large retail firms.

Based on the economic and financial dimensions which have been reached by retail firms one can distinguish between the "large scale" and the "small scale" ones.

The large retail firms can be further divided into two categories, depending on how the firms manage their sales outlets (chain stores, supermarkets, department stores) or other operations (sale by mail order, through automatic vending machines, etc.).

The common problems of both types of firms are those of purchasing and distributing the goods; especially the purchases are determined by management problems of back-up supply aggravated in certain cases by the perishable nature of the products and their being subject to the whim of fashion.

Distribution performed in geographically different points requires divided provisions and poses problems of supply.

The information given herein are, above all, results of direct survey.

The ideas emerging from interviews have been completed by a systematic review of the literature covering problems arising from the use of computers in this sector. The applications and the problems which have been brought up by the interviewed firms can be considered as common also to the firms not interviewed.

The distributive network of United Kingdom is among the most modern and developed in Europe: the large distribution system recorded in the first semester of 1967 35% of the whole turnover, which means the highest incidence reached anywhere in Europe. In the USA large scale sales accounted for more than 60% of all retail sales.

The supermarkets and hypermarkets which are the most popular places for distribution of alimentary goods numbered almost 5,000 on 31.12.68 in the EEC countries.

Number of supermarkets and hypermarkets in the EEC countries as of 31.12.68

Country	Supermarkets	Hypermarkets
Belgium	230	16
France	1,702	73
Germany	1,852	451
Italy	349	-
Netherlands	203	20
Total EEC	4,336	560

SOURCE: AIGID "Notizie per la Stampa"
Mondo Economico 27.12.1969.

In the United Kingdom 1,800 supermarkets were already operating by the end of 1965.

Based on statistics available in the various countries, the trend has been ascertained, in wholesale as well as in retail business.

The rate of increase of the added value in trade during the period from 1958 to 1976 has produced in the various countries the following figures:

Countries	Growth Rate
Belgium	5.1
France	4.6
Germany	5.3
United Kingdom	2.4
Italy	5.2
Netherlands	4.8

The ratio between the added value of this sector in the various countries and the gross national product allows us to determine the incidence of the distributive sector on the economy which, in 1967, amounted to 12.3% in Belgium, to 13.7% in Germany, to 11.1% in France, to 10% in Italy, to 9.7% in United Kingdom.

Taking into consideration employment (in thousands of units) between the years 1962 to 1967 one notes fhe following trend:

Employees in Trade (in thousands of units)

Countries	1962	1967	Growth Rate
Belgium	239	291	4.02
France	-	-	-
Germany	2,393	2,506	0.93
United Kingdom	2,930	2,857	0.50
Italy	685	705	0.58
Netherlands	384	472	4.21

2. Structure

2.1. Economic characteristics

Retail has undergone a noticeable evolution during recent years, due particularly to the new sales formulas which have been adopted on the field of large scale distribution. It is beyond doubt that the different degree of development which has been attained through the new sales systems is closely related to the different legislation by which the commercial activities are disciplined in the various countries.

In France, Germany and Holland there is a solid net of big distributive firms which accounts for approximately 26% of all sales within the examined sector in the Federal Republic of Germany, for 20, in Holland 25%, and in France 16%. In Belgium large distribution systems developed mostly in the last decade: the present participation of large distribution in sales is 11%. Italy occupies a special position: it is the only country within the EEC which still preserves genuinely corporative regulations. In 1967 the percentage of large distribution systems over the total of retail sales was 3.65%.

SALES OF RETAIL BUSINESS AND OF LARGE DISTRIBUTION IN EEC COUNTRIES IN 1967

	SALES OF RETAIL BUSINESS (in millions of dollars)	SALES OF LARGE DISTRIBUTION (in millions of dollars)	% PARTICIPATION OF LARGE DISTRIBUTION OVER RETAIL SALES
BELGIUM	5,820	620	10.7
FRANCE	33,720	5,410	16.1
GERMANY	29,660	5,810	25.9
ITALY	26,100	930	3.65
NETHERLAND	-		25.0 (1)

(1) Estimate. SOURCE: AIGID "NOTIZIE PER LA STAMPA" N. 4-1969.

The present trend of the distributive sector is more and more oriented towards large scale business enterprises. This will lead to a higher percentage of employees in this part of the sector in comparison with the total number of people employed in the whole sector. At the same time family enterprises are decreasing in the more advanced countries.

2.2. Information problems

The main informational problem of retail stores involving all firms, i.e. food supermarkets, chain stores, and mail-order houses, can be summarized as follows: "in the right place at the right time".

There are, of course, aspects of this problem which become more or less important depending on the firms concerned. For example, chain stores have to anticipate what a customer is going to ask for and send the product to the outlet before the customer requests it; this problems is complicated by the perishable nature of certain food products in supermarkets, and is simplified in the case of mail-order sales because the customer posts his order and implicitly accepts the delay caused by the mailing.

In any case, the products have to be available at the moment the request is made; thus there arises the highly important problem of central stock control.

Central stock control was mentioned by all interviewees as the fundamental application requiring countinuous improvement. The first problem is arising from the extent of the range when products are not connected by rigid links, although a product's behaviour strongly influences other products; at least when they are members of the same "family".

Further, distribution enterprises, compared to production plants selling from stock, have much greater flexibility owing to the absence of manufacturing structures. Hence it is possible to modify ranges of products simply by asking the manufacturer in right time to produce them.

This flexibility means that the departments making decisions about the composition of assortments take great responsibilitis about quality, quantity mix and prices.

A further complication for supermarkets and chain stores is the need to supply outlets in such a way that the products range laid down is always represented in full on the shelves.

The solution of problems connected with restocking and the management problems involved in choosing a range of products (and subsequent adjustments by way of pricing) are based on the knowledge of sales attained. The information system must be very efficient as supermarkets, are receiving up to 5 supplies weekly each outlet,because of the outlet's limited stock, capacity the high number of products and, in some cases, their very fast turnover.

3. Data processing equipment

The lack of data allows to explore the actual situation on the field of informational systems only in Germany and United Kingdom, permitting thus a comparison between the number of computer installations in trade in one of the EEC's most advanced countries and that in the only country considered outside the EEC (1).

NUMBER AND VALUE OF COMPUTER INSTALLATIONS IN TRADE IN GERMANY AND THE UK BY SIZE

					GERMANY			
	Number	%	Value of purchase price	%	Number	%	Value of purchase price	%
			(000 $)				(000 $)	
DESK	17	14,9	918,0	2,9	31	9,7	1,965.6	2,8
SMALL	72	63.1	19,245.6	59,8	261	82,4	60,974,4	63,5
MEDIUM	14	12,3	10,430,4	32,4	16	5,1	14,836,8	15,9
LARGE	1	0,9	1,584.4	4,9	8	2,5	11,520,0	12,4
EXTRA-LARGE	-	-	-	-	1	0,3	3,360,0	3,6
UNCLASSIFIED	10	8,8			-	-		
TOTAL	114	100,0	32,178,0	100,0	317	100,0	92,656.8	100,0

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(1) Italy: According to data from the "Cassa di Risparmio delle province Lombarde" there were 131 computers in the trade sector in the first quarter of 1969 with a percentage of the overall number of installations of 5.7%.

France: According to data from the research "01 Scope" there were 170 computers in the trade sector in 1968, or 6.9% of the total number installed.

In Germany the trade sector has a large numer of computers installed, from the view point of value as well as units.

The number has, in fact, reached 8.3% of the total number of all computers installed and is surpassed only by the banking sector (13.6%),whereas as far as value is concerned, trade with 7.2% of the total is surpassed by the banks (12.3%) and by the public R&D Institutes (9.4%) (1). In the United Kingdom the situation is different: installations of computers in trade represent only 3.8% of the total number, while accounting for 2.6% of the total value.

As a consequence, in the trade sector the United Kingdom reaches in the application of EDP lower levels than the EEC countries. A more accurate comparison between the two countries can be made when evaluating the computer installations for their importance in the sector within the economy as a whole.

Germany disposes of one computer each 8,000 employees in the trade sector, whereas the United Kingdom of one per each 25,000. The ratio between the value of the installations (as reflected in the yearly rent paid) and the added value of the sector is 0.14 in Germany.

In United Kindgom the trade sector does not use any extra-large computers, whereas Germany has got only one installed.
One can therefore assume that for the present applications less powerful computers should do all right.

The surveys results confirm that the computer installations of the interviewed enterprises are mostly small and medium size,

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(1) This point is valid if one considers manufacturing subdivided into branches.

At present more than 1,000 computers are being used in the retail business in the whole world, the major part of them being located in the USA.

In that country, in fact, retail possessed at the end of 1968 792 units (4.09% of the total park).

The entire trade sector, including also wholesale distribution, uses a total of 2,024 computers, or more than 10% of all installations. In the US the supermarkets are, above all others, making use of computers: in fact, the supermarkets, representing only 1% of retail firms cover 30% of the computers in the sector.

Among supermarkets with a net income above 20,000 Dollars one out of six is using a computer (1).

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(1) Computers and Automation, September 1969.

4. The most widespread applications of EDP systems

4.1. Applications by firms interviewed

Applications implemented at present by the interviewees are mainly customer invoicing, supplier invoicing, general accounts, stock control (table VII.1). The nature of the operating and processing problems connected with distribution is such as to complicate to a large extent there applications. For example, customer invoicing (performed by all interviewees) is quite normal in the case of mail-order houses. Chain stores and supermarkets, on the other hand, rely on the cash desks at their outlets. Accounting for sales thus becomes rather tough owing to the mass of data and high risk of errors, since the identification of the product is performed through codes which have to be "typed" at the cash-desk. One interviewee only (D4) is referring to cash-registers which prepare a paper tape that is mailed then to the center where it is processed. The other interviewees presumably do their invoicing by considering as sold all the products leaving the general warehouse to supply the sales outlets (this applies particularly to supermarkets); to control peripheral transactions, on the other hand, they use summary information, recorded at the cash-desk and specifying only large families of products.

Another application that four interviewees (D1, D2, D4, D5) already use is stock control.

This application differs considerably depending on whether sales are by mail or through chain stores and supermarkets. The former will generally have a single central warehouse, the latter constitute in practice a network of split stock

TABLE VII.1

CURRENT AND FUTURE APPLICATIONS BY THE INTERVIEWEES

TYPE OF PROCESSING	APPLICATIONS IN FORCE, AT EXPERIMENTAL STAGE UNDER STUDY, ETC.	COMPLETE	TO BE COMPLETED	IN DIFFUSION	EXPERIMENTAL	UNDER STUDY	NOTES
BATCH PROCESSING	Customer Invoicing	D1, D2, D3, D4, D5, D6					
	Suppliers Invoicing	D1, D3, D4, D5, D6					
	Wages	D4, D5					
	General Accounting System	D1, D2, D4, D5					
	Stock Control	D1, D2, D4, D5			D3		
	Customer Order Handling	D3, D5					
	Sales statistics	D1, D2, D3, D4, D5					
	Budgets		D2				
OPERATIONAL INFORMATION SYSTEM	Integrated Sales and Stock Control				D2 (2 years)	D1, D4 (1975) 52 outlets	
	Customer Orders Acceptance and Follow-up			D5 TP		D3	
MANAGEMENT INFORMATION SYSTEM	Outlet Budgets					D2 (1975)	
	MIS					D5	
	Summary peripheral processing (outlets)					D2	

piles (a central warehouse or several distribution warehouses per area and the shelves of the outlets).

Owing to difficulties of data collection and communications, the computer often handles only the central warehouse (and the peripheral stocks). Such a situation makes all the companies comparable, since every outlet behaves like a customer who orders by mail. To close the matter of stock control, while it is true that all the interviewees already have the application in operation (only D3 is still setting up and working in simulation), it is not easy to say how far-reaching the applications are; if, in other words the question is a simple one of accounting for in and out transactions, or if the application covers orders for restocking which are more or less automatic and calculated with more or less sophisticated methods with respect to suppliers. Of course, in the two extreme cases, the contribution for operational purposes changes considerably.

Another application, typical of mail-order sales, is that of centralized acceptance and follow up of orders from customers; this is mentioned by interviewees D3 and D5.

Finally, <u>sales statistics</u>, collected by all interviewees, are mainly prepared for the benefit of purchasing departments.

One interviewee only (D2) is working out a <u>outlets budgetary control</u> system .

4.2. Applications under study

As regards the operational information system, the main problem, being examined by two interviewees (D1 , D4) and at the experimental stage in the case of one (D2), is integrated control of sales and stocks.

The operational links between sales and stocks are illustrated in Fig. VII.1: they are particularly applicable to chain stores and supermarkets. Outlets receive supplies on the basis of two kind of information sent to the head office:

- information on sales which enters the restocking process only when "complete" (i.e. it contains the product code number, quantity and unit price);
- information on requests for new supplies per type of product which every outlet compiles daily (or often) and which represents the only source of information to the central warehouse where sales are recorded only by large families.

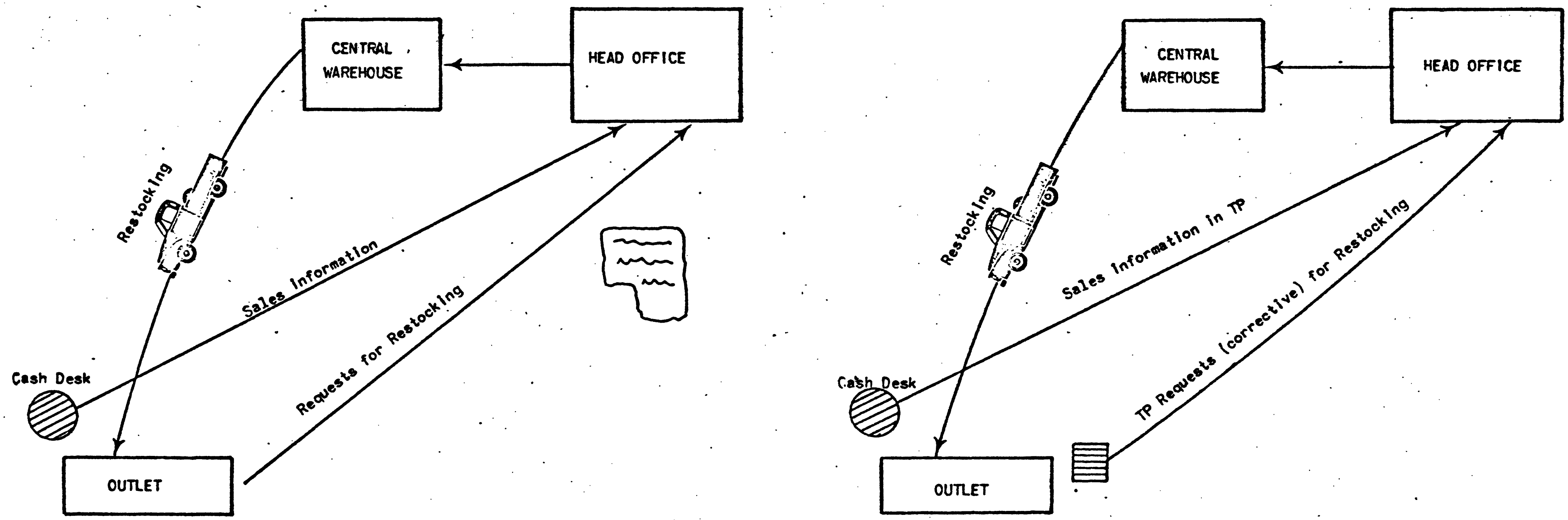
In the simplest case, mail-order sales, "information on sales", and "restocking requests" exist side by side in the customer's order, while restocking in the two cases represents the follow up of the request by the general warehouse.

Interviewees D3 and D5 are also working on the operational integration control-sales. D3 receives orders from customers in sales offices and sends them by telex to the central office. The computer arranges for dispatch by preparing the necessary information which is printed off line in the warehouse. The stock control application that is at the experimental stage will complete the acceptance-follow up cycle of the order.

Interviewee D5, on the other hand, is already setting up

FIG. VII-1

OPERATIONAL INFORMATION SYSTEM FOR LARGE COMPANIES



BY MAIL

TELEPROCESSING

teleprocessing on this application.

Interviewee D4 is also looking into sales-stocks integration, but of a more sophisticated type, although it is not expected to become operative before 1975. He intends to convert his cash registers (now on punched paper tape) to terminals which whould be conected with the centre; it is presumable that corrective information, such as requests for new supplies, will still have to be sent to the head office by the outlets.

4.3. Projects

D2 speaks about the possibility of setting up about 1975 (maybe later) a link between head office and outlets for management-type information (peripheral accounting and budgets). This would be achieved with a solar system and tape to tape transmission of synthetic information produced at the periphery. This as opposed to the operational system which would, of course, remain atomic.

Table VII.1 schows a sharp distinction between widespread applications which are already all complete and the application of the operational system; no interwiee is very far along in developing teleprocessing with outlets.
The only operational application which is already in diffusion is an application of the interviewee D5 who sells by mail and who has few terminals centred in the head office.

In sum, no "really" atomic system is in an advanced stage of preparation.

This situation may be due to the fact that terminals represent a very high investment, if they have to be employed as substitutes for cash-desks at outlets and to the fact that the problem of the large quantity of data to be transmitted on line to the computer, while the customer is waiting to pay at the cash-desk, has not yet been solved.

As for stock control: this has been placed among batch applications to allow integration with simple accounting of the transactions.

Finally, "integrated control of sales and stocks" is handled straight from "customer invoicing" and from "stock control" and hence its degree of operational frequency will be variable and will depend on the corresponding levels of sophistication of the parent applications.

The same can be said for "acceptance follow-up of customer orders" which corresponds to "integrated sales and stock control" for mail-order sales.

With respect to management information one might mention the absence of applications in purchasing (if sales statistics are excluded).

5. Future applications

5.1. Hypotheses of development

It is plausible to put forward the hypothesis that there has been a stop in the development of operational information systems in this sector. The causes of this could depend on the automation of data collection at the origin (cash desk):

- high investments on terminals, because of the large number needed, related to the a low value of products handled;

  time involved in the operation ("typed" at the cash desk).
- the failure to automate cash desks also prevents the spread of credit sales (credit cards issued by the chain stores in question).

One of the problems, the length of the operation and the high risk of errors, will probably be overcome by optical readers which are already in use in some large chain stores (in the United Kingdom or USA) for shelf inventories and at the cash desks. The problem of the cost of terminals remains unsolved, however. Studies are therefore being carried on to overcome the two obstacles.

In computer applications, purchases are extremely important strategically (determination of product mixes within homogeneous "families" at the annual planning phase) and tactically (price rises, changes in assortments by adding new products to the standard mix of the family or special promotion sales).

As we have seen, none of the interviewees spoke of applications for integrating purchases in the "sales and stock" information system, which supplies information on support sales and especially on those tactical operations, at short or very short term, which may have an effect on the short cycle of operational information.

The most likely strategic actions may be: determination of product mixes, permission to purchasing departments to contract "stock plans" with suppliers, etc.

A possible diagram to take account of these problems is shown in Fig. VII.2. Here, an on line and possibly on line,real time connection is hypothesized between sales outlets and the head office for the transmission of sales data collected at the cash desk. Such information can do without requests for restocking, whose function was to organize restocking at the outlet, allowing for various possibile influences (seasonal phases, holidays, etc.), because a simulation model has been introduced to cover the entire pattern of sales in the various areas. In an early phase, this model will simulate alternative product mixes for purchasing, and in the operating phase it would help to solve contingent situations with various pricing alternatives, promotions, etc. It will also provide a stock plan on the basis of which to programme the development in time of the distribution of shelf space among the different families of products. Similar indications could concern the distribution in terms of space among families and among products at sales outlets.

Interviewee D2 already has an O.R. sector for the study of simulation models.

Other news comes from the USA, where a store chain uses an information system which influences the distribution of space on the shelves. The diagram in Fig. VII.2 presupposes from the viewpoint of the operational system a very marked attribution of responsibility.

An intermediate phase could be that shown in Fig. VII.3. Here

FIG. VII.2

HYPOTHESIS FOR A TOTAL INFORMATION SYSTEM FOR THE LARGE RETAIL COMPANIES

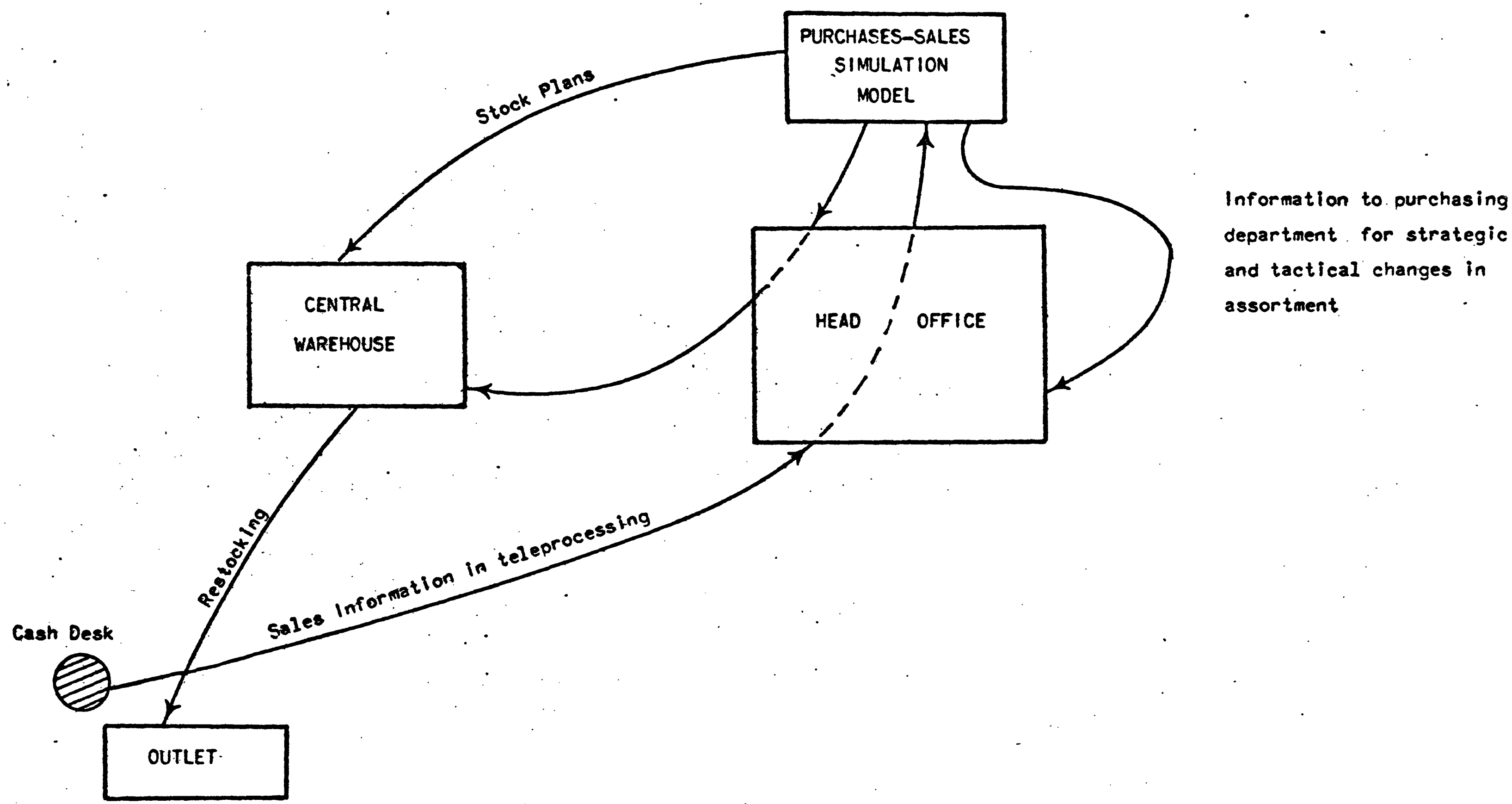
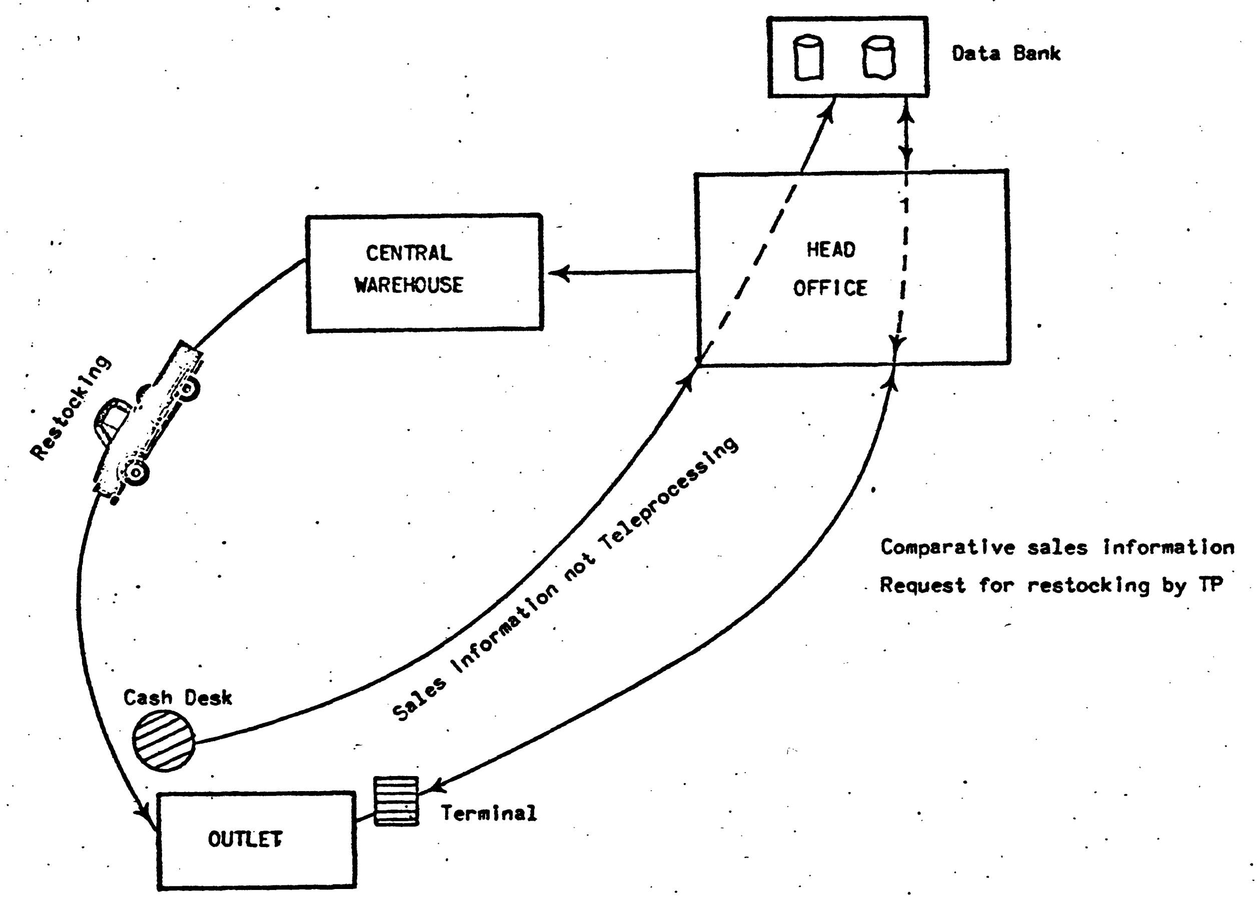


FIG. VII.3 INTERMEDIATE HYPOTHESIS FOR DEVELOPMENT OF APPLICATIONS IN THE LARGE RETAIL COMPANIES



sales information is still off line and thus cannot do without restocking requests.

This, however, could be supplied in teleprocessing. The number of terminals would be confined to one per outlet in supermarkets and to a certain number per outlet in large stores (not as many terminals as cash desks, however).

This information, gathered together and analysed at the head office, would serve on the one hand to constitute a "history" for construction of the model, on the other as a source of more timely information for the purchasing departments. Finally every peripheral manager could learn of restocking decisions of other colleagues in the most important seasonal phases and as regards assortment product leaders.

Everything written thus far is particulary applicable to chain stores and supermarkets. It also applies, however, to mail-order sales, if it is considered that a certain territorial area (or a particular customer sector, e.g. divided by income groups, interarea) can be ideally supposed to represent a sales outlet with all its seasonal or impulsive preferences and influences on central stock.

5.2. Comparison with the USA

The USA is about five years ahead of Europe in this field. In part this difference is due to Europe's delay in starting automatic data processing and in part to the different structural and dimensional characteristics of the enterprises.

In 1965, for example, there were nine supermarket groups with more than 500 outlets each and 15 others with between 100 and 500 outlets.

Few chains in Europe have more than a hundred outlets. This observation is very important in view of the low profits in this field. Even in the USA the large chain stores seem to be awaiting more profitable developments before committing themselves to TP.

For some years now the most recurrent application (apart from the more traditional ones) is the control of the intermediate warehouse (and office) network between individual outlets and the head office. In other words, there is already a solar structure due to the high number of outlets; each zonal office-warehouse in fact is taking care of 50-100 outlets, a number equal to the total outlets of European enterprises.

It might be thought that this would lead to changes in the philosophy of European systems, if growth and concentrations make company dimensions greater. The terminals for teleprocessing from cash desks of outlets are considered too costly.

Those who produce terminals which could be used for cash registrations at sales outlets do not supply terminals appropriate for the use of supermarkets. To be satisfactory, the sales outlet cash registers or terminals must be cheap - about $ 25 (or less) a month. In any case, the time necessary for inserting data in the terminal must be brief so as not to delay customers' purchasing operations.

Then again, the problem of transmitting information is not the only one to be solved for substantially improving the operational system.

In order to be efficient, rapid processing of data relative to the volume of inflowing orders requires, in a centralised system, follow up of orders and a faster intake-outgo of goods.

Further, the present-day system of dispatch and delivery of goods from the central warehouse to the outlet has to be speeded up.

As for department stores, the main requirements are:

- off-line operating systems for orders, control and dispatch of goods from stock;
- cash registration at the outlets and credit control.

As regards terminals at the cash-desks, we have seen that there are still many enterprises which rely on the off-line system.

Nevertheless, new equipment is being developed to make the operation faster and safer, and the possibility of a direct link with the computer is being studied.

Cash registers with optical characters are made such that the optical character replaces the conventional paper tape.

The optical reader can be connected to the optical printer to produce a paper tape with a punched card or it can be connected directly to a computer.

As regards a link-up with purchases and, more generally, the management information system, the sophistication achieved by the retail companies suggests that the most important retail companies in the USA are very close to the system hypothetized in Fig. VII.2 or to the achievement of similar results by means of sophisticated budgetary techniques.

6. Expectations about on hardware and software

On the subject of the central core storage, most of the interviewees opted for 512 K or more (Table VII.2). It should be borne in mind that only D5 (he has 512 K + 256 K in his two present computers) is really reliable; the others are familiar only with much smaller core storages. Access times requested are between 0.3 and 1 μs.

Almost all interviewees asked for large mass core storages together with an atomic system.

The only interviewee who also mentioned a solar system was interviewee D2, who distinguishes operating information (with an atomic system) and management information activity for outlet (and groups of outlets) budgets for setting up over the longer term with a solar system (computers per groups of outlets). All interviewees mention the high cost of terminals.

There were very few specifically software requests. Clearly any disappointments that arose out of already completed applications have already been forgotten; only interviewee D6 asked for advanced basic software and improvements in compilers and complained about poor manufacturer service generally. The problems connected with transmission software have not yet come to light, because it is a detail in the setting up of the operating information system as a whole.

Only interviewee D5 who is experimenting with the operating systems, has definite information and asks for improvements in terminals to reduce errors and software that is less sensitive to errors made by the terminals themselves. In his turn, interviewee D2 (also experimenting the operating system) speaks of peripheral units and their high cost.

TABLE VII.2

EXPECTATIONS ON HARDWARE AND SOFTWARE

INTERVIEWEE	SOFTWARE	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
D1	Packages: too theoretical	$<$512 K Basic time 0,3 µ Price reduction	Faster Core storages $>$300 M bytes Access time $<$5 ms		Atomic type system
D2		Senseless to speak of giant computer - work on peripheral units		High functional guarantees	Solar type system with internal "time sharing" development
D3		$<$512 K Basic time 1µ No need felt for great storing capacity		High cost	Centralized with some terminals at head office (telex at outlets)
D4		$>$512 K Access time 0,3µ	Auxiliary core storages 300 M bytes	High cost	Atomic system with punched paper tape cas registers under study
D5	Software less sensitive to peripheral errors	$>$512 K	Auxiliary core storages $>$300 M bytes	Too many errors	Atomic system with direct access to central and mass core storages of terminal units
D6	Development of basic software Improve compilers Inadequate manufacturer service		Mass core storages 200% 1000 M bytes	Cost too high	Atomic

7. The Big Companies

The main users of computers in the retail sector are firms of substantial size, with sales above 50 million US $.

An examination of the enclosed table shows that in none of the countries in question there exist big companies with extra-large computers, that in Germany there are three large computers, in France 4, in Italy 1, and in the United Kingdom 1.

Number and value of large and extra-large computers installed in big retail companies (1)

Country	Number of computers		Value of computers(1)	
	Large	Extra-large	Large (000$)	Extra-large (000$)
BELGIUM	-	-	-	-
FRANCE	2	-	6,336	-
GERMANY	3	-	6,048	-
U.K.	1	-	1,584	-
ITALY	1	-	1,584	-
NETHERLANDS	-	-	-	-

(1) Purchase price

The value of hardware installed (2) per one thousand dollars sales reaches $ 2.03 in a French firm, $ 1.21 and $ 1.13 in

(1) With sales above 50 million $.

(2) Purchase price of a typical configuration.

a German and an Italian firm respectively, while there is no firm in the United Kingdom and Belgium which reaches 1.

The highest investment in computers per employee has been obtained by a French firm with 996.28 US $, followed by an Italian firm with 719.81, by an English firm with 275.74 and a German one with 238.50 US $.

Among the firms in consideration the ratio of investment in computers to turnover or employment varies greatly, also in firms with analogous dimensions, as indicated by the highest and lowest values listed in the preceding table. A rather important role is played by the different types of organization, centralized or decentralized, of the various firms (1).

(1) Intended by centralized organization are the department stores, by decentralized organization the super - markets.

8. Quantitative hypotheses about the extra-large EDP systems by 1975 and 1980.

The large-scale retail companies are in a phase of far - reaching development from the information system standpoint.

We are in a transition phase which is seeing ever more advanced qualitative applications which users are pursuing for operational and financial reasons (Table VII.3).

We can summarize these applications, which are giving the impetus to a jump in quality, as:

- integrated sales control
- integrated stock and purchase planning control
- control of cash flow.

The latter, which requires terminals at all cash desks of chain stores, is handicapped by the high cost of the terminals and is in fact under study everywhere, although it is not yet in use with any European user.

The interviews show that the investments for hardware (1) in companies with several advanced applications reach values of 0.8 - 1.2 of the hardware investment/turnover ratio and it can be reasonably presumed that in the 80's this ratio will be the norm for all big users in the sector.

On the basis of this assessment obtained from the interviews and using the general forecasting procedure (2), the following conclusion has been reached:

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(1) Value of computers installed in purchase price.

(2) See Annexes.

TABLE VII.3 INTERVIEWEES' FORECAST ON APPLICATION AND HARDWARE

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN:		EVALUATION OF HARDWARE ON BASIS OF DEVELOPMENT OF APPLICATIONS		OPINIONS OF THOSE INTERVIEWED ON POSSIBLE EXTRA LARGE COMPUTER
	ADMINISTRATIVE PROCESSES 1	OPERATIONAL PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1970/71	BY 1975	1975	1980	
D1	Wages	Under study (1980)		360.000	Budget doubled $ 720.000		1 + 2	No, improbable
D2	Wages Suppliers invoicing	Sales-stock experimental (1972)	Under study (1975)	3.340.000				By 1980
D3	Wages General accounting Stock control	(Off-line) Under study		190.000			1 + 2	No
D4		TP with cash registers (52 outlets) 1975				2		Perhaps by 1975
D5		In diffusion by 1975	Under study	950.000		2		Yes, by 1975
D6	Wages General accounting							No quantitative information Improbable

1975 4 users with hardware investments more than $ 5,000,000.
1980 8 users with hardware investments more than $ 5,000,000.

These forecasts refer to potential users in Common Market countries and not to those in the United Kingdom; owing to the considerable decentralization of British retail concerns which are in most cases holding companies controlling numerous specialised companies.

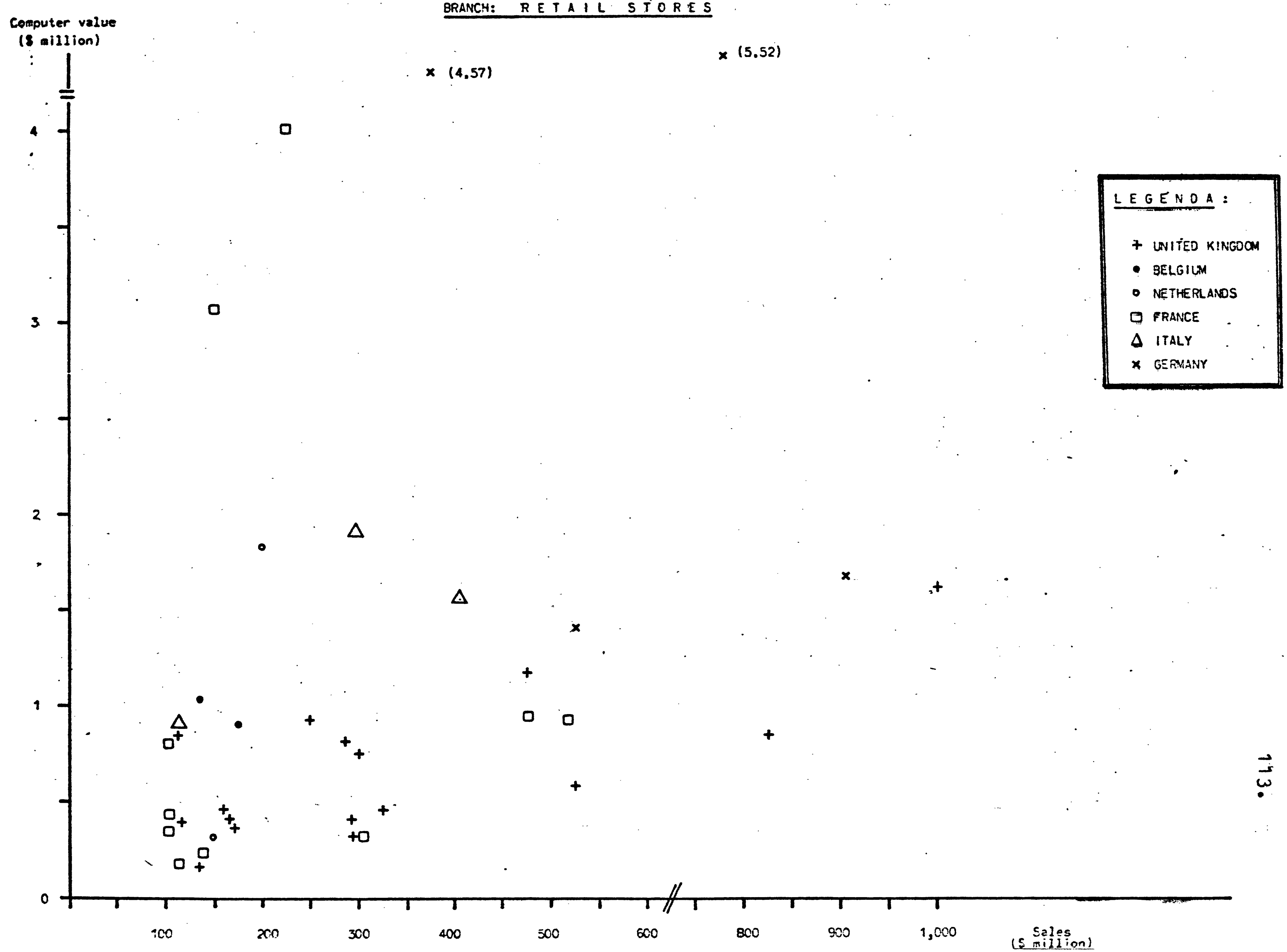
The jump in quality mentioned with respect to users in Common Market countries would thus require in the UK an indispensable reorganization involving the centralized control of administration, purchases and stocks.

If such an event can be taken reasonably for granted, hardware expenses would also increase in the UK up to values comparable with those of European companies, and it would thus be possible to foresee the installation of three extra-large computers in the UK by 1980.

Thus potential users whose value of computers installed will be above $ 5,000,000, in the EEC countries plus the UK, will be 12 by 1980.

FIG. VII, 4 VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: RETAIL STORES



CHAPTER VIII.

BANKS AND INSURANCE COMPANIES

1. Introduction

This chapter examines both present and foreseeable applications of electronic data processing systems, with particular attention to large EDP systems in two sectors, namely:

- banks and postal current accounts
- private insurance

The two areas are dealt with together because, aside from specific applications made in each of them, the use of computers in both is directed toward a solution of the problem of decreasing the negative flow of money by increasing the flow of information.

The report is based mainly on the results of the direct inquiry, with the additional aid of a systematic study of existing literature.

2. Structure

It is difficult to treat the various banks of Common Market countries and the United Kingdom together because their functions and their activities differ depending on the different laws of the several countries.

It should first of all be noted that public and private organizations co-exist in both the banking and the insurance sectors of all the countries involved; for instance, in the French insurance sector, 26 of the 146 companies are nationalized.

In Italy in the sector of ordinary credit, public banks (Banche di interesse nazionale, Istituti di Credito di Diritto Pubblico, Casse di Risparmio) control over 70% of the deposits; in the sector of special credit, all the banks are public.

To these must be added:

- Ufficio Italiano Cambi
- Cassa Depositi e Prestiti.

The public institution's presence in the insurance sector is assured by the presence of the INA group.

In all the countries included in the survey, there are different categories of credit institutions with differentiated functions. Besides the traditional distinction between commercial bank and merchant bank which still holds in many of the countries, with the exception of Germany, and which tends towards disappearance in France, the British financial market reveals a great complexity with its clearing houses, its merchant banks, its discount houses, its building societies, etc.

Institutional differentiations, however, are no obstacle to treating the banking and insurance sectors together as one from the point of view of the use of large electronic data processing systems which make it possible for public or private banks in the different categories to face their common problems.
More important yet, as far as computer use is concerned, the development of international financial relations and the evolution of the economic policies of the different countries have recently caused greater competition among banks.
On the one hand it has become very important to reach a certain size, and thus in many European countries there has been a big push toward concentration which has led to the creation in the Netherlands of the AMRO (Amsterdam Rotterdam Bank) and the Allgemene Bank Nederland; in Belgium to the creation of the Société Générale de Banque (Société Belge de Banque e Banque d'Anvers), in France to the creation of the Banque National de Paris (BNCI and CNEP), and in England to the creation of the National Westminster. There is good reason to believe that the trend toward concentration is far from ended and that within the next ten years it will cause a further reduction in the number of large banks.
Increased competition in the sector required also to solve the coordination and rationalization problems of banking work, in order to reach a satisfactory level of efficiency and productivity.
During this last decade, banks - especially those with many

branches - have tried to find ever more efficient and rational solutions to such problems by extensive use of technical facilities available from the electronic computer industry. In Common Market countries and in the United Kingdom, the banking and insurance sector takes on an importance - in comparison with the whole of the economy - which varies according to its institutional characteristics and its different historical and economic evolution.

In the period from 1958 to 1967 there was a significant increase in the percentage of the added value of the sector in relation to the national product, as can be seen in the following table:

The added value in the banking and insurance sectors

Country	Growth rate 1958-1967	Percentage on GNP 1958	Percentage on GNP 1967
Belgium	3.9	3.0	4.2
France	5.1	3.2	3.8
Germany	6.3	2.8	3.4
Italy	5.9	3.9	5.2
Netherlands	6.0	2.6	2.9
United Kingdom	3.1	2.6	2.7

The banking and insurance sector has a growing importance in the economic system in European countries, even if the incidence of its added value in relation to the national product keeps within low limits, with a 5.2% maximum in Italy and a 2.7% minimum in the United Kingdom.
It is possible to deduce the general trend of banking and insurance activity in the last decade also from the index of total assets, or from the sources (deposits or premiums) or from other uses (credits or investments) in the sector.
Since these are monetary values, they incorporate both the effect of the general process of inflation and of the specific monetary situations which in many European countries have caused a variation in monetary parity (1).
For purposes of comparison it therefore seems suitable to summarize the general development trends of the banking activities by means of increases registered by the total banking deposits.

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(1) Increases in total deposits from 1958 to 1968 by the principal banking firms were as follows: over 300% in France, between 200 and 250% in Germany, Belgium and Netherlands, below 100% in Great Britain. See "Le Banche Europee nel 1968-1969", in Bancaria, dicembre 1969.
Between 1962 and 1967 the annual average growth rate of deposits in the principal banks and Common Market countries was between 10 and 15%, due to general economic trends (growth of national product and monetary amount) and to the more widespread use of particular banking services (such as payment by cheque). Entreprise.

3. Data Processing Equipment

3.1. In European countries

Banking and insurance firms were among the first EDP users in Europe.
The first installation in the insurance sector dates back to 1956 and was followed the next year by the first installation in a bank. According to statistics made available by De Bruijn(1) in the period from 1962 to 1966, the installation of computers in the EEC and UK in the two sectors being examined showed the following increase:

	1962		1966		RATE OF GROWTH 1962-1966	
	Centres	Computers	Centres	Computers	Centres	Computers
BANKS	86	136	339	580	+ 294.1	+ 326.4
INSURANCE COMPANIES	99	131	281	445	+ 183.8	+ 239.6
TOTAL	185	267	620	1,025	+ 235.1	+ 283.8

Both sectors therefore registered a significant development in automation during that period, with an increase in the number of installations equal to 326.4% for the banks and 239.6% for the insurance companies.
Unfortunately, the information quoted has only an approximate value, because the number of computers installed is not indicative of the rate of development of installations of large computers.

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(1) De Bruijn, Computers in Europe in 1966.

It would be more suitable to refer to information disaggregated by price-class of computers installed, but this data is unfortunately available in a dynamic perspective only for the United Kingdom and, in static form, only for Germany; this data does, however, give some indication of the importance of the

sectors considered in relation not only to the total number of installations, but also to the number of installations of large computers.

The installations of computers in the banking and insurance sectors of the two countries being discussed represent in 1967 a significant portion of the total installations, both in number and value, as can be seen from the following table.

COMPUTERS INSTALLED IN BANKING & INSURANCE IN GERMANY IN 1967

	ABSOLUTE VALUES			PERCENTAGE OF TOTAL		
	BANKS	INSURANCE	TOTAL	BANKS	INSURANCE	TOTAL
	NUMBER					
DESK	39	5	44	10.5	1.3	11.8
SMALL	438	204	642	14.6	6.8	21.4
MEDIUM	39	29	68	11.3	8.4	19.7
LARGE	3	5	8	3.4	5.7	9.1
EXTRA LARGE	-	-	-	-	-	-
TOTAL	519	243	762	13.6	6.3	19.9
	VALUE (purchase price in 000 $)					
DESK	2,530.8	320.4	2,851.2	11.0	1.4	12.4
SMALL	118,795.2	58,915.2	177,710.4	15.3	7.6	22.9
MEDIUM	32,956.8	25,171.2	58,128.0	11.4	8.7	20.1
LARGE	4,320.0	7,632.0	11,952.0	2.9	5.1	8.0
EXTRA LARGE	-	-	-	-	-	-
TOTAL	158,602.8	92,038.8	250,641.6	12.3	7.1	19.4

SOURCE: SORIS; ON THE BASIS OF INSTITUT FÜR ANGEWANDTE REAKTORPHYSIK DATA.

The banking and insurance sectors, with a total of 762 computers (519 in the banking sector, and 243 in the insurance sector) for a total value (expressed in terms of purchase price) of over $ 250 million, account for 19,9% of the total installations in Germany and for a slightly lower percentage of the total value (19.4%).
The number of computers owned by banks and insurance companies in the United Kingdom is much less significant, with only 268 computers (162 in the banking, and 106 in the insurance sectors respectively) for a total value of over $ 120 million (in purchase price) representing only 10% of the installations in number, and 15% in value.
If automation appears to have developed rather late in this sector in England in comparison with Germany, the shape of size distribution of Britain's computer equipment can be seen to be quite different from that of Germany. In fact, in 1967 there were already 4 extra-large computers in this sector in the United Kingdom, whereas there was no computer of this size in any of the German banks or insurance companies. England even had 15 large computers, while Germany had only 8. England's computer equipment is therefore characterized by a number of large and extra-large computers which is above-average for the country, while the opposite is true in Germany.

PERCENTAGE COMPOSITION OF TOTAL COMPUTER EQUIPMENT IN BANKING AND INSURANCE IN THE UNITED KINGDOM AND GERMANY CLASSIFIED ACCORDING TO SIZE (1967)

	UNITED KINGDOM				GERMANY			
	BANKS		INSURANCE		BANKS		INSURANCE	
	NO.	VALUE	NO.	VALUE	NO.	VALUE	NO.	VALUE
DESK	13.6	1.4	15.1	2.6	2.1	27,2	0,5	6,2
SMALL	49.4	32.1	66,0	48.8	74.5	37,7	63.9	33,3
MEDIUM	28.4	30.8	13.2	25.8	20.7	28,0	27.3	38,1
LARGE	6.2	19.3	4.7	22.8	2.7	7,1	8.3	22,4
EXTRA LARGE	2.4	16.4	1.0	-	-	-	-	-
TOTAL	100.0	100,0	100.0	100.0	100.0	100,0	100.0	100,0

Equally detailed information is unfortunately not available for the other European countries. It can only be noted that in France a total of 509 computers had been installed in the banking and insurance sector by the end of 1967, equal to 15.8% of the total number of computers in the country (exclusive of desk computers)(1).

(1) Source: BIPE.

3.2. In the United States

In the U.S. there are three distinct classes of banks:

- commercial banks
- savings and loan associations
- mutual savings banks.

Commercial banks generally offer a full range of banking services. There are over 14,000 commercial banks in the United States, and over 15,000 branches, for a total of nearly 30,000 commercial banking offices. Commercial banks vary greatly in size; however, the vast majority of them are small; an estimated 13,000 banks have deposits of less than $25 million and approximately 325 commercial banks have deposits of over $100 million.
Banks must operate according to the laws of the state in which they are located, and this significantly affects the number of branches a bank may have.
According to the latest survey which was conducted by the review "Computers and Automation" (1), installations in the financial sector represented 15.33% of the total number of computers installed in the United States by the end of 1968. According to American Bankers Association surveys, the following was the situation (2) of the 14,000 banks in the U.S. in the years 1963 and 1966 respectively:

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(1) Computers and Automation, September 1969.

(2) EDP Industry and Market Report, December 1, 1966.

Growth of automation in banking	1963	1966
Banks with computers installed	485	943
Banks using off-premise computer services	585	2,055
Banks with plans for automation	1,265	1,358
Banks without plans for automation	11,665	9,638
Total	14,000	13,994

All banks with deposits of over $500 million are using computers, and for those with deposits of $100 million or more, 91% have their own computer system and another 5% use off-premise service.

Bank spending, naturally, tends to be proportional to the size of a bank, as the table shows. The computer, however, is rapidly moving into use by smaller and smaller banks. Most of these will be using off-premise computer service from a service bureau, a correspondent bank, or a joint venture.

MONTHLY COMPUTER COSTS BY SIZE OF BANK (deposits in millions of dollars)

MONTHLY COSTS	UNDER $10	$ 10 to $ 49	$ 50 to $ 99	$ 100 to $ 499	$ 500 and over	TOTAL
Under $ 5,000	87%	54%	14%	6%	1%	35%
$ 5,000-$ 9,999	9	38	68	23	1	34
$ 10,000-$ 14,999	4	3	13	24	1	10
$ 15,000-$ 24,999		1	3	30	13	9
$ 25,000-$ 49,999		3	1	14	33	7
$ 50,000-$ 99,999		1	1	3	38	4
$ 100,000 and over					13	1

The distribution of the large U.S. banks (with deposits of over $ 500 million) according to the size of EDP costs is therefore different from that of European banks of similar dimensions, as can be seen from the following table:

PERCENTUAL DISTRIBUTION OF BANKS WITH DEPOSITS OF OVER $ 500 MILLION ACCORDING TO SIZE OF EDP COSTS

MONTHLY COSTS ($)	US	UK	F	B	I	NL	D
< 25,000	16	64	40	-	44	-	35
25 - 50,000	33	16	50	75	34	40	30
> 50,000	51	20	10	25	22	60	35

It should be noted that in the U.S. some of the banks, especially those with deposits of less than $500 million, resort to joint ventures to obtain the EDP services needed at a cost of less than $10,000 monthly which represents the minimum, beyond which a bank finds it more convenient to operate its own computer.

4. The most widespread applications of EDP systems

4.1. Preliminary remarks

The most important banking EDP applications have been set up by almost all those interviewed,especially as regards "bulk processing". The following activities in particular can be noted for the different companies and organizations interviewed:

COMPANY OR ORGANIZATION	OPERATING ACTIVITY	PURPOSE
BANK AND POST OFFICES	- current accounts - postal Giro	Consumer control and timely service Interbank accounting
SAVINGS BANKS	- deposits	Maximum use possible
INSURANCE	- life insurance policies - other insurance policies	Customer control and control of over-all and partial risks
SOCIAL SECURITY	- current accounts	Control of recipient and timely service

For all these activities, the bulk processing which in the past was performed in batch, that is in lots and off line, tends more and more to be performed now OL (on line), that is to say with the peripheral unit (the branch office and agencies) connected "on line" directly with the central computer. Besides, there is a tendency toward processing OL RT (on line, real time), that is with the peripheral unit

connected on line with the computer, so that the computer can be "questioned" and then give an answer, as if it were a dialogue (in real time, therefore).
The use of bulk processing has required that files and updating programs be set up; the change to teleprocessing and even more the use of OL RT has involved transferring the files to a more costly storage (random access) and the use of more complex and more extensive software.
Other activities can be added to those listed in the foregoing table, but even those are sufficient to identify an operational information system which connects the peripheral unit with the center.
The use of teleprocessing has spread in very differing stages in the various sub-sectors. Banks are generally ahead of insurance companies, probably because insurance company operations need not be as timely as those of banks, and perhaps also because of historical and competitive reasons.
Other reasons for the different speeds with which teleprocessing has been adopted are to be found at the national level. They concern the type and size of the company involved, and the size is particularly decisive where banks are concerned.
InUnited Kingdom, in fact, the most important banking firms (1) are very large and have a great number of branches.

(1) Barclays, Midland, Lloyds, National-Westminster, National and Commercial Bank of Scotland.

In the United States, instead, there are many small or very small banks which cannot, by law, have any branches. In the United States these applications are in explosive expansion. Although there are no experiments regarding the management information system, it can be said that the system concerns :

a. all the information and the parameters necessary:
   - in peripheral divisions to implement the local operations being limited by laws and by the rules fixed by the central office ;

   - in the central office to control the branches in carrying out their operations and to consolidate all the divisional balance-sheets in the over-all balance-sheet of the company.

b. The more the management information system succeeds in modifying the limits placed on the branch offices in order to follow the day-to-day market phenomena, the more effective it will be in the short term. The more it manages to succeed , by the analysis of the consolidated balance-sheet, in determining the evolutionary trends both of the new services (which little by little will be demanded by the market) and of the services already granted, the more effective it will be in the long term. As for the postal current accounts and social security, it is certain that the objective of the management information system is to carry out the services that

the law requires and defines, reducing to a minimum the cash needed to realize them with the required timeliness.
In conclusion, these activities make the peripheral divisions less free and therefore require less efforts of coordination from the central offices.

4.2. Applications by firms interviewed.

The synthesis of applications made by the firms interviewed is divided into two groups, one comprising insurance and the other including banks and postal current accounts, which are important for their interbank-type functions.

Particularly the insurance companies interviewed are almost all in the phase of "expansion of mass applications". Almost all of them spoke of teleprocessing, but apparently none of them has anything operating yet, although there may be something in an experimental stage. This as regards the aspect of the operations information system (remote access from terminals to the central core storage).

A British insurance company (B3), for example, although it has not yet complete mass application, nevertheless speaks in some detail about a Management Information System (profit budget). All five insurance companies, with the possible exception of the Italian one (which however is already installing two terminals), have a data processing department budget which could include the very large computer. Almost all the banks interviewed were in the (advanced) stage of expansion in mass applications; besides, they had all begun teleprocessing and therefore an "operations information system", with one example of a company which had already installed 120 terminals. These characteristics make highly reliable some of the forecasts made by those interviewed on the basis of their previous experience in the field of operational information systems.

Table VIII.1 shows the logical development of the applications mentioned in the interviews. The table groups together the different types of processing: batch processing, processing to furnish information for the management decisional system or for the operational system.

The applications cited in the interviews are also included and an attempt has been made to reconstruct the present stage of the applications in those cases where no mention was made of it.

The applications have been distinguished into five phases: being studied, being experimented, being extended, being completed, completed.

From the table we can see that:

1. Batch processing applications are to be found mainly among applications "being completed" or "completed", while instead those which produce operational information are mainly "being studied" or "being experimented"; and those which produce information for the management system do not go beyond the stage of "being studied".

2. Batch processing applications are completed or are "being experimented" for the operational system(or else they are "being studied"). This particularly regards "policies in teleprocessing", "deposits in teleprocessing", "current accounts in TP" and "Giro in TP", all of which are the beginnings of further developments in the sector.

APPLICATIONS IMPLEMENTED, BEING EXPERIMENTED, BEING STUDIED BY COMPANIES INTERVIEWED.

TYPE OF PROCESSING	APPLICATIONS IMPLEMENTED, BEING EXPERIMENTED, BEING STUDIED	COMPLETED	TO BE COMPLETED	BEING EXTENDED	BEING EXPERIMENTED	BEING STUDIED	COMMENTS
BATCH PROCESSING	* HANDLING LIFE INSURANCE & RCA POLICIES * HANDLING FIRE AND THEFT INSURANCE POLICIES	B3, B6	B6				
	* CONTROL OF PREMIUM PAYMENTS	B3					
	* PERSONNEL PAYROLL	B1, B4, B9	B6			B12	
	* MEDICAL FEES / PENSIONERS PAYROLL	B11, B1	B11, B12				
	* GENERAL ACCOUNTING	B1,B2,B4,B9				B12	B12
	* PERIPHERAL ACCOUNTING	B12	B4				
	* SAVINGS BANK ADMINISTRATION	B1					
	* DEPOSITS ADMINISTRATION	B9					
	* CURRENT ACCOUNTS	B2, B4, B7					
	* CONTROL OF BANK CHECKS		B4, B5				
	* GIRO	B5, B9					
OPERATIONS INFORMATION SYSTEM	* UNIFICATION OF POLICY FILES BY TP					B3	
	* POLICIES IN TP				B6	B8, B11	
	* DEPOSITS IN TP			B1			
	* CURRENT ACCOUNTS IN TP			B7	B2, B4, B5		
	* GIRO IN TP					B9	
	* INPUT DATA CONTROL IN TP			B12			
MANAGEMENT INFORMATION SYSTEM	* AGENCY PROFIT BUDGET					B3	
	* MIS					B1, B4, B9	
	* BRANCH OFFICE ACCOUNTING					B4	

3. An interesting application is the unification of policy files by TP, which is a typical preliminary phase that precedes or runs parallel to experiments in TP.

4. The applications indicated as part of the management system being set up ("agency profit budget", MIS and "branch-office accounting") are all connected to batch processing of an accounting type.

In conclusion, if the sample interviewed has any significance, it can be inferred that the development of computers will not be greatly influenced by batch processing applications, since all the applications cited have already been "completed": any possible increase in this type of processing will be brought about by other new kinds of application or by combinations between different applications which have already been "completed".
The most important influence, at least in the near future (3 to 5 years), should come from the development and widespread use of operational information systems.
The contribution that will be made by management information systems is uncertain, and in any case it is unlikely that they will develop in the near future (beyond five years).

4.3. Projects on the basis of the interviews.

Interviewee B1 included specific questions on future applications in the sector which were named "leading themes". However, those interviewed gave rather generic answers which have been tabulated (table VIII.2).
In general, both banks and insurance companies speak of teleprocessing, of OL applications between peripheral and central processor units, of the use of terminals in the branch-offices, of financial control of the branch-offices, of central data-bank and of information on customers.
These needs are expressed more in terms of form (teleprocessing) than in terms of content, except for the applications already mentioned as being under study, but which should run their course within a few years and would therefore not prejudice the introduction of new ideas for computer applications: that is, of the "leading themes".
What is particularly lacking, except for interviewee B13, is any indication about the requirements for exchange of information among different companies in the sector; these exchanges, as we shall see later, should be the leading operational development of the systems in the future (besides those developments already being studied at company level).
Also lacking are indications on the management information system, except for one bank (B4) wich spoke of financial control of the branch offices, thus touching on the subject

TABLE VIII.2 **APPLICATIONS PLANNED BY COMPANIES INTERVIEWED**

INTERVIEW	APPLICATION
B 1	TELEPROCESSING WITH TV TERMINALS / MIS / MULTIPROGRAMMING
B 2	TELEPROCESSING ON LINE
B 3	DATA BANK (within 2 or 3 years)
B 4	FINANCIAL CONTROL OF BRANCH OFFICES
B 5	TERMINALS IN ALL TP BUREAUS / INTEGRATION BETWEEN CONSUMER AND SERVICE (?)
B 6	TERMINAL AT AGENCY OFFICES. INCREASED LINKS WITH OTHER COMPANIES IN THE GROUP
B 7	TELEPROCESSING AND AMPLE POSSIBILITIES FOR COMMUNICATION
B 8	TELEPROCESSING
B 9	TELEPROCESSING
B 10	TERMINALS FOR ASSEMBLING INFORMATION
B 11	TELEPROCESSING. EXCHANGE OF INTERBANK INFORMATION AMONG COMPUTERS AND NON-DOCUMENTS
B 12	TELEPROCESSING

of peripheral autonomy, and except for several others interviewed who mention in very general terms MIS.

5. Future applications of EDP systems

5.1. Hypotheses of development

We have already stated that the homogeneous nature of the sector is based on the fact that its companies or organizations are all directed toward the handling of money; all the companies can in fact be fit into a single system characterised by the flow of information which can be exchanged and operated by a network of processors.
The hypothetical realization of this system can be expected to take place gradually and over a long period of time: it is unlikely to be accomplished, in Europe at least, by 1980.
The realizations already under way and which are related to the principal themes mainly involve the information processing system in connection with the use of teleprocessing which was mentioned by all those interviewed: by some it was being studied, by others it was being experimented on a limited scale, by others it had already been experimented and was now in the stage of being extended on a large scale throughout the company.
The physical structure of the companies or organizations in the sector is typically de-centralized. This is a permanent situation in the sense that all the organisms of the sector are characterized by a network of fragmented peripheral units and by a central office. This holds true even, if some of the companies interviewed have several central offices, because of the recent merging of several companies. For example, in the

United Kingdom, of the six leading groups forming 80% of the data processing market among banks, 4 were the results of more or less recent mergers of two or more pre-existing companies.

Even if this situation does not alter the philosophy of the operating system-which is atomic in its structure, with peripheral terminals and a large central processor unit - the situation can be prejudicial to the management information system which might instead have a solar philosophy. In fact, more than one of the persons interviewed, both among the banks and the insurance companies, spoke of the present situation (several processing centres) as being permanent.

For example, a French bank foresees installation of three giant computers by the end of 1980 (IBM 360/195 was mentioned) in Paris, Marseilles and Toulouse. In its district offices the interviewee B11 foresees installation of IBM 360/20 which could constitute points of crystallization, if the central bank's control should, as it could, become vaster, all-pervasive and coordinating.

In any case, since the setting up of the management information system, when it takes place, will require more information on periphery for the centre, this in itself might be one of the deciding factors in the choice between atomic and solar system. In fact, if the autonomy granted the agencies is small, the philosophy would still be atomic. If instead the autonomy granted is large, the system could become "solar" with peripheral processing capacity.

Two considerations should be made here:

- even a big peripheral processing need can be met by a central capacity as long as there is a vast storage capacity with random access (as requested by many of those interviewed) and as long as the telecommunications system used is very flexible and low-cost;

- the solar system does not exclude the need for giant central processor units (in fact, the interviewee B7 foresees installation of three 360/195 computers by the end of 1980 with a solar structure); however, potential customers of a very large computer would tend in themselves to be large in size.

It can be concluded that possible interventions should be studied to further the adoption of the atomic system; for example, a study might be made of specialized software (as was requested by more than one of those interviewed), or agreements might be reached with the telecommunications network to encourage customers to use the atomic system.
So far, we have spoken of company networks which connect all the branches with the central office or offices (figs. VIII.1, 2).
Studies are, however, being made in the United States as well as in several European countries on the possibility of local links, on a regional or metropolitan basis. The local network (fig. VIII.3)is connected with a giant computer and allows the customer to make use of many services, among which not only the banks and insurance companies, but also department stores, hotels, restaurants, transportation services and public utilities etc. This is to be done by means of a system of credit cards which can be read by the

FIG. VIII.1 NETWORK OF COMPANY LINKS

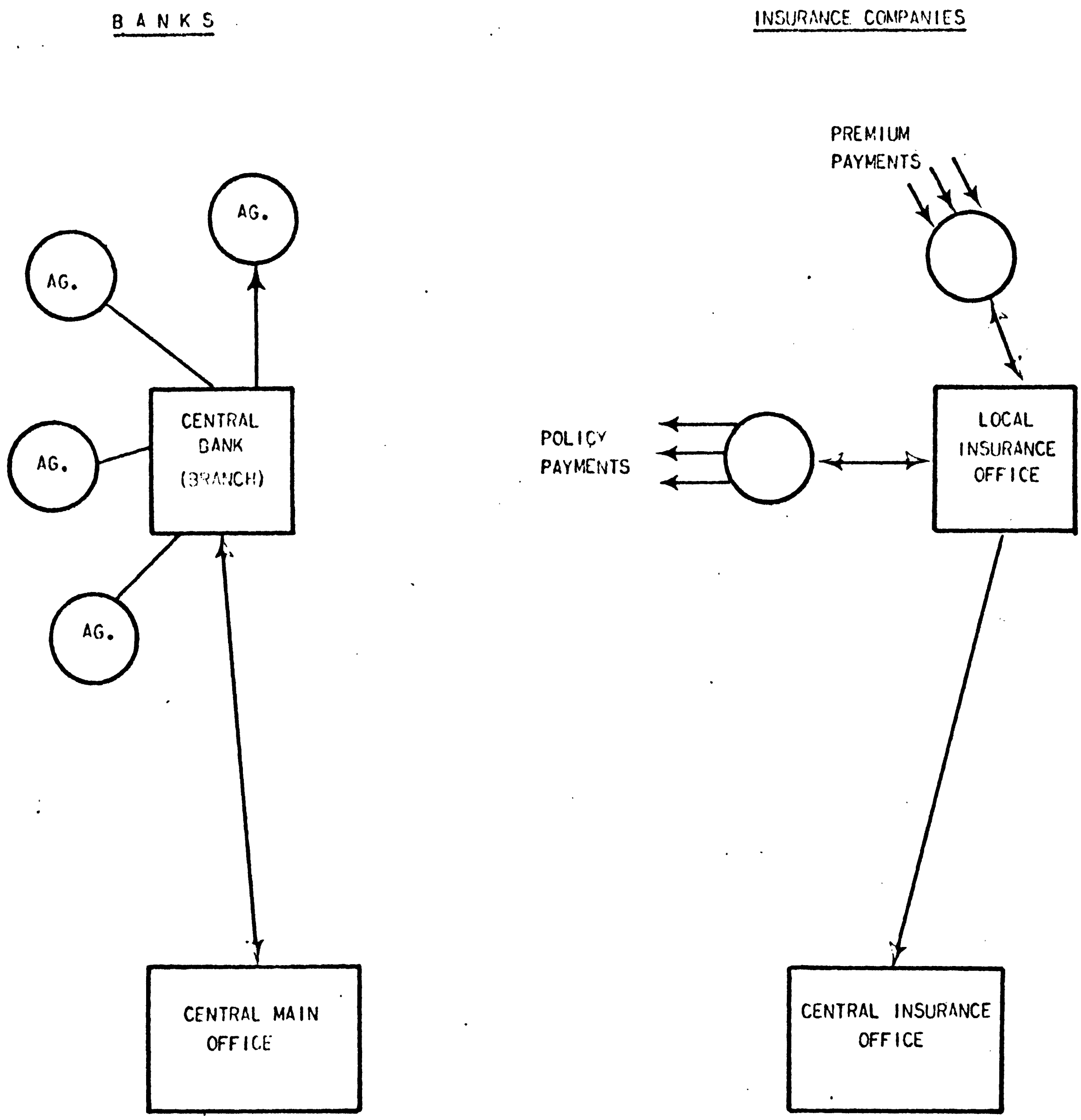


FIG. VIII.2 POST OFFICE CURRENT ACCOUNTS AND PENSIONS

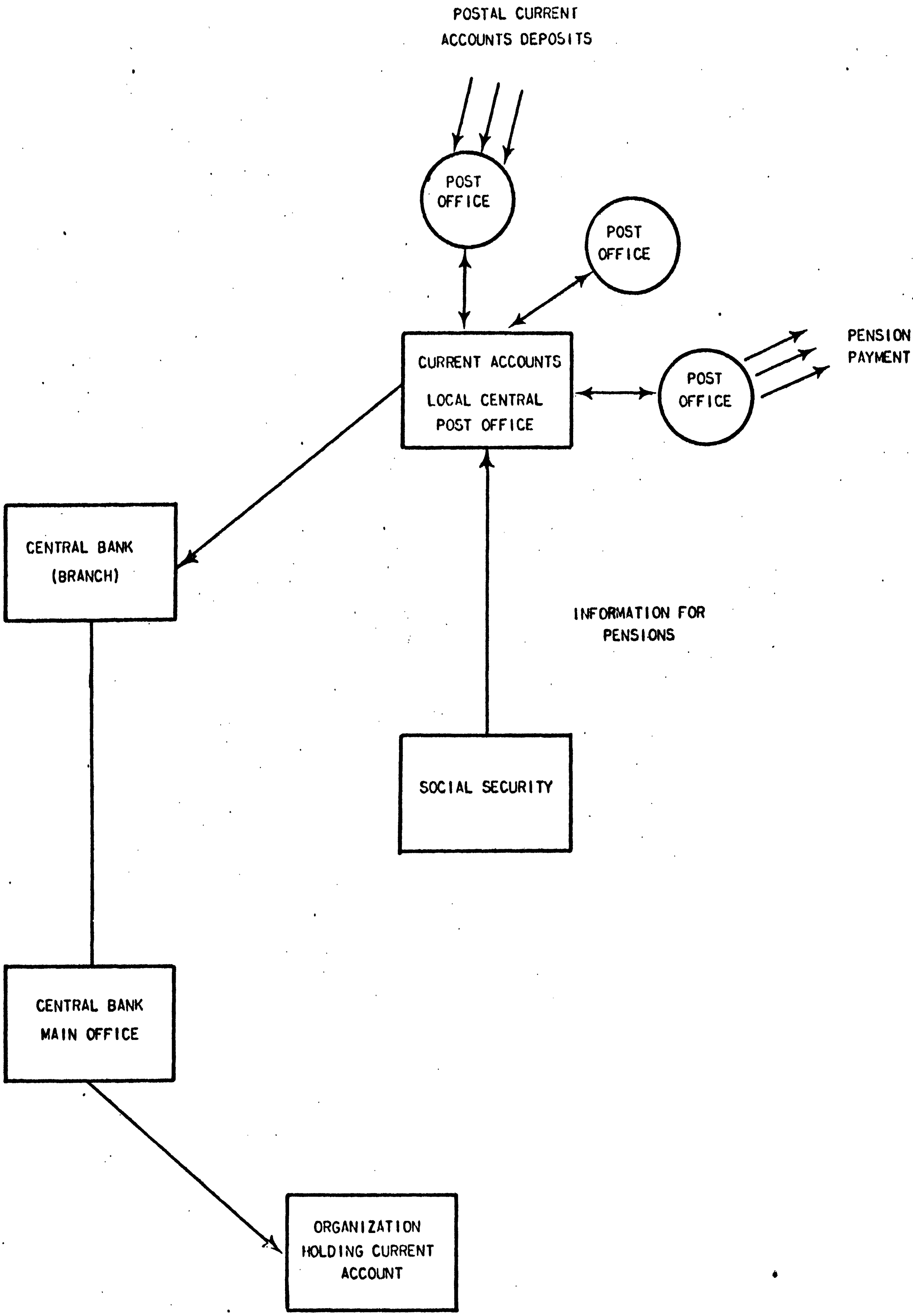
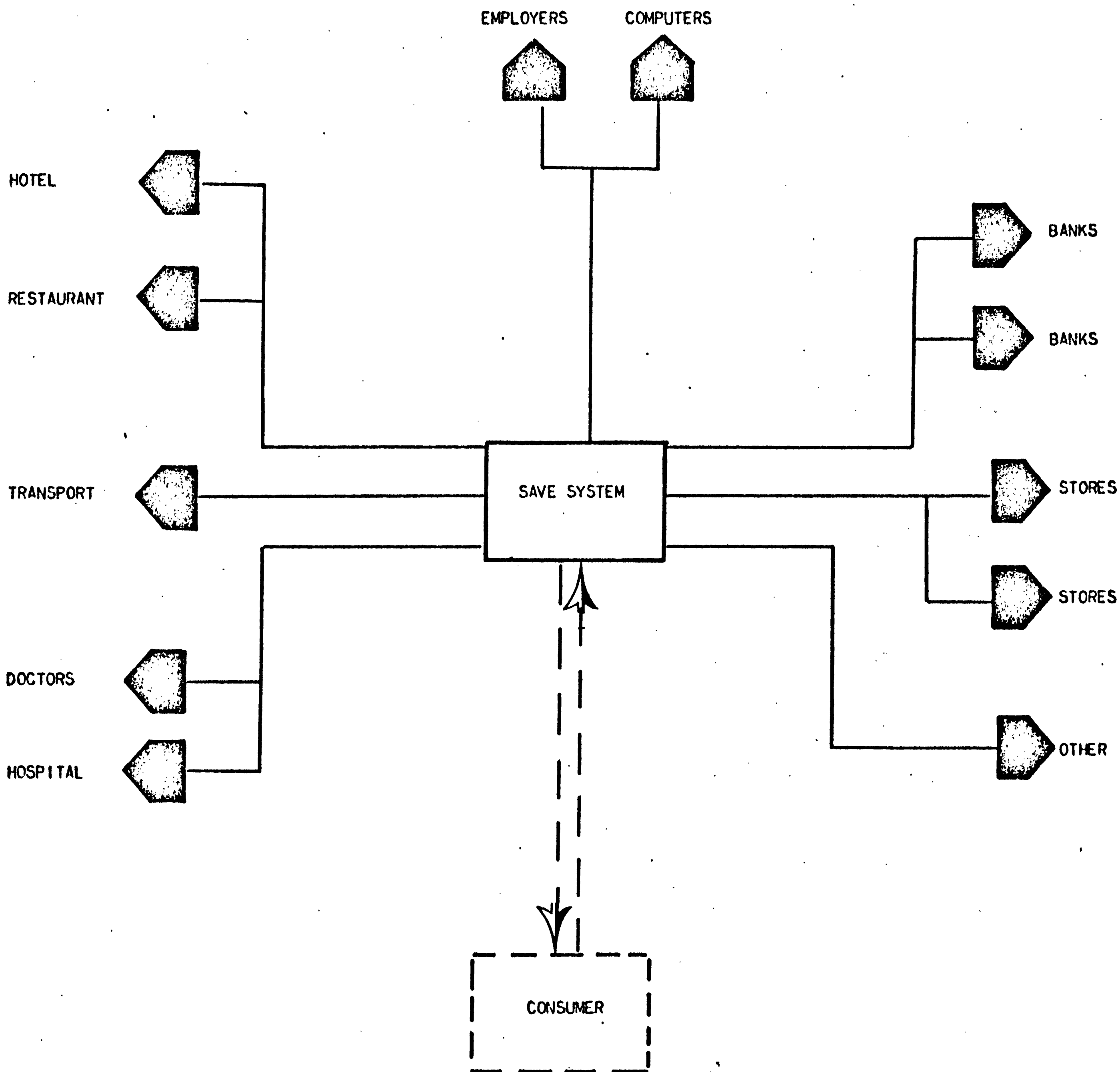


FIG. VIII.3 SAVE SYSTEM: GENERAL MODEL



terminals installed at each of the services and connected with the giant computer which is at the centre of the local network. The system is again based on the need already stated "to decrease the negative flow of money through the increased flow of information", and the very large computer will fit into a single formula the complete financial position of the user and will perform all his crediting and debiting services by means of its OL RT connection with all the possible sources of these movements.

This undertaking might be realized by an interbank (or by the central bank), by computer manufacturers, by the government, or by a joint venture of interested operators.

In Europe, too, there are several premises for the local network: in the Netherlands there is the "Giro System" based on postal current accounts; in Germany there is the "Landesbank" with its "Girozentrale"; in England the Interbank Bureau with interbank exchanges; in Italy the Banca d'Italia.

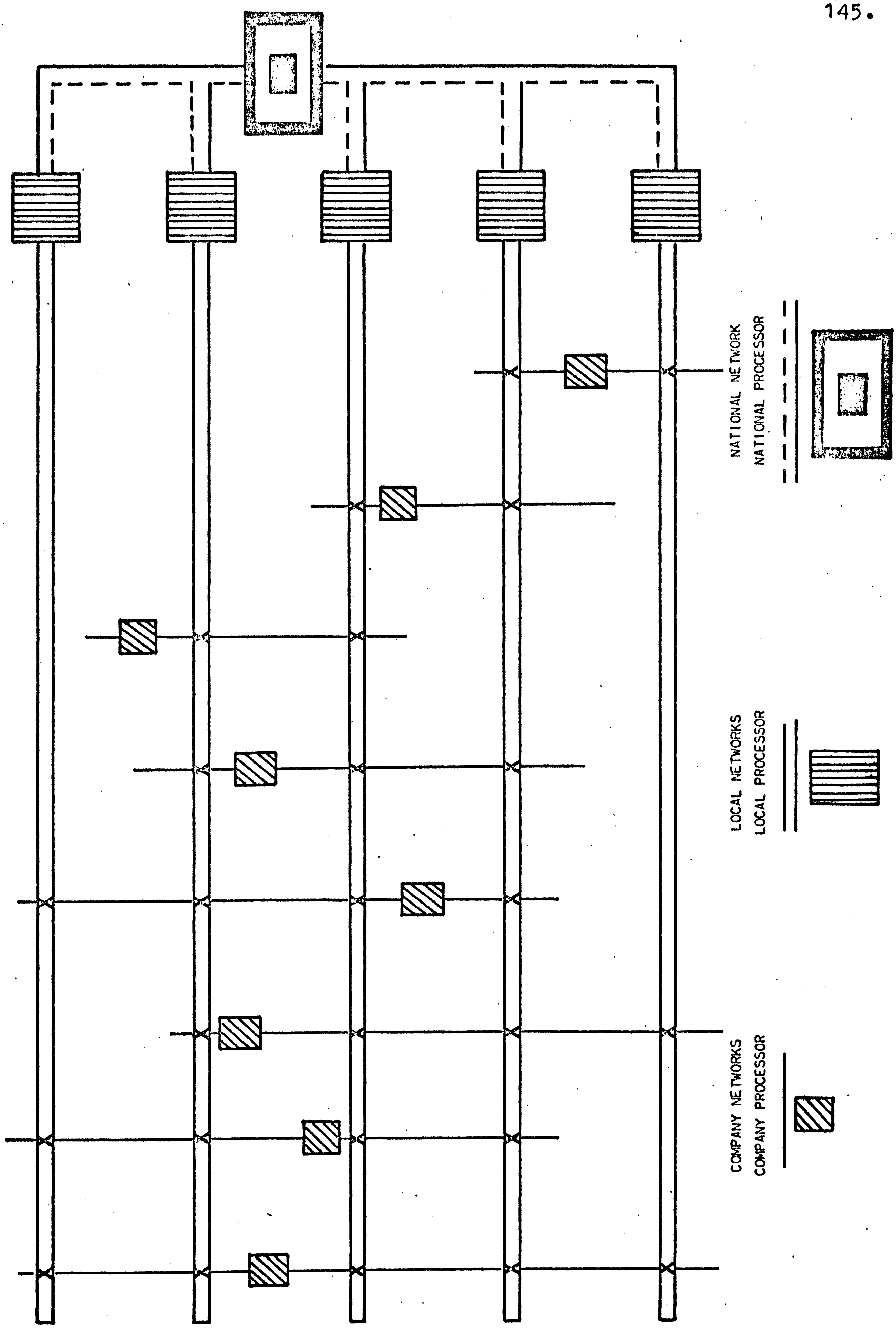
These European examples are a long way from the United States scheme, both because of the slow development of personal credit and because of the prevalence of banking activities. However, it might be the beginning of a coordination of financial flow on a local basis, since banks already represent a network which gathers together much of the movements of money from the various sources (not only consumers, but insurance companies, department stores, etc.).

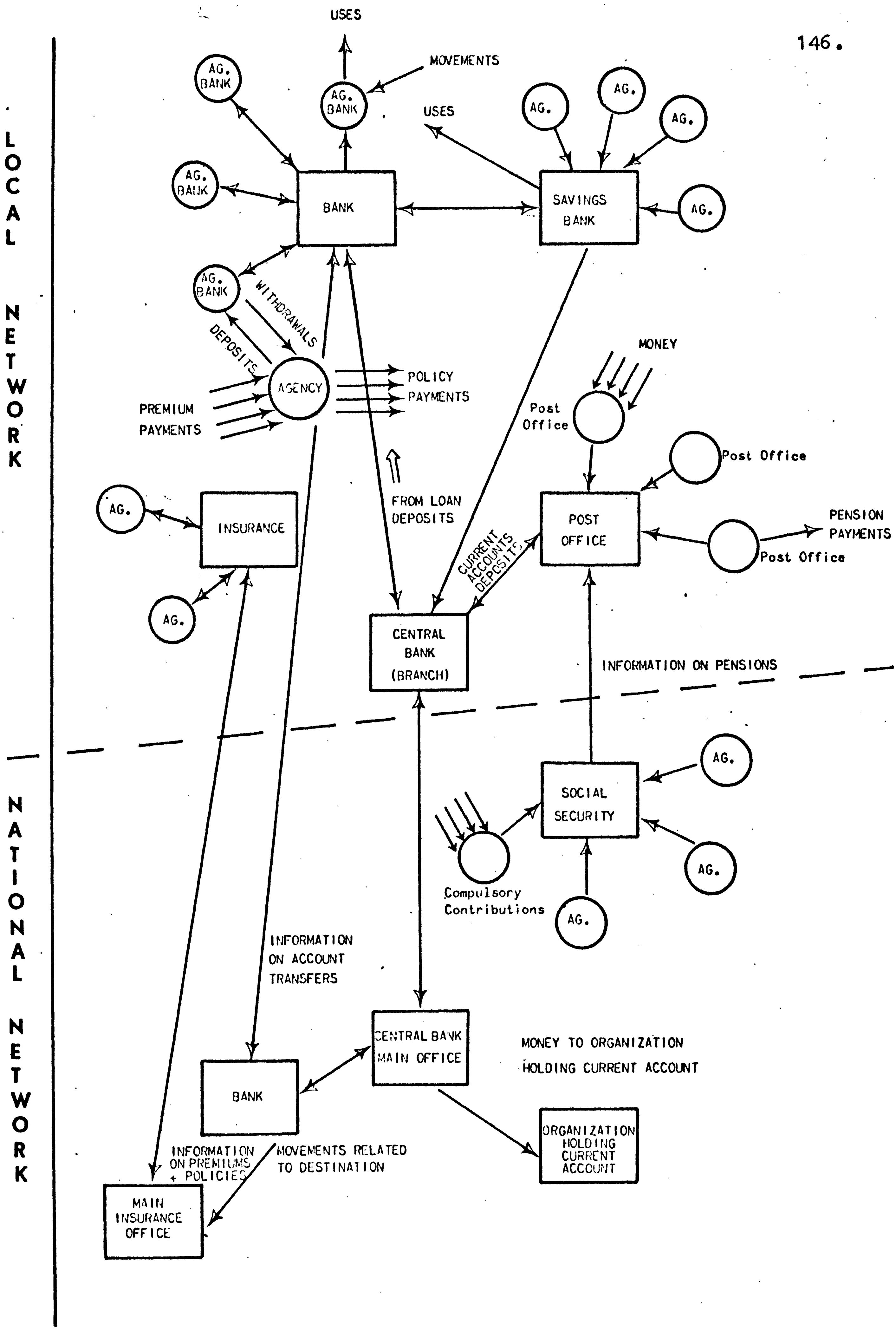
There is another hypothesis: the company networks (especially those operating on a nation-wide basis) are connected cross-wise by the local networks; these networks are therefore points at which flows of money accumulate and must therefore be "compensated" by a national network which thus runs parallel to the company ones (fig. VIII.4). This hypotheses (fig. VIII.5) begins perhaps to be verified in the Banca d'Italia's network and in the applications it foresees in control of banks. To summarize, the three possible hypotheses of interconnecting networks are:

- Company network, whose operating philosophy is physically decentralized with a low peripheral processing need and high peripheral decisional need (current accounts, deposits, policies); for historical reasons the processing needs of certain peripherals are high.
- Local network whose philosophy is clearly outlined, especially in the case of the pure system SAVE in the U.S.
- National network whose philosophy should be with a high peripheral processing need, whether the local computers in the central bank are reinforced or whether the computers of the solar system are connected among themselves.

In conclusion, we can show as follows the use of the giant computer. The local networks and the national network are doubtless potential users, even if their becoming users depends on many other conditions of development.
The company networks are nearing realization: the drawback lies in the size of the companies and is aggravated by a

FIG. VIII.4 CONNECTION AMONG NETWORKS




USES
MOVEMENTS
AG. BANK
AG. BANK
AG. BANK
AG. BANK
BANK
USES
AG.
AG.
AG.
AG.
SAVINGS BANK
WITHDRAWALS
DEPOSITS
AGENCY
PREMIUM PAYMENTS
POLICY PAYMENTS
MONEY
Post Office
Post Office
FROM LOAN DEPOSITS
AG.
INSURANCE
AG.
POST OFFICE
PENSION PAYMENTS
Post Office
CURRENT ACCOUNTS DEPOSITS
CENTRAL BANK (BRANCH)
INFORMATION ON PENSIONS
LOCAL NETWORK
NATIONAL NETWORK
AG.
SOCIAL SECURITY
AG.
Compulsory Contributions
AG.
INFORMATION ON ACCOUNT TRANSFERS
CENTRAL BANK MAIN OFFICE
MONEY TO ORGANIZATION HOLDING CURRENT ACCOUNT
BANK
ORGANIZATION HOLDING CURRENT ACCOUNT
INFORMATION ON PREMIUMS + POLICIES
MOVEMENTS RELATED TO DESTINATION
MAIN INSURANCE OFFICE

tendency, which is however not generalized, toward the solar system for the operative problems.

5.2. Comparison with the United States

The opinion of American banks on the future use of computers in this sector can be gathered from the answers given in the latest American Bankers Association survey. The answers "are indicative of bank reaction to the steps leading to the checkless society", as can be seen from the table VIII.3.

TAB. VIII.3 OUTLOOK FOR THE FUTURE

(%)

HOW DO YOU REGARD THIS DEVELOPMENT ?	AN ACCEPTED FACT			JUST A MATTER OF TIME	AT LEAST 10 YEARS AWAY	NOT LIKELY TO HAPPEN	FOR GIANT BANKS ONLY
	All banks	$ 500 and over	Under $ 10				
Computerization of major bank applications	56	99	34	25	8	4	7
Expansion of new computer services	40	90	24	40	9	5	6
Automated central information files	15	34	12	47	18	9	12
Use of visual display units for information retrieval and display	11	36	10	38	22	15	14
Automatic bill payment service for customers	9	25	7	36	29	17	9
Operations research projects conducted by bank	15	57	10	30	17	17	21
Bill paying via telephone	2	6	2	26	38	26	8
Bank credit cards	14	63	10	32	20	19	15
Elimination of check writing	1	7	1	11	31	53	4
On-line/real-time processing systems	17	54	6	32	25	14	12
Satellite computers linked to large-scale time sharing computer	9	32	4	29	26	23	13
National uniform identification numbers for individuals	5	4	5	36	35	22	2
Computerization of credit inquiry functions nationwide	2	...	3	25	42	26	5
Use of optical character recognition equipment	8	28	5	35	32	16	9

SOURCE : EDP INDUSTRY AND MARKET REPORT, DICEMBRE 1966

The prospects of development of the applications of very large computers in both sectors are very much tied to the on-line real-time applications. In the United States it can be seen that:

- banks are ahead of insurance companies in OL-RT applications and in reaching an atomic (or solar) system;
- insurance companies, however, have large opportunities of development of applications with OL connections, while there seems to be less need for immediate response (= RT) between agents'offices and the centre.

In this connection, it must be added that the structure of banking activities in the U.S. is different from that of Europe: many U.S. banks, for instance, have only few window counters; while the opposite is true in Europe (and Italy). This greater concentration could facilitate and accelerate the process of interconnection and thus aid in catching up with the U.S. A further process of concentration of existing banks is under way in almost all European countries, and this might further accelerate the development, according to the tendencies indicated.
At the same time, the American Bankers Association in the United States is very active in encouraging automation of the banking system.
Obstacles to the increase in applications are represented by the doubt the banks feel about conversion of the existing off - line computer systems, by expectations

of bankers regarding new developments in the terminals, especially low-cost terminals, by the persistent uncertainties about the surest method for customer-identification, and by the slow progress in development of central files as well as of personnel training.
On-line savings is the one application in the banking industry which has progressed beyond the experimental stage. In this application teller machines shared by two tellers are on-line to a central computer. The customer presents his passbook at the savings window and the teller inserts the passbook in the machine, keys in the account number and thereby accomplishes any of a number of savings transactions.(There are also some "no-passbook" systems).
While commercial banks, in total, have more dollar savings than do the savings banks, the commercial banks' savings accounts are spread over many more branches, and therefore it is much more difficult for them to economically justify an on-line system. Several commercial banks which provide on-line savings service to savings and loan associations do not provide the service for their own branches. On-line savings service, however, is gaining some acceptance with commercial banks in the unit-bank (i.e.. no branches) states.
For the seventies the introduction of other OL applications is foreseen, among them:

- demand deposit inquiry
- inquiry system for installment loans, commercial loans, etc.;
- data transmission between country banks and city correspondents.

In general it is seen that life insurance companies are more oriented toward introduction of data transmission systems than are fire and accident insurance companies (casualty sector), because their profits are bigger and because they need more immediate data transmission.
The only application of an on-line system being widely considered at the moment is policy status inquiry.
A system of this type requires a centralized random access file. By 1970 probably half of the top companies in the industry will at least install inquiry systems within the home office.
The necessity for real-time response in the insurance industry is not great when compared to industries such as banking or airlines.
Well over half of the currently planned inquiry systems will not involve real-time response.
Response times will vary from one hour to 24 hours. Major factors retarding the rate of acceptance of these systems include:

- the enormous cost of converting huge master files;
- the cost of terminals for branch offices and agents;
- an apparent controversy in the industry regarding updating and maintenance of the file, particulary as to whether or not agents should have access to the file for purposes of data entry.

For the remote Policy Writing on a Terminal an agent's proposal for a new policy would be transmitted to the central computer via a terminal. The proposal would then be reviewed and rates applied from stored rate tables and the policy itself finally printed out on-line on the terminal in the branch office.
This application appears to be of interest only in the casualty sector.

The Policy Data Collection will involve terminals in branch or district offices or in general agents' offices for transmitting to a central computer such data as premium payments, changes in policies, etc.

6. Expectations about hardware and software

As can be seen in table VIII.4, concerning hardware the banks have answered precisely, probably because they are ahead in the experimentation of teleprocessing and can judge already the need for memories for installed terminals. In fact 4 out of 9 banks have answered to the question about the need of a central memory (2 x 512 K and 2 x 1024 K) and of access time (all $< 3\ \mu s$).

The insurance companies have given generic answers about the central unit; almost all the companies interviewed tend towards billions of characters for the mass memories.

The interviewed parties of the sector have voiced general requests for the improvement of software ("more elastic", "at the same time as the supply of the computer") and have directed accuses against the bulkiness of the "operational systems", besides requesting to have hardware take over some of the tasks at present performed by software.

Interviews demonstrate that this sector, which has a rather homogeneous character, needs software; especially, there are complaints about the "commercially oriented" nature of the software-hardware combination which is available at present.

Besides, there are two special requests from insurance organizations for optical memory accessible by computer and two others for a larger storage facility for the terminals.

Some interviewed parties express worries about transmission software - they would prefer it to be operated by hardware -

TABLE VIII.4

EXPECTATIONS ON HARDWARE AND SOFTWARE

FIRM INTERVIEWED	SOFTWARE	ABOUT HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNIT (D1)	PERIPHERAL UNIT (D2)	TERMINALS (D3)	
B1	More elastic software	$\geq$1,024 K access 0,3 to 1 μsec	Optical readers 300 to 3,000 M access $\leq$ 5 μsec	> Memories	
B2		$\geq$512 K access $\leq$ 0,3 μsec	> Auxiliary memory	Video	
B3		High operational speed		High reliability	
B4	Must be provided by Manufacturers	High reliability degree		Speed and precision	
B5	Improvement of control systems	$\geq$1,024 K access <0,3 μsec	> 3,000 M characters	> Transmission speed and affidability	
B6			Optical storage memory High speed access memory	> Trasmission speed and affidability	
B7		Core memory bottle necks by-passing	Strong need of mass memory		
B8			Mass memory: billions of characters File protection	Reliability of TP and telecommunications network	
B9	More care and timeliness for software	Time < 0,3 μsec > 512 K			
B10		512 K at least basic time < 0,3 μsec	Simultaneous access to 2 units to up-to-date the same information		Tendency to an atomic system
B11	Not suitable computers because of the commercially oriented nature of software			Universal standards are required	
B12					

and about the possibility to use teleprocessing on a large scale which depends on the network of telecommunications. One person interviewed requests the improvement of the possibilities for a colloquium between man and machine.

In general, the opinions of those interviewed, even if very vaguely, express with respect to both hardware and software the needs of a sector whose further EDP development is influenced to a large degree by teleprocessing.

7. The Big Companies

Within the banking and insurance sector the leading businesses in each of the countries being considered have been singled out as well as the value of their computer installations.

Among banks have been considered those with deposits over 500 million dollars in 1968, in addition to, of course, the issuing banks. Among insurance companies all those with over $ 100 million dollars in premiums were taken into consideration.

The table VIII.C in the annexes reports, for the banks as well as the insurance companies which operate in the EEC countries and in the United Kingdom, the total value of the installed computers reflected in their purchase price. This value is distributed according to the computer size and compared to total deposits or the total of premiums taken in.

In the Common Market countries and in the United Kingdom the banks large enough to enter into the universe which is being considered are in total 97 and dispose of 12 extra-large computers.

In two countries, Germany and United Kingdom, the precise extent, by size classes, of the total computer equipment in the banking sector is known; and it may be noted that all the extra-large computers of the banking sector are installed in the large companies considered in this study. The extra-large computers are therefore used mostly by organizations of a certain importance : in the European banking sector they are used at present only by banks with more than 4,000 million dollars in deposits.

Where the banking system is very concentrated, as is the case in the UK, at least as regards commercial banks, the extra-large computer is requested only by banks which are still bigger, i.e. have deposits for an amount exceeding 5 billion Dollars.

Also smaller banks, that is between 2,000 and 4,000 million Dollars in deposits, have at present such a quantity of computer installations as to permit the introduction of extra-large computers.

In order to judge the degree of automation in the banking sector in the various countries, it seems useful to consider, as a measure of comparison, the ratio value of computers installed per 1,000 dollars of deposits, taking into consideration only big users, also if the average ratio has only limited significance, because of the considerable variability of this ratio with the various users. We can notice that the major ratio of installed EDP to the amount of deposits is in the Netherlands (2,8), followed by Germany (1,9) and Belgium (1,8).

Contrary to the banking sector, the insurance sector does not, at the present time and in none of the considered countries, dispose of very large computers; only one English firm is planning to install one. Also the users of large computers are very few: 5 in the UK, 2 in Italy, and 1 in France.

These are the only users whose total expenses for EDP equipment reach to such a level as to permit the introduction of extra-large computers.

The comparison among the values of the EDP installations per 1,000 $ of premiums taken in by the large firms of the insurance sector stresses a certain superiority of the English insurance companies over their counterparts in other European countries.

Also the data concerning the installations with large users shows us that the insurance sector compared with the banking sector has smaller needs for applications, as has already been pointed.

The transition to 40 terminals and later 250 (TP with all agencies) would considerably increase the time needed to process all the messages, so that it seems logical to ~~fore~~ see that the conversion to a very large computer will be necessary.
These considerations can obviously be generalized for the operational information systems (column 2). Finally the "possible management developments" have been indicated (column 3): the future of this application is difficult to define, because the few persons interviewed who are concerned with the problem are, at best, studying it. In table 5 are also listed the indications taken from the interviews about predictable acquisitions of computers by 1970-71 and by 1975.

Summarizing the contents of table 5, we can say that the three insurance companies are potential users: 3 of them will be such very shortly owing to the considerable processing facilities already required by Batch applications.

The most advanced firm of the sector, from the point of view of applications, could possibly arrive at the extralarge computer during the second half of the decade, since it is now only in the phase of studying the operational system.

In general, all insurance companies are thinking about TP or are studying its applications and the great expansion should take place towards 1975.

In 6 out of 9 banks the installation of a very large computer seems to be reasonable in the future: also here several firms have large investments in EDP due to the Batch processing applications.

8. Quantitative hypotheses about the extra-large EDP systems by 1975 and 1980

The sector's development hypotheses foresee three types of users: the company network, the local networks and the national networks.

For each interviewed firm (table VIII.5) there have been listed the new applications which could possibly be realized in Batch (column 1), these applications having been indicated by just the person interviewed or considered reasonable, because indicated by others with similar activities.

The possible operational developments are indicated in column 2 on the basis of the development stage of the application now being under study.

The operational information system does not require especially much capacity of the central memory (the 512 K specified) considering that in the most recent applications the traffic queues have been diverted to auxiliary equipment which have the function to decide on priorities and put out messages.

One can,however,foresee a great expansion in the number of terminals which must be connected because of the computer's operational speed (the 0,3 μs as basic time).

These remarks (especially the one concerning the operating time of 0,3 μs) have been confirmed by one interviewed party (B1) who attributes approx. 30% of his computer's time (2 x 360/50 at 512 K each) to TP of 16 terminals for the "comptes à vue".

One notes, however, already a high percentage of the applications of the operational system (4 out of 7 are being expanded): in fact, one of the interviewed parties has indicated that 30% of the processing time is spent for T.P. with the branch offices with 14 terminals installed which will rise to 40 within 1970.

Forecasting the number of future users of large EDP Systems in banking and insurance sectors in 1975 and 1980 is a very arduous task. Following the general forecasting procedure proposed (1), firstly we have to evaluate the growth of deposits and premiums in the next decade extrapolating on the basis of the rates of growth of the past years which obviously refers to monetary values instead of to real values.
Secondly, the legal framework plays a very important role in determining the rate of growth of individual insurance and banking companies and the development of their activities.
The importance of institutional environment makes comparison between insurance and banking companies of different countries very hazardous, in order to identify the leading companies in EDP applications. Third, in these sectors, especially in the banking sector, we can now see an increasing number of mergers in several European countries, so that it is very difficult to suppose that the number of large companies will be the same or will increase in the next decade.
Our forecasts have taken into account, whenever possible, the effects of the phenomena just described, but in all cases they are to be interpreted very cautiously.

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(1) See annexes.

We examined 43 large companies in the insurance sector, none of which has now an extra-large computer, while two of them, one English and one Germany one, have now EDP investments over 5 million dollars. According to our estimates, as we can see in the previous pages, we could not identify a very clear trend in the future EDP applications for the insurance companies, and the three companies interviewed do not offer a wide picture of the sector.
For these reasons we chose to forecast in this sector with great caution, and we modified the actual percentage of EDP investment (1) to premium only for the English companies, which can reach in 1975-1980 the actual percentage of EDP investments of their national leaders. The results of the forecast can be summarized as follows:

Potential insurance users of EDP large systems

	1975	1980
Number	5	15

For the banking sector, the legal framework is by far more important that in insurance, and therefore we have supposed that the central banks, owing to their institutional functions, will have their own extra-large computer in the next decade, but only two will reach this system before 1975. For the other banks, we have generally supposed that they will have in the future constant ratios EDP investments/deposits, while the most important ones are probably reducing their actual ratio owing to the economies of scale.

(1) Value of computers installed in purchase price.

In our forecasts for the banking sector the actual structure of the computer installations by size class was in one case, especially in England, very important in order to ~~ex~~include some banks which will the extra-large computer in the next decade.

The results of our forecasts show a very important increase in the number of extra-large computer banking users. Starting whith 75 large banks, 7 of which by now dispose of an extra-large computer, we will have in 1975 and 1980 the following situation:

Potential users of extra-large EDP systems in banking

1975	1980
19	35

TABLE VIII.5

INTERVIEWEES' FORECAST APPLICATIONS AND HARDWARE

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			HARDWARE EQUIPMENT FORESEEN		EVALUATION OF HARDWARE ON THE BASIS OF DEVELOPMENT IN APPLICATIONS		OPINIONS OF INTERVIEWEES ON A POSSIBLE LARGE EDP SYSTEM
	ADMINISTRATIVE METHODS 1	OPERATING METHODS 2	MANAGEMENT METHODS 3	BY 1970-1971	BY 1975	1975	1980	
B1	Payroll Giro	Being adopted: 2 to 4 years	Being studied by 1975	1,000,000		1 + 2	3	Yes, by 1975
B2	Deposits		Management integration being studied	1,250,000 (EDP)		1	3	Yes, by 1980
B3	Payroll	To be studied: 5 to 7 years	To be studied	4,000,000 purchase 1,000,000			1 + 2	Yes, by 1980
B4	Deposits	TP current accounts being extended (2 to 4 years)	RT for accounting and branch office control; MIS (7 years)		4 to 5 360/65	1 + 2	3	Yes, more than one by 1975
B5	Deposits Payroll Accounting	Giro in TP	Integration with customers	2,000,000		1 + 2	3	Yes, by 1975
B6	Life insurance Fire insurance 1 to 2 years	Terminals at agents' offices to be completed in 3 to 5 years		348,000			1 + 2	Not sure. Perhaps by 1980 (control of number of branches)
B7		TP on current accounts in expansion (2 to 4 years)		12,600,000 (EDP)		1 + 2	3 X 360/195	Yes, three by 1980, one immediately (Paris)
B8		TP 3 to 5 years		2,160,000			2	Yes, by 1975
B9	Current accounts Giro	Deposits in TP Giro in TP	Job-control information; MIS being studied	369,000		1	2 - 3	Doubtful. Perhaps by 1980
B10	Pension settlements De-centralized Data Collection (TP)	Route scheduling Mail distribution	Management information system	410,000	Development of terminals 1975/1980	1	2 - 3	Yes, by 1980 if MIS has been achieved
B 11	Giro	TP in experimental stage (3 to 5 years)	Control of banks being studied					Yes, 1975
B 12	Integrated cash management Deposits (TP)	Computer center for the Associazione Cassa di Risparmio		380,000	1,500,000 (EDP)	1	2	No

FIG. VIII.6.4.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: B A N K S

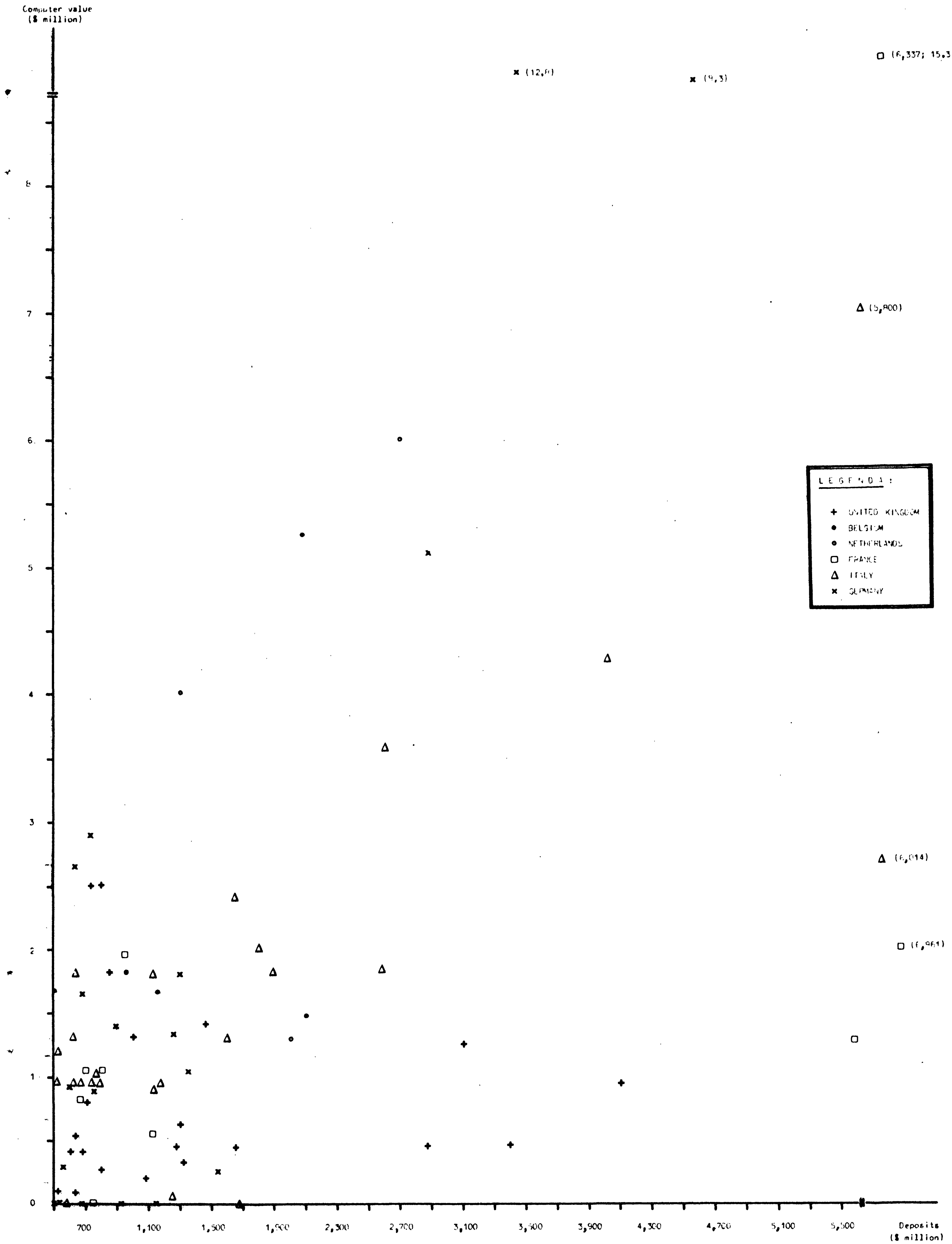
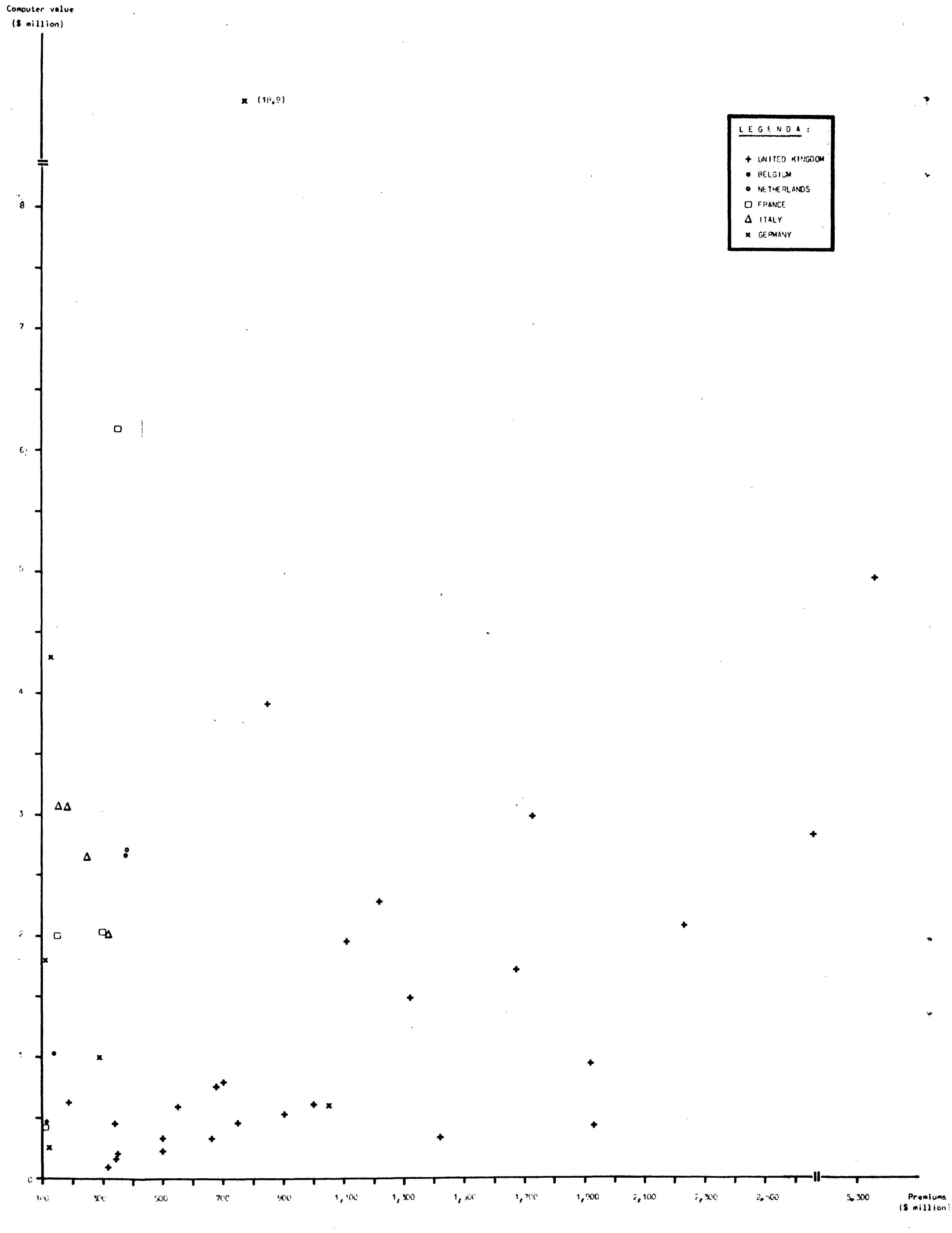


FIG. VIII.6.b. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ASSURANCE



CHAPTER IX

Public Utilities

1. Introduction

The public utilities sector includes electricity, gas, water, public transport and telecommunications.

A public utility is, by definition, an essential service, often subject to government regulations, management or ownership or in some cases it may even be a monopoly.

Such conditions may be found in different proportions in the services included in this sector.

The enterprises in question all employ fixed plants at the service of the customer. Technical investments and ordinary and extraordinary maintenance commitments are considerable due to qualitative and technological evolution and to the need to extend plants.

2. Structure

2.1. Economic characteristics

The essential characteristics and functions of public utility enterprises are different one from another in each single member country of the European Common Market and in the United Kingdom.
Most of these enterprises are public, namely they are controlled wholly or in part by the central or local authority. Private concerns do co-exist, however (for example some large Belgian electricity production and distribution companies).
Depending or the government participation in the enterprise and to its legal status, the public enterprises can be divided into (1):

a. Organisations without legal status, financially independent and run according to the regulations of private law.
Examples of enterprises of this type are the postal and telephonic services of all countries, excluding the telephone service in Belgium, and the German and Italian railways.
Local organisations (with or without legal status) such as municipal enterprises which supply electricity, gas, water services and run urban transports also come into this group.
With the exception of water which in most cases is still distributed on a town basis, and of the German, French and Italian transport systems, still run by the municipality, the other public services tend to be part of an integrated system on a larger territorial scale.

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(1) Centre Europeen de l'Entreprise Publique.
Les Entreprises Publiques dans la Communauté Economique Europeenne, Dunod, Paris, 1967

Thus we have regional or inter-town distributions (typical is the case of part of the electricity distribution system in Belgium and Holland) or distribution on a municipal'level, depending however, on a single national company, as happens with gas distribution in France and Holland.

b. Public or national enterprises, characterised by total (100%) participation of public capital and by commercial management following the regulations of private law. This category includes all nationalized industries (1), the radio and television services, the Dutch and English railway companies and the British "public corporations" (BBC, BEA, BOAC, ITA,National Gas Council - Area Board and Central Electricity Generating Board - Area Board).

c. Mixed companies, with the participation of the government and/or of the local public authorities owning part of the capital and thus active in the management and administration of the enterprise.
There are many examples of this: such companies include the airlines of the countries of the European Common Market, the French and Belgian railway companies, some French, German and Italian shipping companies and the centralized gas services in Holland.

In the application of electronic processing systems to large scale service industries, however, there seems to be no relevant distinction between public and private enterprises.

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(1) Typical are the nationalized coal, electricity and gas industries in France and Great Britain and the nationalized electric industry in Italy.

The choice of processing systems in such industries depends largely on the degree of centralization of the service, especially with regard to the distribution of electricity and gas. Such distribution is concentrated into a single organization in Italy (ENEL: electricity only), in the United Kingdom (Central Electricity Generating Board and Gas Council) and in France (Electricité et Gaz de France).
In the other countries, where the distribution of these services is split up into many different organisms of public or private nature, we see a tendency either to concentrate all into a single organism (Belgium) or at least integrate the EDP service at a single centre of the local organization.

The incidence of occupation in public utility services (1), is approximately the same as total occupation in all the countries considered.
In terms of added value its incidence is higher in the UK and Holland, as demonstrated in following table:

Public Utility Services. Percentage Incidence of Occupation and added value in the EEC countries and the UK (1967)

Countries	Occupation	Added value
Germany	6.6	7.8
France	6.9	6.7
Italy	5.7	8.5
Holland	8.7	10.1
Belgium	7.6	8.6
EEC	6.4	–
United Kingdom	8.0	10.1

(1) Statistical branches: electricity, gas, water, transport and communications.

The average annual increases in these two variables show that activities in the field of public services generally are tending to expand.

In the following table growth rates in the electricity, gas, water, transport and telecommunications industries have been indicated separately, because their trends are different, one reason being the presence of politically or socially influenced terms.

AVERAGE ANNUAL RATES OF INCREASE 1958-1967

COUNTRIES	OCCUPATION			ADDED VALUE			PRODUCTIVITY PER WORKER		
	Electricity gas and water	Transport and communic.	Whole Economy	Electricity gas and water	Transport and communic.	Whole Economy	Electricity gas and water	Transport and communic.	Whole Economy
GERMANY	1.4	0.2	0.2	6.7	3.9	5.5	5.2	3.7	5.3
FRANCE	2.0	1.4	0.5	9.1	4.8	5.2	6.9	3.3	4.7
ITALY	2.1	3.7	-0.8	9.0	6.1	5.3	6.8	2.4	5.6
HOLLAND	1.7	0.5	1.3	11.5	5.0	5.1	9.7	4.4	3.8
BELGIUM	0.4	0.7	0.7	7.2	3.8	4.5	6.7	3.1	3.7
EEC	1.7	1.4	0.3	8.2	4.7	5.3	7.0	3.3	4.6
UK	1.3	-0.6	0.6	5.1	3.4	3.1	3.8	4.0	2.5

2.2. EDP characteristics

The sector is not particularly homogeneous and can be divided into at least two groups according to the nature of the customers to which services are supplied.
Specifically, in the first group we can gather together all activities involving air, rail, sea and urban transportation; these services are characterised by customers booking a transportation service (passengers or goods) from one point to another on the network served. The booking may be handled at a third point on the network and the service may be invoiced at still another point.
It is not difficult to see the definite need for an "atomic" type operating system which may, of course, overlap with an "atomic" or "solar" management system.
The second group of activities subject to this analysis covers radio-television, telephones, water, power and gas networks. In the case of all these activities the customer finds himself either at the end of a network of fixed plants as in the case of telephones, water, power and gas, or at the end of a broadcasting network as in the case of radio and television.
The presence of a fixed network in this second group of services makes the problem of handling service requests, less important.
A distance measurement (possibly centralized) of the services rendered appears to be important for invoicing purposes and for further planning.

This short-term planning necessity (peak loads etc.) becomes a long-term plan when forecasting new installations covering future needs.

Planning has differing importance depending on the activity:

- Radio-television: the plant is costly and installation times are long; however the fact that they are broadcasting devices makes the network fairly flexible;
- Electricity, gas, water: the connections are individual, but the materials involved cost less than those of the radio-television system; furthermore, the network is already fairly extensive and stabilized even though it is still expanding.
- Telecommunications: connections are individual, the network is in expansion, materials are costly and installation times are long; moreover, services diversify with some rapidity and at considerable expense.

A problem common to the second group is that of servicing the network; thus there is a particular need for rapidly restoring interrupted service.

This problem, of course, also applies to the first group both as regards the fixed plant (stations, etc.) and the means of transportation.

A special problem involved in radio-television activities is that of the starting point of broadcast programmes and their preparation: i.e. the content of the programmes which are put out on the network. Planning here thus involves control of equipment and organizing the technical and creative staff; maintaining data files which may be concentrated in central data banks open to long distance enquiries.

3. Data Processing equipment

Very little is known about the expansion and division into classes of the computers installations in the public utilities in the Common Market countries. In 1962 the number of computers in this sector represented 6% of the total installations for all the Common Market countries (1).

More recent information is available only for some European countries. In France, for example, computers installed in this sector in 1968 represented 5.8% of the total number of installations. Figures are also available for Germany in 1967 and for the United Kingdom for the period from 1962 to 1968 (table IX.a). Only the information available for Germany and the United Kingdom gives any indication of the structure of the installations by classes of computers, thus making it possible to identity the users of large machines. The percentage distributions by number and value of installations of computers classified by size are very different in Germany and the United Kingdom.

(1) De Bruijn: Development of the Computer Market in Europe, Netherlands, 1963.

The different structure of the computer equipment in the two countries, partly attributable to the dimensions (mainly regional or municipal) of the organizations which distribute such services in Germany, comes out clearly from the different percentage distribution of the value of the sector's computer equipment in the two countries:

UNITED KINGDOM AND GERMANY - PERCENTAGE DISTRIBUTION OF THE COMPUTER EQUIPMENT'S VALUE, PER SIZE CLASS (1967)

	UNITED KINGDOM			GERMANY		
	Electricity, gas and water	Transport	Total	Electricity, gas and water	Transport	Total
DESK	1.7	1.5	1.7	1.6	1.1	1.3
SMALL	45.5	34.2	41.6	81.2	70.2	75.8
MEDIUM	15.9	16.5	16.1	13.1	15.1	14.1
LARGE	29.4	10.7	22.9	4.1	3.8	3.9
EXTRA-LARGE	7.5	37.2	17.7	-	9.8	4.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

The only information available about computer systems in the US public utilities refers to the end of 1965 (1) and the end of 1968 (2).

(1) Computer Installation Data File of International Data Corporation.

(2) Computer and Automation, September 1969.

Computers installed at the end of 1965 represented 8.2% of the total value of United States installations in 1965 and 6.2% of the total number in 1968.

In these same years the corresponding British percentages were: 8.2% and 7.0%.

It would therefore seem justifiable to state that the equipment and use of computers in the public utilities in the United Kingdom and in the US are much the same.

An example is the case of the American railway companies, which, at the end of 1966, did not yet have an extra large computer available, and no seat-booking type application was functioning.

4. The most widespread applications of EDP systems

4.1. Mass applications

The following services have been examined:

- Transportation
- Radio and Television
- Telecommunications
- Power, gas, water.

Some applications have very general features, while others have specific ones related to the various sectors' requirements.

General accounting and wages, both being carried out at present by all interviewees, are an example of applications with general features. Also supplier invoicing seems to fall into this category: both the flow of orders arising from servicing requirements and purchases made in order to accomplish investment plans do not call for the use of different criteria for the various subsectors.

Cost control concerns almost always operational costs which cannot be standardized so easily as those of the manufacturing enterprises. In the radio-television industry the application is extended to program production cost control. With the exception of this difference, there seem to be no particular processing problems within the sector.

However, concerning invoicing, there exist surveying and processing constraints, for example, for power, gas, water and telephones.

The amount to bill is recorded by a meter of varying type on the premises of the user or in a central position, but at any rate remote from the invoicing center. Reading the data from the meters requires an extensive staff.

The computer has to cope then with a heavy work load, because of the detail of information coming in and going out and because of the need to concentrate billing at fixed times with consequent peak loads for the computer centre. Seasonal invoicing peaks occur also in the radio-television industry of those countries, where users pay fees for this service.

Similar overloading of the computer does not take place in the transportation services , because invoicing takes place generally against payment e.g. in agencies, railroad stations, air or marine terminals. The load on the computer could increase in proportion to the sophistication of statistical outputs and to details required by the accounting system.

Stock control is another universal application. It is, however, greatly influenced by the subsector's problems and the scattered structure of the service distribution area. Such an area is usually covered with a network of warehouses which guarantee rapid restoral of service in case of interruption.

Regarding processing, the work load depends on both the number of items to be controlled and the number of transactions to be processed, with obvious peaks at seasonal high points.

However, the most important factor influencing processing capacity in the case of stock control is the desired degree of sophistication of the results. The work load is small when limiting it to accounting of transactions and calculation of balances; on the other extreme, it might be required to issue automatically buying orders to suppliers and to arrange for restocking of peripheral warehouses by drawing stock from the central warehouse.

The results obtained from direct survey lead to believe that the solutions for stock control adopted by the interviewees are rather sophisticated.

It has to be noted that there exist numerous mass applications in this field whose final goal is to create an organic information network, which will then be used as input for the operational information system: in fact, data from the accounting report for a certain period permit individuation of optimal criteria for control of future operations.

This is particularly the case in the transportation services (a typical application is management of long-distance railroad rolling stock); in the telecommunications industry (measuring the traffic flow in the network) and, in somewhat different form, in the power supply industry (analysis of consumption per distribution channel).

By the same token, also R & D can be considered a mass application, because it is instrumental in the use of other applications.

4.2. Applications of the operational information system

The first application examined in this field is automatic seat reservation: this is a typical application in the transportation industry (excluding urban transport). The need to have it varies according to the types of transportation. For airlines, where the problem is known, the goal is to maximize (within the limits of customer demand) the load factor. A large number of terminals and booking centres have RT access to a central file.

The service area is in fact so extensive that it included, right from the beginning, requests at an international level.

In the case of railways, on the other hand, the need for automatic reservation of seats on a national level is a later application and will probably be developed only for a certain number of lines and trains of particular importance (Wagons-Lits, TEE, etc.).

Automatic reservation systems require OLRT performance. S 1 (airlines) is already using it with 400 terminals which are going to be extended further.

Also handling of goods (loading time, use of containers etc.) has to be performed in OLRT, thus becoming similar to seat reservation under the larger aspect of rolling stock management. Interviewee S6 has already 400 terminals installed, whereas interviewee S1 is in the expanding stage and S3 plans to install 330 terminals.

In the telecommunications and power supply sectors, service production planning is the prevalent application.

The basic problem of telephone communications consists of measuring the flow of traffic and choosing the best itinerary of messages between two users (or the respective centres) through available connection channels; special routing equipment takes care of the automatic search.

In the case of gas, water, power the computer's task consists primarily of finding the nearest source which can supply the required power to the user; then the interconnections which perform the desired link-up have to be activated in real time.

S15 will realize long-distance electric meter reading and entering of figures on users' files; he is also studying OLRT control and optimization of the network load.

S14 (gas and electricity) is completing the installation of 150 terminals for the acquisition and modification of contracts.

There are other miscellaneous RT controls which are of interest to the various subsectors: in particular, the airline S1 will introduce computerized inspection of the behaviour of aircraft parts in flight. This technical application is obviously related to maintenance problems and hence to management of workshops in the various airports. Generally, there is the trend toward interconnecting the service points through "atomic systems". Some interviewees however, (S^6, S^8, S^{15}, S^{14}) have a "solar system " and teleprocessing will be used also to interconnect their processing centers in a single network. Among the applications performed in headquarters and useful for planning long and short term supply service, special mention must be made of the simulation process (see interviewee S15, who refers to electrical energy distribution).

4.3. Projects on the basis of the interviews

An application mentioned by all interviewees independent of their sector is the common information base, accessible in TP and, in certain cases, in RT. Substantially, it is a data bank of technical, service management and miscellaneous information, which the interviewees hold to be necessary (S^6, S^8, S^9, S^{11}, S^{12}, S^{13}). Another application mentioned by all the interviewees in the long distance transportation field (1 airline and 5 railooads) is that of automatic seat reservation. It has to be noted that this application is mentioned at the same time either as partially operating, or as in an advanced study phase, or as a future project. This is due to the fact that development of both seat reservation service and extension of goods traffic is foreseen.

For the latter, reservation of space for the goods would be integrated into real time management of the rolling stock, as has been specifically pointed out for the rail roads (S6).

An explosion of EDP investment in automatic reservation should take place during the next or four years. It is interesting to remember that seat reservation is only one of many existing problems.

Still in the transportation industry interviewees who work over short distances (urban, S4 or inter-urban S5) mention applications of both traffic analysis and improvement of vehicle exploitation.

One interesting control of the optimal location of TV repeaters and more generally of the optimal utilization of the broadcasting network (S10).

This application could be either confined to optimizing through operational research the transmitters' location or extended also to the operational control of new installations (see telecommunications).

In the power industry a future application is the optimization of production/distribution as well as simulation and forecasting of the economic system (S15) .

Information retrieval applications which are being studied by two (S10, S11) of the three interviewees of the radio-television subsector require shorter times, because few points (production centers) have to be connected which have to use the data. Research times are however longer, because the applications require rather sophisticated conversational man-machine software.

Teleprocessing should be another cause for an increase in EDP investments, because it is suitable for many different applications.

Service simulation and graphic representation of the service areas should interest all subsectors with the exception of radio-television.

Few interviewees, however, are paying any interest to these applications at the moment, because the studying times are particularly long, while those of realization should be rather short.

TABLE IX.1. APPLICATIONS IMPLEMENTED, BEING EXPERIMENTED, BEING STUDIED BY COMPANIES INTERVIEWED

TYPE OF PROCESSING	APPLICATIONS IN OPERATION, AT EXPERIMENTAL STAGE, UNDER STUDY, ETC.	COMPLETE	TO BE COMPLETED	IN DIFFUSION	EXPERIMENTAL	UNDER STUDY	NOTES
MASS BATCH OPERATIONS	Billing to customers and subscriptions	S1, S2, S3, S4, S7, S8, S10, S11, S13, S14, S15					Transport, TV, Electricity
	Billing suppliers,	S2, S3, S4, S7, S8, S11, S 15					Transport, TV, Electricity
	Wages	S1, S2, S3, S4, S5, S7, S8, S9, S10, S11, S12, S13, S14, S15					Transport, TV, Electricity
	General accounting	All, except for S6, S12					Transport, TV, Electricity
	Costs	S1, S3, S4, S7, S8, S11				S13	Transport, TV
	Stocks	S1, S2, S3, S4, S5, S8, S10, S11, S12, S14	S3			S9, S13	All
	Stocks and vehicles	S5				S3	Transport
	Production and service programming	S1, S2, S3, S8, S10, S15				S11	All
	RO and scientific calculation	S2, S3, S4, S5, S8, S10, S15				S12	All
	Financial controls	S3					Transport
OPERATING INFORMATION SYSTEM	Automatic reservations	S6	S1	S1	S3	S2, S3, S6, S8, S9	Transport
	RT controls	S S6 (vehicle movements)	S14 (licence holders) S12 (Stocks)			S1 (technical) S15. S2 (traffic)	Transport, electricity
	RT assistance					S1, S8, S9	Transport
	Service simulation (traffic, distribution, energy, etc.)					S2 (goods). S15, S3 (traffic) S8 (traffic)	Transport, electricity
	Telebilling					S15 (meter reading), S1	Electricity
	TP				S10, S13, S14	S5, S6, S7, S8, S15	
	Data banks information retrieval				S10	S11, S6	Transport, TV
	Graphical representation of service area, etc.					S8	Transport
MANAGEMENT INFORMATION SYSTEM	M.I.S.					S8	
	Company planning					S1, S8	

5. Future applications

5.1. Hypotheses of development

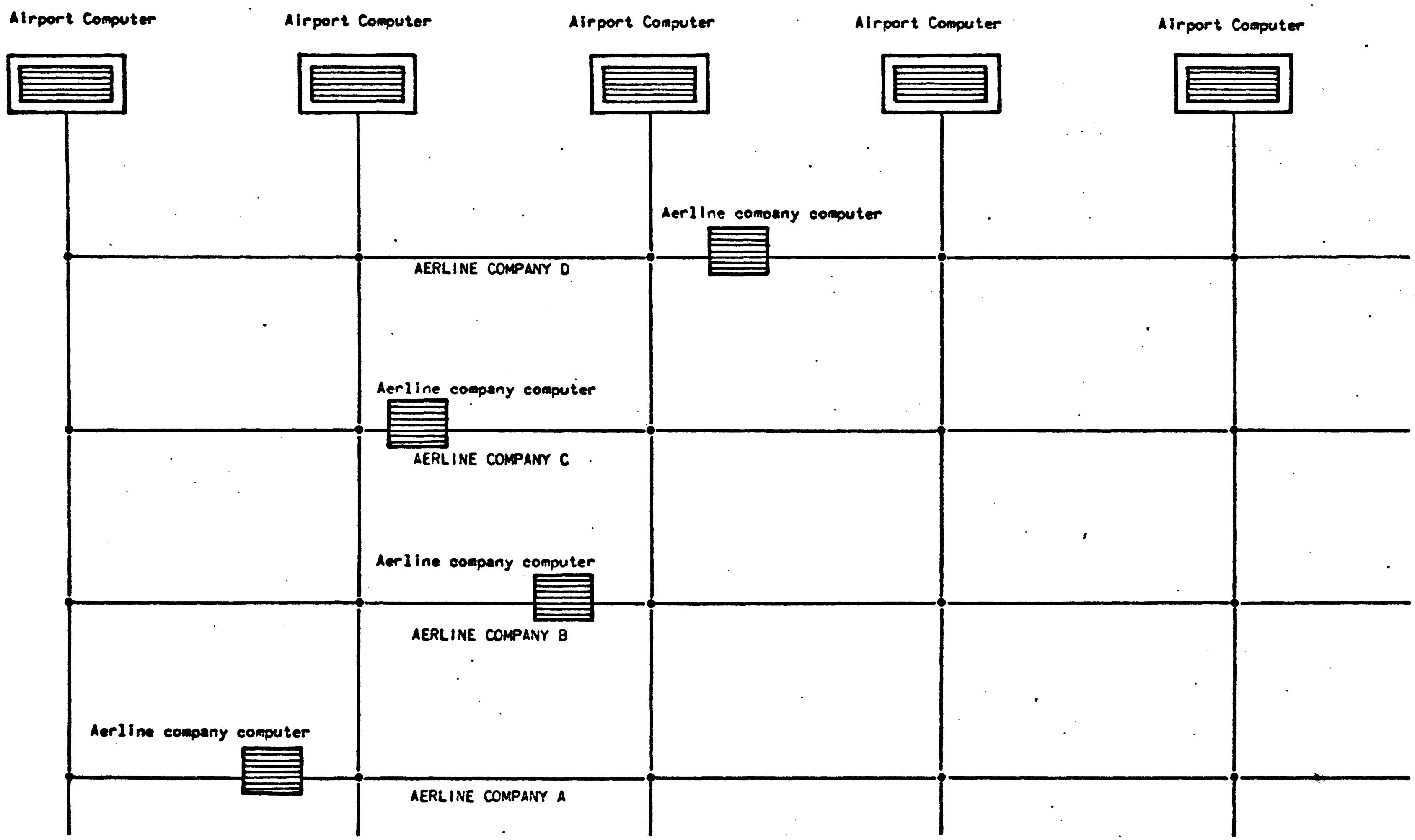
In the Public Utilities sector the applications tend to:

- improve the quality of the service;
- diversify the service itself.

The table IX-3 shows for the different utilities the developments expected over the next 10 years and its repercussions in EDP about current and new applications.
It appears that the quality of service rendered should mainly be influenced by the operational systems. On the other hand, service diversification should require interventions, through the management system, with regard to the choices of investment for the networks of plants.
Finally, the increase in the quantity of service delivered should concern the capacity of the operational management system.
In the transportation industry developments may be foreseen in all fields through the extension and completion of reservation and assistance services already being planned (as results from the interviews), through the increase in absolute values of travel and number of passengers, through the overflowing of the service into adjacent fields such as hotels, tourism, etc.

It can be expected therefore that the seat reservation operational system of each company will be linked up more and more with the others: this is already taking place in airlines which have joint systems for the exchange of seat reservations and which could be induced to install a system for each large airport, thus operating as a seat distributor (Fig. IX.1.).
Still in this regard, the European countries are looking into the possibility of inter-connection of railway seat reservation networks. It might be added here that another great advance will be the connection into a single mixed system of transport of all types and collateral activities, i.e. hotels and tourism. Something is already moving in this direction, although computers have not been called upon yet. The airlines, for example, have already begun investing in hotels. Moving on to telecommunications we can expect a considerable increase in the quantity of service and also important diversifications (such as data transmission). These variations will have an influence on the traffic control and routing operational system and on the control of the setting-up of new plants which will have to be made more flexible by shortening installation times.
The manifold demands to extend plants at many points of the network and to add to the network plants for the supply of the new services requested, create considerable complications in the process of decision-making and choice of investments.
The operational system for the control of new plant

FIG. IX. 1 SCHEME OF SEAT RESERVATION SYSTEM FOR AIRLINES



construction within a management system aiming at making such choices easier by means of simulation will become more sophisticated.

Power, gas and water all have similar development patterns and their principle aim is to increase the quantity of service. There should be no variation in quality and diversification, at least not so as to have any influence on EDP systems.
The increase in the quantity of service should make it necessary to sophisticate the production-distribution control operating system by the use of computers and simulation methods. The problem of the setting-up of new plants and of choices of investments could perhaps be tackled in the same way as it will be tackled in the field of telecommunications.

Finally, in radio television it is expected that the main development will be in the size of the services. This means that the increase in programmes broadcast will also involve an increase in the number of broadcasting networks. It can be assumed that information systems could be installed for the control of investments (operational systems for plant construction; management systems for choice of investment), similar in this case to those employed in telecommunications; studies are already being carried on in this respect.
Another important problem for the radio-television industry is the extension of information retrieval on a wider scale until it is integrated at an international le-

vel. It is difficult to foresee if and when this development will be possible.

To conclude, the transport and telecommunications industries seem to be the leaders in the sector as a whole . It might be added that, among the developments indicated, the operational applications could be ready within the next ten years, whereas management applications are further away.

In any case the industries seems to be aware of the problems and are looking into them.

5.2. Comparison with the United States

The most important factor in any comparison between the U.S. and Europe an public utility services lies in the number and size of companies which supply the service.

The industry includes many small local activities alongside a certain number of giant companies. Within the U.S. these small local companies create an enormous problem of competition as a result of which great importance is given to customer relationships. Telecommunications, power, water and gas, all have OLRT applications to handle customer requests and they give to such requests rapid and exhaustive replies (e.g. on bills paid, contracts, etc.). The importance of the quality of service which is offered to the customers applies also to airlines among which there exists intercontinental competition which affects the corresponding European companies as well.

All companies at the same time are planning a high level of service integration (booking, ticket issuing, hotel reservations, etc.).

This situation does not apply to the other services (railways, telecommunications, etc.); none of these in Europe is thinking of costly operational systems studied especially for customer service.

In the U.S the EDP - supported solution for investment would appear less pressing, possibly because their service is already fairly well stabilized as regards quantity and quality and the diversification development is less tumultuous.

The inter-connection of different systems' computers is thus at the executive stage: e.g. 1/3 of each company's traffic is booked by a competitive company.

Another important guide-line for applications is the programmed maintenance and the connected stock control, both handled in OLRT.

In the railroad field attention is given to goods traffic. Billing is centralized and a great deal of statistical analysis is based on information contained on cards which follow the trucks and are then transmitted off-line to the central computer.

In other words, these are applications which follow the routes of individual trucks and the automation of which makes it possible to reduce the truck's operational cycle (applications which are also being studied in Europe). Advanced systems of this type are the COMBAT system which uses O.R. for optimizing the full exploitment of trucks.
In the telecommunications field there is an interesting system which looks after "tele-billing" for coin-operated telephone calls. This system controls a certain number of circuits and gives "audio" signals for payment of the communication.
Great importance is attached to the customer information service, for example regarding invoices paid and the service in general. MIS is mentioned only generally, and it is thought that it will be developed about 1975.
Finally, in the power, gas, water field there are operating many small size companies. The most important applications are production and distribution control (carried out by means of process computers) and the technical information system which analyses historically plant components under various load conditions.
In this case, too, great importance is attached to the system of answering users' enquiries. The offices involved speak with the customer over a telephone and are equipped with a terminal by means of which they can ask the computer for pertinent replies.

6. Expectations about hardware and software

Since the problems in the various utilities are so different, it is only natural that the opinions expressed regarding extra-large computers are affected by such differences. Most interviewees involved in long distance transport said that they were in favour of large central core storages. Some mentioned the size they wanted ($>$ 512 K), others gave only general indications. It might be pointed out here that most interviewees already have large storage capacity available and this makes forecasts more reliable.
Not all agreed on the need for high processing capacity. For example, interviewee S8 specified that capacity could be confined to that of the IBM 360/65.

As regards mass memory, some spoke generally about the need for these to be large (S1, S2), other mentioned 200 - 300 M characters (S5, short distance transport and S9); others finally mentioned 3,000 (S7, S8).

The main requests made by interviewees can be seen from table IX-2.

7. The Big Companies

The choice of the most important companies in the industry was based on the following criteria:

a. Turnover above 100 million dollars for transportation enterprises:

b. The most important electricity and gas distribution companies;

c. The most important national television networks.

Water distribution is carried out in all countries by small and little-automated concerns.

The table shows for each country and company the value of computers installed, expressed in purchase prices and distributed by size classes of computers, with reference, where possible, to the value of EDP expenditure per 1,000 dollars of turnover.

The information collected can be summarized as follows:

COUNTRIES	NUMBER OF LARGE COMPANIES	EDP VALUE (thousand dollars)	EXTRA-LARGE COMPUTERS INSTALLED
UNITED KINGDOM	7	75,141	3 IBM 360/65, IBM 360/75 UNIVAC 1108
BELGIUM	5	8,323	-
HOLLAND	4	10,944	2 IBM 360/65
ITALY	5	27,718	3 IBM 360/65
FRANCE	6	42,236	4 IBM 360/65 6 UNIVAC 1108
GERMANY	13	26,146	IBM 360/65

As regards transport companies, it may be noted that the value of EDP expenditure per 1,000 dollars of turnover is fairly constant per specific category of transport vehicle.

In the air companies the ratio is between limits of 20 and 30 with the exception of Alitalia (39) and Lufthansa (8); the ratio in railway companies is 0.7 with the exception of the Italian railways.
Moreover, all airlines already use extra-large computers, while among railway transport companies only the French system is using extra-large computers.
In sea transport, automation is as yet little used in all countries considered. With regard to electricity and gas services, all the companies examined use a large computer; in the United Kingdom and in France they also use extra-large computers.
In the field of radio and television services, with the exception of the Italian company, all the other companies considered are using small and medium size computers.

relation to forecast applications (development of seat reservation, control of vehicle movement) and in relation to what each individual company has already done.

. Assessing the possibility for the diffusion of new applications indirect account has also been taken of developments in airlines who supply similar services:

- Shipping companies. We have simply followed current trends, bearing in mind the lack of management innovation in this field.

It is interesting to know that the degree of progress in new applications is also very high in some transport companies, especially in the case of urban and suburban railway networks, even though the small volume of data involved should not lead to any great increase in the size of computers employed.
With regard to the power, gas and water services current trends have been followed with the exception of a correction in the case of indipendent electricity companies in Belgium for which some concentration is foreseen.
This is confirmed by the interviews available and has been placed around the end of the next decade.
The radio and television services do not permit the direct application of the forecasting mechanism since data regarding company turnover are not significant, due to:

- licence fees, which are generally established on the basis of extra-company considerations;

- advertising revenues are not comparable among the different companies as a result of outside constraints on advertsing broadcasts.

In view of the developments expected in major fields, i.e. in applications and number of programmes broadcast the largest radio-television companies were picked out as potential users of extra-large EDP systems.
The telecommunications industry is currently studying a large number of developments in applications, connected with the problem of traffic control, and with the choice of operational investments as a result of the extension in networks.

Consequently, although little information is available, it has been possible to advance some hypotheses regarding the size of computers, hypotheses which are made easier by the concentration of resources already under way in these industries. Results in summary are :

INDUSTRY GROUP	TOTAL USERS			POTENTIAL USERS OF EXTRA LARGE EDP SYSTEMS			
	NUMBER	1975	1980	1975		1980	
		Expenditure capacity (000 $)	Expenditure capacity (000 $)	Number	Expenditure capacity (000 $)	Number	Expenditure capacity (000 $)
TRANSPORT	20	155	240	6	94	11	220
POWER AND GAS	13	134	194	6	121	7	180
RADIO-TV	6	25	40	-	-	4	32
TELECOMMUNIC.	6	100	180	6	100	6	180

These results confirm the theory that this industry is one of the most active with reference to extra-large EDP systems, since it has to deal with repeated operations consisting of simple modular units connected to vast volumes of data.

FIG. IX.2. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES (TRANSPORT)

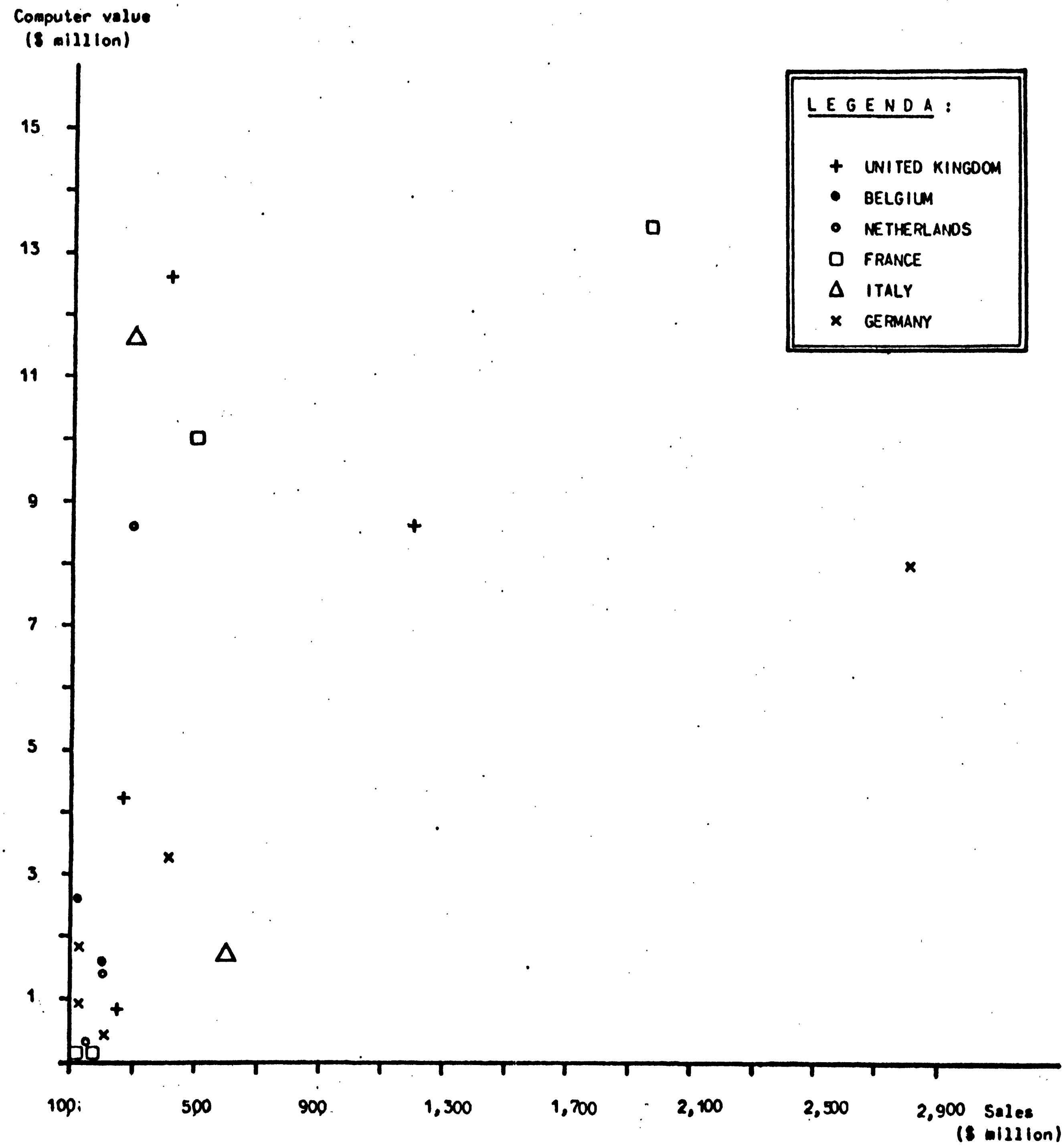


FIG. IX.3. VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES (ELECTRICITY AND GAS)

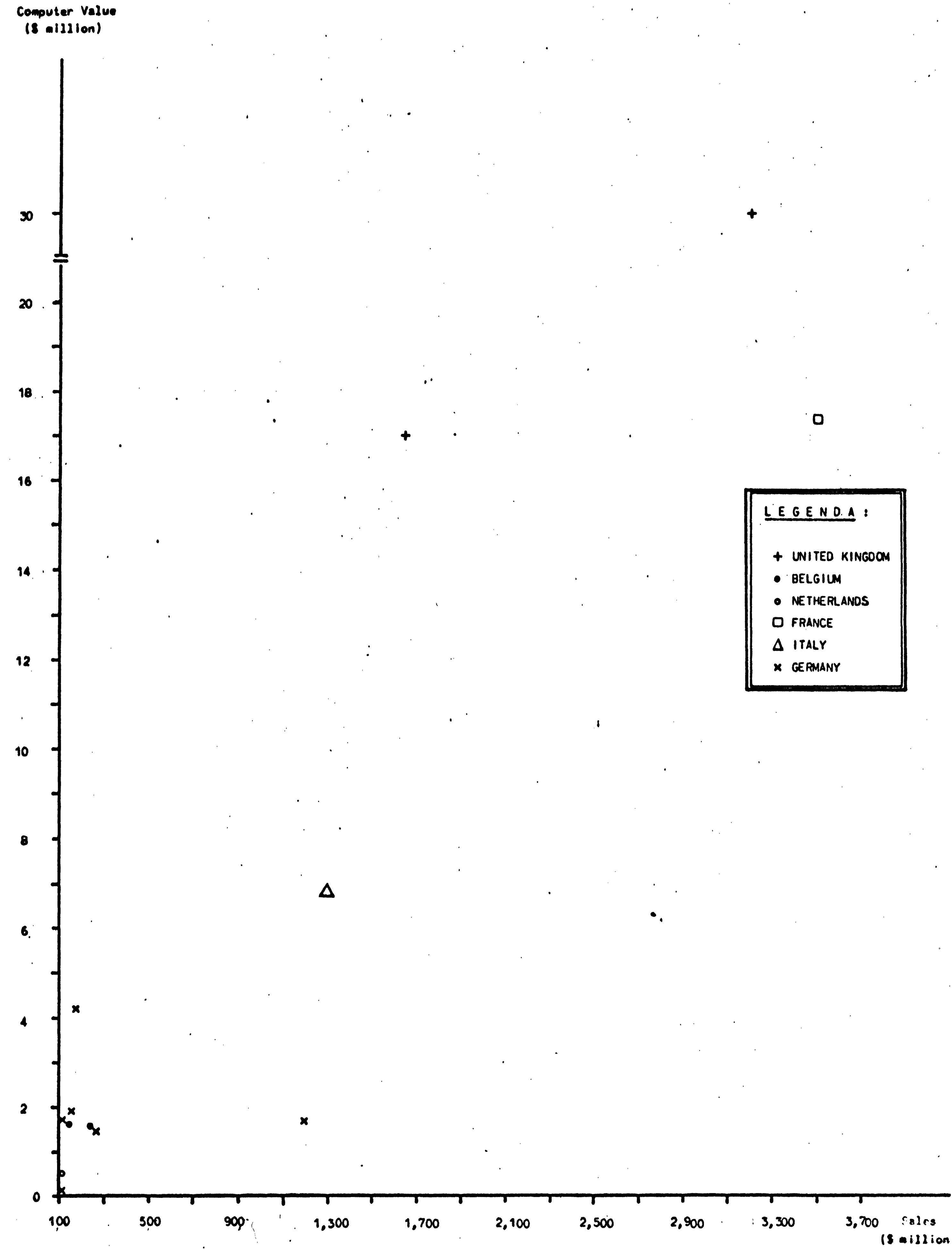


TABLE IX.2.

EXPECTATIONS ON HARDWARE AND SOFTWARE

INTERVIEWEE	SOFTWARE COMMENTS	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
S1	Elastic, links between centre and periphery	Large operating capacity	More accurate optical readers	More specialized Greater elasticity of choice and substitution of terminals	Atomic system
S2	More efficient symbolic languages		Large mass core storages		
S3	Hopes for international standards for computers and terminals			Transmission speed must be increased because too much slower than calculating speed of central unit	
S4		Not interested in large computing capacity			Atomic system
S5	Current specialized software is practically unusable	512 K (currently 64 K)	Mass core storages of 300 M bytes, average access 10 ms	Teleprocessing with optical scanning type terminals	Atomic system
S6	Software with greater real time reliability		Mass core storages of 600 M bytes	Terminals with ability to control input data	Atomic and solar systems alongside, with computer of limited size
S7		512 K	Mass core storages with capacity greater than 3,000 million characters		
S8	Interested in image storage	Dimensions of 360/65 type	Mass core storages of the order of 3,000 million characters at low cost		Atomic and solar system

follows TABLE IX.2.

EXPECTATIONS ON HARDWARE AND SOFTWARE

INTERVIEWEE	SOFTWARE COMMENTS	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
S9	Possibility of direct access to large capacity core		Mass core storages of 200 M characters	Optical readers	Low cost video terminals
S10			The bottle-neck in current system are the I/O units		Atomic system
S11		512 K	Mass core storages of more than 300 M bytes transfer speed$>$300 Kc/s with direct access from terminals		Atomic systems xith few terminals
S12				Greater speed in long-distance transmission	
S13		At least 1024 K, Excessive price of central units	Mass core storages of at least 300 Mc Currently auxilary memories have insufficient capacity and access speed	Updating of files direct from terminals	Atomic system
S14		Large central units	Lower priced mass core storages and much greater capacities	Terminals too costly	Solar system seven centres
S15	Languages are not satisfactory particulary for data banks	Increase in processing speed of 15% with respect to present systems	Improve mass core storages access, input times too long	Problem of cost and performance of telecommunications	Atomic plus solar system for commercial peripheral activities

TABLE IX.3.

INTERVIEWEES' FORECASTS ON APPLICATIONS AND HARDWARE

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			FORECAST HARDWARE EQUIPMENT		HARDWARE ASSESSMENT ON BASIS OF APPLICATION DEVELOPMENTS		OPINION OF INTERVIEWEE ON POSSIBLE G.E.
	ADMINISTRATIVE PROCESSES 1	OPERATING PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1971/72	BY 1975	1975	1980	
S1	Flight planning	Extension of customer services under study	Company planning and management control	3.000.000		1 + 2 600.000	3	Yes, by 1975
S2	Costs, programming	Seat reservations under study		8.000.000		2 1.000.000		Yes, by 1975
S3	Expansion of all applications	Expansion in reservations, management of wagons under study		8.000.000		2 + 1 1.000.000		Yes
S4		Management of vehicles		1.000.000		2		Possible
S5	Customer billing, Supplier billing Costs	Teleprocessing with few terminals under study		480.000		1 + 2		Improbable 1975 Possible 1980
S6		Seat reservations (under study) R.T. traffic in diffusion		5.000.000		1.000.000		Yes, by 1975
S7	Wages, pensions, stocks (to be completed)			200.000				Improbable 1975 Possible 1980
S8		Seat reservations, vehicle management (under study)	M.I.S.	4.600.000 500.000		2 1.000.000	3	Yes, by 1975
S9	Customer billing Supplier billing Costs Stocks	Seat reservations in diffusion	M.I.S.	700.000 500.000		1 + 2 + 3 1.000.000	3	Yes, possible by 1975
S10	Supplier billing Costs Various applications being completed	TP licences, network investments (under study), documentation centre in TP	M.I.S.	2.800.000		1 + 2	3	Yes, possible

follows TABLE IX.3.

INTERVIEWEES' FORECASTS ON APPLICATIONS AND HARDWARE

COMPANY INTERVIEWED	POSSIBLE DEVELOPMENTS OF:			FORECAST HARDWARE EQUIPMENT		HARDWARE ASSESSMENT ON BASIS OF APPLICATION DEVELOPMENTS		OPINION OF INTERVIEWEE ON POSSIBLE G.E.
	ADMINISTRATIVE PROCESSES 1	OPERATING PROCESSES 2	MANAGEMENT PROCESSES 3	BY 1971/72	BY 1975	1975	1980	
S11	Production planning	Information retrieval in TL		120.000				Improbable
S12	Supplier billing General accounting Costs Licences Production planning	RT stock control (under study), data banks	M.I.S. under study	215.000	+130.000	1 + 2	3	Bound by political a development program decisions
S13	Supplier billing Costs Stock control	Data banks Teleprocessing for stock control	M.I.S.	400.000	+228.000	1 + 2	3	Improbable by 1975 perhaps by 1980
S14	Costs Supplier billing Service distribution programme	Licences in TP experimental Data transmission between main centres under study		5.000.000		1 + 2	2	Yes, if processin points are at lea partly centralize
S15	Costs Stocks	O.L. control of energy production and distribution Data banks Remote meter reading Control of investments	M.I.S.	8.000.000	+4.000.000	1 + 2	2 + 3	Yes, in 1975 and 19

1. Introduction

Universities, Research Centres and Service Bureaus have been placed in one sector because of their links.
Teaching and research are considered complementary activities in all Common Market countries. They are also of equal importance, because universities and research centres together carry out most R & D activity. Moreover, some universities are already operating as centres of scientific calculation.
The interest of universities, Research Centres and Service Bureaus in computers (particularly in large computers) is twofold: as users of systems commercially available on the market and as creators of new systems. The contribution of the sector to new systems is concentrated mainly on software, and, to a smaller extent, the sector is also involved in hardware. Hardware will not however be considered in the present chapter.
In addition to the numerous possible applications in the teaching and information retrieval field, much attention is paid to problems connected with research activity (particularly in the nuclear, military and aerospace fields) and to problems of the service bureaus.
In solving such problems, large computers are an indispensable instrument, since, without their immense capacity for calculation, such problems could not be handled in a reasonable time.

CHAPTER X

UNIVERSITIES AND SERVICE BUREAUS

On the other hand, Universities and Service Bureaus are also obliged to meet the requirements to accede to the computer from a great number of users: the result is a trend towards multiple access systems, with advantages of availability for the user and a consequent increase in the dimensions of the system.

2. Structure

2.1. Institutional and Economic characteristics

A. Universities and Research Centres

With the exception of Germany, university teaching and more generally higher education within the Common Market countries depend on the central authorities who exert their control through the Ministry of Education. Sometimes (e.g. in France) the Ministry is supported in this task by special deliberative commissions that may be consulted on the problems of universities, both public and private. Depending on the country concerned, the Universities enjoy their own legal personality and have more or less marked independence with regard to administration, teaching and discipline. The Ministry of Education has instead specific powers as to staff and finance.

In Germany the legislative, administrative and financial power in the Universities is held by the Länder through the authority of their own Ministry of Education.

The German universities have independent legal personalities based on the rectorate statute (Rektoratsverfassung) which confers independence in matters of administration, teaching and discipline, and also gives universities the right to choose their own teaching staff.

In the United Kingdom the universities are autonomous and independent organisms, subject neither to the jurisdiction nor the control of the Government.

In other words the Ministry of Education has no power over the universities, and there is no single organism whose

task is to direct and co-ordinate higher education.
The University Grants Committee informs the Government of university requirements, and examines the possibilities of increasing credit made available by Parliament and distributes it among the universities.
In the field of Research and Development Activity, research policy and finance come under the Ministry of Scientific Research flanked in France, Italy and partly in Germany by consultative committees. In Germany research activity, too, comes under the Länder.
In Holland there is no Ministry of Scientific Research, solely a council of Scientific Policy, and most departments are responsible for their own research.
As there is no Science Ministry in Belgium, research activity is the responsibility of the Prime Minister and, on his behalf, of the CIPS co-ordination board and of the CNPS consultation board.
Finally in the United Kingdom, the Department of Education and Science holds the central responsibility for civil science and formulates and puts into practise the Government's scientific policy.
The Ministry of Technology, on the other hand, is responsible for research in the field of advanced technologies and for their application in industry.
Research activity is carried on by the universities (which concentrate mainly on basic research), by public laboratories and centres and finally by private companies. Most public laboratories or centres are government-organized or are directly dependent on the government or under its control, when they are managed autonomously.

The budget of Public Research Centres and universities comes largely from credits of the Ministry of Scientific Research (where there is one), from the Ministry of Education and, for research activities, from other Ministries too.

In Germany such centres are financed by the Länder; loans are also made by the Federal Government.

Other sources of income include donations, university fees, and research contracts for the Universities and Research Centres.

The free universities (i.e. non-government) are sometimes financed by the State (Holland and Belgium), in other cases they use their own capital which consists of non-public funds as in Italy and in part in Belgium.

Students in the Universities of the Common Market countries in 1958, and in 1966 were as follows, by country:

EEC Countries - University Students (1958 and 1966)

Countries	1958	1966	Average Annual rate of growth
Germany	160,668	254,621	+5.9
France	186,101	459,331	+11.9
Italy (1)	205,965	365,998	+10.0
Belgium	28,275	48,800	+8.1
Holland	22,645	26,581	+2.0

Source: Office Statistiques des Communautés Européennes, Etudes et enquêtes statistiques n. 3 1968.

(1) In 1962 and 1968 (source: Scienza & Tecnica, 1969)

In the United Kingdom, the total university population in 1967 was 154,455 students with a growth rate of 4.7% per annum.

The percentage of students in scientific and technical faculties was as follows:

	1961	1967
United Kingdom	40.9	43.6
France (1)	33.5	28.1
Italy	25.5	36.6
USA (2)	21.5	23.7

(1) Only scientific faculties.

(2) In 1960 and 1965.

University registrations, however, are not comparable, because the length of courses is so different in the different countries.

Funds to universities and finance of research expenditure take up a percentage of the gross national product varying between 0.2% to 0,8% for universities and from 0.6% to 2.3% for R & D activities.

Percentage of GNP to Universities and R & D

	University	R & D
United Kingdom	0.4	2.3
Germany	0.8	1.4
France	0.7	1.6
Italy	0.2	0.6
Belgium	0.3	0.9
Netherlands	0.8	1.9

SOURCES: UNESCO, "L'EDUCATION DANS LE MONDE: IV L'ENSEIGNEMENT SUPERIEUR, 1967".

OCDE: "INTERNATIONAL STATI[illegible] YEAR ON RESEARCH AND DEVELOPMENT", PARIS, 1967.

These percentages are lower than those in the United States where university financing amounts to 1,2% of the GNP and research finance to 3,4%.

In University budgets the staff expense item has a variable impact of from 40% to 60%, while funds for equipment do not normally exceed 20-30% of the total expenditures.

In the R & D field, public money spent in laboratories and public research centres is particularly important and goes from 10-30% approximately of total R & D finance.

B. Service Bureaus

Service and computer bureaus are rapidly expanding companies which offer many services in different forms. They rent computers, they sell machine time to customers, they do consultancy work with users, they effect connections with computers installed elsewhere.

At the beginning such services were offered by the computer manufacturers who today have set up their own autonomous bureaus and still have about 50% of the sector turnover.

The appearance of new computer, software and consultancy firms, namely of service bureaus in general, have changed the previous situation. On the one hand there is a tendency to give out work which used to be done internally (1); on

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(1) For example in the USA the Government has entrusted R & D work which used to be carried out by the public administration in their own centres to service companies.

the other hand, certain medium-sized and small firms are able to acquire the services of an electronic computer without having to go to the expense of renting one or buying it.

Time-sharing and long-distance data transmission have given the greatest impulse to computer access for small firms. Thanks to the computing speed of large computers it is possible to split computer time among many users. The service companies are in the best position to enable potential users to avail themselves of these facilities. The needs of such users are often too limited to justify even a small computer on a full-time basis.

It has been estimated that the minimum threshold for the full-time economic use of a small dimension computer is an annual turnover greater than one million dollars.

This figure is the critical turnover resulting from the ratio C_H (cost of hardware) and %H (% hardware on turnover) in the hypothesis of a hardware cost (in terms of yearly rent) of $ 15,600 and a percentage of 1.5. More generally, for each size class of computer, the economic size for full-time use is:

$$F_a > \frac{C_H}{\%H} \quad \text{(or critical turnover)}$$

where F_a indicates annual tunover and to C_H and %H the values of each computer class are assigned.

The development of new techniques, and thus of service bureaus also, will become more and more striking when progress in telecommunications enables anyone to make long-distance enquiries (by telephone, telex, or any other way) to a computer and receive a reply almost immediately.

In this case the point which decides the user to purchase his own computer or to avail himself of a service bureau. depends on the ratio of his own and the centre's hardware cost, the software available, the cost of telecommunications and the cost of the necessary terminal equipment. The usefulness of a service performed outside the company may be expressed by the following formula:

$$G = C_o \left[1 - \frac{1}{\eta} \left(\frac{C_o}{C_1} \right)^{n-1} - \frac{C_t}{C_o} \right] \quad (1)$$

where:

C_o = internal cost

C_1 = service bureau cost

C_t = total cost

η = effective computer performance.

In 1968 American service companies turned over about 2,000 million dollars, and it is forecast that the average annual growth rate will be 24% against an increase of only 15% in hardware expenses.

At the moment there are about 2,000 private companies in this sector in America. They have resisted the competition of the manufacturers' service bureaus by coming to various types of agreements or merging. It is interesting to note that IBM, which has a 70% share of the hardware market in US., takes only 10% in the specific sector service companies. In European countries the sector turnover is still very low and, with the exception of the United Kingdom, it is

(1) Cf. F.H. Raymond - Impacts économiques de l'informatique, in Economie Appliquée, n. 4, 1969.

not easy to find out exactly how much business they do. On the basis of an estimate made by experts, turnovers for 1968/1969 and probable growth rates by 1976 are as follows:

	Turnover (M$)	Average annual growth
Germany	80	+32.0
France	80	+32.0
Italy	24	+48.6

Forecasts made by the Hoskyns Groups Limited for the United Kingdom (1) start from a turnover of 96 million dollars for 1968/1969 and forecast an average increase of 30% by 1975 and of 22% between 1975 and 1980.
The sector would thus be turning over amounts of 336 and 1,159 million dollars respectively in 1975 and 1980. The incidence of service companies on the total value of EDP should go from 12 to 30 between 1970 and 1980- this being due in part to the reduction in the hardware/ software ratio which is expected to be 1/3 in 1975 as against 2/1 around 1960 (2).

(1) Hoskyns Group, UK Computer Industry Trends 1970 to 1980 London, October, 1969

(2) Expansion, July/August 1968.

2.2. EDP Characteristics

A. Universities and Research Centres

There is today no branch of research in which the need for the electronic processing of data has not been felt. Consequently, even in Europe, in many universities, however small, there is a computer centre equipped with at least a medium or small computer (fast core storage of 16 K words of 32 bytes).

The main activity performed by these centres is to serve University researchers. This service almost always takes on an inter-departmental character. Then again, the interest of universities in electronic data processing is based on a great number of reasons. First of all, the extremely rapid development of technology makes research in electronic processing more and more important. Most developments in the hardware and software aspects of computers have been possible thanks to the close co-operation of university staff and university laboratories. Thus in many science and engineering faculties in European Universities there exists, like in the US, at least one group of persons making specific research in the EDP field. Such groups come from mathematics, physics and engineering departments and are often mixed.

The second reason for university interest, which is closely connected with the previous reason, is teaching, due to the ever growing need for highly qualified staff: engineers and physicists for hardware, and technical and scienfic graduates as specialists in systems analysis.

Computer science and EDP have thus become official teaching subjects in courses which are attracting greater and greater numbers of students.
The third reason is that there is no research field today in which electronic processing does not open the way to substantial progress. The need for electronic computers as a research instrument was first felt by science. Physicists have been and continue to be the main users of university computer centres, followed by engineers, chemists etc. But even humanistic subjects such as pedagogy, linguistics and especially those of mixed tradition, such as economic and commercial sciences, today find it indispensable to have computer centres solve problems which otherwise could not be tackled.
Alongside these research-oriented interests, others have developed, due to the growing size of university organisations. Problems of management, above all, are identical to those in other fields of public administration and thus require the use of computers. Although the requirements of management are different and partially contradictory to those of scientific calculation, the very physical closeness of the activities means that in many cases administrative work will be carried on in the same centres, using the same systems, as are employed for scientific calculation and research in general.
Two new fields have recently been added to these traditional fields of employment (as from 1962-1964) and they will to become more and more important: computer assisted instruction and information retrieval.

B. Service Bureaus

The particular nature of computer and service Bureaus means that there are no typical EDP features in the sector. The problems that such centres solve by the use of computers are the problems of users in all other economic sectors (from the public administration to manufacturing enter - prises), which make use of an outside computer centre. Within the framework of computer and service bureaus however, the following services may be distinguished from an EDP standpoint:

- computer time (including time-sharing), i.e. the renting of computer capacity by private or manufacturers' service bureaus, functions of this type are sometimes performed by other enterprises which do not belong to the sector but which cannot employ their own computers full-time;
- software, i.e. systems programming and analysis;
- problem solving, which consists of the use of sophisticated techniques (e.g. operational research) for the solving of company problems;
- on-line service bureaus, which supply information for the updating and solving of general problems.

3. Data processing equipment

A. Universities and Research Centres.

This is one of those sectors which have been using the electronic computer for many years; for example the first computer in Holland was installed in a University in 1952.
In 1962 the computer installations in the Universities of the Common Market countries consisted of 67 centres with 109 computers. The number of large computers was still limited.(1).
The most common types were: Zuse 22, CAB 500, IBM 650, IBM 1620. However, even in 1962 there was a clear tendency towards the use of computers with greater power.
Also in the United Kingdom the number of high performance computers with universities and research centres was not particularly great in 1962 with respect to the total of computers installed (5.8%). However in terms of the value of hardware installed, the percentage of large and extra-large computers rose to 55%.
The relative weight of large and extra-large computers in this field and in the economy as a whole is as follows:

UNITED KINGDOM - PERCENTAGE BY VALUE OF LARGE AND EXTRA-LARGE COMPUTERS IN 1962 AND 1968

	UNIVERSITIES AND RESEARCH CENTRES		OVERALL ECONOMY	
	1962	1968	1962	1968
LARGE	19.0	11.4	12.3	12.5
EXTRA - LARGE	35.8	31.0	8.2	12.1
TOTAL	54.8	42.4	20.5	24.6

De Bruijn - Development of the computer market in Europe, 1963.

In other words the sector spends between 40% and 50% of its hardware investment resources in large computers and about 30% in extra-large computers.

The information available on the equipment of computers in the universities and research centres of the Common Market countries are those given in the study by De Bruijn published in 1966 concerning the number of computers installed. This information however is not exhaustive about large computers, because they are not classified by size.

As regards the size of computers there is some information (number and value) regarding the computers installed in public research centres in Germany in 1967 and those used in teaching and R & D activity in France in 1968.

Classed by number and purchase value the results are as follows:

GERMANY - EQUIPMENT IN PUBLIC RESEARCH CENTRES IN 1967 (1)

	NUMBER		VALUE	
	UNITS	%	(000 $)	%
DESK	64	28.2	3,013	3.3
SMALL	107	47.1	27,931	22.8
MEDIUM	29	12.8	22,795	18.6
LARGE	22	9.7	45,667	37.3
EXTRA-LARGE	5	2.2	21,984	18.0
TOTAL	227	100.0	121,390	100.0

FRANCE - EQUIPMENT IN TEACHING INSTITUTES AND RESEARCH CENTRES IN 1968 (2)

	NUMBER		VALUE	
	UNITS	%	(000 $)	%
DESK+SMALL	135	82.2	19,523	31.5
MEDIUM	19	11.6	16,041	25.9
LARGE	5	3.1	9,000	14.5
EXTRA-LARGE	5	3.1	17,352	28.1
TOTAL	164	100.0	61,916	100.0

(1) SOURCE: O.1. Informatique, May, 1969

(2) SOURCE: Institut für Angewandte Reaktorphysik.

In the United Kingdom the percentage incidence of extra-large computers is twice as great as the corresponding incidence of this class of computers on the national total. It might be mentioned here that the French computer equipment is still at an initial phase; in fact the sector is in expansion and the constraints are financial rather than technical. As regards equipment, the fifth plan forecast in 1966 a national network of electronic centres divided into three categories:

1. Category A, centres capable of solving complex problems, with large capacity central computers and high computing speed. These centres were expected to be set up in Paris (financed by CNRS), Grenoble and Toulouse (both financed by the Department de l'Education Supérieur).
2. Category B, medium centres for solving current problems and aimed at regional requirements and the specific requirements of centres linked with those of Category A.
3. Category C, centres for current needs on a local level.

Of the planned three centres of category A only Toulouse is still underequipped, i.e. it does not have extra-large computers yet.

In the course of 1969/1970 it is expected to install three large computers and five computers with a capacity equal to 256K.

B. Service Bureaus

Like the universities the service bureaus have been using computers for a long time. At the beginning, indeed, such centres were set up by computer manufacturers.

In 1962, out of a total of 53 service bureaus (with 105 computers) in the EEC countries, 70% consisted of centres run by the manufacturers (1).

Thereafter the number of independent service bureaus continued to increase, although they were generally smaller than the centres set-up by the manufacturers. In 1965, the number of independent centres in Europe was about equal to that of the manufacturers'centres.

However since such independent centres are smaller, the number of computers available to them is also smaller; while the ratio of private centres to manufacturers' centre was 0.8:1, the corresponding computer ratio was 0.7:1.

This ratio would be even lower, if calculated on the basis of the value of the installation, because even today independent centres are equipped in many cases only with medium-size computers.

There is no detailed information for service bureaus by type of computer employed, with the exception of the German equipment in 1967 and the UK's from 1962 to 1968.

Examination of table X.a which refers to the growth in number and value of the English installations in the service bureaus and the value of the German computer equipment in 1967, shows the great importance of the part

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(1) - De Bruijn - Development of the Computer Market in Europe, 1963.

played in this sector by large and extra-large computers. As in the case of universities and research centres, although to a smaller extent, these centres spend a higher proportion of hardware investment than the national average in large and extra-large equipment.

Percentage of the value of large computers in the U.K. and Germany in 1967

	Service bureaus		National total	
	Germany	U.K.	Germany	U.K.
Large	13.6	9.9	8.9	12.7
Extra-large	10.8	21.2	2.0	13.9
Total	24.4	31.1	11.9	26.6

4. The most widespread applications of EDP systems

The typical applications in this field were identified through the results of the interviews.
The sample is clearly biased towards the univeristies and research centres (70% of interviewees), who, at the current stage of development, also carry on activities as service and calculation centres. An attempt was therefore made to divide replies between "internal" applications, i.e. for the institutes themselves, and "external" apllications, i.e. for outside parties (table X.1).

4.1 Present Applications

A. Universities and Research Centres

The applications currently in use in universities and research centres cover an extensive range of internal requirements; from research for the different faculties and institutes to basic documentation, from diffusion of software packages for technical and scientific calculation to applications for the administrative and financial departments.
The universities have seen computers used in the reverse way of what has been the case in other fields.
Computers were first of all employed as working tools for theoretical and applied research projects and for the solving of the mathematical problems of the teaching functions proper to universities. Only later,

and not yet in a general way, computers have been used in administrative and management areas.
Moreover, the use of long distance on-line processing techniques is still negligible, one reason being the dispersion of efforts in the computer field within the universities, and the consequent failure to concentrate services for groups of Universities in a few large centres. It is simpler and less expensive to use off-line batch techniques, because of the short distances between users and centre and because replies to enquiries are not normally needed very urgently.
Specifically:

- a large Dutch university (U3) uses various technical, scientific and specific research applications and is now developing the application in the administrative field which also covers the management of the students. Noteworthy research activities include software for terminals and automation.
  The degree of progress of applications in the documentation area is also very interesting.

- a French research centre (U7) operating in the tele-communications field applies mathematical methods for specific investigation, but also applications which could be used in other research institutes in the area of the budget control of projects under study (resource estimates, control of stages of project).

The same institute has already partially applied the data bank concept, in the scientific field :

- almost all intervieews have libraries rich in mathematical packages and studies in the field of operational research;
- application of traditional type are not yet well integrated and the relative files are not standardized;
- computers : seem to be little used in the specific field of teaching.

B. Service bureaus

In the areas of service bureaus two main guidelines can be distinguished, in relation to the differing objectives of the computer manufacturers, who also run service bureaus and the independent private centres.
In the first case it is not difficult to see that the service centre will be used mainly as an advertising office whether for the machines themselves or for their applications, with the aim of converting users of services into users of computers.
Therefore there is no particular attempt to supply a more integrated service up-stream from the processing phase.
In the second case, however, there is already a trend to extend the type of services, although this generally means only a diversification by sector, specialized by class of users or applications.

Services provided at present involve mainly administrative and operating areas (production, distribution, technical calculation and engineering).

Service bureaus also process management models of operational research. Whereas the first class of applications covers low turnover companies, the second type also caters to medium or large sized companies, but is directed towards integrating EDP equipment, already installed within the company, together with supplying outside services at least in the technical and scientific areas. As regards the methodology of data handling, remote job entry and time sharing applications are in use in a middle sized company, although they are not particularly extensive and are mainly aimed at calculations and operational research. The more traditional administrative operations and management processes, which are less demanding with respect to response times, are processed with off-line batch techniques.

Specifically we have:

- a large French calculation centre (U1), linked with a series of users of the same type, is already doing a great deal of long distance jobs, including work in the data filing field;
- a Belgian information company (U6) presents a complete range of services, and is particularly active in budgetary control applications;
- an English service bureau (U9) is especially active in the development of applications in the production programming area, linked to stock control, in distribution management

and in transport programming;

- the universities which work for third parties generally supply applications for the technical and scientific field and for the operational research depending to some extent on how specialized their software libraries are :
- in some cases, software packages have been developed for financial management (investment analysis, discounted cash flow, investment simulation):
- general accouting is becoming the most widespread administrative application, related as it is to the desire of management to achieve greater procedural standardization, at least within the same centre of activity.

4.2 Applications under study

A. Universities and Research Centres

Two main developments can be distinguished with respect to the "internal" applications in Universities. On the one hand, the rapid increase in the student population has led to studies for complete automation of administrative procedures and their gradual integration into an information system.

On the other hand, with a view to employing available equipment more rationally, attempts will be made to link up different universities with long distance processing lines, either by remote job entry for calculation, documentation and research applications, or by time sharing which would initially be confined to calculation and operational research applications. Mention should be made of some of the opinions held by the interviewees:

- a Dutch university (U2) foresees short term developments in procedures for student population handling and new information retrieval applications for library documentation. Because of considerable cost of communication lines, it is expected that there will be delays in the spread of terminal systems with respect to solutions using several decentralized medium-sized computers;
- another Dutch university (U3) is working on behalf of the university hospital in order to extend the applications towards health information;
- improvements in software for terminals are being studied in French research centres;
- the creation of data banks for scientific research, accessible by on-line long distance enquiry, are under study in the institutes of most of the interviewees.

B. Service bureaus

The service bureaus are taking the first steps towards diversifying and extending the services they supply. There has been a sharp falling off in the prospects for off-line batch processing, while even in the traditional administrative areas remote job entry is becoming more widespread (1).
Time sharing services are also increasing, although these are confined to calculations and operational research processing.
A deeper examination of the different interviewees shows:

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(1) see note in the following page.

- a large Belgian centre (U6) expects much greater use of mathematical and operational research applications;
- the first data bank applications are coming into use and these are up-dated and overlapped with remote batch and time sharing applications;
- a French calculation centre (U1) expects that methods for the graphical handling of information will become generalized.

4.3 Applications being planned

A. Universities and Research Centres

The Interviews suggest that future applications in this sub-sector will follow these broad lines;

- the creation of large data banks
- the integration of different sub-systems
- the extension of research into the software and automation areas.

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(1) The organizational difficulties which have to be overcome before this type of data processing becomes more widespread, are of two types:
- the need to standardize procedures, at least for broad sectors of activities;
- organization and pricing of the same works for customers whose sizes are greatly different.

Time sharing would seem to be the most indicated long term application, because it is thought that the difficulties involved in the technical characteristics and costs of the lines and those due to hardware/software limitations of terminals now available will be solved in the same length of time.
The spread of this philosophy will lead to the concentration of resources into a few centres with highly advanced equipment, and to the construction of inter-university data transmission networks. Within the different universities it is expected that there will be a spread of computer use from the scientific and technical faculties to the departments of humanities, for scientific reasearch and teaching purposes.
Interviewees place great stress on researches into specialist languages for terminals and new software standards which are considered turning points in the field of university projects and in research centres specialized in information system.
Operational research is also emphasized as a suitable tool for improving the handling of messages in terminal networks.
It is expected that traditional applications will be integrated into management information systems, on the models used in industry.

B. Service bureaus

During the time which will be probably necessary to achieve the projects indicated by the interviewees, the service bureaus as we know them today, will have practically disappeared.
Off-line processings and simple renting of machine hours will no longer be common. Applications will be most frequently concentrat

ed. in the management area, although it is unlikely that companies will entrust their planning stategy completely to service bureaux.
Nevertheless , we will find service bureaus helping the larger companies at least with their problems of operational research and supply of software packages, and working in the organization and analysis fields.

As regards processing itself, this will be mainly on-line and, although not all the interviewees agree on this, time sharing techniques seem to be becoming more widespread, at least for the applications for which they are most suitable.

Other topics include the programming and control of production by means of an intensive development in mathematical and statistical type applications and the introduction of multiprogramming within the bureaus .

TABLE X.1. (A) TYPICAL APPLICATIONS OF UNIVERSITIES AND RESEARCH CENTERS

	APPLICATIONS	BEING PERFORMED	BEING STUDIED	BEING PLANNED
BATCH OFF LINE	ADMINISTRATIVE APPLICATIONS			
	GENERAL ACCOUNTING	U2 U3 U5 U7 U8		
	PERSONNEL ACCOUNTING	U3 U7	U2	
	COST CONTROL	U7	U2	
	PROJECT BUDGET CONTROL	U7	U2	
	FINANCIAL MANAGEMENT	U7	U2	
	STUDENT MANAGEMENT	U3		
	OPERATIONAL APPLICATIONS			
	TECHNICAL-SCIENTIFIC CALCULATION	U2 U3 U5 U7 U8		
	DOCUMENTATION	U3	U2	
	SCIENTIFIC RESEARCH	U3 U4 U5 U7 U8		
	MATHEMATICAL METHODS	U2 U3 U4 U5 U7		
	AUTOMATION	U3		
	STATISTICAL SURVEY	U3 U5		
	MANAGEMENT APPLICATIONS			
	OPERATIONAL RESEARCH	U3 U4 U5 U7		
	DATA BANKS	U7		
	MIS			

FOLLOWS TABLE X.1. (A)

TYPICAL APPLICATIONS OF UNIVERSITIES AND RESEARCH CENTERS

	APPLICATIONS	BEING PERFORMED	BEING STUDIED	BEING PLANNED
REMOTE JOB ENTRY	ADMINISTRATIVE APPLICATIONS			
	GENERAL ACCOUNTING			
	PERSONNEL ACCOUNTING			
	COST CONTROL			
	PROJECT BUDGET CONTROL			
	FINANCIAL MANAGEMENT			
	STUDENT MANAGEMENT			
	OPERATIONAL APPLICATIONS			
	TECHNICAL-SCIENTIFIC CALCULATION		U2 U3 U5 U7 U8	
	DOCUMENTATION		U2 U3	
	SCIENTIFIC RESEARCH		U3 U4 U5 U7 U8	
	MATHEMATICAL METHODS		U3 U4 U5	
	AUTOMATION			
	STATISTICAL SURVEYS			
	MANAGEMENT APPLICATIONS			
	OPERATIONAL RESEARCH		U2 U3 U4 U5 U7 U8	
	DATA BANKS		U2 U3 U4 U7	
	MIS			U2 U3

FOLLOWS TABLE X.1. (A)

TYPICAL APPLICATIONS OF UNIVERSITIES AND RESEARCH CENTERS

	APPLICATIONS	BEING PERFORMED	BEING STUDIED	BEING PLANNED
TIME SHARING	ADMINISTRATIVE APPLICATIONS			
	GENERAL ACCOUNTING			
	PERSONNEL ACCOUNTING			
	COST CONTROL			
	PROJECT BUDGET CONTROL			
	FINANCIAL MANAGEMENT			
	STUDENT MANAGEMENT			
	OPERATIONAL APPLICATIONS			
	TECHNICAL-SCIENTIFIC CALCULATION		U3 U7	U2 U3 U5 U7 U8
	DOCUMENTATION			U3
	SCIENTIFIC RESEARCH			U3 U5 U7 U8
	MATHEMATICAL METHODS		U3	U3 U5 U7
	AUTOMATION			
	STATISTICAL SURVEYS			
	MANAGEMENT APPLICATIONS			
	OPERATIONAL RESEARCH			U2 U5 U7 U8
	DATA BANKS			U2 U3 U4 U5 U7
	MIS			U2 U3

TABLE X.1. (B) TYPICAL APPLICATIONS OF SERVICE BUREAUS

	APPLICATIONS	BEING PERFORMED	BEING STUDIED	BEING PLANNED
BATCH OFF LINE	ADMINISTRATIVE APPLICATIONS			
	GENERAL ACCOUNTING	U2 U6 U7 U9		
	PERSONNEL ACCOUNTING	U2 U3 U6 U7 U9		
	CLIENTS ACCOUNTING	U2 U6 U7 U9		
	SUPPLIERS ACCOUNTING	U2 U6 U7 U9		
	STOCK CONTROL	U6 U7 U9		
	COST CONTROL	U2 U6 U7 U9		
	FINANCIAL MANAGEMENT	U2 U6 U7 U9		
	OPERATIONAL APPLICATIONS			
	PRODUCTION PLANNING	U9		
	SUPPLY MANAGEMENT	U6 U9		
	VEHICLE MANAGEMENT	U9		
	TECHNICAL-SCIENTIFIC CALCULATION	U1 U2 U3 U4 U5 U6 U7 U8		
	MANAGEMENT APPLICATIONS			
	OPERATIONAL RESEARCH	U1 U2 U3 U4 U5 U6 U7 U8		
	DATA BANKS	U1 U7		

FOLLOWS TABLE X.1. (B)

TYPICAL APPLICATIONS OF SERVICE BUREAUS

	APPLICATIONS	BEING PERFORMED	BEING STUDIED	BEING PLANNED
REMOTE JOB ENTRY	ADMINISTRATIVE APPLICATIONS			
	GENERAL ACCOUNTING		U2 U6 U7 U9	
	PERSONNEL ACCOUNTING		U2 U6 U7 U9	
	CLIENTS ACCOUNTING		U2 U6 U7 U9	
	SUPPLIERS ACCOUNTING		U2 U6 U7 U9	
	STOCK CONTROL		U6 U7 U9	
	COST CONTROL		U2 U6 U7 U9	
	FINANCIAL MANAGEMENT		U2 U6 U7 U9	
	OPERATIONAL APPLICATIONS			
	PRODUCTION PLANNING	U9	U9	
	SUPPLY MANAGEMENT		U6 U9	
	VEHICLE MANAGEMENT		U9	
	TECHNICAL-SCIENTIFIC CALCULATION	U1 U3 U4 U5 U7	U1 U2 U3 U4 U5 U6 U7 U8 U9	
	MANAGEMENT APPLICATIONS			
	OPERATIONAL RESEARCH	U1 U3 U4 U5	U1 U2 U3 U4 U5 U6 U7 U8 U9	
	DATA BANKS	U1	U1 U3 U5 U7 U8 U9	

FOLLOWS TABLE X.1. (B)

TYPICAL APPLICATIONS OF SERVICE BUREAUS

	APPLICATIONS	BEING PERFORMED	BEING STUDIED	BEING PLANNED
TIME SHARING	**ADMINISTRATIVE APPLICATIONS**			
	GENERAL ACCOUNTING			
	PERSONNEL ACCOUNTING			
	CLIENTS ACCOUNTING			
	SUPPLIERS ACCOUNTING			
	STOCK CONTROL			
	COST CONTROL			
	FINANCIAL MANAGEMENT			
	OPERATIONAL APPLICATIONS			
	PRODUCTION PLANNING			
	SUPPLY MANAGEMENT			
	VEHICLE MANAGEMENT			
	TECHNICAL-SCIENTIFIC CALCULATION	U3 U4	U1 U3 U4 U5 U6 U7 U8 U9	U1 U2 U3 U4 U5 U6 U7 U8 U9
	MANAGEMENT APPLICATIONS			
	OPERATIONAL RESEARCH	U3 U4	U1 U3 U4 U5 U6	U1 U2 U3 U4 U5 U6 U7 U8 U9
	DATA BANKS		U3 U9	U1 U2 U3 U6 U7 U8 U9

5. Future applications of EDP systems

5.1 Hypotheses of development

A. Universities and Research Centres.

In order to define the probable development of EDP within universities, a basic distinction must be drawn among the fields of traditional use: General and Specific Research and Scientific Calculation (basic and applied research and scientific calculation) and business-like applications (accounting and administrative applications) and the new applications: computer-based or assisted instruction and information retrieval).

With regard to applications in the first group, no substantial changes in the nature of processing tasks, nor in the way in which these are carried out are foreseen in the near future (1975) or the more distant future (1980).

The second group includes applications which are still at their early stages and which have no great weight on the commitments of the universities centre at present. Considering that the number of students in the EDP field is expected to increase greatly in the European countries (1) a future application could be the training of EDP staff in advanced programming courses using time-sharing terminals. About 100 terminal hours per student/per annum will be used.

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(1) AICA, "Rapporto preliminare sul problema della preparazione del personale", Roma, 1968.

For example in Italy AICA forecasts 7.000 students per annum in the period 1969-1975.

An IBM programmed instruction system will become operative in Europe by June 1970. This will involve the installation of a medium sized computer (IBM 360/40), linked to a similar satellite computer in Frankfurt for the management of the courses. It is expected to set up 250 terminals. Computer-based instruction is particularly suited for the teaching of programming, because the whole course can be put on to computer terminals. For programming courses, terminals consist of simple 10/12 character per second teleprinters, fitted with a paper tape reader and punch and are quite adequate for man/machine communication. Various levels of instructional packages are also available. The adoption on a large scale of programmed instruction methods has become almost obligatory, because of the increase in the student population.
The problem cannot be overcome simply by a proportional increase in teaching staff and equipment (class-rooms, laboratories).
Various proposals have been made (e.g. the English Open University plan which hopes to serve 30,000 students by 1971 and about 200,000 by 1975) and we can therefore expect that computer-managed instruction will spread rapidly in Europe during the next five years.
Applications in the field of Information Retrieval in the university sector are still at the preliminary stages in Europe, but what is being done in the USA and in some Public Agencies in Europe suggests that in a relatively short time there will be a substantial increase in applications. By 1975 it can be expected that all libraries in the various departments of the major universities will

have a large electronic documentation service. These three applications (Computer-Based Instruction, Computer Assisted Instruction, and Information Retrieval) would therefore seem most open to expansion in the university field in the near future (1975), and later (1980). Finally it should be pointed out that all three of these applications essentially involve real time service with time-sharing of the central unit: there will therefore be a great need for much more advanced terminals than those currently available.

B. Service bureaus.

Service bureaus were originally intended as alternatives to internal company installations in small industries. For the most part they handle traditional administrative works for small users, or, for large companies, operating tasks of scientific calculation for production planning models and the technical calculation involved in engineering work. Service bureaus are almost never used for large management strategy-type works, except perhaps at the phase of preparing models and files. We may therefore expect that any future improvement in the quality of applications within the various sectors will have relatively little effect on the applications used by the bureaus. The principal changes which will be seen in services rendered by bureaus can be looked at from three different standpoints:

- types of application

- type of software service per application
- processing technique

With respect to what was mentioned earlier, we can expect to see a gradual shift through the following steps:

1. administrative applications
2. operational applications
3. scientific and technical calculations
4. data files for documentation of all types.

We are dealing with a progression from administrative and operating area works to more typically managerial processes, although the major management problems will barely be touched upon.

Analysing the development in types of service rendered we can expect to see the following progression:

- an intensification of assistance effort, to the user, by means of specialist staff of the bureau;
- the supply of standard software packages for new mathematical applications in the fields of scientific and technical calculations and in the area of financial management;
- the supply of semi-standard of parametrical packages, i.e. elastic programmes which can be fitted to the requirements of the user; for the administrative and commercial areas;
- the preparation of semi-standard information systems for whole sectors of users;
- the preparation of organization and analysis standards so as to complete the horizontal integration of the entire

information process.

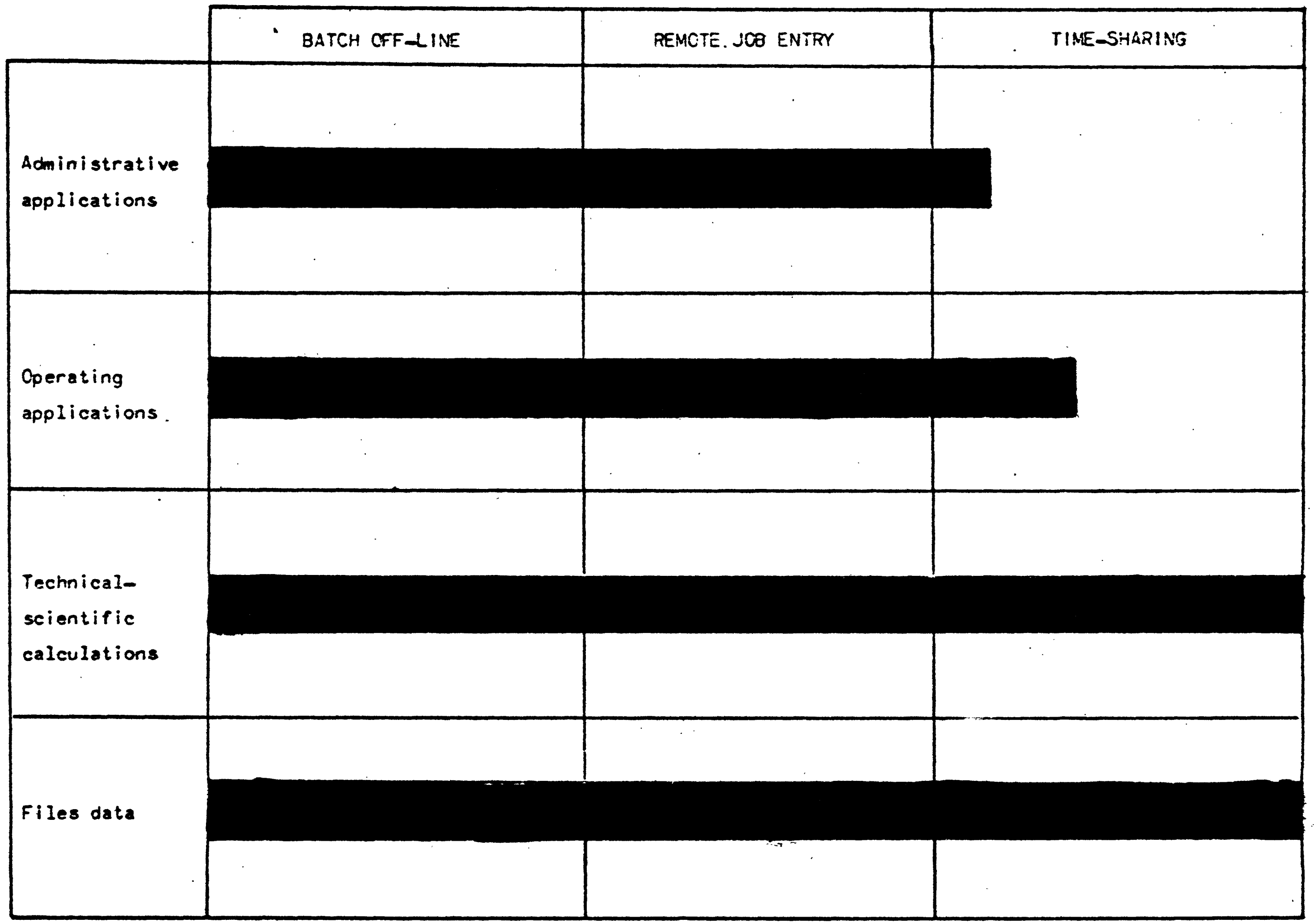
The service bureaus, particularly those which are independent from the manufacturers, are thus tending to move upwards with respect to the production flow of new applications, to the point of a complete integration of the analysis-programming-processing cycle. This will be offered to the client just as happens with the engineering-construction cycle of a plant.
At the same time, their own industrial services are becoming more specialisted with diversification by types of users and applications. No forecast of developments can be complete, however, without mentioning the third point, i.e. the different processing techniques.
Three different types of data processing, characteristic of the service bureaus, can already be distinguished:

- batch processing,
- remote job entry processing (remote batch),
- time sharing processing.

The forecasts made for types of applications must be reviewed from the point of view of these different processing techniques.(fig. X.1).
It can be said that the off-line batch processes which today comprise 90% of the turnover of European bureaus will be about 50% in 1975 and will reach 80% in 1980.
Time sharing which is practically non-existent today, will represent about 10% in 1975 and about 30% in 1980 (fig.X.2).
Time sharing will find most room for development in scientific

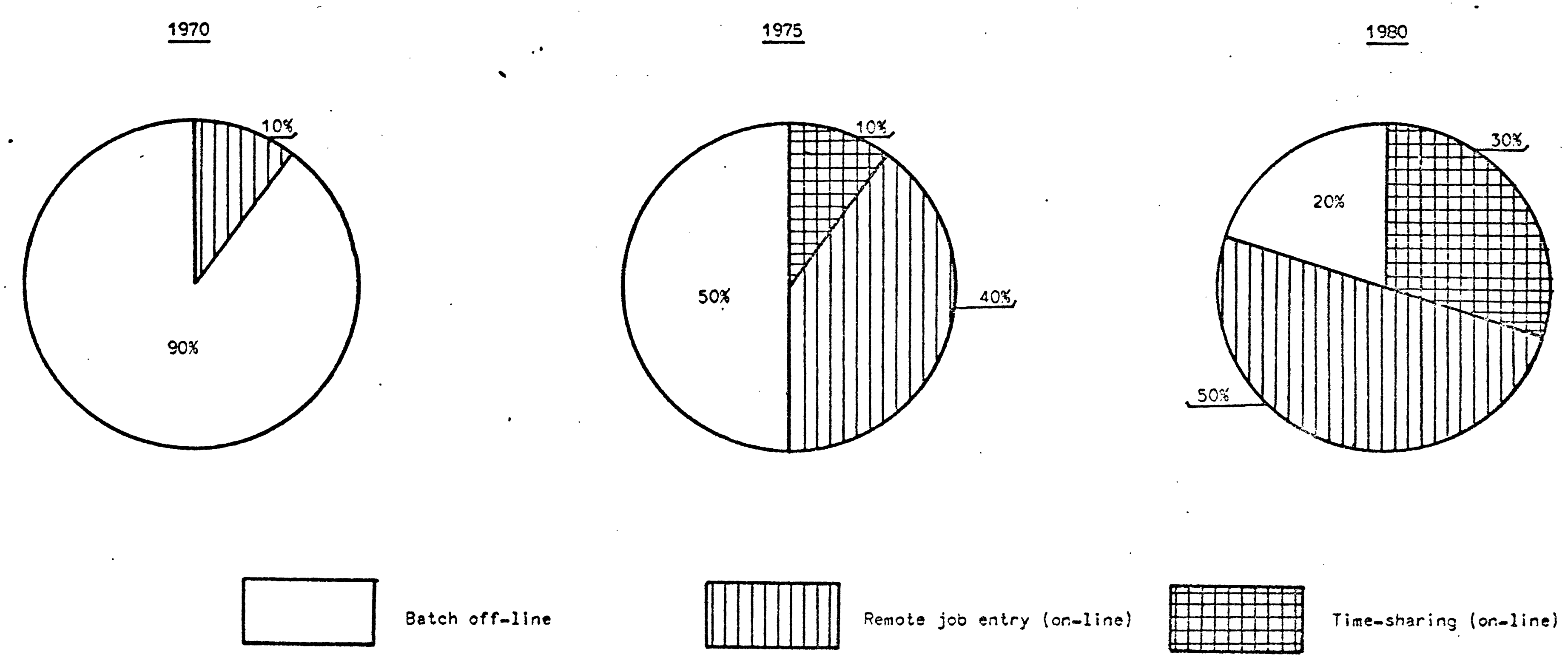
FIG. X.1. APPLICATIONS BY TYPE OF PROCESSING

(DEVELOPMENT HYPOTHESES)



SOURCE: SORIS, based on interviews.

FIG. X.2. FUTURE TREND OF PROCESSING



SOURCE: SORIS, based on interviews.

and technical calculation applications and in those for enquiry and up-dating of data banks.

No definite trends can be detected at the moment with regard to the philosophy of future service bureau hardware configurations. In the beginning, service bureaus used medium sized computers and their staff was limited in quantity and deficient in quality.

The intense development of services in quantity and quality has given rise to a concentration of efforts with a view to ensuring greater resources for investment in equipment and staff.

The introduction of time sharing has given a great impetus to the previous tendency,with a greater demand for larger computers.

Three types of basic networks can be foreseen:

- a central computer linked to a network of messages switching computers or "solar" system configuration;
- central computer for data files linked to a network of peripheral computers for carrying out local calculation. This is still a solar system configuration modified only by the "weight" of the satellite computers;
- central computer linked to a network of terminals, probably more advanced than those currently in use (possibly with limited capability for local calculations) or atomic system configuration.

Although there is some uncertainty as to the prospects for each of the above configurations, the third one may become more popular than the others, one reason being that the manufacturers tend to favour large centres.

The above mentioned hypotheses of development are greatly influenced, of course, by the possibilities of totally reorganizing existing communication lines; in Europe these present two types of handicap compared with the US:

- technical inadequacy,
- high cost of the services.

In order to quantify these differences which may conflict to the extent of interrupting current trends, it should be remembered that the average speed of transmission in Europe is about 1,200 bauds, with peaks of 4,800 on the best lines and of 9,600 for phase modulation lines in France.
This compares with a US average of 2,400 on normal lines, of 48,000 bauds on the TELPAC rented coaxial cable system, with peaks of 100,000 bauds.
Although it is difficult to compare tariffs, it may be considered that to rent a line the average tariff in the US is 2.35 \$ month/mile and about 3\$ month /mile in Europe, not to speak of the differences in rates for direct trunk dialling which depend on distance and vary greatly from country to country.

5.2. Comparison with the US

A. Universities and Research Centres

Some of the problems mentioned in the development hypotheses for Universities and research centres in Europe have been partially or totally solved in the USA.

The preparation of technical and scientific data banks for research, the increase in the quantity of technical and scientific calculation and of operational research applications, and the spread of internal administrative applications are becoming integrated more and more towards the management information system concept. If, however, the differences with the European environment are not particularly profound qualitatively in these areas, there is a considerable difference in the quality of teaching applications, namely applications which use the computer as a support or as a basic information instrument applied to teaching.

Current trends in the US towards widespread applications of computer-assisted or computer-based instruction observable in the behaviour of some leading centres of learning, and from the opinion of the experts in advanced teaching technologies, make this sector one of the most interesting markets for the spread of EDP techniques, particularly of specialist hardware for data transmission. While problems common to Europe also will be tackled with traditional processing techniques, the forecasts in the more specific field of teaching are for a rapid expansion in the use of on-line terminals with a prevalence of time sharing techniques. Currently about 1,500 computers are installed in American Universities and their value is about 10% of total US hardware investment. Several thousand on-line terminals have already been installed or are being installed. Among the major users of on-line services we find as long ago as 1965 MIT with more than 100 terminals, Carnegie with about 50 terminals and the University of Texas with 30 terminals.

In most of these applications the computer is used to integrate previous educational supports. It is not difficult to understand why these technologies first attracted the technical and scientific faculties, where both the theoretical and practical part of the subject taught can easily be programmed.

Experiments aimed at completely handing over the running of courses to computers have shown that this type of instruction is already more efficient than traditional instruction and is cheaper for the mass applications that will be the rule in the future. Total costs are about 50 cents per student /per hour, compared with the 2$ approximately of traditional teaching.

B. Service Bureaus.

There are about 1,000 service bureaux in the USA, about 2/3 of them of medium/large size.

About half of these are run by the manufacturers and therefore follow the promotional policy of the parent firm; the other half are private and pursue different objectives with a view to expanding the services they can offer and to specializing.

Among the most important systems of private bureaux, there is that of a large software company which, at the end of 1971, expects to have eleven centres each with 2 UNIVAC

1108 s for time sharing and remote job entry. The renting of machine hours is still looked for by companies with exceeding capacity in their own internal centres, but bureaux themselves are moving away from this towards customer assistance in the field of software preparation and the analysis of company problems. Alongside this development in operation and organizational integration, there are other service bureaux which specialize in particular areas of information such as stock exchange quotations, hotel reservations systems, and transport. These aim at the preparation of files which can be integrated and up-dated online and in real-time.
On the basis of the diversity of services supplied, the US bureaux can be classified as follows:

- conventional service bureaux. These generally sell machine time and are generally small, although there is a trend at the moment to concentrate. Most of the work in these bureaux is processed with off-line batch techniques;
- service bureaux run by the manufacturers. The applications offered by these bureaux vary with the commercial policy of the parent firm. For example NCR concentrates on commercial and banking applications, whereas GE, IBM and Control Data specialize in company management applications and engineering and scientific calculations, processed on-line and partly in time sharing. The profit motive is not important in these bureaux and their main function is to demonstrate the features of the new machines presented by the manufacturers;
- departments of large companies. Many companies, several of them in the electronic and areo-spacial fields, offer

services to third parties.
The reason for this policy was initially to help the companies to install more powerful computers at lower unit processing cost, the excess capacity being sold to outside customers for this purpose. Today, these activities have taken on considerable independence, although most of the total machine time available and the staff are still occupied with the interval problems of the company. Because of the capacity of the computers generally employed, the users of this group of service bureaux tend to be large companies involved in engineering or scientific and mathematical applications which need high power of calculation. The overhead expenses of these bureaux are generally so high that they cannot compete with the small bureaux in traditional works;

- unconventional service bureaux. This category includes a vast series of unofficial centres whose services are offered informally, machine time being exploited outside of the normal shift. There has been a considerable decline in the number of these bureaux ,except in the banking sector, where customers are offered services with the promotional objective of obtaining new bank deposits;
- on line service bureaux. This is the fastest growing sector in the US . Applications are o. remote batch works where the response is not urgent, real-time sharing for the administration of files with simple enquiry and on response operation, or more complex techniques for scientific and technical applications.

6. Expectations about hardware and software

There is widespread agreement about prospects in the hardware field. The following conclusions may be drawn:

a) Central Unit

- interviewees in general think that the core store capacities currently available for central units are sufficient;
- there was agreement about the need for access times between 0.3 and 1µs.

b) Peripheral Units

- interviewees insist on the need for vary large auxiliary mass core stores, with capacities up to 3,000 M bytes and access times of less than 10 ms;
- the hope for new optical and phonic input-output means seems to be general;
- interviewees urge on greater output speed and hope for a more widespread use of plotters.

c) Terminals

- general criticism was expressed with regard to the current state of available hardware for time sharing terminals;
- current data transmission speeds were held to be sufficient;
- interviewees insisted on the need for medium cost video terminals.

There was greater diversification in the opinions expressed about software development:

- interviewees were particularly concerned about greater software standardization for reducing programming costs and programme tests;

- the need for improved software for handling messages and terminals was stressed by some universities;
- some interviewees suggested the need to transfer certain very powerful software instructions to hardware level.

Finally, as for the foreseeable tendencies, there was a prevalence of opinion in favour of the atomic system, with extra-large central processors linked to terminal networks; many interviewees, however, opted for the "solar" system solution with a large central computer linked to a network of satellite processors. Some mentioned solutions with decentralized un-linked medium computers, and this reply was typical of a situation of technical deficiency and high communication line cost in Europe (table X.2).

TAB. X.2

EXPECTATIONS ON HARDWARE AND SOFTWARE

INTERVIEWEE	SOFTWARE	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
U1		1108 sufficient	Auxiliary mass memories with lower access times plotters	Current speed adequate	Atomic system
U2	Standard interface software for integrated systems	Greater than 1024 K, access times less than 0.1÷0.3 μs	Auxiliary mass memories; capacity up to 3000 M bytes; access times less than 10 ms	Improve time sharing	Atomic system and decentralized independent medium computers
U3	Languages for terminal systems	Capacity up to 512 k with words of 32 bits, access times 0.3÷1 μs	Auxiliary mass memories, capacity up to 3000 M bytes; access times less than 50 ms; transfer speed 300 K/sec; optical readers	Video terminals	Solar system
U4	Specialist languages		Optical readers; phonic input-output I/O	Video terminals	Solar system
U5	Improve software for time-sharing	Capacity up to 512K with words of 60 bits, access times 0.3÷1 μs	Auxiliary mass memories; capacity more than 300 M bytes; access times less than 100 ms	Improve time-sharing	Atomic system

Follows: TAB. X.2

EXPECTATIONS ON HARDWARE AND SOFTWARE

INTERVIEWEE	SOFTWARE	HARDWARE			SYSTEM PHILOSOPHY
		CENTRAL UNITS	PERIPHERAL UNITS	TERMINALS	
U6	Surár software	Capacity greater than 91024 K access times 0.3÷1 μs	Auxillary mass memories; capacity greater than 300 M bytes; access times less than 100 ms faster printers,optical readers		Atomic system
U7	Improve message handling				Solar system
U8	Firmware and software standards		Very large auxiliary mass memories and direct access	Message switchers	Solar systems
U9	Software standards	Those available adequate			Atomic system

7. Universities and Service Bureaus

A. Universities and Research Centres

Lacking more detailed information, the figure we have chosen for selecting universities which are potential users of extra-large information systems is that of the number of students enrolled.

For universities with more than 5,000 students (1) we have enclosed the value of hardware investment expressed at purchase price, by classes of computers.

Since the processing requirements of technical universities or institutes may be considerable, even if they have a smaller number of students enrolled, such universities have been included even when they are below the number of students indicated as long as they have at least medium-type equipment.

Not knowing the budgets of the Research Centres, we have indicated those which currently have medium computers installed. We have omitted military research centres. Moreover, in the case of several research centres coming under a single organism or Ministry the figure shown in the table X.b refers to the total number of computers in all the research centres concerned: for example, Ministry of Technology in the United Kingdom for: National Gas Turbine, National Physical Laboratory, etc.

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(1) Obtained, like the Research Centres, from the World of Learning 1969-70, 20th edition, European Publication Limited, London, 1970.

The incompleteness of the information (1) limits the reliability of the data in table X.b and any forecasts based on them are hazardous.
Those universities which currently possess extra-large computers would seem to have excess capacity and their computer is thus used for other universities or for third parties. In other words they are working as service bureaus.
Among the research centres which use extra-large computers, particular importance must be ascribed to those which perform in the more advanced fields, i.e. nuclear and aero-spacial.

B. Service Bureaus.

We have chosen the leading users in the sector among independent service bureaus and among those run by the manufacturers, which today have particular characteristics (2). Specifically, the group of firms considered by country includes almost all manufacturers' and private centres equipped with computers, when the size of their computer suggests that over the next decade such centres will become potential users of extra-large computers.

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(1) For example, the two international space centres ELDO and ESRO are missing from the Research Centres

(2) The indication have been taken from the following sources:
"The international Directory of Computer and Information System Services, 1969" Europa Publication Ltd., London.
Computer Service Bureaus 1969, in "Computer Survey" January/February 1969.
O.1. Informatique Scope, Paris, 1969.

From the group of considered bureaus we have excluded ." inderect " service bureaus, i.e. bureaus run by users of extra-large computers which have an excess capacity and therefore work as computer centres for third parties: typical is the case of certain companies and some universities.

Divided by country, the computer installations in 1969 of the centres considered, expressed in purchase value of the computers is shown in the following table:

COUNTRY	NUMBER OF BUREAUS	TOTAL HARDWARE EXPENDITURE	COMPUTERS EXPENDITURE	
			Large (000 $)	Extra large (000 $)
UNITED KINGDOM	23	87.365	13.824	25.528
GERMANY	11	46.238	16.838	3.360
FRANCE	19	64.673	6.672	29.760
ITALY	8	30.720	6.792	(3.360)
BELGIUM	4	5.946	-	-
NETHERLANDS	10	19.153	-	3.648

( ) = Ordered

Extra-large computers are almost exclusively installed in manufacturers' bureaus centres; except for a few cases, particularly in the United Kingdom and in France, the other companies still use medium size computers.

The equipment of the manufacturers depends on what they specialize in and is greater the higher the market share of the manufacturer is in the particular country. In particular, the UNIVAC service centres have no extra-large computers, because they tend to concentrate on the development of scientific calculation software and hence to link up with the universities.

IBM's policy is interesting. Its aim is to set up a network of service centres in all countries with different computer installations depending on the importance of the town in which the centre operates.

8. Quantitative hypotheses about the extra-large EDP systems by 1975 and 1980.

A. Universities and Research Centres

General forecasting procedures cannot be applied mechanically in this field because of the special characteristics of Universities and Research Centres (1).

It is especially difficult to quantify the future value of computers installed , of the various institutes and decide on a parameter upon which to base forecasts as to which centres will develop in the direction of extra-large computers.

Moreover, considering that many installations are recent (1969) and that many Universities, such as the Italian and to some extent the English ones buy their computers, it would seem improbable that these will be replaced within the next five years.

Consequently indications with respect to potential users are supplied only for 1980 on the basis of the following criteria:

- it is supposed that regional centres with extra-large computers will be set up along the lines of the regional centres included in the French Fifth Plan and the English Computer Board (2). Potential university users represent centres to which other

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(1) See annexes.

(2) Computer Board for Universities and Research Councils, HMSO London 1969.

smaller Universities, Research Institutes and sometimes school institutes will have access.
These smaller institutes will have less powerful computers but, together with the regional centres, will be in a position to form an integrated system.
Where other indications were lacking, the estimated number of potential centres has been based on the educational set-up, the type of instruction given, the estimated number of students and the research centres that will possibly be linked with a particular University centre.

- The potential users among research centres have been picked out from centres which currently have a great processing requirement.
  The concentration of such centres and the size of certain nuclear centres imply a user/extra-large-computer ratio which is higher than 1 even today.
  It follows that the estimated number of potential users is certainly lower than the number of extra-large computers which will actually be required by such centres.

Furthermore, unlike the Universities, the centres in question could be potential users as early as 1975 if the supply is equal to their scientific requirements.

On the basis of these criteria the following results were obtained for 1980:

Potential number of users in
the EEC and United Kingdom

(1980)

Universities	Research Centres
32	15

It is clear that these indications may be underestimated, and it is equally clear that Universities could be potential users as early as 1975 if the two applications "E.D.P. staff training" and "Programmed learning" develop quicker than seems likely at present.

B. Service bureaus

Three main difficulties were encountered in working out the forecast picture by 1975 and 1980:

a. uncertainty about current turnover data of bureaux;
b. difficulty in assessing turnover growth rates for the next few years;
c. difficulty in assessing the bureaux turnover which will indicate a potential user of extra-large computers.

These problems were overcome in the following ways:

a. to estimate current turnover in the bureaux use was made of the information on the class of computers which are used in these bureaux at the moment and parameters estimated on the basis of American service fees (1). Using the turnover/ rental parameter, orientative turnover figures were obtained in terms of the central processing unit, including however all cost items and profit. These turnover estimates constitute the inputs for the forecasting mechanism.

b. For estimates of turnover growth by 1975 and 1980, we have used the rates estimated in paragraph 2.1 up to 1975, smoothed for the subsequent years by use of the average forecast rate for the coming years in the USA.

c. Potential users have been defined as those centres whose turnover (estimate) currently exceeds 3M $/annum. Centres run by manufacturers have been included independently of the turnover estimates, bearing in mind that this type of centre is a showcase for new hardware.

Because of the very high turnover growth rates for the sector, even those bureaux which only have a medium sized computer at the moment could become potential users of extra-large computers over the next decade. This broad growth hypothesis, however, could only become effective, if in other areas of activity - the potential market for service bureaux - the potential users of extra-large computers (forecast on the basis of current

(1) Auerbach Time Sharing Reports, 1970, Service Summary Charts: Service Fees.

trends) were to adopt a common policy towards specialist bureaux for each sector.
This hypothesis for the growth of EDP centres among users could greatly alter the breakdown of extra-large computers by sectors of activity over the next decade.
This hypothesis has been left aside, because it depends on choices which are difficult to forecast today and because trends in this direction are to be seen at the moment only in the banking sector.
With allowance made for the hypotheses presented and their inherent limitations, the applications of the forecasting mechanism to bureaux defined as potential users, gives the following results:

EEC countries and the United Kingdom
Forecasts of potential users of extra-large computers by 1975 and 1980

	1975	1980
Potential users	27	29
Computers investment estimates M$	832	2480

It should be pointed out that about 50% of the investment estimate in the two years, refers to investments of IBM service bureaus. On the basis of the policy which has always been followed by IBM up to now, it can be foreseen that a great number of small bureaux will be set up along with larger centres. It follows that not all the investment estimates shown will be automatically translated into extra-large computers.

Annexes

FORECAST METHODOLOGY

Forecast for the Industries

Formulation of forecasts for the industries means:

a. identification of the principal firms or organizations which operate in each industry, of their current hardware expense and of their size.

b. forecast of the development of the various industries and the principal firms during the decade 1970-1980.

c. examination of the trends for development of the computer applications

d. forecast of the hardware expense of the principal users as related to the applications' development and identification of potential users of extra-large computers.

a. We have identified the principal users through lists provided by the organizations of each category, specialized economic journals, etc. These lists were based on dimensional indicators varying from industry to industry, such as, for example amount of deposits for the banks, premium paid for the insurance companies, turnover for the other firms etc.
Information about the principal users' computer equipment has been obtained from special sources in some countries: in the United Kingdom from a census of the users conducted by Computer Survey and in France from an O.I. Scope inquiry which comprised however only slightly more than 2/3 of the users. For the other countries we have resorted to direct surveys, conducted in Belgium by SOBEMAP, in Holland by the Rijkskantoormachinecentrale and in Germany and Italy by SORIS.

Information about principal users and their current computer equipment is naturally difficult to obtain: an analytic method, such as the one which had to be used, brings with it considerable gaps and possibilities of mistakes.
The principal users' current computer installations have been evaluated on the basis of the purchase price for the figuring out of indexes, such as the value of the installation per employee and turnover. These indexes permit evaluation of the relative position of the various users as compared to the size of the computer installations and are the first element of the forecast.

b. For the development forecasts for the various industries during the decade 1970-1980 we have used, where available, the guidelines mentioned in national or international plans (especially EEC plans), limiting ourselves to estimates of trends in the other cases.
The trends toward industry restructuring through concentration have been taken into account, at least on a qualitative level, especially in those industries, where these trends are more pronounced and where they could thus change considerably the number of large users during the next few years.

c. The development trends of the applications typical of large computers have been derived primarily from interviews conducted in the industries verified later by information from available technical literature, dealing especially with the presently more advanced applications in the US.

d. When forecasting the hardware expenditure of the principal users, account was taken not only of the qualitative influence of the applications' development, but also of the influence of each user's behaviour on the behaviour of other users. Important is the criterion of imitating the industry's leaders, i.e. those firms which, while performing the same type of economic activity and having the same turnover. have in the same country, or other European countries or the US, a higher ratio hardware expenditure/turnover.

Thus, as results from the enclosed forecast procedure, the first step toward determining the future behaviour of the large users in the industry is their present position concerning hardware investments as compared to other firms of the same industry and country.
If already in 1969 there existed other firms of equal size active in the same industry, we can conclude that, as an effect of the imitative model, the interviewee will tend toward achieving their present level of the hardware/ turnover ratio. Smaller will be the effect of the imitative model, if the leader belongs to another country. If the leader is national, it can be safely assumed that the other firms equal in size will try to achieve his level of hardware expenditure per turnover. If the leader is from another European country or the US, he will challenge the other firms to increase their EDP expenditure/turnover ratio.

The enclosed diagram shows the general forecast procedures of har[d]ware expenditures at the level of each individual firm. This procedure has been formulated according to steps of calculus and periodic checkups of the qualitative evaluations made by the research group. The various logic knots are:

1. User's present sales and value of computers installed

In this preliminary phase the data available on sales and value of computers installed (the value of computers installed being expressed in the purchase price): in this way it is possible to localize in a diagram, which has as ordinate the value of computers installed and as abscissa the sales, a representative point of the considered firm and to determine the straight line passing through that point (defining this line as a locus of points which represents a constant ratio between the value of computers installed and sales).

2. Test A - Has the firm been interviewed ?

If the firm has been interviewed evaluations of the hardware development are considered; the latter being corrected by the researcher on the basis of the advancement of the specific applications of each industry.

3. Tests B/C/D/ - Is there a national leader? A European or an American one ?

Moving from the firm's representative point upwards, maintaining the same class of sales, one can single out the leaders of the particular subsectors, i.e. the firms of the same type and size as the one being examined which have already reached higher values of computers installed. National, European or even American leaders can be found. The guiding effect of these leaders depends on the leader's country of origin. In case there are no leaders, we have chosen to stay on the original ratio.

4. Evaluation of the application explosion

It is necessary at this point to make an evaluation of possible new applications for the subsector which imply further increases in the size of hardware expenses. This evaluation is therefore valid for the interviewed and not-interviewed firms, whether these are leaders or not, because an upgrading in applications of this kind can naturally also be applied to the top firms in this group.

5. Test E - Trends toward concentration?

If higher concentration in the user's branch can be foreseen, it is necessary to find a new ratio of the total value of computers installed and their total sales.

6. Test F - The new ratio is critical?

In some subsectors we can find a critical ratio, beyond which it is necessary to make a negative correction, due to the specific decreasing course of the ratio: value of computers installed / sales. If the critical level has been reached, a negative correction will be applied.

7. Determination of user's sales and value of computers installed in 1975 and 1980

Based on available data specific rates of sales increase for 1975 and 1980 have been applied and one enters into the abscissa of the above-mentioned diagram putting in ordinate the forecast of a firm's value of computers installed in 1975 and 1980.

8. Users with > US$ 5 million value of computers installed in 1975 and 1980

Comparing the future value of computers installed (step 7) with the threshold of the purchase price of the extra-large computers (US$ 5 million), the potential users in 1975 and 1980 can be determined.

9. Test G - Atomic System?

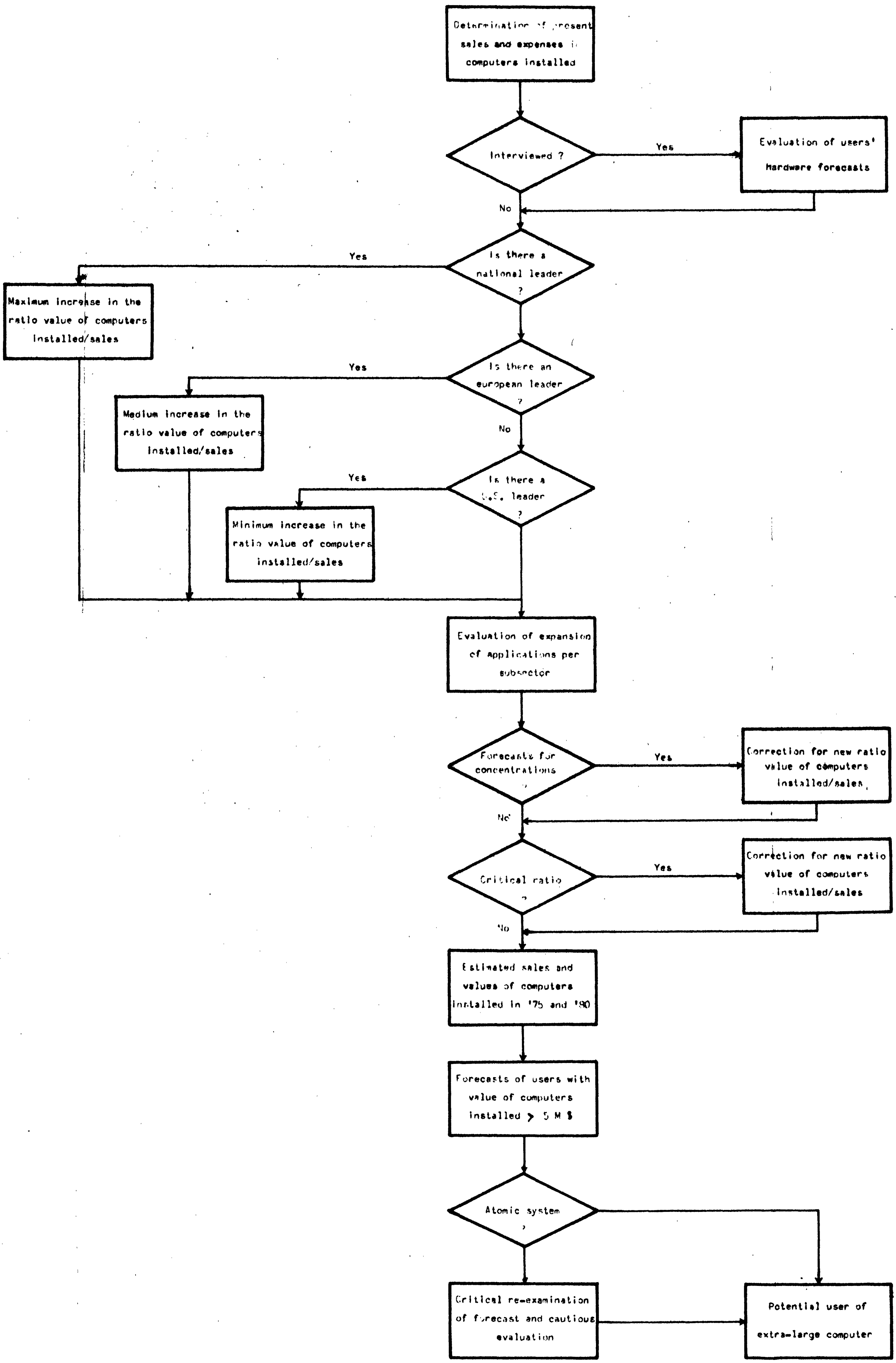
It is necessary to make a critical evaluation for the future, referring to the present hardware equipment of the firm and to its EDP philosophy.
Defining the "atomic system" as a system with very large central computer and many peripheral terminals without intermediate computers, one reaches a confirmation of the forecasts concerning value in the case of a positive answer of the test.
In the opposite case, when the forecast philosophy is oriented towards the "solar system" (defining "solar system" as a system with a large central computer, some intermediate computers and many peripheral terminals), one has to reconsider the judgement along more conservative lines. This criterion

can be decisive in those cases in which the threshold of the value in only barely reached, especially in the near future (1975).

10. Forecast of potential users of extra-large computers in 1975 and 1980

Of course, the value of computers installed as determined in the above-mentioned manner, can have much higher results than the minimim limit of 5 million dollars, thus giving way to the possibility of using more than one extra-large computer.

GENERALIZED SCHEME OF FORECAST



CHAPTER VI

TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: MANUFACTURING (1)

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	17	29	39	56	83	160	318	62,9
SMALL	172	311	464	557	789	995	1.197	38,2
MEDIUM	4	25	47	62	81	105	137	80,2
LARGE	3	3	3	13	19	26	28	45,1
EXTRA LARGE	-	-	-	-	2	7	11	134,5
UNCLASSIFIED	-	-	-	-	1	3	7	164,6
TOTAL	196	368	533	688	975	1.296	1.698	43,3
TOTAL EXCLUDING DESK	179	339	514	632	892	1.136	1.380	40,6
	PERCENTAGE							
DESK	8,7	7,9	7,1	8,1	8,5	12,4	18,7	
SMALL	87,8	84,5	83,9	81,0	80,9	76,8	70,5	
MEDIUM	2,0	6,8	8,5	9,0	8,3	8,1	8,1	
LARGE	1,5	0,8	0,5	1,9	2,0	2,0	1,7	
EXTRA LARGE	-	-	-	-	0,2	0,5	0,6	
UNCLASSIFIED	-	-	-	-	0,1	0,2	0,4	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

(1) Retail wholesale included.

follows TABLE ... a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: MANUFACTURING (1)

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	244,4	424,4	581,3	745,9	1.039,0	1.941,2	3.883,3	58,6
SMALL	10.773,6	18.307,2	27.843,4	36.468,0	52.431,8	66.956,0	78.731,0	39,3
MEDIUM	638,4	3.913,2	7.537,2	9.456,0	13.786,8	18.672,0	24.872,4	84,1
LARGE	972,0	972,0	972,0	7.700,4	8.554,8	10.570,8	11.068,8	50,0
EXTRA LARGE	-	-	-	-	1.680,0	5.880,0	9.240,0	134,5
TOTAL	12.628,4	23.616,8	36.933,9	54.370,3	77.492,4	104.020,0	127.795,5	47,1
TOTAL EXCLUDING DESK	12.384,0	23.192,4	36.352,6	53.624,4	76.453,4	102.078,8	123.912,2	46,8
	PERCENTAGE							
DESK	1,9	1,8	1,6	1,4	1,3	1,9	3,0	
SMALL	85,3	77,5	75,4	67,1	67,7	64,4	61,6	
MEDIUM	5,1	16,6	20,4	17,4	17,8	17,9	19,5	
LARGE	7,7	4,1	2,6	14,1	11,0	10,2	8,7	
EXTRA LARGE	-	-	-	-	2,2	5,6	7,2	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

(1) Retail wholesale included.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: FERROUS AND NON FERROUS METAL

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	2	10	10	13	14	22	27	54,3
SMALL	13	22	42	50	60	74	97	39,8
MEDIUM	-	2	5	4	6	8	15	49,6
LARGE	1	1	1	1	1	2	1	-
EXTRA LARGE	-	-	-	-	-	-	-	-
UNCLASSIFIED	-	-	-	-	-	-	1	-
TOTAL	16	35	58	68	81	106	141	43,7
TOTAL EXCLUDING DESK	14	25	48	55	67	84	114	41,8
	PERCENTAGE							
DESK	12,5	28,6	17,3	19,1	17,3	20,8	19,2	
SMALL	81,2	62,8	72,4	73,5	74,1	69,8	68,8	
MEDIUM	-	5,7	8,6	5,9	7,4	7,5	10,6	
LARGE	6,3	2,9	1,7	1,5	1,2	1,9	0,7	
EXTRA LARGE	-	-	-	-	-	-	-	
UNCLASSIFIED	-	-	-	-	-	-	0,7	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: FERROUS AND NON FERROUS METAL

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	32,4	147,6	176,4	187,2	202,5	257,4	378,9	50,7
SMALL	697,2	1.216,8	2.324,5	3.257,3	3.742,4	5.024,3	6.046,1	43,3
MEDIUM	-	319,2	754,8	674,4	1.028,4	1.495,2	2.743,2	53,8
LARGE	324,0	324,0	324,0	324,0	324,0	720,0	324,0	-
EXTRA LARGE	-	-	-	-	-	-	-	-
TOTAL	1.053,6	2.007,6	3.579,7	4.442,9	5.297,3	7.496,9	9.492,2	44,2
TOTAL EXCLUDING DESK	1.021,2	1.860,0	3.403,3	4.255,7	5.094,8	7.239,5	9.113,3	44,0
	PERCENTAGE							
DESK	3,1	7,4	4,9	4,2	3,8	3,4	4,0	
SMALL	66,2	60,6	64,9	73,3	70,7	67,0	63,7	
MEDIUM	-	15,9	21,1	15,2	19,4	20,0	28,9	
LARGE	30,7	16,1	9,1	7,3	6,1	9,6	3,4	
EXTRA LARGE	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI-a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: OIL

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	1	1	1	2	2	4	8	41,4
SMALL	17	24	25	13	22	26	35	12,8
MEDIUM	1	2	5	5	7	7	7	38,3
LARGE	1	1	1	1	2	4	2	12,2
EXTRA LARGE	-	-	-	-	1	4	5	123,6
UNCLASSIFIED	-	-	-	-	-	1	2	-
TOTAL	20	28	32	21	34	46	59	19,8
TOTAL EXCLUDING DESK	19	27	31	19	32	42	51	17,9
	PERCENTAGE							
DESK	5,0	3,6	3,1	9,5	5,9	8,7	13,5	
SMALL	85,0	85,7	78,2	61,9	64,7	56,5	59,3	
MEDIUM	5,0	7,1	15,6	23,8	20,6	15,2	11,9	
LARGE	5,0	3,6	3,1	4,8	5,9	8,7	3,4	
EXTRA LARGE	-	-	-	-	2,9	8,7	8,5	
UNCLASSIFIED	-	-	-	-	-	2,2	3,4	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: OIL

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	7,2	7,2	7,2	21,6	22,4	49,4	98,8	54,7
SMALL	992,4	1.294,8	1.413,6	760,8	1.341.6	1.613,0	2.045,0	12,8
MEDIUM	145,2	319,2	901,2	901,2	1.250,4	1.368,0	1.368,0	45,3
LARGE	324,0	324,0	324,0	324,0	648,0	1.368,0	720,0	14,2
EXTRA LARGE	-	-	-	-	840,0	3.360,0	4.200,0	123,6
TOTAL	1.468,8	1.945,2	2.646,0	2.007,6	4.102,4	7.758,4	8.431,8	33,8
TOTAL EXCLUDING DESK	1.461,6	1.938,0	2.638,8	1.986,0	4.080,0	7.709,0	8.333,0	33,7
	PERCENTAGE							
DESK	0,5	0,4	0,3	1,1	0,5	0,7	1,2	
SMALL	67,6	66,6	53,4	37,9	32,7	20,8	24,3	
MEDIUM	9,9	16,4	34,1	44,9	30,5	17,6	16,2	
LARGE	22,0	16,6	12,2	16,1	15,8	17,6	8,5	
EXTRA LARGE	-	-	-	-	20,5	43,3	49,8	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI-a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM : 1962 TO 1968

BRANCH: CHEMICAL, RUBBER, GLASS,

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	4	5	8	9	13	21	41	47,4
SMALL	25	50	72	77	118	159	184	39,5
MEDIUM	1	7	5	9	12	13	14	55,2
LARGE	-	-	-	2	4	6	8	58,7
EXTRA LARGE	-	-	-	-	-	-	1	-
UNCLASSIFIED	-	-	-	-	1	-	-	-
TOTAL	30	62	85	97	148	199	248	42,2
TOTAL EXCLUDING DESK	26	57	77	88	135	178	207	41,3
	PERCENTAGE							
DESK	13,3	8,1	9,4	9,3	8,8	10,6	16,5	
SMALL	83,4	80,6	84,7	79,4	79,7	79,9	74,2	
MEDIUM	3,3	11,3	5,9	9,3	8,1	6,5	5,7	
LARGE	-	-	-	2,0	2,7	3,0	3,2	
EXTRA LARGE	-	-	-	-	-	-	0,4	
UNCLASSIFIED	-	-	-	-	0,7	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: CHEMICAL, RUBBER, GLASS,

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	58,3	74,5	83,7	52,2	91,8	193,5	375,9	36,4
SMALL	1.867,2	3.189,6	4.591,3	5.383,8	8.226,3	10.939,3	12.374,4	37,1
MEDIUM	174,0	1.078,8	788,4	717,6	1.978,8	2.302,8	2.565,6	56,6
LARGE	-	-	-	1.706,4	1.780,8	2.572,8	3.364,8	25,4
EXTRA LARGE	-	-	-	-	-	-	840,0	-
TOTAL	2.099,5	4.342,9	5.463,4	7.860,0	12.077,7	16.008,4	19.520,7	45,0
TOTAL EXCLUDING DESK	2.041,2	4.268,4	5.379,7	7.807,8	11.985,9	15.814,9	19.144,8	45,2
	PERCENTAGE							
DESK	2,8	1,7	1,5	0,7	0,8	1,2	1,9	
SMALL	88,9	73,4	84,0	68,5	68,1	68,3	63,4	
MEDIUM	8,3	24,9	14,5	9,1	16,4	14,4	13,2	
LARGE	-	-	-	21,7	14,7	16,1	17,2	
EXTRA LARGE	-	-	-	-	-	-	4,3	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE VI-a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: MOTOR

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	-	-	-	1	2	4	10	115,4
SMALL	15	23	30	41	45	46	61	26,3
MEDIUM	-	2	4	4	10	8	12	43,1
LARGE	-	-	-	6	4	4	5	5,9
EXTRA LARGE	-	-	-	-	1	3	4	100,0
UNCLASSIFIED	-	-	-	-	-	-	-	-
TOTAL	15	25	34	52	62	65	92	35,3
TOTAL EXCLUDING DESK	15	25	34	51	60	61	82	32,7
	PERCENTAGE							
DESK	-	-	-	1,9	3,2	6,2	10,9	
SMALL	100,0	92,0	88,2	78,9	72,6	70,7	66,3	
MEDIUM	-	8,0	11,8	7,7	16,1	12,3	13,0	
LARGE	-	-	-	11,5	6,5	6,2	5,4	
EXTRA LARGE	-	-	-	-	1,6	4,6	4,4	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: MOTOR

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	-	-	-	6,3	19,8	46,8	124,2	170,0
SMALL	1.236,0	1.657,2	2.106,0	2.980,8	3.297,6	3.447,6	4.177,1	22,5
MEDIUM	-	319,2	580,8	580,8	1.746,0	1.455,6	2.151,6	46,5
LARGE	-	-	-	3.840,0	2.316,0	1.584,0	1.980,0	- 19,8
EXTRA LARGE	-	-	-	-	840,0	2.520,0	3.360,0	100,0
TOTAL	1.236,0	1.976,4	2.686,8	7.407,9	8.219,4	9.054,4	11.792,9	45,6
TOTAL EXCLUDING DESK	1.236,0	1.976,4	2.686,8	7.401,6	8.199,6	9.007,2	11.668,7	45,4
	PERCENTAGE							
DESK	-	-	-	0,1	0,3	0,5	1,1	
SMALL	100,0	83,8	78,4	40,2	40,1	38,1	35,4	
MEDIUM	-	16,2	21,6	7,9	21,2	16,1	18,2	
LARGE	-	-	-	51,8	28,2	17,5	16,8	
EXTRA LARGE	-	-	-	-	10,2	27,8	28,5	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: AIRCRAFT AND GUIDED WEAPONS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	1	2	1	2	2	3	9	44,2
SMALL	31	35	43	44	53	57	54	9,7
MEDIUM	-	-	2	3	4	8	11	53,1
LARGE	1	1	1	2	4	3	3	20,1
EXTRA LARGE	-	-	-	-	-	-	-	-
UNCLASSIFIED	-	-	-	-	-	-	1	-
TOTAL	33	38	47	51	63	71	78	15,4
TOTAL EXCLUDING DESK	32	36	46	49	61	68	69	13,7
	PERCENTAGE							
DESK	3,0	5,3	2,1	3,9	3,2	4,2	11,5	
SMALL	94,0	92,1	91,5	86,3	84,2	80,3	69,2	
MEDIUM	-	-	4,3	5,9	6,3	11,3	14,1	
LARGE	3,0	2,6	2,1	3,9	6,3	4,2	3,9	
EXTRA LARGE	-	-	-	-	-	-	-	
UNCLASSIFIED	-	-	-	-	-	-	1,3	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows : TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: AIRCRAFT AND GUIDED WEAPONS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	7,2	23,4	16,2	24,2	24,2	32,2	80,9	49,7
SMALL	1.495,2	1.819,2	2.417,3	2.483,9	3.486,4	3.499,9	3.552,7	15,5
MEDIUM	-	-	300,0	450,0	600,0	1.290,0	1.902,0	58,7
LARGE	324,0	324,0	324,0	1.086,0	1.878,0	1.554,0	1.188,0	24,2
EXTRA LARGE	-	-	-	-	-	-	-	-
TOTAL	1.826,4	2.166,6	3.057,5	4.044,1	5.988,6	6.376,1	6.723,6	24,3
TOTAL EXCLUDING DESK	1.819,2	2.143,2	3.041,3	4.019,9	5.964,4	6.343,9	6.642,7	24,1
	PERCENTAGE							
DESK	0,4	1,1	0,5	0,6	0,4	0,5	1,2	
SMALL	81,9	84,0	79,1	61,4	58,2	54,9	52,8	
MEDIUM	-	-	9,8	11,1	10,0	20,2	28,3	
LARGE	17,7	14,9	10,6	26,9	31,4	24,4	17,7	
EXTRA LARGE	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: ELECTRICAL ENGINEERING

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	5	5	7	9	16	25	34	37,6
SMALL	31	55	56	71	97	110	122	25,1
MEDIUM	-	3	4	6	11	16	21	47,6
LARGE	-	-	-	1	2	2	2	26,0
EXTRA LARGE	-	-	-	-	-	-	-	-
UNCLASSIFIED	-	-	-	-	-	2	2	-
TOTAL	36	63	67	87	126	155	181	30,9
TOTAL EXCLUDING DESK	31	58	60	78	110	130	147	29,6
	PERCENTAGE							
DESK	13,9	7,9	10,4	10,4	12,7	16,1	18,8	
SMALL	86,1	87,3	83,6	81,6	77,0	71,0	67,4	
MEDIUM	-	4,8	6,0	6,9	8,7	10,3	11,6	
LARGE	-	-	-	1,1	1,6	1,3	1,1	
EXTRA LARGE	-	-	-	-	-	-	-	
UNCLASSIFIED	-	-	-	-	-	1,3	1,1	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows Table VI.4

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: ELECTRICAL ENGINEERING

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	76,3	81,0	105,2	145,8	193,6	293,2	400,4	31,8
SMALL	1.753,2	2.910,0	3.260,8	4.439,8	5.692,8	6.845,3	7.666,8	27,9
MEDIUM	-	459,6	628,8	1.004,4	1.916,4	2.752,8	3.891,6	53,3
LARGE	-	-	-	420,0	816,0	816,0	792,0	23,5
EXTRA LARGE	-	-	-	-	-	-	-	-
TOTAL	1.829,5	3.450,6	3.994,8	6.010,0	8.618,8	10.707,3	12.750,8	38,2
TOTAL EXCLUDING DESK	1.753,2	3.369,6	3.889,6	5.864,2	8.425,2	10.414,1	12.350,4	38,5
	PERCENTAGE							
DESK	4,2	2,4	2,6	2,4	2,2	2,8	3,2	
SMALL	95,8	84,3	81,6	73,9	66,1	63,9	60,1	
MEDIUM	-	13,3	15,8	16,7	22,2	25,7	30,5	
LARGE	-	-	-	7,0	9,5	7,6	6,2	
EXTRA LARGE	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: PUBLISHING, PRINTING, PAPER

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK			-	2	6	20	35	159,6
SMALL			14	18	24	46	64	46,2
MEDIUM			1	-	4	5	4	41,4
LARGE			-	-	-	1	1	-
EXTRA LARGE			-	-	-	-	1	-
UNCLASSIFIED			-	-	-	-	-	-
TOTAL			15	20	34	72	105	38,3
TOTAL EXCLUDING DESK			15	18	28	52	70	29,3
	PERCENTAGE							
DESK			-	10,0	17,6	27,8	33,3	
SMALL			93,3	90,0	70,6	63,9	60,9	
MEDIUM			6,7	-	11,8	6,9	3,8	
LARGE			-	-	-	1,4	1,0	
EXTRA LARGE			-	-	-	-	1,0	
UNCLASSIFIED			-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: PUBLISHING, PRINTING, PAPER

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK			-	30,6	79,2	234,8	418,3	139,1
SMALL			903,0	1.289,4	1.765,2	3.472,9	4.530,7	49,7
MEDIUM			145,2	-	639,6	902,4	757,2	51,1
LARGE			-	-	-	396,0	396,0	-
EXTRA LARGE			-	-	-	-	840,0	-
TOTAL			1.048,2	1.320,0	2.484,0	5.006,1	6.942,2	60,4
TOTAL EXCLUDING DESK			1.048,2	1.289,4	2.404,8	4.771,3	6523,9	57,9
	PERCENTAGE							
DESK			-	2,3	3,2	4,7	6,0	
SMALL			86,1	97,7	71,1	69,4	65,3	
MEDIUM			13,9	-	25,7	18,0	10,9	
LARGE			-	-	-	7,9	5,7	
EXTRA LARGE			-	-	-	-	12,1	
TOTAL			100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE VI.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: OTHERS MANUFACTURING (1)

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	4	6	12	18	28	61	154	83,7
SMALL	40	102	182	243	370	477	580	56,2
MEDIUM	2	8	19	31	26	39	53	72,7
LARGE	-	1	2	-	3	5	6	43,1
EXTRA LARGE	-	-	-	-	-	-	-	-
UNCLASSIFIED	-	-	-	-	-	-	1	-
TOTAL	46	117	215	292	427	582	794	60,8
TOTAL EXCLUDING DESK	42	111	203	274	399	521	640	57,4
	PERCENTAGE							
DESK	8,7	5,1	5,6	6,2	6,6	10,5	19,4	
SMALL	87,0	87,2	84,7	83,2	86,6	81,9	73,0	
MEDIUM	4,3	6,9	8,8	10,6	6,1	6,7	6,7	
LARGE	-	0,8	0,9	-	0,7	0,9	0,8	
EXTRA LARGE	-	-	-	-	-	-	-	
UNCLASSIFIED	-	-	-	-	-	-	0,1	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

(1) Foods, general and constructional engineering, retail, wholesale, sports, hotels.

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: OTHERS MANUFACTURING (1)

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	63,0	90,7	192,6	278,0	405,5	833,9	2.005,9	78,0
SMALL	2.732,4	6.219,6	10.827,0	15.872,4	24.879,6	32.113,9	38.338,4	55,3
MEDIUM	319,2	1.417,2	3.438,0	5.127,6	4.627,2	7.105,2	9.493,2	76,0
LARGE	-	-	-	-	792,0	1.560,0	2.304,0	70,6
EXTRA LARGE	-	-	-	-	-	-	-	-
TOTAL	3.114,6	7.727,5	14.457,6	21.278,0	30.704,3	41.613,3	52.141,5	59,9
TOTAL EXCLUDING DESK	3.051,6	7.636,8	14.265,0	21.000,0	30.298,8	40.779,1	50.135,6	59,4
	PERCENTAGE							
DESK	2,0	1,2	1,3	1,3	1,3	2,0	3,9	
SMALL	87,7	80,5	74,9	74,6	81,0	77,2	73,5	
MEDIUM	10,3	18,3	23,8	24,1	15,1	17,1	18,2	
LARGE	-	-	-	-	2,6	3,7	4,4	
EXTRA LARGE	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

(1) Foods, general and constructional engineering, retail; wholesale, sports, hotels.

TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: STEEL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERMANY (1)										
GROUPE THSSEN OBERHAUSEN	2.286,12	108.100	2.251,2	523,2	1.728,0	-	-	-	0,1	20,8
GROUPE FRIED, KRUPP	1.664,49	87.100	7.195,2	811,2	1.728,0	1.296,0	3.360,0	1 IBM 360/65	4,3	82,6
MANNESMANN	1.320,00	71.935	619,2	619,2	-	-	-	-	0,5	8,6
GROUPE RHEINISCHE STAHLWERKE	1.176,53	81.400	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
METALLGESELLSCHAFT AG	1.033,06	30.183	446,4	446,4	-	-	-	-	0,4	14,8
SALZGITTER KONZERN	918,37	72.000	787,2	787,2	-	-	-	-	0,9	10,9
OTTOWULFF KONZERN	631,22	29.020	446,4	446,4	-	-	-	-	0,7	15,4
KLOCHNER WERKE	615,92	38.853	2.308,8	1.396,8	912,0	-	-	-	3,7	59,4
STAHL PEINE-SALZGITTER	573,88	20.000	n.a	n.a	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
BUDERUS KONZERN	436,12	31.000	2.913,6	2.097,6	816,0	-	-	-	6,7	94,0
NORDDEUTSCHE RAFFINERIE	419,59	2.800	643,2	643,2	-	-	-	-	1,5	229,7
GEBRUDER STUMM GMBH	367,35	23.000	64,8	64,8	-	-	-	-	0,17	2,8
THSSEN ROHREN-WERKE	358,16	16.000	2.524,8	2.524,8	-	-	-	-	7,0	157,8
L. POSSEHL CO. GMBH	275,51	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
STAHLWERKE SUDWESTFALEN	274,29	12.460	393,6	393,6	-	-	-	-	1,4	31,6
FERROSTAAL	266,33	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
VEREINIGTE ALUMINIUM WERKE	237,76	12.732	886,8	886,8	-	-	-	-	3,7	69,7
VEREINIGTE DEUTSCHE METALL WERKE	226,12	13.000	1.012,8	1.012,8	-	-	-	-	4,5	77,9
DEUTSCHE EDELSTAHLWERKE	224,08	13.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
KABEL UND METALL WERKE	222,24	12.000	513,6	513,6	-	-	-	-	2,3	42,8
ROCHLING'SCHE EISEN STAHL WERKE	176,73	15.000	1.636,8	820,8	816,0	-	-	-	9,3	109,1

(1) SOURCE: DIRECT SURVEY

follows TABLE VI:b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: STEEL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
GERMANY										
EISENWERK MAXIMILIAN SHUTTEX	160,20	9.030	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PRUSSAG AG	(158,37)	6.000	1.617,6	705,6	912,0	-	-	-	10,2	269,6
AG DER DILLINGER HUTTENWERKE	157,55	5.334	580,8	580,8	-	-	-	-	3,7	108,9
NEUNKIRKER EISENWERKEAG	137,76	10.179	261,6	261,6	-	-	-	-	1,9	25,7
EISEN UND METALL	130,82	1.400	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
EISEN UND HUTTENWERKE	128,57	10.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DUISBURGER KUPFERHUETTE	120,41	4.091	1.008,0	384,0	624,0	-	-	-	8,4	246,4
HUTTENWERKE SIEGERLAND	116,94	4.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
HOESCH WALZWERKE HOHENLIMBURG	114,69	-	134,4	134,4	-	-	-	-	1,2	-
EDEL STAHLWERKE WITTEN AG	101,02	6.700	259,2	259,2	-	-	-	-	2,6	38,7
ITALY (1)										
ITALSIDER	919,45	37.427	8.121,6	2.745,6	912,0	4.464,0	-	-	8,8	217,0
ACCIAIERIE FERRIERE LOMBARDE FALK	175,69	13.504	912,0	-	912,0	-	-	-	5,2	67,5
DALMINE	169,56	11.460	3.168,0	-	-	3.168,0	-	-	18,7	276,4

(1) SOURCE: DIRECT SURVEY

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: STEEL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
FRANCE (1)										
PECHINEY	1.284,69	6.526	1.824,0	1008,0	816,0	-	-	-	1,4	279,5
WENDEL SIDELOR	829,59	47.184	1.766,4	273,6	1.492,8	-	-	-	2,1	37,4
USINOR	633,06	35.508	1.281,6	1.281,6	-	-	-	-	2,0	36,1
VALLOUREC	482,04	20.980	404,4	404,4	-	-	-	-	0,8	19,3
FORGES ET ATELIERS DU CREUSOT	306,12	17.010	1.383,6	1.383,6	-	-	-	-	4,5	81,3
ATELIEURS ET FORGES DE LA LOIRE	236,73	14.869	777,6	777,6	-	-	-	-	3,3	52,3
PENNAROYA	221,02	16.431	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-
CARNAUD ET FORGES BASSE INDRE	168,57	9.906	446,4	446,4	-	-	-	-	2,6	45,1
FONDERIES DE PONT A MOUSSON	133,06	6.310	1.718,4	134,4	-	1584,0	-	-	12,9	272,3
CHATILLON COMMENTRY NEUVES MAISONS	125,92	4.445	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LE NICHEL	125,92	4.786	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
HAUTS FORNEAUX DE LA CHIERS	118,57	6.779	64,8	64,8	-	-	-	-	0,5	9,6
LYON ALEMAND LOUYOT ET CIE	102,24	2.106	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NETHERLANDS (2)										
HOOGOVENS	331,38	16.900	2964,0	252,0	2.712,0	-	-	-	8,9	175,4
NEDERLANDSCHE STAATSMIJNEN	300,00	20.575	4368,0	-	1.008,0	-	3.360,0	UNIVAC 1108	16,2	179,8
NEDERLANDSCHE KABELFAB	250,00	10.964	1.339,2	1.339,2	-	-	-	-	5,4	122,1

(1) SOURCE: 0.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)
(2) SOURCE: J.M. VAN OORSCHOT

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: :STEEL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
NETHERLANDS										
BILLITON MAATSCMAPPIS	234,08	10.500	61,2	61,2	-	-	-	-	0,3	5,8
BELGIUM (1)										
METALLURGIE HOBOKEN	992,24	-	259,2	259,2	-	-	-	-	0,3	-
COCKERILL DUGREE PROVIDENCE	673,47	39.000	2.420,4	1.508,4	912,0	-	-	-	3,6	62,1
S.TE' MET HAINAULT - SAMBRE	125,51	7.628	964,8	100,8	864,0	-	-	-	7,7	126,5
SIDMAR	106,33	3.564	3.408,0	240,0	-	3.168,0	-	-	32,1	956,2
FORGES THY-MARCINELLE ET MONCEAU	106,33	5.950	374,4	374,4	-	-	-	-	3,5	62,9
UNITED KINGDOM (2)										
BRITISH STEEL	2.520,00	220.000	21.234,0	11.101,2	10.132,8	-	-	-	8,4	96,5
GUEST, KEEN & NETTLE FOLDS	1.213,94	100.816	480,0	480,0	-	-	-	-	0,4	4,8
RIO TINTO ZINC	814,02	6.449	744,0	744,0	-	-	-	-	0,9	115,4
AMALGAMATED METAL	546,84	825	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DELTA METAL	439,60	20.200	240,0	240,0	-	-	-	-	0,6	11,9
JOHNSON, MATTHEY & CO.	379,54	8.135	240,0	240,0	-	-	-	-	0,6	29,5

(1) SOURCE: SOBEMAP

(2) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: STEEL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
UNITED KINGDOM										
CONSOLIDATED TIN SMELTERS	283,22	1.465	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ALCAN ALUMINIUM	188,08	7.255	480,0	480,0	-	-	-	-	2,6	66,2
GEORGE COHENGOO GROUP	159,66	8.678	168,0	168,0	-	-	-	-	-	-
LEAD INDUSTRIES GROUP	156,30	6.162	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PILLAR	138,96	7.785	54,0	54,0	-	-	-	-	0,4	6,9
DUPORT	125,36	10.346	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
RICHARD JOHNSON & NEPHEW	112,39	3.160	168,0	168,0	-	-	-	-	1,5	53,2
MC. KECHNIE BROS	101,39	1.971	168,0	168,0	-	-	-	-	1,7	85,3
									3,9	62,4

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: STEEL

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
U.S. STEEL	4.537	201	49,61	10,93	246
BETHLEHEM STEEL	2.863	131	29,84	10,42	227
ARMCO STEEL	1.375	45	11,46	8,33	255
ALCOA	1.353	47	16,93	10,51	360
INLAND STEEL	1.074	30	10,63	9,90	354
KAISER ALUM. & CHEM.	850	28	11,88	13,98	424

SOURCE: EDP INDUSTRY REPORT, OCTOBER 9.1969.

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: OIL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERMANY (1)										
ESSO DEUTSCHLAND	1.268,98	5.131	6.619,2	1.766,4	1.492,8	-	3.360,0	1 IBM 360/65	5,2	1.290,0
ARAL AG	1.149,39	2.710	2.496,0	-	912,0	1.584,0	-	-	2,2	921,0
DEUTSCHE SHELL AG	1.104,69	5.562	3.561,6	201,6	-	-	3.360,0	1 UNIVAC 1108	3,2	640,3
B.P. DEUTSCHLAND	776,53	5.267	72,0	72,0	-	-	-	-	0,1	13,7
DEUTSCHE ERDOEL (TEXACO)	710,41	15.604	998,4	134,4	864,0	-	-	-	1,4	6,4
WINTERSHALL AG (BASF)	480,41	11.383	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
MOBIL OIL DEUTSCHLAND	352,86	2.414	1.171,2	259,2	912,0	-	-	-	3,3	485,2
GEISENBERG BENZIN AG	336,73	38.280	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
GASOLIN AG (ARAL)	231,43	-	259,2	259,2	-	-	-	-	1,1	n.a.
STROMEYER - LAGERHAUS (VEBA)	214,29	2.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
UNION RHEIN-BRAUN-KOHL KRAFTSTOFF	200,41	2.655	1.080,0	480,0	600,0	-	-	-	5,4	406,8
AGIP DEUTSCHLAND	177,14	360	259,2	259,2	-	-	-	-	1,5	720,0
FINA DEUTSCHLAND GRUPPE	165,71	935	134,4	134,4	-	-	-	-	0,8	143,7
									2,7	409,7
ITALY (2)										
AGIP (ENI)	1.097,38	6.208	4.042,8	874,8	-	3.168,0	-	-	3,7	651,2
ESSO STANDARD ITALIANA	878,37	2.342	2.275,2	691,2	-	1.584,0	-	-	2,6	971,5
SHELL ITALIANA	637,56	3.712	2.030,4	446,4	-	1.584,0	-	-	3,2	547,0
B.P. ITALIANA	336,38	1.267	350.4	350,4	-	-	-	-	1,0	276,6

(1) SOURCE: DIRECT SURVEY
(2) SOURCE: DIRECT SURVEY

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: OIL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows: ITALY										
TOTAL ITALIA	272,58	897	912,0	-	912,0	-	-	-	3,3	1.016,7
MOBIL OIL ITALIANA	252,87	1.475	1.152,0	240,0	912,0	-	-	-	4,6	781,0
API	172,83	928	134,4	134,4	-	-	-	-	0,8	144,8
CHEVRON OIL ITALIANA	166,14	566	912,0	-	912,0	-	-	-	5,5	1.611,3
FINA ITALIANA	136,56	913	446,4	446,4	-	-	-	-	3,3	488,9
AMOCO ITALIA	106,61	479	134,4	134,4	-	-	-	-	1,3	280,6
FRANCE (1)										
FRANCAISE DES PETROLES	1.572,65	24.000	446,4	446,4	-	-	-	-	0,3	18,6
ERAP ELF	1.112,24	15.980	1.920,0	-	-	1.920,0	-	-	1,7	120,2
SHELL FRANCAISE	798,98	-	3.777,6	417,6	-	-	3.360,0	1 UNIVAC 1108	-	-
FRANCAISE DE RAFFINAGE	763,88	3.504	2.380,8	748,8	1.632,0	-	-	-	3,1	679,5
ESSO STANDARD S.A.F.	516,33	5.469	3.172,8	676,8	912,0	1.584,0	-	-	6,1	580,1
PETROLES B.P.	500,61	5.760	1.915,2	331,2	-	1.584,0	-	-	3,8	332,5
BERRE	371,22	253	n.a.	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.
PETROLES D'AQUITAINE	270,61	4.300	912,0	-	912,0	-	-	-	3,4	212,1
ANTAR PETROLES DE L'ATLANTIQUE	242,04	3.873	1.012,8	432,0	580,8	-	-	-	4,2	261,5
MOBIL OIL FRANCAISE	235,10	2.801	878,4	878,4	-	-	-	-	3,7	313,6
PURFINA FRANCAISE	207,55	1.164	446,4	446,4	-	-	-	-	2,2	383,5

(1) SOURCE: 0.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

follows TABLE VI.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: OIL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
NETHERLANDS (1)										
ROYAL DUTCH - SHELL (2)	10.102,04	171.000	10.078,8	642,0	580,8	1.584,0	7.272,0	1 IBM 360/75 1 IBM 360/65	-	-
ESSO NEDERLAND	294,44	1.700	446,4	446,4	-	-	-	-	1,5	262,6
BELGIUM (3)										
PETROFINA (4)	1.493,88	18.500	1.824,0	-	1.824,0	-	-	-	-	-
UNITED KINGDOM (5)										
SHELL	-	-	13.671,4	446,4	912,0	1.584,0	6.720,0	2 UNIVAC 1108	-	-
BRITISH PETROLEUM (6)	-	23.900	9.918,0	1.662,0	1.536,0	-	6.720,0	2 UNIVAC 1108	-	-
SHELL MEX & B.P.	2.136,0	16.211	7.046,4	326,4	-	-	6.720,0	2 UNIVAC 1108	3,3	434,7
ESSO PETROLEUM	1.459,16	12.236	6.070,8	1.126,8	-	1.584,0	3.360,0	1 IBM 360/65	4,2	496,1
BURMAH OIL	590,77	8.109	912,0	-	912,0	-	-	-	1,5	112,5
CAWOODS HOLDING	189,14	3.076	n a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CHARRINGTON GARDNER	173,63	3.736	331,2	331,2	-	-	-	-	1,9	88,7
PETROFINA UK	171,61	1.670	446,4	446,4	-	-	-	-	2,6	267,3
ULTRAMARCO	155,01	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(1) SOURCE: J.M. VAN OORSCHOT
(2) CONSOLIDATED SALES, EQUIPMENTS INSTALLED IN THE COUNTRY ONLY
(3) SOURCE: SOBEMAP
(4) CONSOLIDATED SALES, EQUIPMENT INSTALLED IN THE COUNTRY ONLY
(5) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969
(6) CONSOLIDATED SALES, EQUIPMENTS INSTALLED IN THE COUNTRY ONLY

follows TABLE VI.b.[3]

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: OIL

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
STANDARD OIL (N.J.)	14.091	151	58,24	4,13	385
MOBIL OIL	6.221	78	49,71	7,99	637
TEXACO	5.460	78	30,49	5,58	391
GULF OIL	4.559	60	45,67	10,02	761
STANDARD OIL (CAL.)	3.634	48	30,22	8,34	629
STANDARD OIL (IND.)	3.214	48	44,17	13,74	920
CONTINENTAL OIL	2.251	34	13,88	6,16	408
PHILLIPS PETROLEUM	2.107	35	21,72	10,31	620
SUN OIL CO.	1.778	29	30,44	17,40	1.067
UNION OIL OF CAL.	1.536	17	12,04	7,84	708
SINCLAIR REFINING.	1.465	20	13,90	9,49	695
CITIES SERVICE	1.440	23	15,45	10,73	672
ATLANTIC RICHFIELD	1.414	20	23,13	16,36	1.156
STANDARD OIL (OHIO)	716	15	9,52	13,30	634

SOURCE: EDP INDUSTRY REPORT, OCTOBER 9.1969.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: CHEMICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERMANY (1)										
FARBEN FABRIKEN BAYER AG	2.559,80	90.000	10.645,2	1.837,2	-	8.808,0	-	-	4,2	118,3
FARB WERKE HOECHST AG	2.269,59	88.260	3.772,8	1.036,8	912,0	1.824,0	-	-	1,7	42,7
GROUPE BASF-WINTERSHALL	2.066,33	83.650	10.747,2	667,2	-	-	10.080,0	2 IBM 360/67 1 IBM 360/65	5,2	128,5
HENKEL INTERNATIONAL GMBH	734,69	26.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DEGUSSA AG.	676,12	13.050	1.479,6	471,6	1.008,0	-	-	-	2,2	113,4
GLANZ STOFF GROUPE (AKU)	459,18	26.000	4.454,4	1.094,4	-	-	3.360,0	1 UNIVAC 1108	9,7	171,3
VEBACHEMIE AG (SCHOLVEN CHEMIE)	430,41	6.422	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
AGFA - GEVAERT GROUPE	426,12	28.600	2.882,4	1.250,4	1.632,0	-	-	-	6,8	100,8
CONTINENTAL GUMMI WERKE AG.	413,67	26.504	3.320,4	1.496,4	1.824,0	-	-	-	8,0	125,3
CHEMISCHE WERKE HULS AG.	358,57	15.130	3.398,4	2.102,4	-	1.296,0	-	-	9,5	224,6
DYNAMITE NOBEL AG. (FLILK)	289,59	27.000	1.171,2	259,2	912,0	-	-	-	4,0	43,4
SCHERING AG. (PHARMACIE)	211,22	7.153	912,0	-	912,0	-	-	-	4,3	127,5
RUTAG-RUTGERS WERKE AG.	210,0	10.500	393,6	393,6	-	-	-	-	1,9	37,5
METZELER AG.	206,53	16.000	301,2	301,2	-	-	-	-	1,5	18,8
ANDREAE NORIS ZAHN	172,04	3.000	2.563,2	979,2	-	1.584,0	-	-	14,9	854,4
GROUPE DEUTSCHE SOLVAY WERKE GMBH	172,04	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
KNAPPSACK AG. (FARB HOECHST)	172,04	5.000	1.137,6	1.137,6	-	-	-	-	6,6	227,5
E. MERCK AG.	172,04	10.000	259,2	259,2	-	-	-	-	1,5	25,9
P. BEIERSDORF UNDCO AG.	143,88	4.300	364,8	364,8	-	-	-	-	2,5	84,8
IMPERIAL CHEMICAL INDUSTRIES DEUTSCHLAND GMBH	138,98	7.800	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(1) SOURCE: DIRECT SURVEY

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: CHEMICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
GERMANY										
WACKER CHEMIE GMBH	132,24	6.200	835,2	835,2	-	-	-	-	6,3	134,7
SALZ DETFURTH AG.	130,0	6.510	254,4	254,4	-	-	-	-	2,0	39,1
PHOENIX GUMMI WERKE	121,22	11.407	1.089,6	1.089,6	-	-	-	-	9,0	95,5
WELLA AG.	114,69	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
MESSER GRIESHEIM GMBH	104,29	-	912,0	-	912,0	-	-	-	8,7	-
EAU DE COLOGNE PARFUMERIE FABRIK-GMBH	103,27	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PHRIX WERKE AG.	100,20	-	912,0	-	912,0	-	-	-	9,1	-
ITALY (1)										
MONTECATINI EDISON	915,54	52.580	9.916,8	22.368,0	2.736,0	1.584,0	3.360,0	1 IBM 360/65	10,8	188,6
PIRELLI SPA	336,54	24.000	700,8	700,8	-	-	-	-	2,1	29,2
SNIA VISCOSA	316,27	21.276	1.824,0	-	1.824,0	-	-	-	5,8	85,7
ANIC	250,93	9.041	3.168,0	-	-	3.168,0	-	-	12,6	350,4
CHATILLON	138,93	8.491	1.358,4	446,4	912,0	-	-	-	9,8	160,0
MICHELIN ITALIANA	129,03	9.900	912,0	-	912,0	-	-	-	7,1	92,1
SOCIETA' RHODIATOCE P.A. (RHONE POULENC)	127,41	8.241	3.667,2	787,2	-	2.880,0	-	-	28,8	445,0

(1) SOURCE: DIRECT SURVEY

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: CHEMICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
ITALY										
SOCIETA' ITALIANA RESINE S.I.R.	126,82	4.968	268,8	268,8	-	-	-	-	2,1	54,1
CEAT	125,81	5.000	446,4	446,4	-	-	-	-	3,5	89,3
LEPETIT	107,09	3.820	1.180,8	364,8	816,0	-	-	-	11,0	309,1
FRANCE (1)										
RHONE POULENC-PROGIL-PECHINEY ST. GOBAIU-NAPHTCHIMIE	2.100,0	120.500	4.515,6	1.347,6	-	3.168,0	-	-	2,2	37,5
MICHELIN GROUPE (2)	1.020,41	68.000	643,2	643,2	-	-	-	-	-	-
UGINE KUHLMANN	1.003,47	28.530	583,2	583,2	-	-	-	-	0,6	20,4
ENTREPRISE MINIERE ET CHIMIQUE	367,35	14.909	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ROUSSEL UCLAF-CENTRALE DE DYNAMITE	359,18	-	1.598,4	686,4	912,0	-	-	-	4,5	-
L'AIR LIQUIDE	346,94	22.000	1.041,6	129,6	912,0	-	-	-	3,0	47,3
L'OREAL	219,39	15.000	1.171,2	259,2	912,0	-	-	-	5,3	78,1
KODAK-PATHE	164,29	8.500	1.400,4	1.400,4	-	-	-	-	8,5	164,8
KLEBER-COLOMBES	142,45	8.458	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PIERREFITTE	120,00	3.281	64,8	64,8	-	-	-	-	0,5	19,8
LEVER	111,43	2.239	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(1) SOURCE: 0.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)
(2) CONSOLIDATED SALES, EQUIPMENTS INSTALLED IN THE COUNTRY ONLY

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: CHEMICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
FRANCE										
DUNLOP	106,33	7.473	134,4	134,4	-	-	-	-	1,3	18,0
NETHERLANDS (1)										
AKU - KONINKLIJKE 20 UT. ORGANON (GROUPE)	1.467,76	91.300	4.832,4	512,4	2.736,0	1.584,0	-	-	3,3	52,9
SCHULTEN/HONIG	108,88	5.210	163,2	163,2	-	-	-	-	1,5	31,3
BELGIUM (2)										
SOLVAY	734,69	39.475	446,4	446,4	-	-	-	-	0,6	11,3
UNION CHIMIQUE BELGE	140,20	-	411,6	411,6	-	-	-	-	2,9	-

(1) SOURCE: J.M. VAN OORSCHOT

(2) SOURCE: SOBEMAP

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: CHEMICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
UNITED KINGDOM (1)										
IMPERIAL CHEMICAL INDUSTRIES	3.464,44	187.000	18.477.6	3.477,6	6.888,0	4.752,0	3.360,0	1 IBM 360/65	5,3	98,8
DUNLOP CO.	1.260,0	102.500	2.625.6	1.041,6	-	1.584,0	-	-	2,1	25,6
BOOTS PURE DRUG. CO.	594,08	46.000	3.195,6	1.371,6	1.824,0		-	-	5,4	69,5
BRITISH OXYGEN.	376,21	31.600	1.320,0	624,0	696,0	-	-	-	3,5	41,8
BEECHAM GROUP	374,78	15.494	1.718,4	134,4	-	1.584,0	-	-	4,6	110,9
GLAXO GROUP	360,08	26.940	930,0	930,0	-	-	-	-	2,6	34,5
ALBRIGHT & WILSON	313,32	14.800	1.200,0	1.200,0	-	-	-	-	3,8	81,1
TURNER & NEWALL	285,57	35.708	762,0	18,0	744,0	-	-	-	2,7	21,3
FISONS	241,98	8.878	571,2	571,2	-	-	-	-	2,4	64,3
WELLCOME FOUNDATION	175,0	5.659	777,6	777,6	-	-	-	-	4,4	131,4
GOODYEAR TIRE & RUBBER	164,53	9.312	1.852,8	268,8	-	1.584,0	-	-	11,3	199,0
PROCTER & GAMBLE	148,29	4.083	478,8	478,8	-	-	-	-	3,2	117,3
BRITISH ROPES	126,31	9.691	54,0	54,0	-	-	-	-	0,4	5,6
BAKELITE XYLONITE	121,46	11.026	446,4	446,4	-	-	-	-	3,7	40,5
BERGER, JENSON & NICHOLSON	114,41	4.254	384,0	384,0	-	-	-	-	3,4	90,3
BRITISH TITAN PRODUCTS CO.	103,54	2.292	387,6	387,6	-	-	-	-	3,7	169,1
LA PORTE INDUSTRIES	102,73	5.811	54,0	54,0		-	-	-	0,5	9,3

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: CHEMICALS

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
DU PONT	3.481	114	53,30	15,31	468
GOODYEAR TIRE & RUBBER	2.926	120	24,85	8,49	207
UNION CARBIDE	2.686	100	33,88	12,61	338
EASTMAN KODAK	2.644	108	33,43	12,64	310
FIRESTONE TIRE & RUBBER	2.131	102	10,19	4,78	100
TENNECO INC.	2.063	62	19,22	9,32	310
MONSANTO	1.793	60	19,82	11,05	330
W.R. GRACE	1.738	69	11,51	6,62	166
DOW CHEMICAL	1.652	47	23,04	13,95	490
UNIROYAL	1.429	68	15,47	10,82	227
ALLIED CHEMICAL	1.278	36	12,12	9,48	336
B.F. GOODRICH	1.140	48	17,55	15,39	366
GENERAL TIRE & RUBBER	1.039	46	25,40	25,45	552
OLIN MATHIESON	1.002	31	10,53	10,51	339
CHARLES PFIFZER & CO.	726	26	9,96	13,72	383
HERCULES	718	35	11,56	16,10	330

SOURCE: EDP INDUSTRY REPORT, OCTOBER 9.1969.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: MECHANICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERNAMY (1)										
VOLKSWAGEN WERK AG.	3.357,76	130.000	3.585,6	2.001,6	-	1.584,0	-	-	1,1	27,6
DAIMLER BENZ AG (MERCEDES)	2.037,55	108.100	4.137,6	825,6	1.728,0	1.584,0	-	-	2,0	38,3
ADAM OPEL AG	1.098,98	50.850	259,2	259,2	-	-	-	-	0,2	5,1
FORD WERKE AG.	737,35	37.100	3.744,0	1.296,0	2.448,0	-	-	-	5,1	100,9
KLOCHNER AUMBOLAT DEUTZ AG.	459,18	30.000	2.232,0	648,0	-	1.584,0	-	-	4,9	74,4
M.A.N. (Maschinenfabrik Augsburg Nurnberg)	441,02	35.230	2.073,6	1.161,6	912,0	-	-	-	4,7	58,9
AUDI-N.S.U.-AUTO UNION AG (VOLKSWAGEN)	367,35	22.000	518,4	518,4	-	-	-	-	1,4	23,7
B.M.W.	315,51	13.000	2.496,0	-	912,0	1.584,0	-	-	7,9	192,0
DEMAG AG	315,51	18.310	1.190,4	518,4	672,0	-	-	-	3,8	65,0
DEUTSCHE BABCOCK WILCOX AG.	271,84	12.500	2.064,0	480,0	-	1.584,0	-	-	7,6	165,1
FIRMA CARL-ZEISS GRUPPE	217,96	30.000	1.063,2	1.063,2	-	-	-	-	4,9	35,4
HANOMAG RENSCHELL FAHRZEUG WERKE	204,08	-	3.408,0	331,2	1.492,8	1.584,0	-	-	16,7	-
LINDE AG (FROID INDUSTRIEL)	194,29	10.411	1.339,2	1.339,2	-	-	-	-	6,9	128,6
AUTO UNION GMBH	185,71	77.000	259,2	259,2	-	-	-	-	1,4	3,4
DEUTSCHE FIAT	183,27	1.480	705,6	705,6	-	-	-	-	3,9	476,8
NSU MOTOREN WERKE AG.	181,63	11.000	892,8	892,8	-	-	-	-	4,9	81,2
ZAHNRADFABRIEK FRIEDRICHSHAFEN	179,18	14.826	259,2	259,2	-	-	-	-	1,5	17,5
DIEHL WERKE HECHENMASCHINEN	169,18	13.700	446,4	446,4	-	-	-	-	2,6	32,6
SACHS GRUPPE GMBH	159,80	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SKF KUGELLAGER FABRIK	152,04	16.500	518,4	518,4	-	-	-	-	3,4	31,4
RHEINMETALL BERLIN AG.	129,59	5.200	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(1) SOURCE: DIRECT SURVEY

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: MECHANICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
GERMANY										
DEUTSCHE RENAULT	127,96	1.247	134,4	134,4	-	-	-	-	1,1	107,8
J.M. VOLTH MASCHINENFABRIK GMBH	123,27	10.000	762,0	762,0	-	-	-	-	6,2	76,2
DEUTSCHE INDUSTRIL ANLAGEN GMBH	117,55	10.290	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LIEBHERR GMBH	111,22	5.990	388,8	388,8	-	-	-	-	3,5	64,9
KNORR BREMSE KG.	110,41	7.370	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
GERR. CLAAS MASCHINENFRABRIK GMBH	109,39	6.800	446,4	446,4	-	-	-	-	4,1	65,7
KRAUSS MAFFEI AG.	105,92	7.000	446,4	446,4	-	-	-	-	4,2	63,8
GUTEHOFFNUNGSHUTTE STERKRADE AG.	100,20	8.000	552,0	552,0	-	-	-	-	5,5	69,0
ITALY (1)										
FIAT	2.152,77	149.004	16.912,8	4.336,8	5.856,0	-	7.720,0	1 IBM 360/65 1 UNIVAC 1108	7,8	113,6
ING. OLIVETTI & CO.	664,49	60.700	5.874,8	718,8	3.572,0	1.584,0	-	(2 IBM 360/65)	8,3	96,8
ALFA ROMEO	305,29	14.639	1.824,0	-	1.824,0	-	-	-	6,0	124,6
SNAM PROGETTI	172,51	9.586	1.584,0	-	-	1.584,0	-	-	9,2	165,2
INNOCENTI	137,74	6.280	580,8	580,8	-	-	-	-	4,2	92,5
LANCIA	120,85	11.121	969,6	105,6	864,0	-	-	-	8,0	87,2
RIV-SKF	116,90	10.077	1.958,4	134,4	1.824,0	-	-	-	16,8	194,3

(1) SOURCE: DIRECT SURVEY

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: MECHANICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
FRANCE (1)										
RENAULT	1.955,10	76.060	2.764,8	1.468,8	-	1.296,0	-	-	1,4	36,4
PEUGEOT	982,24	61.354	1.939,2	446,4	1.492,8	-	-	-	2,0	31,6
CITROEN	782,86	-	867,6	867,6	-	-	-	-	1,1	-
SIMCA	543,86	22.318	1.099,2	1.099,2	-	-	-	-	2,0	49,3
F.F.S.A.	357,14	8.417	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
BABCOCK-WILCOX-FIVESLILLE-CAIL	300,00	27.855	802,8	802,8	-	-	-	-	2,7	28,8
BERLIET	295,31	17.212	1.766,4	134,4	1.632,0	-	-	-	6,0	102,6
SAVEM	249,59	11.292	715,2	715,2	-	-	-	-	2,9	63,3
FRANCAISE DU FERODO	137,35	10.658	494,4	494,4	-	-	-	-	3,6	46,4
MASSEY FERGUSON	133,67	4.550	268,8	268,8	-	-	-	-	2,0	59,1
CHAUSSON	133,47	9.601	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TUNZINI AMELIORAIR	133,06	7.713	64,8	64,8	-	-	-	-	0,5	8,4
INTERNATIONAL HARVESTER FRANCE	122,24	5.898	580,8	580,8	-	-	-	-	4,8	98,5
STEINET ROUBAIX	102,04	4.000	196,8	196,8	-	-	-	-	1,9	49,2
NETHERLANDS (2)										
VERENIGDE MACHINE FABRIEKEN	312,24	27.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DAF	179,18	8.496	1.012,8	100,8	912,0	-	-	-	5,7	119,2

(1) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

(2) SOURCE: J.M. VAN OORSCHOT

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: MECHANICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
NETHERLANDS										
FORD NEDERLANDSCHE	136,53	1.457	134,4	134,4	-	-	-	-	1,0	92,2
UNITED KINGDOM (1)										
BRITISH LEYLAND MOTOR	2.539,60	188.247	8.895,6	5.247,6	3.648,0	-	-	-	3,5	47,3
FORD MOTOR	1.366,40	-	7.842,0	1.458,0	-	3.024,0	3.360,0	1 IBM 360/65	5,7	-
TUBE INVESTIMENTS	700,36	61.195	355,2	355,2	-	-	-	-	0,5	5,8
VAUXHALL MOTORS	605,81	36.353	6.187,2	283,2	2.736,0	3.168,0	-	-	10,2	170,2
JOSEPH LUCAS (INDUSTRIES)	597,24	69.155	2.835,6	1.179.6	1.656,0	-	-	-	4,8	41,0
ROOTES MOTORS	492,55	24.253	1.632,0	720,0	912,0	-	-	-	3,3	67,3
MASSEY-FERGUSON HOLDINGS	352,04	18.016	3.417,6	921,6	912,0	1.584,0	-	-	9,7	189,7
BABCOK & WILCOX	280,42	21.432	1.638,0	726,0	912,0	-	-	-	5,8	76,4
JOHN BROWN	217,84	19.145	427,2	427,2	-	-	-	-	2,0	22,3
KENNING MOTORS GROUP	203,70	8.455	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ASSOCIATED ENGINEERING	198,07	26.135	2.115,6	2.115,6	-	-	-	-	10,7	81,0
SIMON ENGINEERING	190,93	9.904	744,0	-	744,0	-	-	-	3,90	75,1
BIRMID QUALCAST	183,71	17.599	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
THOS W WARD	182,28	11.197	168,0	168,0	-	-	-	-	0,9	15,0

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH : MECHANICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
UNITED KINGDOM										
SMITHS INDUSTRIES	171,50	23.200	1.292,4	1.292,4	-	-	-	-	7,5	55,7
DAVID BROWN CORPN.	166,80	17.800	396,0	396,0	-	-	-	-	2,4	22,3
HOOVER	164,33	9.134	1.852,8	268,8	-	1.584,0	-	-	11,3	202,9
STONE PLATT INDUSTRIES	156,91	14.943	1.395,6	1.395,6	-	-	-	-	8,9	93,4
HENLYS	156,69	4.613	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DAVY ASHMORE	140,59	8.553	598,8	-	-	-	-	-	4,3	70,0
WEIR GROUP	135,21	12.017	733,2	61,2	672,0	-	-	-	5,4	61,0
STAWELEY INDUSTRIES	130,37	10.828	1.288,8	376,8	912,0	-	-	-	9,9	119,0
AUTOMATIVE PRODUCT ASSOC.	126,84	10.386	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a
COPE ALLMAN INTERNATIONAL	126,20	7.510	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
HARGREAVES GROUP CO	116,65	2.387	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CATERPILLAR TRACTOR	113,71	4.878	1.152,0	1.152,0	-	-	-	-	10,1	236,2
JOHN THOMPSON	113,09	7.439	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ALFRED HERBERT	111,38	11.495	187,2	187,2	-	-	-	-	1,7	16,3
DOWTY GROUP	110,24	12.481	240,0	-	-	-	-	-	2,2	19,2
BIRMINGHAM SMAL ARMS	112,31	7.811	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: MECHANICAL

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
GENERAL MOTORS	22.755	757	228,90	10,06	302
FORD MOTOR CO.	14.075	415	139,00	9,88	334
CHRYSLER	7.745	231	67,84	8,76	293
INT'L HARESTER	2.540	106	26,98	10,62	254
CATERPILLAR TRACTOR	1.707	61	23,42	13,72	383
J. DEERE CO.	1.030	42	15,51	15,06	369

SOURCE: EDP INDUSTRY REPORT, OCTOBER 9.1969.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: AERONAUTICAL

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERMANY (1)										
MESSERSCHMITT BOLKOW BLOHM GMBH GRUPPE	258,16	20.600	3.100,8	2.188,8	912,0	-	-	-	12,0	150,5
VFW GMBH	160,61	12.000	5.294,4	393,6	3.316,8	1.584,0	-	-	33,0	441,2
FRANCE (2)										
SUD AVIATION - NORD AVIATION-SEREB	540,00	42.000	19.584,2	2.736,2	4.320,0	5.088,0	7.440,0	IBM 360/65 CDC 6.600	36,3	466,3
SNECMA	269,59	17.745	3.115,2	902,4	2.212,8	-	-	-	11,6	175,6
ENGINS MATRA	66,33	2.746	1.584,0	-	-	1.584,0	-	-	23,9	576,8
UNITED KINGDOM (3)										
HAWKER SIDDELEY GROUP	1.070,66	98.000	8.439,6	5.127,6	3.312,0	-	-	-	7,9	86,1
ROLLS - ROYCE	894,71	85.064	20.760,4	6.272,1	3.024,0	1.584,0	10.080,0	3 IBM 360/65	23,4	246,4
BRITISH AIRCRAFT	536,0	35.879	17.259,6	3.315,6	7.608,0	6.636,0	(3.360,0)	(1 IBM 360/65)	32,2	481,1
WESTLAND AIRCRAFT	112,92	11.475	1.584,0	-	-	1.584,0	-	-	14,0	138,0

(1) SOURCE: DIRECT SURVEY

(2) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

(3) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: AERONAUTICAL

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
MC DONNELL-DOUGLAS	3.609	125	98,50	27,29	788
BOEING	3.274	142	140,00	42,76	986
GENERAL DYNAMISS	2.662	101	60,85	22,86	602
NORTH AM. ROCKWELL	2.640	114	82,56	31,27	724
UNITED AIRCRAFT	2.408	76	41,50	17,23	546
LOCKHEED	2.217	95	93,90	42,35	988
TRW	1.488	80	29,88	20,08	373
GRUMMAN AIRCRAFT	1.152	36	26,99	23,43	749
MARTIN MARIETTA	682	27	34,06	14,94	1.261
NORTHROP	485	25	14,38	29,65	575

SOURCE: EDP INDUSTRY REPORT, OCTOBER 9.1969.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ELECTRICAL AND ELECTRONICS

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERMANY (1)										
SIEMENS AG.	2.509,39	256.400	27.594,0	16.170,0	11.424,0	-	-	-	11,0	107,6
AEG-TELEFUNKEN	1.679,39	146.400	1.824,0	379,2	1.444,8	-	-	-	1,1	12,5
GUTEHOFFNUNGSHUETTE	1.395,31	93.080	552,0	552,0	-	-	-	-	0,4	5,9
ROBERT BOSCH GMBH	1.061,84	98.900	3.549,6	957,6	-	2.592,0	-	-	3,3	35,9
GRUNDING VERKE GMBH	503,06	23.000	259,2	259,2	-	-	-	-	0,5	11,3
ALLGEMEINE DEUTSCHE PHILIPS INDUSTRIE GMBH	483,47	25.340	705,6	705,6	-	-	-	-	1,5	27,9
DEUTSCHE BROWN BOVERY AG.	417,14	35.600	3.288,0	1.080,0	912,0	1.296,0	-	-	7,9	92,4
FELTEN GUILLEAUME CARLS WERKE AG.	363,06	21.000	1.008,0	-	1.008,0	-	-	-	2,8	48,0
STANDARD ELECTRIK LORENZ AG (ITT)	327,14	30.000	3.177,6	1.353,6	1.824,0	-	-	-	9,7	105,9
BERG. ANN ELEKTRICITAETS WERKE AG.	201,02	18.300	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
VARTA AG. (PILES)	180,41	6.100	2.064,0	825,6	-	1.238,4	-	-	11,4	338,4
OSRAM GMBH	172,04	13.000	2.707,2	259,2	2.448,0	-	-	-	15,7	208,3
G. BAUKNECHT ELEKTRO-TECHNISCHE	149,18	11.000	259,2	259,2	-	-	-	-	1,7	23,6
TELEFONBAU NORMALZEIT LEHNER & CO.	137,76	16.700	580,8	580,8	-	-	-	-	4,2	34,8
VORWERK & CO. ELEKTRO WERKE KG.	118,37	10.000	1.824,0	-	1.824,0	-	-	-	15,4	182,4
OLYMPIA WERKE AG.	117,14	16.200	3.129,6	393,6	2.736,0	-	-	-	26,7	193,2
MIELE & GE GMBH	114,69	7.600	705,6	705,6	-	-	-	-	6,2	92,8
ALFRED TEVES (GMBH)	112,86	10.500	1.492,8	580,8	912,0	-	-	-	13,2	142,2

(1) SOURCE: DIRECT SURVEY

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ELECTRICAL AND ELECTRONICS

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
ITALY (1)										
ELETTROCARBONIUM	203,27	-	134,4	134,4	-	-	-	-	0,7	-
PHILIPS	127,98	7.222	480,0	480,0	-	-	-	-	3,8	66,5
INDUSTRIE A. ZANUSSI	122,41	10.138	1.824,0	-	1.824,0	-	-	-	14,9	179,9
IGNIS	117,85	8.518	417,6	417,6	-	-	-	-	3,5	49,0
FRANCE (2)										
GENERALE D'ELECTRICITE	1.124,29	77.200	912,0	-	912,0	-	-	-	0,8	11,8
THOMSON BRANDT (Y COMPRIS CSF)	1.045,31	76.136	1.344,0	1.344,0	-	-	-	-	1,3	17,7
FRANCAISE PHILIPS	551,02	-	518,4	518,4	-	-	-	-	0,9	-
ALSTHOM	260,82	14.146	456,0	456,0	-	-	-	-	1,7	32,2
COMPAGNIE DES COMPTEURS	207,35	20.024	494,4	494,4	-	-	-	-	2,4	24,7
JEUMONT SCHNEIDER	189,59	11.705	139,2	139,2	-	-	-	-	0,7	11,9
D.B.A.	189,39	18.524	134,4	134,4	-	-	-	-	0,7	7,3
SAGEM	175,51	13.073	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
RADIOTECHNIQUE	158,78	10.477	364,8	364,8	-	-	-	-	2,3	34,8
COMPAGNIE ELECTRO-MECANIQUE	149,39	10.578	259,2	259,2	-	-	-	-	1,7	24,5

(1) SOURCE: DIRECT SURVEY
(2) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE 1968

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ELECTRICAL AND ELECTRONICS

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
NETHERLANDS (1)										
PHILIPS N.V.	3.013,67	265.000	17.932,8	4.276,8	3.072,0	6.672,0	3.912,0	1 IBM 360/75	5,9	67,7
BELGIUM (2)										
A.C.E.C.	143,88	13.400	3.648,0	240,0	1.824,0	1.584,0	-	-	25,4	272,2
UNITED KINGDOM (3)										
BRITISH INSULATED CALLENDERS CABLES	915,60	33.500	1.363,2	763,2	600,0	-	-	-	1,5	40,7
THORN ELECTRICAL	491,82	48.404	2.146,8	2.146,8	-	-	-	-	4,4	44,4
ELECTRIC & MUSICAL INDUSTRIES	344,40	27.900	2.208,0	1.627,2	580,8		-	-	6,4	79,1
RAYROLL CARSONS	215,52	21.590	2.256,0	672,0	-	1.584,0	-	-	10,5	104,5
CHLORIDE ELECTRICAL STORAGE	153,44	15.911	364,8	364,8	-	-	-	-	2,4	22,9
GESTETNER	152,74	5.280	446,4	446,4	-	-	-	-	2,9	84,6
DECCA	131,60	7.967	1.358,4	446,4	912,0	-	-	-	10,3	170,5
EVER READY CO. (GREAT BRITAIN)	107,94	9.099	1.608,0	-	1.608,0	-	-	-	14,9	176,7
RENOLD	102,31	11.945	696,0	-	696,0	-	-	-	6,8	58,3

(1) SOURCE: J.M. VAN OORSCHOT

(2) SOURCE: SOBEMAP

(3) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: ELECTRICAL AND ELECTRONICS

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
GENERAL ELECTRIC	8.382	400	220,00	26,25	550
ITT	4.066	293	42,38	10,40	144
WESTERN ELECTRIC	4.032	177	60,67	15,05	342
WESTINGHOUSE	3.296	138	89,18	27,06	646
RCA	3.106	125	60,00	19,32	480
GENERAL TELEPHONE	2.927	161	47,94	16,38	298
SPERRY RAND	1.563	101	85,00	54,38	841
BENDIX	1.389	68	23,65	17,03	347
HONEYWELL	1.281	74	24,75	19,32	334
RAYTHEON	1.158	52	26,64	23,01	512
NCR	1.102	91	30,00	27,22	330
XEROX	896	28	27,42	30,60	979
MOTOROLA	775	41	17,79	22,95	433
ALLIS-CHALMERS	767	31	10,03	13,08	323
TEXAS INSTRUMENTS	671	47	11,69	17,42	249
BURROUGHS	658	45	17,91	27,22	398

SOURCE: EDP INDUSTRY, OCTOBER 9.1969.

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLISHING AND PAPER MAKING

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
GERMANY (1)										
AXEL SPRINGER GMBH	257,14	13.000	1.382,4	1.382,4	-	-	-	-	5,4	106,4
FELDMUHLE AG.	236,12	29.043	912,0	-	912,0	-	-	-	3,9	31,4
BERTELSMANN VERSAG GUTERSLOH	177,76	-	259,2	259,2	-	-	-	-	1,5	-
SCHMALBACH LUBECA AG.	168,78	13.180	1.113,6	201,6	912,0	-	-	-	6,6	84,5
ZELLSTOFFABRIK WALDHOF	149,59	10.129	360,0	360,0	-	-	-	-	2,4	35,5
GRUNER & JAHR GMBH	143,67	4.390	580,8	580,8	-	-	-	-	4,0	132,3
MELITTA WERKE	137,14	8.000	705,6	705,6	-	-	-	-	5,2	88,2
BURDABRUCK VERLAG GMBH	135,92	4.750	864,0	-	864,0	-	-	-	6,4	181,9
HEIHR	131,02	-	446,4	446,4	-	-	-	-	3,4	-
FRANCE (2)										
NUOVELLE MESSAGERIE PRESS PARISIENNE	n.a.	n.a	7.729,0	-	-	-	7.720,0	2 IBM 360/65	-	-
CELLULOSE DU PIN	149,39	7.200	196,8	196,8	-	-	-	-	1,3	27,3

(1) SOURCE: DIRECT SURVEY

(2) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLISHING AND PAPER MAKING

COMPANIES	SALES (millions $)	EMPLOYEES (number)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
NETHERLANDS (1)										
BUHRMANNS - TETTERODENIJ	153,06	4.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
KONINKLIJKE PAPIERFABRIKEM	140,41	2.675	374,4	374,4	-	-	-	-	2,7	140,4
MEULENHOFF & CO.	124,90	-	134,4	134,4	-	-	-	-	1,1	-
VAN GELDER ZONEN	111,11	6.800	446,4	446,4	-	-	-	-	4,0	65,6
UNITED KINGDOM (2)										
BEED PAPER GROUP	790,61	54.000	2.349.6	2.349,6	-	-	-	-	3,0	43,5
BOWATER PAPER CORPN	598,08	29.500	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
INTERNATIONAL PUB CORPN	436,86	30.600	3.250,8	754,8	912,0	1.584,0	-	(1 UNIVAC 1108)	7,4	106,2
DICKINSON ROBINSON	315,17	26.910	892,8	892,8		-	-	-	2,8	33,2
WIGGINS TEAPE	285,12	20.423	782,4	782,4	-	-	-	-	2,7	38,3
THOMSON ORGANISATION	251,72	19.028	873,6	873,6	-	-	-	-	3,5	45,9
BRITISH PRINTING CORPN	174,52	19.822	806,4	806,4	-	-	-	-	4,6	40,7
BPB INDUSTRIES	162,85	10.800	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ASSOCIATED NEWSPAPERS	142,16	14.600	4.334,4	1.732,8	2.601,6	-	-	-	30,5	309,6
BEAVER BROOK NEWSPAPERS	116,31	9.420	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
BUNZL PULP AND PAPER	111,30	3.467	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(1) SOURCE: J.M. VAN OORSCHOT

(2) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE VI.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN USA

BRANCH: PUBLISHING AND PAPER MAKING

COMPANIES	SALES (millions $)	EMPLOYEES (.000 $)	VALUE OF COMPUTERS INSTALLED (millions $)	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE PAR EMPLOYEES ($)
INT'L PAPER	1.562	54	12,30	7,87	227
WEYERHAUSER	1.033	38	18,43	17,84	485
MEAD	897	23	12,37	13,79	537

SOURCE: EDP INDUSTRY, OCTOBER 9.1969.

CHAPTER VII

TABLE VII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES IN U.K. IN 1969

BRANCH: RETAIL STORES

COMPANIES	SALES (millions $)	EMPLOYEES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE $ EMPLOYEES
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
UNITED KINGDOM (1)										
GREAT UNIVERSAL STORES	999,80	55.506	1.584,0		-	1.584,0	-		1,6	28,54
F.W. WOOLWORTH	828,02	92.335	868,8	868,8	-	-	-		1,0	9,41
TESCO STORES	535,95	21.220	618,0	618,0	-	-	-		1,2	29,12
LITTLE WOODS	476,00	28.000	1.185,6	1.185,6	-	-	-		2,5	42,34
UNITED DRAPERY STORES	325,53	32.445	480,0	480,0	-	-	-		1,5	14,79
HOUSE OF FRASER	305,98	27.270	750,0		750,0	-	-		2,5	27,50
DEBENHAMS	294,39	31.786	331,2	331,2	-	-	-		1,1	10,42
W.H. SMITH & SON	282,77	18.735	777,6	777,6	-	-	-		2,7	41,51
INTERNATIONAL STORES	281,00	n.a.	446,4	446,4	-	-	-		1,6	
JOHN LEWIS PARTNERSHIP	252,28	18.250	912,0	-	912,0		-		3,6	49,97
CORY	168,80	3.900	360,0	360,0	-	-	-		2,1	92,31
BRITISH HOME STORES	165,68	12.123	446,4	446,4	-	-	-		2,7	36,82
GRATTAN WAREHOUSES	155,23	3.741	480,0	480,0		-	-		3,1	128,31
MOORER STORES	131,96	7.742	168,0	168,0	-	-	-		1,3	21,70
JOHN MENZIES	122,53	5.960	316,8	316,8	-	-	-		2,6	53,15

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM, NOVEMBER/DECEMBER 1969

follows TABLE VII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES IN U.K. IN 1969

BRANCH: RETAIL STORES

COMPANIES	SALES (millions $)	EMPLOYEES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE $ EMPLOYEES
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
UNITED KINGDOM										
FREEMANS	117,07	5.270	840,0	-	840,0	-	-		7,2	159,39
MORRIS & DAVID JONES	114,80	2.340	n.a.							
JOHN HOLT & CO.	101,61	1.206	168,0	168,0	-	-	-		1,7	139,30
BELGIUM (1)										
SARMA	170,00	8.000	892,8	892,8	-	-	-		5,3	111,60
G.B. ENTREPRISES	135,42	n.a.	1.046,4	134,4	912,0	-	-		7,7	
NETHERLANDS (2)										
ALBERT HEYN	201,94	8.547	1.824,0	-	1.824,0	-	-		9,0	213,41
DE GRUYTER	150,00	7.203	350,4	350,4	-	-	-		2,3	48,65

(1) SOURCE: SOBEMAP

(2) SOURCE: J.M. VAN OORSCHOT

follows TABLE VII-b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES IN U.K. IN 1969

BRANCH: RETAIL STORES

COMPANIES	SALES (millions $)	EMPLOYEES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE $ EMPLOYEES
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
FRANCE (1)										
LIBRERIE HACHETTE	517,55	6.000	964,8	964,8	-	-	-		1,9	160,80
NOUVELLES GALERIES REUNIES	473,13	23.200	976,8	64,8	912,0	-	-		2,1	42,10
GALERIES LAFAYETTE	423,14	17.398	4.060,8	892,8	-	3.168,0	-		9,6	233,41
AU PRINTEMPS PRISUNIC	402,43	14.500	n.a.							
CASINO GUICHARD PERRACHON	317,41	8.000	n.a.							
DOCKS REMOLS FAMILISTERE	304,90	11.891	364,8	364,8	-	-	-		1,2	30,68
PARIS FRANCE	180,71	8.097	n.a.							
LA REDOUTE	155,93	3.183	3.168,0	-	-	3.168,0	-		20,3	995,28
SAFIC ALCAN	148,29	166	n.a.							
DOCKS DE FRANCE	134,58	3.602	259,2	259,2	-	-	-		1,9	71,96
POMONA	122,66	2.463	204,0	204,0	-	-	-		1,7	8,28
GOULET TURPIN	114,59	3.371	364,8	364,8					3,2	108,22
SOCIETE FELIX POTIN	107,05	2.017	n.a.							
BAZAR DE L'HOTEL DE VILLE	105,51	2.716	794,4	794,4					7,5	292,49
ECONOMATS DU CENTRE	101,82	3.454	n.a.							

(1) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

follows TABLE VII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES IN U.K. IN 1969

BRANCH: RETAIL STORES

COMPANIES	SALES (millions $)	EMPLOYEES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE $ EMPLOYEES
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
FRANCE										
CEDIS	100,80	3.289	480,0	480,0					4,8	145,94
ITALY (1)										
MAGAZZINI STANDA	409,0	17.538	1.584,0	-	-	1.584,0	-		3,9	90,32
LA RINASCENTE	291,0	11.970	1.824,0	-	1.824,0	-	-		6,3	152,38
SIDERCOMIT	113,0	1.267	912,0	-	912,0	-	-		8,1	719,81
				-	-	-	-			
GERMANY (2)										
KARSTADT	907,25	n.a.	1.704,0	264,0	-	1.440,0	-		1,8	
KAUFHOF KONZERN	777,50	n.a.	5.520,0	768,0	4.752,0	-	-		7,2	

(1) SOURCE: DIRECT SURVEY
(2) SOURCE: DIRECT SURVEY

follows TABLE VII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES IN U.K. IN 1969

BRANCH: RETAIL STORES

COMPANIES	SALES (millions $)	EMPLOYEES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES	COMPUTERS VALUE $ EMPLOYEES
			TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE			
follows:										
GERMANY										
HORTEN	528,00	30.000	1.440,0	-	-	1.440,0	-		2,7	48,00
NECKERMANN VERSAND	378,00	19.200	4.579,2	1.411,2	-	3.168,0	-		12,1	238,50

CHAPTER VIII

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: BANKS, STOCKBROKERS BUILDING SOCIETIES

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	-	2	4	19	15	38	72	104,8
SMALL	32	64	95	119	129	150	206	36,4
MEDIUM	3	13	25	29	39	60	68	68,2
LARGE	-	-	2	3	8	15	17	70,7
EXTRA LARGE	-	-	-	-	1	4	5	123,6
UNCLASSIFIED	-	-	-	-	-	1	-	-
TOTAL	35	79	126	170	192	268	368	48,0
TOTAL EXCLUDING DESK	35	77	122	151	177	230	296	42,7
	PERCENTAGE							
DESK	-	2,5	3,2	11,2	7,8	14,1	19,6	
SMALL	91,4	81,0	75,4	70,0	67,2	56,0	56,0	
MEDIUM	8,6	16,5	19,8	17,0	20,3	22,4	18,5	
LARGE	-	-	1,6	1,8	4,2	5,6	4,6	
EXTRA LARGE	-	-	-	-	0,5	1,5	1,3	
UNCLASSIFIED	-	-	-	-	-	0,4	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VIII.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: BANKS, STOCKBROKERS, BUILDING SOCIETIES

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands of dollars)							
DESK	-	12,6	45,0	288,0	233,1	551,7	1.021,2	140,8
SMALL	1.986,6	3.907,8	5.999,4	8.222,4	9.011,4	11.453,9	14.706,1	39,6
MEDIUM	522,0	2.086,8	3.967,2	4.916,4	6.751,2	8.891,9	12.616,8	70,0
LARGE	-	-	988,8	1.384,8	4.130,4	6.235,2	7.027,2	63,3
EXTRA LARGE	-	-	-	-	840,0	3.360,0	4.200,0	123,6
TOTAL	2.508,6	6.007,2	11.000,4	14.811,6	20.966,1	30.492,7	39.571,3	58,4
TOTAL EXCLUDING DESK	2.508,6	5.994,6	10.955,4	14.523,6	20.733,0	29.941,0	38.550,1	57,7
	PERCENTAGE							
DESK	-	0,2	0,4	1,9	1,1	1,8	2,6	
SMALL	79,2	65,1	54,5	55,5	43,0	37,6	37,2	
MEDIUM	20,8	34,7	36,1	33,2	32,2	29,2	31,9	
LARGE	-	-	9,0	9,4	19,7	20,4	17,7	
EXTRA LARGE	-	-	-	-	4,0	11,0	10,6	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE VIII.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM: 1962 TO 1968

BRANCH: BANKS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	-	2	2	3	2	22	53	92,6
SMALL	15	30	44	62	72	80	119	41,2
MEDIUM	2	6	15	18	26	46	50	71,0
LARGE	-	-	-	1	5	10	12	128,9
EXTRA LARGE	-	-	-	-	1	4	5	123,6
UNCLASSIFIED	-	-	-	-	-	-	-	-
TOTAL	17	38	61	84	106	162	239	55,5
TOTAL EXCLUDING DESK	17	36	59	81	104	140	186	49,0
	PERCENTAGE							
DESK	-	5,3	3,3	3,6	1,9	13,6	22,2	
SMALL	88,2	78,9	72,1	73,8	67,9	49,4	49,8	
MEDIUM	11,8	15,8	24,6	21,4	24,5	28,4	20,9	
LARGE	-	-	-	1,2	4,7	6,2	5,0	
EXTRA LARGE	-	-	-	-	1,0	2,4	2,1	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VIII.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: BANKS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands of dollars)							
DESK	-	12,6	12,6	28,8	22,5	292,5	715,2	124,3
SMALL	1.012,2	1.938,6	2.906,4	4.363,8	5.102,4	6.589,7	8.664,3	43,0
MEDIUM	348,0	952,8	2.346,0	3.058,8	4.455,6	6.321,5	9.248,4	72,7
LARGE	-	-	-	396,0	1.980,0	3.960,0	4.752,0	128,9
EXTRA LARGE	-	-	-	-	840,0	3.360,0	4.200,0	123,6
TOTAL	1.360,2	2.904,0	5.265,0	7.847,4	12.400,5	20.523,7	27.579,9	65,1
TOTAL EXCLUDING DESK	1.360,2	2.891,4	5.252,4	7.818,6	12.378,0	20.231,2	26.864,7	64,4
	PERCENTAGE							
DESK	-	0,4	0,2	0,4	0,2	1,4	2,6	
SMALL	74,4	66,8	55,2	55,6	41,1	32,1	31,4	
MEDIUM	25,6	32,8	44,6	39,0	35,9	30,8	33,6	
LARGE	-	-	-	5,0	16,0	19,3	17,2	
EXTRA LARGE	-	-	-	-	6,8	16,4	15,2	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE VIII.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: STOCKBROKERS, BUILDING SOCIETIES

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	-	-	2	16	13	16	19	75,6
SMALL	17	34	51	57	57	70	87	31,3
MEDIUM	1	7	10	11	13	14	18	61,9
LARGE	-	-	2	2	3	5	5	25,7
EXTRA LARGE	-	-	-	-	-	-	-	-
UNCLASSIFIED	-	-	-	-	-	1	-	-
TOTAL	18	41	65	86	86	106	129	38,9
TOTAL EXCLUDING DESK	18	41	63	70	73	90	110	35,2
	PERCENTAGE							
DESK	-	-	3,1	18,6	15,1	15,1	14,7	
SMALL	94,4	82,9	78,4	66,3	66,3	66,0	67,4	
MEDIUM	5,6	17,1	15,4	12,8	15,1	13,2	14,0	
LARGE	-	-	3,1	2,3	3,5	4,7	3,9	
EXTRA LARGE	-	-	-	-	-	-	-	
UNCLASSIFIED	-	-	-	-	-	1,0	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE viii.a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: STOCKBROKERS BUILDING SOCIETIES

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands of dollars)							
DESK	-	-	32,4	259,2	210,6	259,2	306,0	75,3
SMALL	974,4	1.969,2	3.093,0	3.858,6	3.909,0	4.864,2	6.041,8	35,5
MEDIUM	174,0	1.134,0	1.621,2	1.857,6	2.295,6	2.570,4	3.368,4	63,9
LARGE	-	-	988,8	988,8	2.150,4	2.275,2	2.275,2	23,2
EXTRA LARGE	-	-	-	-	-	-	-	-
TOTAL	1.148,4	3.103,2	5.735,4	6.964,2	8.565,6	9.969,0	11.991,4	47,8
TOTAL EXCLUDING DESK	1.148,4	3.103,2	5.703,0	6.705,0	8.355,0	9.709,8	11.685,4	47,2
	PERCENTAGE							
DESK	-	-	0,6	3,7	2,5	2,6	2,5	
SMALL	84,8	63,5	53,9	55,4	45,6	48,8	50,4	
MEDIUM	15,2	36,5	28,3	26,7	26,8	25,8	28,1	
LARGE	-	-	17,2	14,2	25,1	22,8	19,0	
EXTRA LARGE	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
UNITED KINGDOM (1)								
BANK OF ENGLAND	-	1.200,0	1.200,0	-	-	-		-
NATIONAL WESTMINSTER	10.880,72	31.137,6	5.745,6	7.392,0	7.920,0	10.080,0	3 IBM 360/65	2,9
BARCLAYS BANK LIMITED	7.194,24	19.881,6	5.433,6	-	11.088,0	3.360,0	1 IBM 360/65	2,8
MIDLAND BANK LIMITED	5.992,08	9.380,4	1.474,8	4.737,6	3.168,0	-		1,6
LLOYDS BANK LIMITED	5.632,62	11.769,6	2.356,8	6.052,8	-	3.360,0	1 IBM 360/65	2,1
HALIFAX	4.118,38	912,0	-	912,0	-	-		0,2
AUSTRALIA AND NEWZELAND BANK LIMITED	3.457,69	446,4	446,4	-	-	-		0,1
ABBEY NATIONAL	3.126,53	1.257,6	1.257,6	-	-	-		0,4
THE STANDARD BANK LIMITED	2.896,85	446,4	446,4	-	-	-		0,2
CO-OPERATIVE PERMANENT	1.658,20	446,4	446,4	-	-	-		0,3
MARTINS BANK LIMITED	1.446,54	1.416,0	835,2	580,8	-	-		1,0
THE CHARTERED BANK	1.330,62	384,0	384,0					0,3
BANK OF LONDON AND SOUTH AM.	1.312,33	696,6	-	696,6	-	-		0,5
WOOLWICH EQUITABLE	1.297,83	446,4	446,4	-	-	-		0,3

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM, NOVEMBER/DECEMBER 1969.

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
UNITED KINGDOM								
LEEDS PERMANENT	1.159,33	n.a.						n.a.
NATIONAL AND GRINDLAYS BANK LIMITED	1.073,46	225,6	225,6	-	-	-		0,2
DISTRICT BANK LIMITED	1.022,11	1.315,2	643,2	672,0	-	-		1,3
BANK OF IRELAND	929,54	n.a.						n.a.
NATIONAL COMM. BANK OF SCOTLAND LIMITED	843,16	1.824,0	-	1.824,0	-	-		2,2
UNITED DOMINIONS TRUST LIMITED	799,71	2.424,0	240,0	600,0	1.584,0	-		3,0
ALLIANCE	795,19	331,2	331,2	-	-	-		0,4
BANK OF SCOTLAND	730,88	2.523,6	939,6	-	1.584,0	-		3,5
CLYDESDALE BANK LIMITED	707,84	835,2	835,2	-	-	-		1,2
MOSCOW NARODNY BANK LIMITED	687,32	417,6	417,6					0,6
LEEK & WESTBOURNE	681,07	-	-	-	-	-		-
HAMBROS BANK LIMITED	662,26	596,4	596,4	-	-	-		0,9
NATIONAL DISCOUNT CO. LIMITED	644,11	108,0	108,0					0,2
LEICESTER PERMANENT	626,75	417,6	417,6					0,7

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
UNITED KINGDOM								
ENGLISH, SCOTTISH AND AUSTRALIAN BANK LIMITED	532,36							
CATER RYDER & CO. LIMITED	519,71	162,0	162,0	-	-	-		0,3
WILLIAMS DEACON'S BANK LIMITED	498,74							
BELGIUM (1)								
BANQUE DE BRUXELLES S.A. BANQUE DE COMMERCE S.A.	2.183,56	1.497,6	825,6	672,0	-	-		0,7
SOCIETE GENERAL DE BANQUE	2.018,20	5.260,8	268,8	1.824,0	3.168,0			2,6
KREDIETBANK	1.147,28	1.723,2	859,2	864,0				1,5
BANCA NAZIONALE DEL BELGIO	-	446,4	446,4					-
CAISSE GENERALE D'EPARGNE ET DE RETRAITE	415,00	1.718,4	134,4	-	1.584,0	-		4,1
								-

(1) SOURCE: SOBEMAP

Follows TABLE VIII.b)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
NETHERLANDS (1)								
NEDERLANDSCHE BANK	-	417,6	417,6	-	-	-		-
ABN - ALGEMENE BANK NEDERLAND	2.724,21	5.956,8	-	5.956,8	-	-		2,2
COOP. RAIFFEISENBANK	2.055,55	1.358,4	446,4	912,0	-	-		0,7
AMRO (AMSTERDAM-ROTTERDAM) BANK	1.976,70	11.644,8	364,8	4.560,0	-	6.720,0	2 IBM 360/65	5,9
BOERENLEENBANK	1.311,94	4.075,2	1.339,2	2.736,0	-	-		3,1
NEDERLANDSE MIDDENSTANDSBANK	954,17	1.824,0	-	1.824,0	-	-		1,9
FRANCE (2)								
BANQUE DE FRANCE	-	2.784,0	1.872,0	912,0	-	-		-
BANQUE NATIONALE DE PARIS	6.961,46	2.078,4	494,4	-	1.584,0	-		0,3
CREDIT LYONNAIS	6.337,08	15.249,6	6.369,6	-	2.160,0	6.720,0	2 IBM 360/65	2,4
SOC. GEN. POUR FAVORISER LE DEVELOPPEMENT DU COMMERCE ET DE L'INDUSTRIE EN FRANCE	5.666,77	1.296,0	1.296,0	-	-	-		0,2

(1) SOURCE: J.M. VAN OORSCHOT

(2) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
FRANCE								
BANQUE DE PARIS ET DES PAYS-BAS	1.176,98	633,6	633,6	-	-	-		0,5
CREDIT COMMERCIALE DE FRANCE	948,56	1.958,4	134,4	1.824,0	-	-		2,1
CREDIT DU NORD	810,30	1.142,4	1.142,4	-	-	-		1,4
BANQUE COMMERCIALE POUR L'EUROPE DU NORD	759,19	n.a.						
CREDIT INDUSTRIEL ET COMMERCIAL	717,73	1.171,2	259,2	912,0	-	-		1,6
BANQUE FRANCAISE DU COMMERCE EXTERIEUR	678,73	892,8	892,8	-	-	-		1,3
ITALY (1)								
BANCA D'ITALIA	-	7.497,6	777,6	-	-	6.720,0	2 IBM 360/65	-
BANCA NAZIONALE DEL LAVORO	6.014	2.750,4	254,4	912,0	1.584,0	-		0,5
BANCA COMMERCIALE ITALIANA	5.838	7.036,8	700,8	-	6.336,0			1,2
CREDITO ITALIANO	4.542	5.064,0	-	3.072,0	1.992,0	-		1,1

(1) SOURCE: DIRECT SURVEY

follows TABLE VIII.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
ITALY								
BANCO DI ROMA	4.082	4.272,0	-	912,0	-	3.360,0	1 IBM 360/65	1,0
BANCO DI NAPOLI	2.683	3.648,0	-	3.648,0				1,4
CASSA DI RISPARMIO DELLE PROVINCE LOMBARDE	2.639	1.584,0	-	-	1.584,0	-		0,6
MONTE DEI PASCHI	1.939	1.824,0	-	1.824,0	-	-		0,9
BANCO DI SICILIA	1.802	2.030,4	446,4	-	1.584,0	-		1,1
BANCA POPOLARE NOVARA	1.691	n.a.						
ISTITUTO BANCARIO S. PAOLO	1.681	2.241,6	657,6	-	1.584,0			1,3
BANCA NAZIONALE DELL'AGRICOLTURA	1.617	1.358,4	446,4	912,0	-	-		0,8
MEDIOBANCA	1.256	134,4	134,4	-	-	-		0,1
BANCA D'AMERICA E D'ITALIA	1.193	993,6	105,6	888,0	-	-		0,8
CASSA RISPARMIO TORINO	1.188	912,0		912,0				0,8
CASSA CENTRALE RISPARMIO PROVINCE SICILIANE	1.132	1.824,0		1.824,0				1,6
BANCO S. SPIRITO	786	1.046,4	134,4	912,0				1,3

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
ITALY								
BANCO AMBROSIANO	780	912,0		912,0				1,2
BANCA POPOLARE MILANO	721	912,0		912,0				1,3
CASSA RISPARMIO ROMA	677	912,0		912,0				1,3
BANCA TOSCANA	658	1.358,4	446,4	912,0				2,1
BANCA PROVINCIALE LOMBARDA	648	912,0		912,0				1,4
CASSA RISPARMIO FIRENZE	641	1.824,0		1.824,0				2,8
ISTITUTO BANCARIO ITALIANO	588	n.a.						
CREDITO COMMERCIALE	577	1.224,0	1.224,0					2,1
CASSA RISPARMIO GENOVA	544	912,0		912,0				1,7

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
GERMANY (1)								
DEUTSCHE BUNDESBANK	-	480,0	480,0	-	-	-		-
DEUTSCHE BANK AG	4.549,22	9.338,4	6.890,4	2.448,0	-	-		2,0
DRESDNER BANK AG	3.466,23	12.811,2	5.227,2	3.264,0	4.320,0	-		3,7
COMMERZ BANK AG	2.884,34	5.155,2	2.659,2	912,0	1.584,0	-		1,7
RHEINISCHE GIROZENTRALE UND PROVINZIAL BANK	1.728,69	n.a.						
BAYERISCHE GEMEINDEBANK (GIROZENTRALE)	1.538,45	259,2	259,2	-	-	-		0,1
BANKFUR GEMEINWIRTSCHAFT AG	1.350,13	1.027,2	1.027,2	-	-	-		0,7
BAYERISCHE HYPOTHEKEN UND WECHSEL BANK	1.307,47	1.814,4	374,4	-	1.440,0	-		1,3
DEUTSCHE GENOSSENSCHAFTSCASSE	1.260,51	1.358,4	446,4	912,0	-			1,0
LANDESBANK FÜR WESTFALEN GIROZENTRALE	1.014,45	n.a.						
HESSISCHE LANDESBANK GIROZENTRALE	899,51	n.a.						
BAYERISCHE VEREINSBANK	768,29	n.a.						
BAYERISCHE STAATSBANK	765,98	892,8	892,8	-	-	-		1,1

(1) SOURCE: DIRECT SURVEY

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: BANKS

COMPANIES	DEPOSITS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ DEPOSITS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
GERMANY								
BADISCHE KOMMUNALE LANDESBANK GIRO-ZENTRALE	725,92	2.899,2	2.899,2	-	-	-		3,9
NIEDERSACHSISCHE LANDESBANK GIRO-ZENTRALE	694,18	446,4	446,4	-	-	-		0,6
HAMBURGER SPARCASSE VON 1827	687,55	-	-	-	-	-		-
WURTT GIROZENTRALE	654,15	n.a.						
STADT GIROKASSESTUTTGART	629,25	2.688,0	864,0	1.824,0	-	-		4,2
SPARKASSE DEP STADT BERLIN WEST	592,93	976,8	64,8	912,0	-	-		1,6
SPARKASSE DER STADT KOLN	546,90	259,2	259,2					0,4

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ASSURANCE

COMPANIES	PREMIUMS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ PREMIUMS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
UNITED KINGDOM (1)								
PRUDENTIAL	5.360,32	4.939,2	984,0	-	3.955,2	-		0,9
LEGAL AND GENERAL	2.666,36	2.832,0	336,0	912,0	1.584,0	-		1,1
COMMERCIAL UNION	2.233,56	2.064,0	672,0	1.392,0	-	-		0,9
STANDARD LIFE	1.939,87	446,4	446,4	-	-	-		0,2
GUARDIAN ROYAL EXCHANGE	1.912,26	912,0	-	912,0	-	-		0,5
ROYAL	1.724,41	2.937,6	1.353,6	-	1.584,0	-		1,7
NORWICH UNION	1.647,55	1.977,6	-	-	1.977,6	-		1,2
PEARL	1.412,43	393,6	393,6	-	-	-		0,3
CO-OPERATIVE	1.315,10	1.492,8	580,8	912,0		-		1,1
GENERAL ACCIDENT	1.218,42	2.270,4	446,4	1.824,0	-	-		1,9
EAGLE STAR	1.133,72	1.824,0	-	1.824,0	-	-		1,6
SUN LIFE	1.013,26	600,0	-	600,0	-	-		0,6
SCOTTISH WIDOWS	902,02	537,6	537,6	-	-	-		0,6

(1) COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ASSURANCE

COMPANIES	PREMIUMS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ PREMIUMS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
SUN ALLIANCE AND LONDON	843,11	3.854,4	446,4	1.824,0	1.584,0			4,6
LIVERPOOL VICTORIA	757,54	480,0	480,0	-	-	-		0,6
FRIENDS PROVIDENT	699,24	777,6	777,6	-	-	-		1,1
ROYAL LONDON	667,44	705,6	705,6	-	-	-		1,1
REFUGE	666,51	297,6	297,6	-	-	-		0,4
SCOTTISH AMICABLE	578,56	658,8	658,8					1,1
BRITANNIC	515,82	240,0	240,0	-	-	-		0,5
EQUITY AND LAW	513,83	297,6	297,6	-	-	-		0,6
LONDON AND MANCHESTER	358,57	240,0	240,0	-	-	-		0,7
U.K. PROVIDENT	352,27	225,6	225,6	-	-	-		0,6
ROYAL LIVER	347,87	417,6	417,6	-	-	-		1,2
SCOTTISH PROVIDENT	327,88	134,4	134,4	-	-	-		0,4
PHOENIX	197,79	696,0	-	696,0	-	-		3,5

follows TABLE VIII.b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ASSURANCE

COMPANIES	PREMIUMS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ PREMIUMS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
BELGIUM (1)								
ROYAL BELGE VIE-ACCIDENTS INCEDIE-REASSURANCE	131,98	1.046,4	134,4	912,0	-	-		7,9
ASSURANCES GENERALES	105,78	451,2	451,2	-	-	-		4,3
NETHERLANDS (2)								
NATIONALE NEDERLANDEN	370,82	2.764,8	268,8	912,0	1.584,0	-		7,5
FRANCE (3)								
L'UNION DES ASSURANCES DE PARIS "L'UNION" I.A.R.D. - VIE	344,40	6.214,0	2.230,0	-	3.984,0	-		18,0
ASSURANCES GENERALES DE FRANCE ET VIE A.G.	303,45	2.073,6	777,6	-	1.296,0	-		6,8
MUTUELLE GENERALE FRANCAISE ACCIDENTS	156,17	2.001,6	705,6	-	1.296,0	-		12,8

(1) SOURCE: SOBEMAP

(2) SOURCE: J.M. VAN OORSCHOT

(3) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ASSURANCE

COMPANIES	PREMIUMS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ PREMIUMS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
follows:								
FRANCE								
ASSURANCES GENERALES DE FRANCE								
"LE PHOENIX" VIE I.A.R.D. S.A.	110,30	405,6	405,6	-	-	-		3,7
ITALY (1)								
ASSICURAZIONI GENERALI	328	2.092,8	268,8	1.824,0				6,4
INA - ISTITUTO NAZIONALE ASSICURAZ.	161	3.168,0			3.168,0			19,7
SAI - ASSICURAZIONI INDUSTRIALI	131	3.168,0			3.168,0			24,2
RAS - RIUNIONE ADRIATICA SICURTA'	113	2.736,0		2.736,0				12,1
L'ASSICURATRICE ITALIANA	114							

(1) SOURCE: DIRECT SURVEY

follows TABLE VIII.b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: ASSURANCE

COMPANIES	PREMIUMS (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ PREMIUMS
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
GERMANY (1)								
MUNCHENER RUCK VERSICHERUNGS GESELLSCHAFT	1.043,67	580,8	-	580,8	-	-		0,5
ALLIANZ VERSICHERUNGS AK	775,15	18.957,6	909,6	912,0	17.136,0	-		24,4
GERLING KONZERN VERSICHERUNGS	289,19	1.036,8	1.036,8	-	-	-		3,5
VOLKSFURSORGE LEBENS VERSICHERUNGS	135,04	4.320,0	-	-	4.320,0	-		31,9
VICTORIA VERSICHERUNGS	124,72	295,2	259,2	-	-	-		2,0
AGRIPPINA VERSICHERUNGS	117,17	4.267,2	1.483,2	2.784,0	-	-		36,4
HAMBURG MANNHEIMER VERSICHERUNGS	109,01	1.804,8	892,8	912,0	-	-		16,5
DEUTSCHE KRANKEN VERSICHERUNGS	102,69	n.a.						

(1) DIRECT SURVEY

CHAPTER IX

TABLE IX. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: PUBLIC UTILITIES AND COAL, TRANSPORT, DOCKS AND HARBOURS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	3	5	6	6	10	24	32	48,4
SMALL	29	63	94	81	88	119	173	34,7
MEDIUM	1	2	4	7	12	22	33	79,1
LARGE	1	1	2	3	3	7	8	41,4
EXTRA LARGE	-	-	-	1	4	4	5	71,0
UNCLASSIFIED	-	-	-	-	-	-	-	-
TOTAL	34	71	106	98	117	176	251	39,5
TOTAL EXCLUDING DESK	31	66	100	82	107	152	219	38,5
	PERCENTAGE							
DESK	8,9	7,1	5,6	6,1	8,5	13,6	12,8	
SMALL	85,3	88,7	88,7	82,7	75,2	67,6	68,9	
MEDIUM	2,9	2,8	3,8	7,1	10,3	12,5	13,1	
LARGE	2,9	1,4	1,9	3,1	2,6	4,0	3,2	
EXTRA LARGE	-	-	-	1,0	3,4	2,3	2,0	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE IX. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: PUBLIC UTILITIES AND COAL, TRANSPORT, DOCKS AND HARBOURS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	36,0	66,6	82,8	72,9	132,3	327,6	419,5	50,6
SMALL	1.850,4	4.209,0	6.447,7	5.742,5	6.298,3	8.254,0	9.871,3	32,2
MEDIUM	174,0	319,2	609,6	1.221,6	2.032,8	4.090,8	6.543,6	83,0
LARGE	324,0	324,0	1.086,0	1.482,0	1.482,0	2.604,0	3.441,6	48,3
EXTRA LARGE	-	-	-	840,0	3.498,0	3.498,0	4.338,0	72,8
TOTAL	2.384,4	4.918,8	8.226,1	9.359,0	13.443,4	18.774,4	24.614,0	47,6
TOTAL EXCLUDING DESK	2.348,4	4.852,2	8.143,3	9.286,1	13.311,1	18.446,8	24.194,5	47,5
	PERCENTAGE							
DESK	1,5	1,3	1,0	0,8	1,0	1,7	1,7	
SMALL	77,6	85,6	78,4	61,4	46,9	44,0	40,1	
MEDIUM	7,3	6,5	7,4	13,0	15,1	21,8	26,6	
LARGE	13,6	6,6	13,2	15,8	11,0	13,9	14,0	
EXTRA LARGE	-	-	-	9,0	26,0	18,6	17,6	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE IX. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: PUBLIC UTILITIES AND COAL

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	-	1	1	1	3	16	19	80,2
SMALL	17	39	53	64	69	85	96	33,4
MEDIUM	1	2	2	5	9	16	22	67,4
LARGE	1	1	2	1	1	5	6	34,8
EXTRA LARGE	-	-	-	-	1	1	2	41,4
UNCLASSIFIED	-	-	-	-	-	-	-	-
TOTAL	19	43	58	71	83	123	145	40,3
TOTAL EXCLUDING DESK	19	42	57	70	80	107	126	37,1
	PERCENTAGE							
DESK	-	2,3	1,8	1,4	3,6	13,0	13,1	
SMALL	89,4	90,7	91,4	90,1	83,1	69,1	66,2	
MEDIUM	5,3	4,7	3,4	7,1	10,9	13,0	15,2	
LARGE	5,3	2,3	3,4	1,4	1,2	4,1	4,1	
EXTRA LARGE	-	-	-	-	1,2	0,8	1,4	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE IX. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: PUBLIC UTILITIES AND COAL

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	-	14,4	14,4	14,4	43,2	228,6	270,0	79,7
SMALL	1.117,2	2.633,4	3.513,1	4.345,1	4.864,3	5.934,0	6.130,4	32,8
MEDIUM	174,0	319,2	319,2	931,2	1.526,4	2971,2	4.272,0	70,5
LARGE	324,0	324,0	1.086,0	762,0	762,0	1.884,0	2.721,6	42,6
EXTRA LARGE	-	-	-	-	978,0	978,0	1.818,0	36,3
TOTAL	1.615,2	3.291,0	4.932,7	6.052,7	8.173,9	11.995,8	15.212,0	45,3
TOTAL EXCLUDING DESK	1.615,2	3.276,6	4.918,3	6.038,3	8.130,7	11.767,2	14.942,0	44,9
	PERCENTAGE							
DESK	-	0,4	0,3	0,2	0,5	1,9	1,8	
SMALL	69,2	80,0	71,2	71,8	59,5	49,5	40,3	
MEDIUM	10,8	9,7	6,5	15,4	18,7	24,8	28,1	
LARGE	20,0	9,9	22,0	12,6	9,3	15,7	17,9	
EXTRA LARGE	-	-	-	-	12,0	8,1	11,9	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE IX. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: TRANSPORT, DOCKS AND HARBOURS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	3	4	5	5	7	8	13	27,7
SMALL	12	24	41	17	19	34	77	36,3
MEDIUM	-	-	2	2	3	6	11	53,1
LARGE	-	-	-	2	2	2	2	-
EXTRA LARGE	-	-	-	1	3	3	3	44,2
UNCLASSIFIED	-	-	-	-	-	-	-	-
TOTAL	15	28	48	27	34	53	106	38,5
TOTAL EXCLUDING DESK	12	24	43	22	27	45	93	40,7
	PERCENTAGE							
DESK	20,0	14,3	10,4	18,5	20,6	15,1	12,3	
SMALL	80,0	85,7	85,4	63,0	55,9	64,1	72,6	
MEDIUM	-	-	4,2	7,4	8,8	11,3	10,4	
LARGE	-	-	-	7,4	5,9	3,8	1,9	
EXTRA LARGE	-	-	-	3,7	8,8	5,7	2,8	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE IX. a

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: TRANSPORT, DOCKS AND HARBOURS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	36,0	52,2	68,4	58,5	89,1	99,0	149,5	26,8
SMALL	733,2	1.575,6	2.934,6	1.397,4	1.434,0	2.320,0	3.740,9	31,2
MEDIUM	-	-	290,4	290,4	506,4	1.119,6	2.271,6	67,2
LARGE	-	-	-	720,0	720,0	720,0	720,0	-
EXTRA LARGE	-	-	-	840,0	2.520,0	2.520,0	2.520,0	44,2
TOTAL	769,2	1.627,8	3.293,4	3.306,3	5.269,5	6.778,6	9.402,0	51,8
TOTAL EXCLUDING DESK	733,2	1.575,6	3.225,0	3.247,8	5.180,4	6.679,6	9.252,5	52,6
	PERCENTAGE							
DESK	4,7	3,2	2,1	1,8	1,7	1,5	1,6	
SMALL	95,3	96,8	89,1	42,2	27,2	34,2	39,8	
MEDIUM	-	-	8,8	8,8	9,6	16,5	24,2	
LARGE	-	-	-	21,8	13,7	10,6	7,6	
EXTRA LARGE	-	-	-	25,4	47,8	37,2	26,8	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

TABLE IX. b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES AND TRANSPORT

TRANSPORT

COMPANIES	SALES (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
UNITED KINGDOM (1)								
BRITISH RAIL	1.248	8.633,4	2.973,6	5.659,8	-	-		6,9
BOAC	421	12.541,2	968,4	1.492,8	-	10.080,0	3 IBM 360/65	29,9
BEA	258	4.216,8	1.336,8		2.880,0			16,3
LONDON/TRANSPORT RAIL	260	796,0	796,0					3,1
BELGIUM (2)								
SOCIETE NATIONALE DES CHEMINS DE FER BELGES	n.a.	1.584,0			1.584,0			
SOCIETE NATIONALE DES CHEMINS DE FER VICINAUX	n.a.	912,0		912,0				
SABENA	128	2.611,2	1.699,2	912,0				20,4
NETHERLANDS (3)								
KLM	297	8.673,6	129,6	1.824,0	-	6.720,0	2 IBM 360/65	29,2
SOCIETE NATIONALE DES CHEMINS DE FER DES PAYS BAS	200	1.422,0	558,0	864,0				7,1
VAN OMMEREN	156	331,2	331,2					2,1

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM, NOVEMBER/DECEMBER 1969.
(2) SOURCE: SOBEMAP
(3) SOURCE: J. M. VAN OORSCHOT

Follows TABLE IX. b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES AND TRANSPORT

TRANSPORT

COMPANIES	SALES (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
ITALY (1)								
FFSS	613	1.704,0	888,0	816,0				2,8
ALITALIA	294	11.635,2	259,2		1.296,0	10.080,0	3 IBM 360/65	39,5
FRANCE (2)								
SNCF	1.962	13.440,0				13.440,0	4 UNIVAC 1108	6,9
AIR FRANCE	499	10.080,0				10.080,0	IBM 360/65 - 2 UNIVAC 1108	20,2
SOCIETE GENERALE TRANSATLANTIQUE	168	129,6	129,6					0,8
MESSAGERIE MARITIMES	113	129,6	129,6					1,1
GERMANY (3)								
DEUTSCHE BUNDESBAHN	2.800	7.984,4	3.040,8		1.584,0	3.	IBM 360/65	2,8
DEUTSCHE LUFTHANSA	426	3.288,6	2.707,2	580,8				7,7
KUNNE & NAGEL	235	n.a.						
SCHENKER & CO	200	446,4	446,4					2,2
HAMBOURG AMERIKA	138	892,8	892,8					6,5
NORD DEUTSCHE LLOYD.	133	1.838,4	254,4		1.584,0			13,8

(1) SOURCE: DIRECT SURVEY

(2) SOURCE: 0.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

(3) SOURCE: DIRECT SURVEY

Follows TABLE IX. b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES AND TRANSPORT

PUBLIC UTILITIES

COMPANIES	SALES (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
UNITED KINGDOM (1)								
CENTRAL ELECTRICITY GENERATING BOARD (AREA BOARD INCLUDED)	3.197	29.916,0	7.980,0	11.688,0	6.336,0	3.912,0	IBM 360/75	9,4
GAS COUNCIL (AREA BOARD INCLUDED)	1.650	17.047,2	3.535,2	5.880,0	4.272,0	3.360,0	UNIVAC 1108	10,2
BELGIUM (2)								
INTERCOM	244	1.584,0			1.584,0			6,5
ENERGIE DU BASSIN DE L'ESCAOT	141	1.632,0						11,5
NETHERLANDS (3)								
GASUNIE	103	518,4	518,4					5,0
ITALY (4)								
ENEL	1.324	6.806,4	3.326,4	1.896,0	1.584,0			5,1
ITALGAS	n.a.	2.241,6	1.353,6	888,0				

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969.

(2) SOURCE: ~~SOBEMAP~~

(3) SOURCE: J.M. VAN OORSCHOT

(4) SOURCE: DIRECT SURVEY

Follows TABLE IX. b.

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES AND TRANSPORT

PUBLIC UTILITIES

COMPANIES	SALES (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
FRANCE (1)								
SERVICE DE TRAITEMENT DE L'INFORMATION DE L'ELECTRICITE DU GAS	3.470	17.356,8	892,8	1.632,0	4.752,0	10.080,0	3 IBM 360/65	5,0
GERMANY (2)								
RWE RHEIN WEST. ELEK.	1.232	1.722,0	282,0		1.440,0			1,4
VEREINIGTE ELEKTRIZITATS WERKE WESTFALEN	261	1.502,4	590,4	912,0				5,7
RUHRGAS AG	167	4.200,0	120,0	912,0	3.168,0			25,1
HAMBURGISCHE ELEKTRIZITAT	151	1.951,2	458,4	1.492,8				12,8
BERLINER KRAFT & LICHT BEWAG	122	1.742,4	302,4		1.440,0			14,3
NORDWESTD KRAFTWERKE	106	134,4	134,4					1,3

(1) SOURCE: O.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

(2) SOURCE: DIRECT SURVEY

Follows TABLE IX. b

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND IN U.K. IN 1969

BRANCH: PUBLIC UTILITIES AND TRANSPORT

TELEVISION

COMPANIES	SALES (millions $)	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)					EXTRA LARGE COMPUTERS INSTALLED	COMPUTERS VALUE 1.000 $ SALES
		TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE		
BRITISH BROADCASTING CO (UK)	n.a.	1.992,0	1.128,0	864,0				
RAI (I)	n.a.	5.332,8	580,8		4.752,0			
ORTF (F)	n.a.	1.099,2	518,4	580,8				
SECOND GERMAN TELEVISION NETWORK (D)	n.a.	446,4	446,4					

CHAPTER X

TABLE X.a (A)

UNITED KINGDOM

COMPUTER INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: UNIVERSITIES, ATOMIC ENERGY AND OTHER R&D DEPARTMENTS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	13	27	30	31	63	86	123	45,4
SMALL	67	100	123	106	158	176	200	20,0
MEDIUM	1	8	13	19	22	29	42	86,4
LARGE	3	2	3	2	4	6	9	20,1
EXTRA LARGE	2	3	5	7	9	10	11	32,9
TOTAL	86	140	174	165	256	307	385	28,4
TOTAL EXCLUDING DESK	73	113	144	134	193	221	262	23,7
	PERCENTAGE							
DESK	15,1	19,3	17,2	18,8	24,6	28,0	31,9	
SMALL	77,9	71,4	70,7	64,3	61,7	57,3	52,0	
MEDIUM	1,2	5,7	7,5	11,5	8,6	9,4	10,9	
LARGE	3,5	1,4	1,7	1,2	1,6	2,0	2,3	
EXTRA LARGE	2,3	2,2	2,9	4,2	3,5	3,3	2,9	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE X.a (A)

UNITED KINGDOM

COMPUTER INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: UNIVERSITIES, ATOMIC ENERGY AND OTHER R&D DEPARTMENTS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (thousands dollars)							
DESK	201,6	420,1	474,9	374,2	669,0	839,5	1.164,2	33,9
SMALL	3.477,6	5.241,6	6.585,2	5.474,0	8.917,2	10.014,6	12.096,6	23,1
MEDIUM	145,2	1.233,6	1.983,6	2.883,6	3.393,6	4.675,2	7.010,4	90,8
LARGE	1.612,0	1.524,0	2.286,0	1.524,0	2.172,0	2.892,0	4.032,0	16,5
EXTRA LARGE	3.030,0	4.140,0	6.360,0	8.050,0	10.138,0	10.708,0	10.918,0	23,8
TOTAL	8.466,4	12.559,3	17.689,7	18.305,8	25.289,3	29.129,3	35.221,2	26,8
TOTAL EXCLUDING DESK	8.264,8	12.139,2	17.214,8	17.931,6	24.620,8	28.289,8	34.057,0	26,6
	PERCENTAGE							
DESK	2,4	3,4	2,7	2,0	2,6	2,9	3,3	
SMALL	41,1	41,7	37,2	29,9	35,3	34,4	34,3	
MEDIUM	1,7	9,8	11,2	15,8	13,4	16,0	19,9	
LARGE	19,0	12,1	12,9	8,3	8,6	9,9	11,5	
EXTRA LARGE	35,8	33,0	36,0	44,09	40,1	36,8	31,0	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE X.a (A)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: UNIVERSITIES AND EDUCATION

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	8	13	15	21	41	50	75	45,2
SMALL	30	49	61	54	87	107	123	26,5
MEDIUM	-	5	8	11	14	20	32	45,0
LARGE	-	-	1	1	3	4	4	41,4
EXTRA LARGE	1	2	3	4	4	6	6	34,8
UNCLASSIFIED								
TOTAL	39	69	88	91	149	187	240	35,4
TOTAL EXCLUDING DESK	31	56	73	70	108	137	165	32,1
	PERCENTAGE							
DESK	20,5	18,8	17,1	23,1	27,5	26,7	31,3	
SMALL	76,9	71,0	69,3	59,3	58,4	57,2	51,3	
MEDIUM	-	7,3	9,1	12,1	9,4	10,7	13,3	
LARGE	-	-	1,1	1,1	2,0	2,2	1,7	
EXTRA LARGE	2,6	2,9	3,4	4,4	2,7	3,2	2,5	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE X.a (A)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: UNIVERSITIES AND EDUCATION

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	127,8	207,9	250,0	255,8	439,7	496,5	726,1	33,6
SMALL	1.486,8	2.439,6	3.162,3	2.682,4	4.696,1	5.892,1	7.480,3	30,9
MEDIUM	-	750,0	1.200,0	1.650,0	2.100,0	3.144,0	5.268,0	47,7
LARGE	-	-	762,0	762,0	1.410,0	1.734,0	1.734,0	22,8
EXTRA LARGE	1.110,0	2.220,0	3.330,0	4.180,0	4.180,0	5.860,0	5.770,0	31,6
TOTAL	2.724,6	5.617,5	8.704,3	9.530,2	12.825,8	17.126,6	20.978,4	40,5
TOTAL EXCLUDING DESK	2.596,8	5.409,6	8.454,3	9.274,4	12.386,1	16.630,1	20.252,3	40,8
	PERCENTAGE							
DESK	4,7	3,7	2,9	2,7	3,4	2,9	3,5	
SMALL	54,6	43,4	36,3	28,1	36,6	34,4	35,6	
MEDIUM	-	13,4	13,8	17,3	16,4	18,4	25,1	
LARGE	-	-	8,7	8,0	11,0	10,1	8,3	
EXTRA LARGE	40,7	39,5	38,3	43,9	32,6	34,2	27,5	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE X.a (A)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: ATOMIC ENERGY

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	-	-	8,0	16,0	54,4	117,8	117,8	95,9
SMALL	900,0	1.168,8	1.309,2	844,8	962,4	1.060,3	1.069,0	2,9
MEDIUM	-	169,2	169,2	450,0	150,0	654,0	654,0	31,0
LARGE	1.187,0	762,0	1.524,0	762,0	762,0	1.158,0	1.530,0	4,3
EXTRA LARGE	1.920,0	1920,0	3.030,0	1.920,0	3.030,0	3.030,0	1.110,0	-8,7
TOTAL	4.007,0	4.020,0	6.040,4	3.992,8	4.958,8	6.020,1	4.480,8	1,9
TOTAL EXCLUDING DESK	4.007,0	4.020,0	6.032,4	3.976,8	4.904,4	5.902,3	4.363,0	1,4
	PERCENTAGE							
DESK	-	-	0,1	0,4	1,1	2,0	2,6	
SMALL	22,5	29,1	21,7	21,1	19,4	17,6	23,9	
MEDIUM	-	4,2	2,8	11,3	3,0	10,9	14,6	
LARGE	29,6	18,9	25,2	19,1	15,4	19,2	34,1	
EXTRA LARGE	47,9	47,8	50,2	48,1	61,1	50,3	24,8	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE X.a (A)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: ATOMIC ENERGY

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	-	-	1	2	6	15	18	106,0
SMALL	15	18	20	14	16	17	16	1,1
MEDIUM	-	1	1	3	1	4	4	31,9
LARGE	2	1	2	1	1	2	3	7,0
EXTRA LARGE	1	1	2	1	2	2	1	-
UNCLASSIFIED								
TOTAL	18	21	26	21	26	40	42	15,2
TOTAL EXCLUDING DESK	18	21	25	19	20	25	24	4,9
	PERCENTAGE							
DESK	-	-	3,9	9,5	23,1	37,5	42,9	
SMALL	83,3	85,6	76,9	66,6	61,6	42,5	38,1	
MEDIUM	-	4,8	3,8	14,3	3,8	10,0	9,5	
LARGE	11,1	4,8	7,7	4,8	3,8	5,0	7,1	
EXTRA LARGE	5,6	4,8	7,7	4,8	7,7	5,0	2,4	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE X.a (A)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: GOVERNMENT AND OTHER R&D DEPARTMENTS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	5	14	14	8	16	21	30	34,8
SMALL	22	33	42	38	55	52	61	18,5
MEDIUM	1	2	4	5	7	5	6	34,8
LARGE	1	1	-	-	-	-	2	12,2
EXTRA LARGE	-	-	-	2	3	2	4	26,0
UNCLASSIFIED								
TOTAL	29	50	60	53	81	80	103	23,5
TOTAL EXCLUDING DESK	24	36	46	45	65	59	73	20,4
	PERCENTAGE							
DESK	17,3	28,0	23,3	15,1	19,8	26,2	29,1	
SMALL	75,9	66,0	70,0	71,7	67,9	65,0	59,2	
MEDIUM	3,4	4,0	6,7	9,4	8,6	6,3	5,8	
LARGE	3,4	2,0	-	-	-	-	2,0	
EXTRA LARGE	-	-	-	3,8	3,7	2,5	3,9	
UNCLASSIFIED	-	-	-	-	-	-	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

Follows TABLE X.a (A)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: GOVERNMENT AND OTHER R&D DEPARTMENTS

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	73,8	212,2	216,9	102,4	174,9	225,2	320,3	27,7
SMALL	1.090,8	1.633,2	2.113,7	1.946,8	3.258,7	3.062,2	3.547,3	21,7
MEDIUM	145,2	314,4	614,4	783,6	1.143,6	877,2	1.088,4	39,9
LARGE	425,0	762,0	-	-	-	-	768,0	10,4
EXTRA LARGE	-	-	-	1.950,0	2.928,0	1.818,0	4.038,0	27,5
TOTAL	1.734,8	2.921,8	2.945,0	4.782,8	7.505,2	5.982,6	9.762,0	33,4
TOTAL EXCLUDING DESK	1.661,0	2.709,6	2.728,1	4.680,4	7.330,3	5.757,4	9.441,7	33,6
	PERCENTAGE							
DESK	4,2	7,3	7,4	2,1	2,3	3,8	3,3	
SMALL	62,9	55,9	71,8	40,7	43,4	51,2	36,3	
MEDIUM	8,4	10,7	20,8	16,4	15,3	14,6	11,1	
LARGE	24,5	26,1	-	-	-	-	7,9	
EXTRA LARGE	-	-	-	40,8	39,0	30,4	41,4	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

TABLE X.a (B)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: COMPUTERS MANFS BUREAUX AND OTHER BUREAUX

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	NUMBER							
DESK	8	13	14	9	11	13	22	18,4
SMALL	44	71	98	95	139	159	197	28,4
MEDIUM	7	14	18	20	29	46	69	46,4
LARGE	1	1	3	2	5	8	11	49,1
EXTRA LARGE	-	1	1	1	4	6	9	55,2
UNCLASSIFIED	-	-	-	-	1	1	-	-
TOTAL	60	100	134	127	189	233	308	31,3
TOTAL EXCLUDING DESK	52	87	120	118	178	220	286	32,9
	PERCENTAGE							
DESK	13,3	13,0	10,5	7,1	5,8	5,6	7,1	
SMALL	73,3	71,0	73,1	74,8	73,6	68,2	64,0	
MEDIUM	11,7	14,0	13,4	15,7	15,3	19,7	22,4	
LARGE	1,7	1,0	2,2	1,6	2,7	3,4	3,6	
EXTRA LARGE	-	1,0	0,8	0,8	2,1	2,6	2,9	
UNCLASSIFIED	-	-	-	-	0,5	0,4	-	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SCRIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

follows TABLE X.a (B)

UNITED KINGDOM

COMPUTERS INSTALLED BY SIZE CLASSES FROM 1962 TO 1968

BRANCH: COMPUTERS MANFS BUREAUX AND OTHER BUREAUX

CLASS	1962	1963	1964	1965	1966	1967	1968	AVERAGE ANNUAL GROWTH
	VALUE (Thousands dollars)							
DESK	105,3	163,8	165,5	84,5	112,4	133,7	240,8	14,8
SMALL	2.878,2	4.583,4	6.102,6	6.346,8	9.364,0	11.207,4	13.881,9	30,0
MEDIUM	1.245,6	2.290,8	2.858,4	3.494,4	5.218,8	8.646,0	13.410,0	48,6
LARGE	762,0	762,0	1.686,0	924,0	2.040,0	2.874,0	4.758,0	35,7
EXTRA LARGE	-	850,0	850,0	850,0	3.370,0	6.160,0	8.020,0	56,7
TOTAL	4.991,1	8.650,0	11.662,5	11.699,7	20.105,2	29.021,1	40.310,7	41,6
TOTAL EXCLUDING DESK	4.885,8	8.486,2	11.497,0	11.615,2	19.992,8	28.887,4	40.069,9	42,0
	PERCENTAGE							
DESK	2,1	1,9	1,4	0,7	0,6	0,5	0,6	
SMALL	57,7	53,0	52,3	54,2	46,6	38,6	34,4	
MEDIUM	25,0	26,5	24,5	29,9	25,9	29,8	33,3	
LARGE	15,2	8,8	14,5	7,9	10,1	9,9	11,8	
EXTRA LARGE	-	9,8	7,3	7,3	16,8	21,2	19,9	
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

SOURCE: SORIS, ON THE BASIS OF COMPUTER SURVEY, MARCH OF EACH YEAR.

TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K. IN 1969

UNIVERSITY	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
GERMANY (1)					
FREIE UNIVERSITÄT BERLIN	2.212,8	331,2	1.881,6	-	-
RUHR-UNIVERSITÄT BOCHUM	536,4	536,4	-	-	-
RHEINISCHE FRIEDRICH-WILHELMS UNIVERSITÄT BONN	3.048,0	-	-	3.048,0	-
UNIVERSITÄT DORTMUND					
JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN	1.065,6	-	1.065,6	-	-
FRIEDRICH-ALEXANDER-UNIVERSITÄT ZU ERLANGEN NÜRNBERG	n.a.	n.a.	n.a.	n.a.	n.a.
JOHANN-WOLFGANG-GOETHE-UNIVERSITÄT	3.360,0	-	-	-	3.360,0
ALBERT LUDWIGS-UNIVERSITÄT	-	-	-	-	-
GEORG -AUGUST- UNIVERSITÄT ZU GÖTTINGEN	..	..	..	..	..
UNIVERSITÄT HAMBURG	864,0	-	864,0	-	-
RUPRECHT-KARL-UNIVERSITÄT	..	..	..	..	..
UNIVERSITÄT FRIDERICIANA	..	..	1.065,6	..	..
CHRISTIAN-ALBRECHTS-UNIVERSITÄT	n.a.	n.a.	n.a.	n.a.	n.a.
UNIVERSITÄT KÖLN	1.238,4	-	-	1.238,4	-
JOHANNES-GUTENBERG-UNIVERSITÄT	1.065,6	-	1.065,6	-	-
EBERHARD-KARLS-UNIVERSITÄT	...	..	624,0	..	..
PHILIPPS UNIVERSITÄT	n.a.	n.a.	n.a.	n.a.	n.a.
LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN	864,0	-	864,0	-	-
WESTFÄLISCHE-WILHEMS-UNIVERSITÄT MUNSTER	..	..	..	..	..

(1) SOURCE: DIRECT SURVEY

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K.[1] IN 1969

UNIVERSITY	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows:	..	..	..	..	..
GERMANY					
JULIUS-MAXIMILIANS-UNIVERSITÄT	..	..	..	..	..
UNIVERSITÄT DES SAARLANDES	n.a.	n.a.	n.a.	n.a.	n.a.
UNIVERSITÄT STUTTGART	7.344,0	-	8.64,0	2.400,0	4.080,0
RHEINISCH WESTFALISCHE TECHNISCHE HOCHSCHULE	2.784,0	-	-	2.784,0	-
TECHNISCHE HOCHSCHULE DARMSTADT	..	..	..	..	..
TECHNISCHE HOCHSCHULE HANNOVER	2.160,0	-	-	2.160,0	-
TECHNISCHE HOCHSCHULE MÜNCHEN	1.238,4	-	-	1.238,0	-
ITALIA (1)					
UNIVERSITA' DEGLI STUDI DI BARI	5.020,8	196,8	912,0	-	3.912,0
UNIVERSITA' DEGLI STUDI DI BOLOGNA	4.886,4	806,4	-	-	4.080,0
UNIVERSITA' DEGLI STUDI DI CAGLIARI	393,6	806,4	-	-	-
UNIVERSITA' DEGLI STUDI DI CATANIA	417,6	417,6	-	-	-
UNIVERSITA' DEGLI STUDI DI FIRENZE	440,4	440,4	-	-	-
UNIVERSITA' DEGLI STUDI DI GENOVA	427,2	427,2	-	-	-
UNIVERSITA' DEGLI STUDI DI MESSINA	61,2	61,2	-	-	-
UNIVERSITA' DEGLI STUDI DI MILANO	892,8	220,8	672,0	-	-

(1) SOURCE: DIRECT SURVEY

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K. IN 1969

UNIVERSITY	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows: ITALY					
UNIVERSITA' DEGLI STUDI DI NAPOLI	940,8	196,8	744,0	-	-
UNIVERSITA' DEGLI STUDI DI PADOVA	292,8	292,8	-	-	-
UNIVERSITA' DEGLI STUDI DI PALERMO	417,6	417,6	-	-	-
UNIVERSITA' DEGLI STUDI DI PARMA	355,2	355,2	-	-	-
UNIVERSITA' DEGLI STUDI DI PAVIA	220,8	220,8	-	-	-
UNIVERSITA' DEGLI STUDI DI PERUGIA	196,8	196,8	-	-	-
UNIVERSITA' DEGLI STUDI DI ROMA	6.152,4	2.120,4	672,0	-	3.360,0
UNIVERSITA' DEGLI STUDI DI TORINO	1.161,6	441,6	720,0	-	-
UNIVERSITA' DEGLI STUDI DI TRIESTE	1.248,0	196,8	1.051,2	-	-
POLITECNICO DI MILANO	3.360,0	-	-	-	3.360,0
POLITECNICO DI TORINO	220,8	220,8	-	-	-
UNIVERSITA' CATTOLICHE DEL SACRO CUORE	446,4	446,4	-	-	-
FRANCE (1)					
UNIVERSITE D'AIX MARSEILLE	417,6	417,6	-	-	-
UNIVERSITE DE BESANCON	417,6	417,6	-	-	-
UNIVERSITE DE BORDEAUX	763,2	43,2	720,0	-	-
UNIVERSITE DE CAIN	648,0	648,0	-	-	-

(1) SOURCE: 0.1 ANNUAIRE GENERAL DE L'INFORMATIQUE (1968)

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K. IN 1969

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows:					
FRANCE					
UNIVERSITE DE CLERMONT-FERRAND	240,0	240,0	-	-	-
UNIVERSITE DE DIJON	n.a.	n.a.	n.a.	n.a.	n.a.
UNIVERSITE DE GRENOBLE	5.346,0	1.074,0	912,0	-	3.360,0
UNIVERSITE DE LILLE	585,6	585,6	-	-	-
UNIVERSITE DE LYON	64,8	64,8	-	-	-
UNIVERSITE DE MONTPELLIER	1.248,0	336,0	912,0	-	-
UNIVERSITE DE NANCY	374,4	374,4	-	-	-
UNIVERSITE DE NANTES	446,4	446,4	-	-	-
UNIVERSITE DE NICE	n.a.	n.a.	n.a.	n.a.	n.a.
UNIVERSITE D'ORLEANS-TOURS	n.a.	n.a.	n.a.	n.a.	n.a.
UNIVERSITE DE PARIS A LA SORBONNE	3.345,6	1.425,6	-	1.920,0	-
UNIVERSITE DE POITIERS	196,8	196,8	-	-	-
UNIVERSITE DE RENNES	196,8	196,8	-	-	-
UNIVERSITE DE STRASBOURG	4.831,2	559,2	912,0	-	3.360,0
UNIVERSITE DE TOULOUSE	2.245,2	1.194,0	1.051,2	-	-
FACULTE DE SCIENCES ORSAY	9.068,4	764,4	-	1.584,0	6720,0

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K. IN 1969

UNIVERSITY	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
NETHERLANDS (1)					
UNIVERSITEIT VAN AMSTERDAM	1.286,4	662,4	624,0	-	-
VRIJE UNIVERSITEIT VAN AMSTERDAM	243,6	243,6	-	-	-
RIJKSUNIVERSITEIT TE GRONINGEN	864,0	-	864,0	-	-
RIJKSUNIVERSITEIT TE LEIDEN	1.824,0	240,0	-	1.584,0	-
KATHOLIEKE TE NIJMEGEN	1.584,0	-	-	1.584,0	-
RIJKSUNIVERSITEIT TE UTRECHT	1.444,8	844,8	600,0	-	-
TECHNISCHE HOGESHOOL TE DELFT	5.186,4	362,4	1.464,0	-	3.360,0
TECHNISCHE HOGESCHOOL TE ENSCHEDE	1.584,0	-	-	1.584,0	-
BELGIUM (2)					
UNIVERSITÉ DE BRUXELLES	3.456,0	-	672,0	2.784,0	-
RIJKS UNIVERSITEIT GENT	643,2	643,2	-	-	-
UNIVERSITE DE LIEGE	1.790,4	20 6,4	1.584,0	-	-
UNIVERSITE CATOLIQUE DE LOUVAIN	1.108,8	196,8	912,0	-	-

(1) SOURCE: J.M. VAN OORSCHOT

(2) SOURCE: SOBEMAP

follows TABLE X.6 (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K. IN 1969

UNIVERSITY	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
UNITED KINGDOM (1)					
UNIVERSITY OF ABERDEEN	744,0	-	744,0	-	-
UNIVERSITY OF BIRMINGHAM	600,0	-	600,0	-	-
UNIVERSITY OF BRISTOL	2.462,4	542,4	-	1.920,0	-
UNIVERSITY OF CAMBRIDGE	240,0	240,0	-	-	-
UNIVERSITY OF EDINBURGH	2.520,0	-	600,0	1.920,0	-
UNIVERSITY OF GLASGOW	600,0	-	600,0	-	-
UNIVERSITY OF LEEDS	600,0	-	600,0	-	-
UNIVERSITY OF LIVERPOOL	600,0	-	600,0	-	-
UNIVERSITY OF LONDON	4.324,8	364,8	600,0	-	3.360,0
VICTORIA UNIVERSITY OF MANCHESTER	3.360,0	-	-	-	3.360,0
UNIVERSITY OF NEWCASTIE-UPON-TYNE	3.360,0	-	-	-	3.360,0
UNIVERSITY OG OXFORD	600,0	-	600,0	-	-
UNIVERSITY OF SHEFFIELD	1.296,0	-	-	1.296,0	-
UNIVERSITY OF STRATHCLYDE	600,0	-	600,0	-	-
UNIVERSITY OF WALES	2.712,0	768,0	1.944,0	-	-
IMPERIAL COLLEGE	9.057,0	1.497,0	-	-	7.560,0
QUEEN'S UNIVERSITY OF BELFAST	1.296,0	-	-	1.296,0	-
NORTHERN POLYTECHNIC	787,2	187,2	600,0	-	-
HATFIELD POLYTECHNIC	888,0	144,0	744,0	-	-

(1) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL UNIVERSITIES IN THE EEC COUNTRIES AND THE U.K.' IN 1969

UNIVERSITY	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows:					
UNITED KINGDOM					
LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY	832,8	232,8	600,0	-	-
NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE	600,0	-	600,0	-	-
STAFFORDSHIRE COLLEGE OF TECHNOLOGY	925,2	181,2	744,0		

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL RESEARCH INSTITUTES IN THE EEC COUNTRIES AND THE U.K.: IN 1969

RESEARCH INSTITUTE	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
GERMANY (1)					
DEUTSCHE VERSUCHSANSTALT FÜR LUFT-UND RAUMFAHRT	1.238,4	-	-	1.238,4	-
DEUTSCHE FORSCHUNGSANSTALT FÜR LUFT-UND RAUMFHART	1.338,0	522,0	816,0	-	-
KERNFORSCHUNGSZENTRUM (KARLRUHE - JULICH)	7.272,0	-	-	-	7.272,0
INSTITUT FUR ASTROPHYSIK	6.720,0	-	-	-	6.720,0
DEUTSCHES RECHENZENTRUM	6.000,0	-	-	2.640, 0	3.360,0
ITALY (2)					
NATIONAL PHATOGRAM ANALIS CENTRE (NGN)	5.016,0	1.368,0	-	-	3.648,0
CETIS (EURATOM)	7.372,8	964,8	-	3.048,0	3.360,0
ISTITUTO SUPERIORE DELLA SANITA'	1.584,0	240,0	1.344,0	-	-
FRANCE (3)					
CEA	24.802,8	7.186,8	1.488,0	5.088,0	11.040,0
SOGREAM	4.406,4	134,4	912,0	-	3.360,0
CNES	974,4	302,4	672,0	-	(4.080,0)
CENTRE D'ESSAIS EN VOL	1.795,2	499,2	-	1.296,0	-

(1) SOURCE: DIRECT SURVEY
(2) SOURCE: DIRECT SURVEY
(3) SOURCE: 0.1 ANNUAIRE GENERAL DEL L'INFORMATIQUE (1968)

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL RESEARCH INSTITUTES IN THE EEC COUNTRIES AND THE U.K. IN 1969

RESEARCH INSTITUTE	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows :					
FRANCE					
INSTITUT BLAISE PASCAL	4.227,6	723,6	-	3.504,0	-
SAINT LOUIS	672,0	-	672,0	-	-
CNET	480,0	480,0	-	-	-
NETHERLANDS (1)					
STICHTING NETERLANDS SCHEEPS BOUWKUNDING PROEFSTATION	1.545,6	480,0	1.065,0	-	-
RIJKSCENTRAALE VOOR MECHANISCHE ADMINISTRATIE (RMA)	2.164,8	-	580,8	1.584,0	-
BELGIUM (2)					
BELGO NUCLEAIRE	916,8	196,8	720,0	-	-
INSTITUT DE RECHERCHE	1.569,6	657,6	912,0	-	-
UNITED KINGDOM (3)					
UKAEA	17.923,2	4.747,2	2.616,0	6.120,0	4.440,0

(1) SOURCE: J.M. VAN OORSCHOT

(2) SOURCE: SOBEMAP

(3) SOURCE: COMPUTER SURVEY, ALPHABETICAL LIST OF USERS IN THE UNITED KINGDOM NOVEMBER/DECEMBER 1969

follows TABLE X.b (A)

VALUE OF COMPUTERS INSTALLED IN THE PRINCIPAL RESEARCH INSTITUTES IN THE EEC COUNTRIES AND THE U.K. IN 1969

RESEARCH INSTITUTE	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows :					
UNITED KINGDOM					
MINTECH CENTRES	15.318,0	8.166,0	1.200,0	2.592,0	3.360,0
SCIENCE RESEARCH COUNCIL	13.046,4	712,4	1.704,0	-	10.630,0
AGRICULTURAL RESEARCH COUNCIL	677,0	-	677,0	-	-
MEDICAL RESEARCH COUNCIL	458,0	458,0	-	-	-

TABLE X.b (B)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND THE U.K. IN 1969

BRANCH: SERVICE BUREAUS

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
GERMANY					
GESELLSCHAFT FÜR AUTOMATISCHE DATENVERARBEITUN GMBH	2059,2	1478,4	580,8	-	-
CONTROL DATA CORPORATION	624,0	-	624,0	-	-
EDV - ELETRONISCHE DATENVERARBEITUNGSGESELL-SCHAFT MBH	580,8	-	580,8	-	-
GESCHAFTSBEREICH DER DEUTSCHEN ITT INDUSTRIES GMBH - ITT DATENSERVICE	3177,6	1353,6	1824,0	-	-
IBM DEUTSCHLAND	22147,2	1747,2	9120,0	7920,0	3360,0
NATIONAL REGISTRIERKASSEN GMBH	2467,2	144,0	2323,2	-	-
PRAKLA GMBH	1209,6	144,0	1065,6	-	-
REMINGTON RAND GMBH GESCHAEFTSBEREICH UNIVAC	2601,6	201,6	-	2400,0	-
RIB - RECHENINSTITUT FUR DAS BAUWESEN	1756,8	518,4	-	1238,4	-
SIEMENS AG	2606,4	1790,4	816,0	-	-
AEG-TELEFUNKEN	7008,0	-	1728,0	5280,0	-

SOURCE: THE INTERNATIONAL DIRECTORY OF COMPUTER AND INFORMATION SYSTEM SERVICES 1969, EUROPA PUBLICATION LTD, LONDON 1969

follows TABLE X.b (B)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND THE U.K. IN 1969

BRANCH: SERVICE BUREAUS

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
ITALY					
CDC	1065,6	-	1065,6	-	-
CENTRO DI CALCOLO CNUCE	7155,6	747,6	-	3048,0	(3.360,0)
CENTRO MECCANOGRAFICO SERVIZI	960,0	-	960,0	-	-
GE INFORMATION SYSTEM	3120,0	-	960,0	2160,0	-
HONEYWELL DATA CENTRE	768,0	768,0	-	-	-
IBM	15529,2	8473,2	5472,0	1584,0	-
SIEMENS ELETTRA	1056,0	1056,0	-	-	-
SINTAX	1065,6	-	1065,6	-	-
FRANCE (1)					
ASS. RECHERCHES TECH. ET D'ORGANISATION	1358,4	777,6	580,8	-	-
CENTRE DE TIME SHARING BGE	1324,8	364,8	960,0	-	-
BULL GENERAL ELECTRIC - CENTRE NATIONAL DE CALCUL ELECTRONIC	2817,6	1953,6	864,0	-	-
CCMC - COMPAGNIE DES CENTRES MECANO-COMPTABLES	3398,4	1814,4	-	1584,0	-
CENTRE FRANÇAIS DE RECHERCHE OPERATIONNELLE CFRO SEDRE	4747,2	1387,2	-	-	3360,0

SOURCES: THE INTERNATIONAL DIRECTORY OF COMPUTER AND INFORMATION SYSTEM SERVICE 1969, EUROPA PUBLICATION LTD, LONDON 1969

(1) O.1. INFORMATIQUE SCOPE, PARIS 1969

follows TABLE X.b (B)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND THE U.K. IN 1969

BRANCH: SERVICE BUREAUS

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows:					
FRANCE	4747,2	1387,2	-	-	3360,0
CEPLAM	720,0	-	720,0	-	-
COMPAGNIE INTERNATIONAL POUR L'INFORMATIQUE					
CII - CENTRE DE CALCUL	1864,8	1284,0	580,8	-	-
COMPTABILITE STATISTIQUE SA	1706,4	794,4	912,0	-	-
COMPTA - CARTE	871,2	199,2	672,0	-	-
CENTRE SOGECIM - SOCIETE POUR LA GESTION ET LA MECANOGRAPHIE	1680,0	768,0	912,0	-	-
HONEYWELL	2008,8	1428,0	580,8	-	-
IBM	15264,0	2304,0	912,0	3168,0	8880,0
IMSAC - INSTITUT MECANOGRAPH. DE STATISTIQUE ET APPLIC. COMPTABLES	6866,4	2594,4	912,0	-	3360,0
NATIONAL NCR	724,8	144,0	580,8	-	-
SIEMENS S.A.F.	816,0	-	816,0	-	-
SOCIETE D'INFORMATIONS APPLIQUEES (SEMA)	7396,8	580,8	816,0	1920,0	4080,0
SOCIETE FRANCAISE DE GESTION ET MECANOGRAPHIE	912,0	-	912,0	-	-
UNIVAC	3475,2	115,2	-	-	3360,0
CCSA	6720,0	-	-	-	6720,0

follows TABLE X.b (B)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND THE U.K. IN 1969

BRANCH: SERVICE BUREAUS

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
NETHERLANDS					
BULL GENERAL ELECTRIC	1536,0	576,0	960,0	-	-
CENTRUM VOOR INFORMATIEVERWERKING N.V.	1075,2	259,2	816,0	-	-
NV COMMERCIEEL COMPUTER CENTRUM	580,8	-	580,8	-	-
TIE SERVICE CENTRUM (ASC) VAN N. SAMSON N.V.	1430,4	518,4	912,0	-	-
N.V. ELECTROLOGICA	600,0	-	600,0	-	-
IBM NEDERLAND N.V.	8755,2	3283,2	1824,0	-	3648,0
INGENIEURSBUREAU RESCONA	1123,2	542,4	580,8	-	-
N.V. INSTITUT VOOR ELECTRONISCHE	1824,0	912,0	912,0	-	-
NCR NEDERLAND N.V.	1215,6	54,0	1161,6	-	-
NEDERLANDSCHE SIEMENS MAATSCHAPPIJ	1012,8	196,8	816,0	-	-
BELGIUM					
AUTOMATION CENTER	1214,4	350,4	864,0	-	-
IBM OF BELGIUM S.A.	2662,8	1750,8	912,0	-	-
S.A. SIEMENS N.V.	1012,8	196,8	816,0	-	-
SIA -SOBEMAP	1056,0	-	1056,0	-	-

... follows TABLE X.b (B)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND THE U.K. IN 1969

BRANCH: SERVICE BUREAUS

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
UNITED KINGDOM					
ASSETS COMPUTER SERVICES LTD	840,0	240,0	600,0	-	-
AUTOMATIC DATA PROCESSING LTD	600,0	-	600,0	-	-
CAPITAL COMPUTER APPLICATIONS	1689,6	777,6	912,0	-	-
COMPUTER PROJECTS LTD	2644,8	1732,8	912,0	-	-
COMPUTER SERVICES LTD	1752,0	840,0	912,0	-	-
UNIVERSITY COMPUTING CO.	13427,2	907,2	-	4800,0	7720,0
CONTRACT COMPUTING LTD	624,0	-	624,0	-	-
DATASOLVE LTD	744,0	-	744,0	-	-
DE LA RUE BULL INFORMATION PROCESSING CENTRE	960,0	-	960,0	-	-
FLETCHER COMPUTER SERVICES LTD	672,0	-	672,0	-	-
GENERAL COMPUTER SERVICES LTD	1420,8	364,8	1056,0	-	-
HONEYWELL CONTROLS LTD	5433,6	1257,6	2496,0	1680,0	-
INDATA LTD	912,0	-	912,0	-	-
IBM UNITED KINGDOM LTD	17692,8	5068,8	2736,0	2880,0	7008,0
INTERNATIONAL COMPUTING SERVICE	11442,0	2029,2	6052,8	-	3360,0
ITT DATA SERVICES UK	2716,8	892,8	1824,0		-
NCR CO.	2879,6	537,6	2342,0	-	-
THE NATIONAL COMPUTING CENTRE	1137,6	537,6	600,0	-	-
OXFORD UNIVERSITY COMPUTING LABORATORY	600,0	-	600,0	-	-
SANACO COMPUTER SERVICE	4056,0	-	696,0	-	3360,0

SOURCE: THE INTERNATIONAL DIRECTORY OF COMPUTER AND INFORMATION SYSTEM SERVICE 1969, EUROPA PUBLICATION LTD, LONDON 1969. COMPUTER SERVICE BUREAUX 1969, IN "COMPUTER SURVEY" JANNARY, FEBRUARY 1969

follows TABLE X.b (B)

VALUE OF COMPUTERS INSTALLED IN THE MAIN COMPANIES OF THE BRANCH IN THE EEC COUNTRIES AND THE U.K. IN 1969

BRANCH: SERVICE BUREAUS

COMPANIES	VALUE OF COMPUTERS INSTALLED BY SIZE CLASSES (.000 $)				
	TOTAL	DESK and SMALL	MEDIUM	LARGE	EXTRA LARGE
follows: UNITED KINGDOM					
SYSTEMS PROCESSING CENTRE LTD	864,0	-	864,0	-	-
NATIONAL DATA PROCESSING SERVICE	10176,0	672,0	5040,0	4464,0	-
SIA	4080,0				4080,0