RESEARCH AND EXPERIMENTAL DEVELOPMENT (R&D) STATISTICS 1998

by Jane Morgan ONS email: info@statistics.gov.uk

RESEARCH AND EXPERIMENTAL DEVELOPMENT (R&D) STATISTICS 1998

List of Tables

Summary of trends

- Measuring expenditure and employment of R&D is difficult because of the subjective judgements that have to be made about the dividing line between R&D and other activities. There are discontinuities in the series arising from the interpretation of definitions, and because of changes in the actual or perceived status of organisations (ref 1, chapter 1 details this). Some general conclusions can be drawn, but significance should not be given to small percentage changes between years.
- In 1998 Gross Domestic Expenditure on R&D (GERD) was 1.82% of GDP, very similar to 1997 (Table 2). In terms of international comparisons in 1998 the UK was ranked 5th amongst G7 countries and was just above the EU average of 1.81% (ref 5).
- Within the UK, net expenditure in real terms on R&D by government peaked in 1980/81. Since then there has been a gradual downward trend (Table 4). The overall level of net government expenditure on defence R&D has fallen from 44% in 1990 to 37% in 1998 (Table 6).
- Expenditure in real terms performed by the business sector has increased by 3% on the total in 1997 (Table 7).
- Within the manufacturing sector, the chemicals broad product group has the largest share of total R&D expenditure at 29%. The services sector accounts for 23% of total R&D expenditure (Table 8).
- Within the regions, spending is highest in the South East for both the business & government sectors (Table 14).

Background

This article is the latest in an annual series, the previous issue was published in the August 1999 edition of Economic Trends. Most of the figures have already been published by the Office for National Statistics, the Department of Trade and Industry (Office of Science and Technology) or the OECD (refs 1,2,4,5). The purpose of this report is to bring together a range of data produced & published by ONS in a single annual article and our aim is to continue to inform and stimulate debate within the R&D community.

The R&D statistics published here are consistent with OECD's Frascati Manual (ref 3) which defines Research and Experimental Development (R&D) and gives guidelines on how to measure expenditure and employment on R&D. The manual is applied throughout the OECD so it is possible to make comparisons between countries (refs 5 & 6).

R&D is defined as creative work undertaken systematically to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this knowledge to devise new applications.

Care should be exercised when using R&D statistics for economic analysis. R&D can lead to the technological inventions that are necessary for a successful innovative economy. However, such inventions are not a sufficient condition for success - many other economic and social factors are important. Undue weight should not be given to the economic significance of R&D's role as a generator of inventions. On the other hand, the economic benefit of R&D is not limited to that role: R&D develops skills and techniques that are important for any economy.

Sources of information

Performers and funders of R&D are divided into four economic sectors: Government, Business, Higher Education Institutions (HEIs), and the Private Non-Profit (PNP) sector. Definitions are provided at the end of this article.

The ONS conducts an annual survey of Central Government R&D, which is addressed to all Government departments. The survey collects data on expenditure and employment for outturn and planning years. The latest detailed results will be published in August 2000 in OST's *Science, Engineering and Technology Statistics 2000* (SET 2000) (ref 1). This document will be available on OST's web site at http://www.dti.gov.uk/ost/.

The ONS also conducts an annual survey of R&D in businesses. As in previous years the 1998 survey used a sample survey to minimise burdens on contributors. The register of R&D performers is continually updated and results and detailed methodology notes can be found in the 1998 Business Monitor (ref 2).

Statistics on expenditure and employment on R&D in Higher Education Institutions (HEIs) are based on information collected by Higher Education Funding Councils and HESA (Higher Education Statistics Agency). In 1994 a new methodology was introduced to estimate expenditure on R&D in HEIs. This was based on the allocation of various Funding Council Grants. Full details of the new methodology will be contained in SET 2000 (ref 1).

The Tables

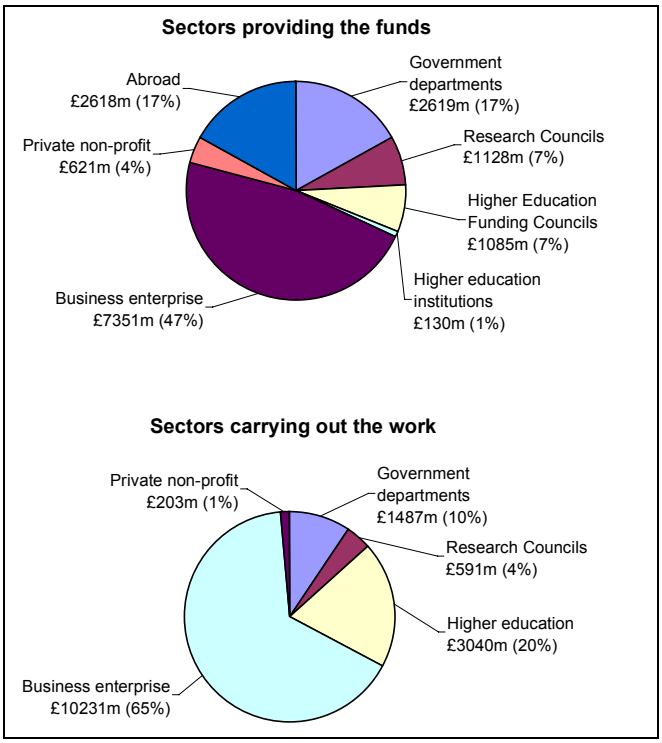
Gross Domestic Expenditure on R&D (GERD) (Tables 1-3)

These tables show the performers and funders of R&D in the UK. Measuring expenditure on R&D performed within each sector avoids problems of omission and double counting that can arise when measuring funds provided for R&D. GERD is the sum of R&D performed in the four sectors. Tables 1 and 2 show that UK GERD in 1998 was £15.6 billion in cash terms. GERD is often quoted as a percentage of GDP when making international comparisons. In 1998 UK GERD was 1.82% of GDP, similar to the previous year's figure, just above the EU average of 1.81%.

Table 1 shows the interaction between R&D funders and performers. For example £10.2 billion was spent on R&D in the business sector. Of this, £1.2 billion was provided by the government, £2.2 billion came from abroad and £6.8 billion was funded by businesses from their own sources. Funds from abroad include those from overseas parent companies, contracts for R&D projects, support for R&D provided through European Union schemes and international collaborative projects typically for aerospace or defence projects.

Figure 1 shows that the business sector is the most important sector of the economy in terms of providing funds for and carrying out R&D.

Figure 1
Gross Expenditure on R&D in the UK, by sectors, 1998

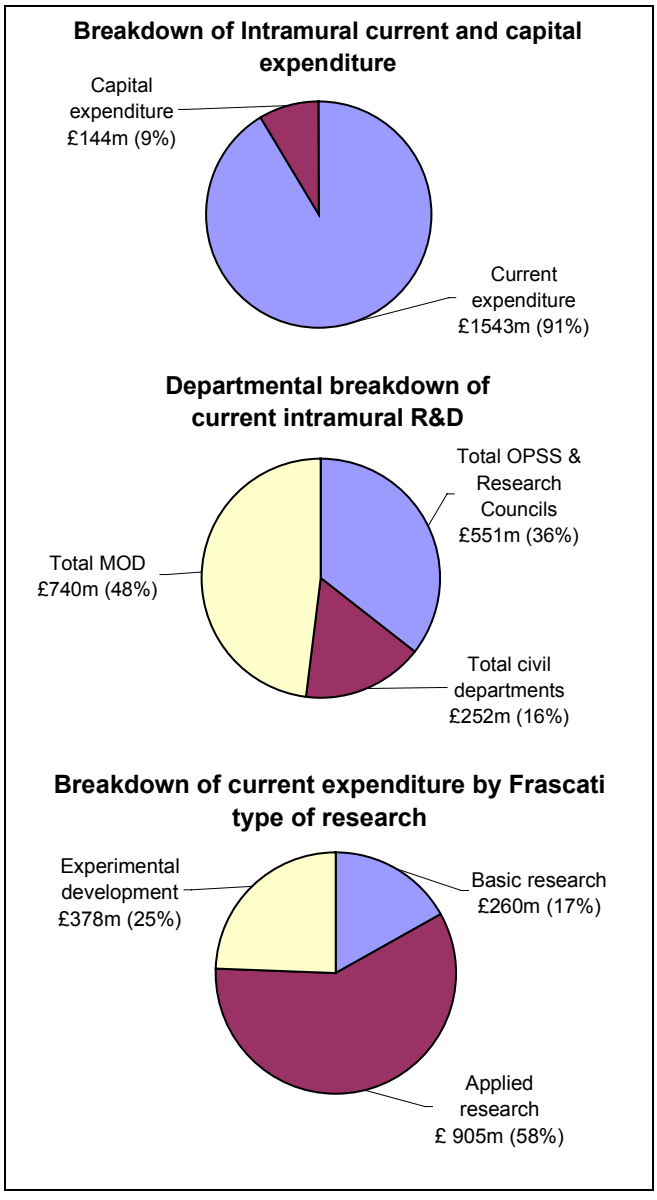


Government R&D expenditure (Tables 4 to 6)

A department's net expenditure on R&D is its expenditure on R&D performed within the department (intramural) plus its expenditure on R&D outside the department (extramural) minus receipts for R&D.

The sum of a department's net expenditure is the R&D element of the government's budget expenditure. This is used for international comparisons of Government appropriations for R&D (eg Table 18). The UK has a high proportion of Central Government expenditure devoted to R&D for defence purposes.

Figure 2
Analysis of Central Government intramural expenditure 1998-99



Figures in Tables 4 and 6 for Government's net expenditure on R&D differ from Government funding figures in Tables 1 and 3. This is because Tables 1 to 3 are based on information supplied by R&D **(performers)** whilst Tables 4 to 6 contain expenditure figures reported by Government departments **(funders)**. The gap is mainly accounted for by differences in the reporting of Government contracts with businesses for certain types of defence R&D and R&D performed abroad but funded by the UK Government. In addition the difference is also attributed to other factors such as time lag problems due to differences in accounting periods and not all monies given being used in that financial period, treatment of VAT and sub-contracting of R&D work.

R&D in NHS hospitals previously included in Table 5 on the basis of the Culyer report (ref 7), are now reported as extramural expenditure. The figures for Central Government intramural R&D in Table 5 are lower than those performed by the government sector in Tables 1 and 2. This is because the latter includes estimates for a small amount of R&D not available from the Government survey and R&D performed by local authorities.

Table 4 shows a time series dating back to 1966/67. This shows that in 1998/99 the net Government expenditure on R&D (by civil and defence departments) was £5.3 billion, a slight decrease on 1997/98. In real terms, spending on R&D was flat in the late sixties but rose in the seventies to a peak in 1980/81. Since then it has declined although spending in 1998/99 was still more than in 1966/67.

Table 5 shows the breakdown of departmental intramural expenditure (see figure 2); the current (which is also shown by Frascati type of research) and capital expenditure. Figure 2 shows that 91% (£1.5 billion) of intramural expenditure is current expenditure. Applied research accounts for 54% of the total intramural expenditure. Total intramural expenditure is further broken down in Table 5 into Social Science & Humanities (SSH) and Natural Science & Engineering (NSE) research.

Table 6 provides an analysis of net government R&D expenditure by Frascati type of research activity for the period 1990-91 to 1998-99. The share of expenditure attributed to applied research has remained fairly constant over the nine-year period, whereas the share attributed to basic research has increased at the expense of the share attributed to experimental development. In 1990-91 defence expenditure accounted for 44% of total expenditure. This share had declined to 37% by 1998-99.

R&D performed by the Business Sector (Tables 7-12)

Table 7 and figure 3 show a time series dating back to 1966 for expenditure performed by the Business sector. They show that in 1998 R&D expenditure was £10.2 billion. Expenditure in real terms in the business sector peaked in 1990. After falling by 8% in 1991, expenditure increased each year to 1994. Since then there has been a gradual decrease until 1998 which shows a 3% increase on 1997. R&D performed by business has increased in real terms by 63% since 1966.

Figure 3
Net Business enterprise expenditure on R&D, in cash and real terms, 1966 to 1998

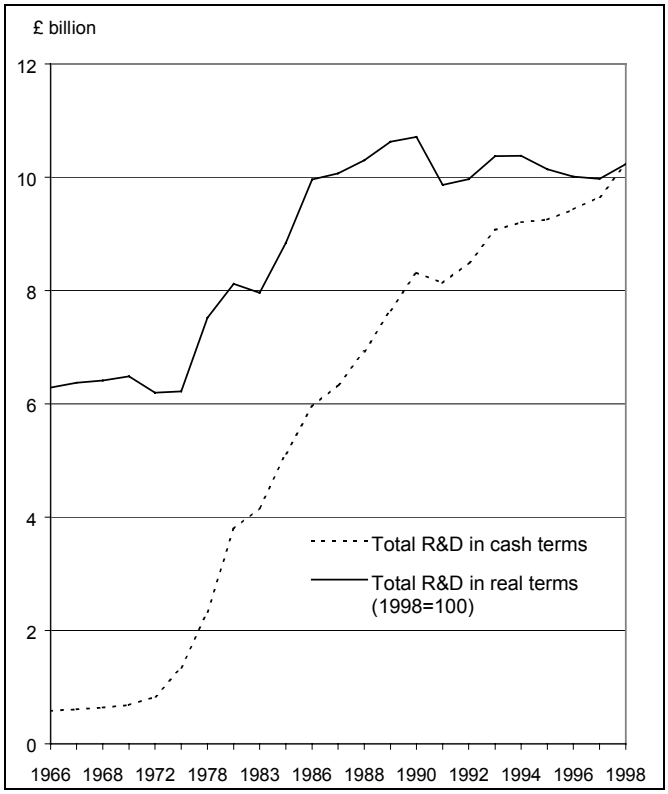


Table 8 shows that within the business sector, the services broad product group accounted for 23% of the total expenditure in 1998. In the manufacturing sector the pharmaceuticals and chemicals broad product group had the largest share of R&D expenditure at 29% of the total.

Statistics for civil and defence have been collected separately since 1989. Defence includes all R&D programmes undertaken primarily for defence reasons, regardless of their content or whether they have secondary civil applications.

In 1998, civil R&D represented 85% of all R&D expenditure performed by business (Table 9), compared to 79% in 1990. Table 10 and figure 4 show that, in 1998, 74% of civil R&D performed by businesses was funded by businesses themselves. Government funded 5% of civil R&D, whereas it funded 51% of defence R&D.

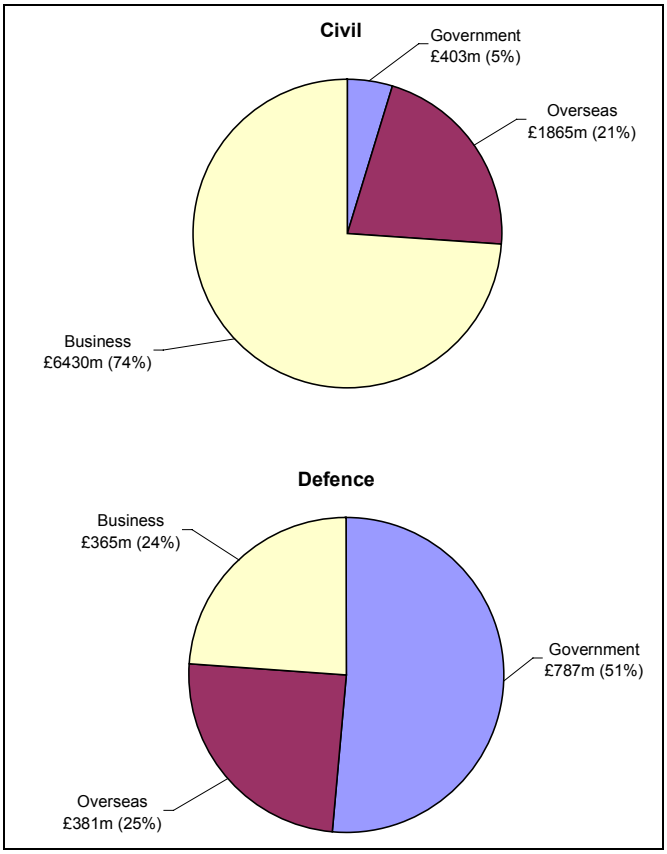
The breakdown into detailed product groups is shown in Tables 11 and 12. The product group with the largest expenditure is pharmaceuticals, medical chemicals and botanical products, which accounted for £2.2 billion in 1998, followed by Aerospace at £1.0 billion.

Table 12 shows the split of current and capital expenditure on R&D performed by UK businesses. Current expenditure is the sum of salaries and wages, basic and applied research and experimental development. Capital is the expenditure on land, buildings, plant and machinery.

R&D employment - Government and Business Enterprise (Table 13)

Between 1997 and 1998, employment has risen by 8% in Business Enterprise and 21% in government departments. Research Councils' employment has remained fairly stable during the period 1990 to 1998.

Figure 4
Sources of funds for Business Enterprise R&D, 1997



Regional R&D statistics (Tables 14-15)

Regional estimates for the Government and Business sectors are derived from the ONS surveys of Government and Business Enterprises.

The Higher Education Institutions (HEI) regional R&D estimates are less reliable and should be treated with special caution. The expenditure estimates are obtained by allocating total R&D performed by HEIs (HERD) to individual HEIs in proportion to their income from research grants and contracts. An estimate of the labour force in Full Time Equivalents (FTE) is not available.

Estimates are given for UK Government Office Regions (GOR). Of the 12 GOR regions the South East of England has the highest number of R&D personnel and the largest expenditure on R&D (this reflects in part the greater size of the South East). To adjust for this the R&D personnel estimates are also shown as a percentage of the labour force (see figure 6). At the time of publication, it is not possible to show R&D expenditure as a percentage of GDP because of the unavailability of regional GDP for 1998 (see figure 5). Tables 14 and 15 show that, within the UK, the Eastern and South East have the highest concentration of R&D expenditure performed by business. For the Government sector the highest regions are the South East, the South West and the Eastern region, whilst for the Higher Education Sector, London, the South East and Scotland are prominent (see figure 5). In terms of personnel estimates as a percentage of the labour force (see figure 6), the South East and the Eastern region are prominent in both the Business and Government sectors.

Figure 5

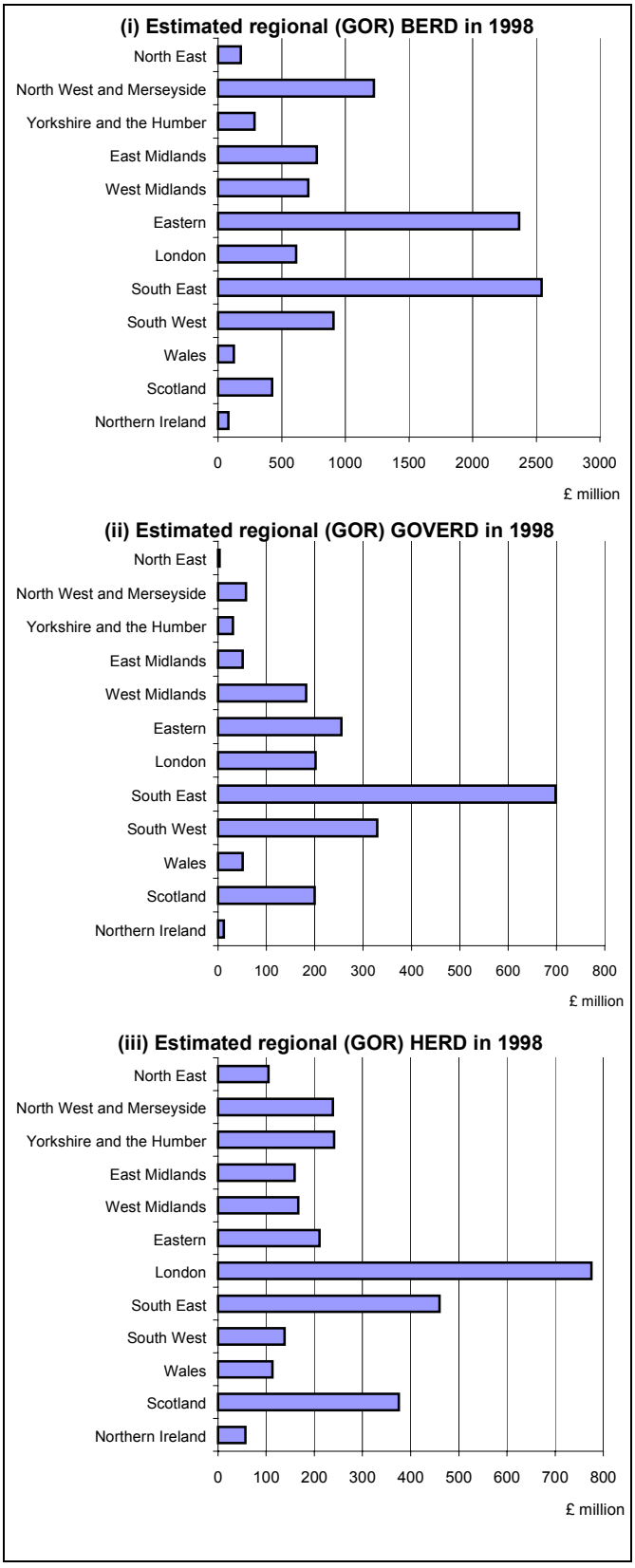
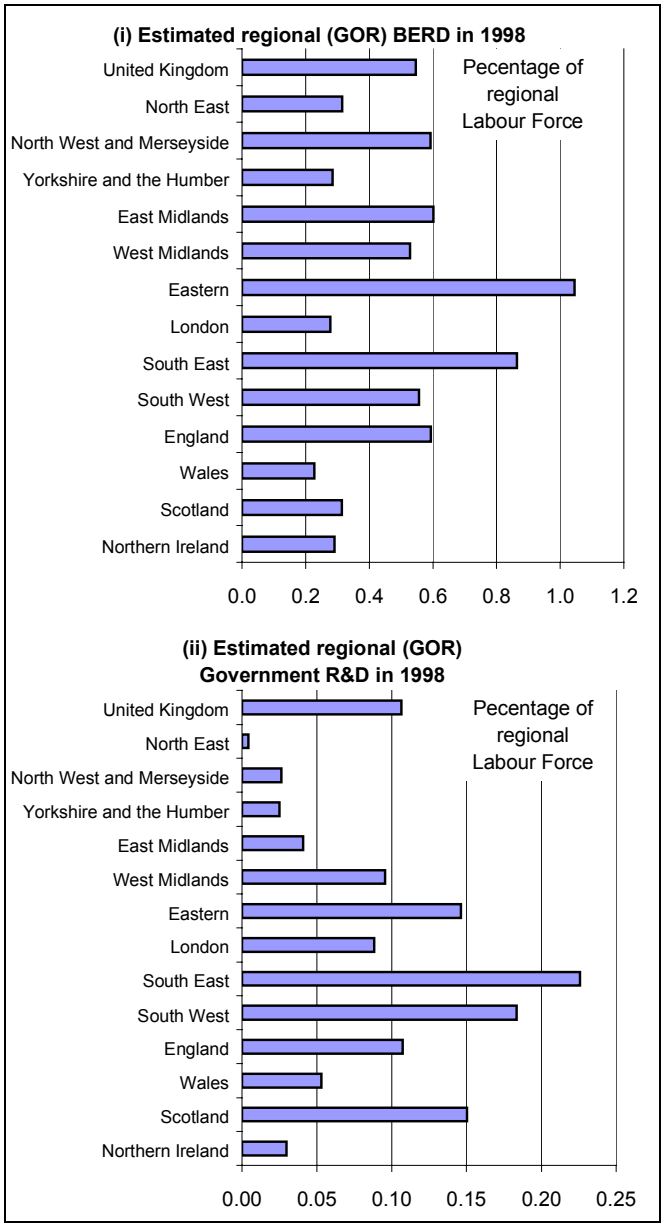


Figure 6

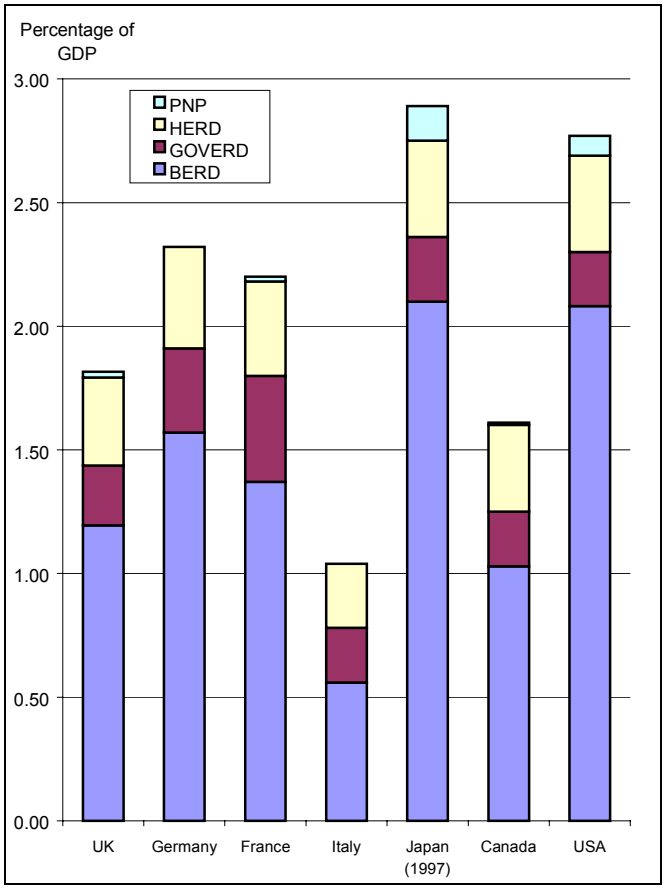


International comparisons of R&D (Tables 16-19)

Although the guidelines in the Frascati Manual are generally followed, methods of collecting R&D data do vary from country to country (ref 5 discusses national variations). Therefore small differences should not be treated as significant when making international comparisons.

The figures shown for Japan in the tables are estimated by OECD.

Figure 7
Comparison of BERD, GOVERD, HERD and PNP as a percentage of GDP, 1998



Source: OECD

Table 16 shows the trend of R&D as a percentage of GDP for the G7 countries over the time period 1990 to 1998. The ratio for GERD has been fairly constant over this time for most of the countries. Figure 7 shows the position in 1998. The UK was ranked 5th . Table 16 also shows BERD and GOVERD as a percentage of GDP.

Table 17 shows the international comparisons of GERD by sector of performance and source of funding. Table 18 shows R&D performed in the business sector. Table 16 also shows this as a percentage of GDP; Japan and the USA are the top spenders with the UK holding a middle ranking position. International comparison of Government funding of R&D in 1997 by socio-economic objective is shown in table 19. Of the G7 countries, the USA and the UK devoted the highest proportion of their total Government funding of R&D to defence. For Germany, Italy and Japan about half of their total Government funding of R&D was classified as the advancement of knowledge compared to approximately a third for France.

Definitions

Type of R&D

Basic or fundamental research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

Applied research is research undertaken with either a general or a particular application in view.

Experimental Development is the use of the results of basic and applied research directed to the introduction of new materials, processes, products, devices and systems, or the improvement of existing ones. It should include the prototype or pilot plant stage, design and drawing required during R&D and innovative work done on contracts with outside organisations, government departments, and public bodies. Firms in the aerospace industry are asked to include expenditure on development batches.

Sectors of the Economy

The four sectors of the economy are defined in an ONS publication (ref 4). However higher education is identified separately as recommended in the Frascati Manual.

Central Government includes the central government departments, research councils, higher education funding councils, NDPBs, and Executive Agencies.

Business Enterprises include private businesses, public corporations, and research associations serving businesses.

Higher Education includes the former polytechnics and central institutions in Scotland as well as the old universities.

Private Non-Profit sector makes up the remainder and includes medical research charities.

Regional data

Data is classified according to the Government Office Regions (GOR).

Rounding

Throughout the tables components of totals have been rounded independently of the totals. Therefore the rounded totals will not always be equal to the sums of the rounded components. Symbols follow the conventions used elsewhere in Economic Trends.

Revisions and Discontinuities

In the Government Tables, a new method for estimating Government funded R&D in HE was introduced in 1994/95, therefore 1993/94 figures have been revised. It is not possible to revise the data for prior years because of the structural changes in the HE sector.

Government figures in some tables (see table footnotes) for 1995/96 onwards, now include NHS Hospital R&D estimates for the first time.

The 1996 and 1997 Business Survey results have been revised where necessary to take account of company misreporting. There have also been some small changes due to misclassification and updated population information. Full details on the revisions were included in ONS's First Release (99) 403 published on 19 November 1999 (ref 9).

Figures relating to gross expenditure on R&D published in the ONS First Release (2000) 119 (ref 4) on 31 March 2000 have been revised slightly due to government department amendments.

Regional data is published using GOR regions and these should not be compared to NUTS regional data previously published in this annual article. Because regional GDP is unavailable at the time of publication, it is not possible to show R&D as a percentage of regional GDP for 1998 (see Table 5).

Data Analysis Service

The ONS is now able to offer additional analysis concerning R&D statistics eg sizeband and regional breakdowns. The contact for this service is:

Jane Morgan Tel no: 01633 813109
e-mail: jane.morgan@ons.gov.uk

For further information on:	ONS Contacts:
Business R&D (Ref 2)	Jane Morgan Tel. 01633 813109
Information on aggregated R&D data	Jane Morgan Tel. 01633 813109
Definitions of R&D (Ref 3)	Jane Morgan Tel. 01633 813109
GERD (Ref 4)	Jane Morgan Tel. 01633 813109
General information on Science & Technology (Ref 1)	Steve Churchill Tel. 01633 812003
International comparisons (Ref 5, 6, 8)	Steve Churchill Tel. 01633 812003

References

(1) Science, Engineering and Technology Statistics 2000, DTI, OST. TSO, August 2000

(2) ONS UK Business Reference, Research and Development in UK Business, MA14. ONS Direct, January 2000, ISSN 1463 6115

(3) Proposed Standard Practice for Surveys of Research and Experimental Development (The Frascati Manual), OECD Paris 1993

(4) ONS First Release ONS (2000) 119, 31 March 2000, Gross Domestic Expenditure on Research and Development 1998

(5) Main Science and Technological Indicators 1999/2, OECD, Paris 1999

(6) Research and Development: Annual Statistics 1998, Eurostat, Luxembourg 1997, ISBN 92-828-4876-0

(7) "Supporting Research and Development In The NHS", (A report to the Minister of Health by a research and development task force chaired by Professor Anthony Culyer), September 1994; ISBN 0-11-321831-1

(8) Economic Trends, No 549, August 1999, ONS (ISSN 0013 0400)

(9) ONS First Release ONS (99) 403, 19 November 1999, Business Enterprise Research and Development 1998

Abbreviations

BERD	Business Expenditure on R&D
EU	European Union
EUROSTAT	The Statistical Office of the European Communities
FTE	Full Time Equivalent
G7	Group of Seven countries, comprising: UK, Germany, France, Italy, Japan, Canada, USA
GDP	Gross Domestic Product
GERD	Gross (Domestic) Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GOR	Government Office Regions
HEFC	Higher Education Funding Council
HEIs	Higher Education Institutions
HERD	Higher Education Expenditure on R&D
HESA	Higher Education Statistics Agency
NDPB	Non-Departmental Public Body
NHS	National Health Service
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
ONS	Office For National Statistics
OST	Office of Science and Technology (part of DTI since April 1996)
PPP	Purchasing Power Parities
PNP	Private Non-Profit
R&D	Research and (Experimental) Development

Table 1 Gross expenditure on civil and defence R&D performed in the UK in 1998 (1)

£ million

	Sectors carrying out the work (2) (3)						
Sectors providing the funds (2) (3)	**Government departments (4)**	**Research Councils**	**Higher education**	**Business enterprise**	**Private non-profit**	**Totals**	**Abroad**
Government departments (4)	1161	76	177	1184	20	2619	141
Research Councils	18	398	697	6	10	1128	128
Higher Education Funding Councils	-	-	1085	-	-	1085	
Higher education institutions	0	6	122	-	1	130	
Business enterprise	260	38	221	6795	38	7351	
Private non-profit	11	35	463	-	113	621	
Abroad	38	39	275	2246	21	2618	
TOTAL	**1487**	**591**	**3040**	**10231**	**203**	**15553**	**n/a**
Civil							
Government departments (4)	504	69	142	397	20	1132	129
Research Councils	17	398	697	6	10	1128	128
Higher Education Funding Councils	-	-	1085	-	-	1085	
Higher education institutions	0	6	122	-	1	130	
Business enterprise	202	38	196	6430	38	6903	
Private non-profit	11	35	463	-	113	621	
Abroad	8	39	275	1865	21	2207	
TOTAL	**742**	**585**	**2980**	**8698**	**203**	**13207**	**n/a**
Defence							
Government departments (4)	658	7	35	787	0	1487	12
Research Councils	0	-	-	-	-	0	-
Higher Education Funding Councils	-	-	-	-	-	-	
Higher education institutions	0	-	-	-	-	0	
Business enterprise	58	-	25	365	-	448	
Private non-profit	0	-	-	-	-	0	
Abroad	30	-	-	381	-	411	
TOTAL	**746**	**7**	**60**	**1533**	**0**	**2346**	**n/a**

Notes:

General Note:

These estimates are derived from the ONS surveys of government and business enterprise R&D and from information from the HEFC. More details are in the ONS First Release ONS(2000)(119). The First Release has been revised slightly due to departmental amendments

Notes:

1. Research in the social sciences and humanities is included.
2. The OECD terminology is used for describing the breakdown of GERD by sector.
3. Some of the numbers have been estimated.
4. The total for R&D performed by government includes estimates for a small amount of R&D not available from the Government Survey; R&D performed by local authorities. Since 1996 UK NHS figures have been obtainec from the Department of Health and the Scottish Office on the basis of the Culyer report.

Table 2 Gross expenditure on R&D in the UK by performing sector 1990 to 1998 (1)

£ million

	1990	1991	1992	1993	1994	1995	1996r	1997r	1998
Expenditure in cash terms (£m):									
Performed by:									
Government	1566	1757	1846	1928	2051	1462	1495	1427	1487
Research Councils	-	-	-	-	-	581	575	590	591
Business enterprise	8318	8135	8489	9069	9204	9254	9431	9657	10231
Higher education	1873	2020	2129	2312	2623	2696	2792	2893	3040
Private non-profit	234	219	224	232	168	177	177	190	203
TOTAL	**11991**	**12131**	**12689**	**13541**	**14046**	**14172**	**14470**	**14758**	**15553**
Expenditure in real terms (1998=100) (2) (£m):									
Performed by:									
Government	2018	2131	2168	2205	2313	1603	1587	1473	1487
Research Councils	0	0	0	0	0	637	610	609	591
Business enterprise	10714	9867	9966	10372	10377	10142	10013	9972	10231
Higher education	2413	2450	2500	2644	2957	2955	2964	2988	3040
Private non-profit	301	266	263	265	190	194	188	196	203
TOTAL	**15446**	**14713**	**14897**	**15486**	**15837**	**15531**	**15362**	**15239**	**15553**
Total as % of GDP (3)	**2.13**	**2.06**	**2.07**	**2.09**	**2.05**	**1.96**	**1.89**	**1.81**	**1.82**

Notes:

1. See notes at Table 1.
2. GDP deflators are:

1990	1991	1992	1993	1994	1995	1996	1997	1998
77.6	**82.5**	**85.2**	**87.4**	**88.7**	**91.3**	**94.2**	**96.8**	**100.0**

3. Gross domestic product values are: **£ million**

1990	1991	1992	1993	1994	1995	1996	1997	1998
562674	**589836**	**612630**	**647249**	**685805**	**722333**	**766330**	**814688**	**856662**

Table 3 Gross expenditure on R&D in the UK by source of funds 1990 to 1998 (1) (2)

£ million

	1990	1991	1992	1993	1994	1995	1996r	1997r	1998
Sector providing funds									
Expenditure in cash terms (£m):									
Funded by:									
Government	4123	4131	4239	4400	4657	2611	2494	2421	2619
Research Councils	-	-	-	-	-	1078	1092	1135	1128
Higher Education Funding Councils	-	-	-	-	-	1018	1027	1033	1085
Higher education	86	92	99	103	116	119	120	123	130
Business enterprise	5986	6054	6461	6974	7025	6796	6846	7321	7351
Private non-profit	365	397	435	451	495	511	546	579	621
Abroad	1433	1458	1455	1613	1753	2039	2345	2146	2618
TOTAL	**11991**	**12131**	**12689**	**13541**	**14046**	**14172**	**14470**	**14758**	**15553**
Expenditure in real terms (1998=100) (£m):									
Funded by:									
Government	5310	5010	4976	5032	5251	2862	2648	2500	2619
Research Councils	-	-	-	-	-	1181	1160	1172	1128
Higher Education Funding Councils	-	-	-	-	-	1115	1091	1066	1085
Higher education	111	111	117	117	130	130	128	127	130
Business enterprise	7711	7343	7585	7976	7921	7448	7268	7560	7351
Private non-profit	470	481	511	516	558	560	579	598	621
Abroad	1845	1768	1708	1845	1977	2235	2489	2217	2618
TOTAL	**15446**	**14713**	**14897**	**15486**	**15837**	**15531**	**15362**	**15239**	**15553**
Total as % of GDP	**2.13**	**2.06**	**2.07**	**2.09**	**2.05**	**1.96**	**1.89**	**1.81**	**1.82**

Notes:

1. See notes at Table 1.
2. See notes at Table 2.

Table 4 Total Net Government expenditure on R&D in cash terms and real terms 1966-67 to 1998-99

£ million

	Total Net Government R&D	
Year	In cash terms excluding NHS figures	In real terms (1998=100) (1)
1966-67	486	5270
1967-68	503	5297
1968-69	531	5327
1969-70	562	5360
1970-71	606	5333
1971-72	755	6089
1972-73	847	6319
1973-74	964	6714
1974-75	1169	6798
1975-76	1495	6939
1976-77	1647	6725
1977-78	1814	6520
1978-79	2097	6786
1979-80	2601	7207
1980-81	3184	7461
1981-82	3395	7265
1982-83	3519	7042
1983-84	3730	7135
1984-85	3964	7204
1985-86	4175	7207
1986-87	4255	7122
1987-88	4408	7005
1988-89	4497	6692
1989-90	4772	6628
1990-91	4955	6382
1991-92	5027	6098
1992-93	5078	5961
1993-94	5402	6178
1994-95	5200	5864
1995-96 (2)	5295	5803
1996-97 (2)	5351	5682
1997-98 (2)	5504	5684
1998-99 (2)	5304	5304

Notes:
1. See note at Table 2.
2. Figures for NHS are available in SET 2000 (ref 1).

Table 5 Analysis of Government Intramural expenditure, 1998-99 (1) (2)

£ million

	Current expenditure	Breakdown of current Frascati R&D expenditure: Basic	Applied	Experimental development	Capital expenditure	TOTAL INTRAMURA	SSH	NSE
OST - DTI	-	-	-	-	-	-	-	-
Research Councils								
BBSRC	145.4	48.3	97.1	-	10.9	156.3	-	156.3
ESRC	3.6	3.6	-	-	0.4	4.0	4.0	-
MRC	146.8	91.6	55.2	-	16.2	163.1	-	163.1
NERC	112.4	25.3	82.8	4.3	6.6	118.9	-	118.9
EPSRC	16.5	8.2	8.2	-	0.6	17.1	-	17.1
PPARC	29.3	26.4	2.9	-	4.1	33.4	-	33.4
CCLRC	96.5	18.1	78.4	-	13.5	110.0	-	110.0
Total OPSS & Research Councils	**550.5**	**221.6**	**324.6**	**4.3**	**52.1**	**602.7**	**4.0**	**598.7**
Higher Education Funding Councils	-	-	-	-	-	-	-	-
Total Higher Education Funding Councils	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Civil departments								
MAFF	80.7	16.2	59.8	4.6	5.6	86.2	0.1	86.1
DFEE	5.6	-	2.2	3.4	-	5.6	5.6	-
DETR (formerly DOT & DOE)	9.4	-	8.7	0.7	-	9.4	1.3	8.0
DH (includes NHS)	32.9	1.6	25.7	5.6	3.4	36.3	3.6	32.8
NHS(3)	*0.0*	-	*0.0*	-	-	*0.0*	*0.0*	*0.0*
DSS	0.9	0.9	-	-	-	0.9	0.9	-
HSC	7.7	-	7.0	0.8	0.4	8.1	0.7	7.5
HO	15.8	-	14.3	1.5	0.8	16.5	11.1	5.5
DCMS (formerly DNH)	10.1	8.8	1.2	0.2	0.5	10.5	0.5	10.0
DFID (formerly ODA)	2.4	-	2.4	-	-	2.4	0.7	1.6
DTI (ex OST)	5.5	2.7	2.7	-	-	5.5	-	5.5
NI	8.7	0.8	7.3	0.6	0.5	9.2	2.2	7.0
SE (formerly SO)	48.3	7.0	40.6	0.7	0.6	48.9	3.1	45.7
NAW (formerly WO)	3.0	-	3.0	-	-	3.0	2.9	0.0
Other departments	21.1	0.1	18.2	2.8	1.9	23.0	6.1	16.9
Total civil departments	**252.0**	**38.2**	**193.1**	**20.7**	**13.6**	**265.6**	**38.9**	**226.6**
Total civil R&D	**802.5**	**259.7**	**517.7**	**25.0**	**65.8**	**868.2**	**42.9**	**825.3**
MOD	740.0	-	386.8	353.2	77.9	817.9	14.2	803.7
TOTAL	**1542.5**	**259.7**	**904.5**	**378.3**	**143.6**	**1686.1**	**57.1**	**1629.1**

Notes:
1. Excludes Research Councils' pensions/other costs.
2. Includes intramural R&D funded by other departments
3. NHS expenditure figures are now reported as extramural.

Table 6 Analysis of net Government R&D expenditure by Frascati type of research activity 1990-91 to 1998-99 (1)

£ million

		1990-91	1991-92	1992-93	1993-94	1994-95	1995-96(2)	1996-97(2)	1997-98(2)	1998-99(2)
Total Government R&D										
Basic		1288	1362	1513	1572	-	-	-	-	-
	- pure	-	-	-	-	1251	1273	1322	1334	1369
	- orientated	-	-	-	-	471	504	524	523	535
Applied	- strategic	768	850	955	1021	879	1004	1109	1079	1020
	- specific	1031	885	868	1048	1076	1322	1224	1198	1178
Experimental developmen		1868	1931	1747	1761	1494	1530	1570	1757	1592
Total £m		**4955**	**5027**	**5078**	**5402**	**5171**	**5634**	**5750**	**5891**	**5695**
Civil R&D										
Basic		1290	1363	1510	1571	-	-	-	-	-
	- pure	-	-	-	-	1252	1273	1323	1334	1369
	- orientated	-	-	-	-	472	505	524	523	535
Applied	- strategic	727	815	907	962	810	839	949	923	875
	- specific	683	508	403	453	479	811	680	698	704
Experimental developmen		94	128	176	137	126	136	131	102	116
Total £m		**2794**	**2814**	**2996**	**3123**	**3139**	**3564**	**3607**	**3580**	**3599**
Defence R&D										
Basic		-	-	-	-	-	-	-	-	-
	- pure	-	-	-	-	-	-	-	-	-
	- orientated	-	-	-	-	-	-	-	-	-
Applied	- strategic	41	35	46	57	69	166	160	156	145
	- specific	348	376	466	597	597	510	544	500	475
Experimental developmen		1773	1802	1569	1625	1367	1394	1439	1655	1476
Total £m		**2162**	**2214**	**2081**	**2279**	**2032**	**2070**	**2144**	**2311**	**2096**

Notes:

1. For the purpose of this analysis Research Councils expenditure for Pensions/Other costs have been excluded from 1994-95 onwards.
2. Includes NHS (ref 1)

Table 7 Business Enterprise R&D, in cash terms and real terms 1966 to 1998

£ million

	Total Business Enterprise R&D	
	In cash terms	In real terms
Year		(1998=100) (1)
1966	580	6289
1967	605	6371
1968	639	6410
1969	680	6485
1970	N/S	N/S
1971	N/S	N/S
1972	831	6199
1973	N/S	N/S
1974	N/S	N/S
1975	1340	6219
1976	N/S	N/S
1977	N/S	N/S
1978	2324	7520
1979	N/S	N/S
1980	N/S	N/S
1981	3793	8117
1982	N/S	N/S
1983	4163	7962
1984	N/S	N/S
1985	5122	8841
1986	5951	9961
1987	6335	10068
1988	6922	10302
1989	7650	10626
1990	8318	10714
1991	8135	9867
1992	8489	9966
1993	9069	10372
1994	9204	10378
1995	9254	10141
1996	9431	10013
1997	9657	9972
1998	10231	10231

Notes:
1. See notes at Table 2.

(N/S) = No survey carried out

Table 8 Expenditure on R&D performed in UK businesses: broad product groups, in cash & real terms 1990 to 1998

£ million

In cash terms	1990	1991	1992	1993	1994	1995	1996r	1997r	1998
Manufacturing: Total	6362	6118	6305	6741	6848	6917	7035	7360	7872
Chemicals	1928	1906	2166	2400	2509	2514	2479	2831	2926
Mechanical engineering	532	538	580	665	761	683	668	709	730
Electrical machinery	1566	1329	1258	1386	1218	1245	1313	1181	1320
Transport equipment	620	638	670	717	710	833	977	966	983
Aerospace	984	1005	898	782	860	886	812	893	1039
Other manufacturing	732	702	733	791	790	755	787	779	874
Services	1956	2017	2184	2328	2356	2337	2396	2297	2359
TOTAL	**8318**	**8135**	**8489**	**9069**	**9204**	**9254**	**9431**	**9657**	**10231**

In real terms (at 1998 prices)	1990	1991	1992	1993	1994	1995	1996r	1997r	1998
Manufacturing: Total	8195	7420	7402	7709	7721	7580	7469	7600	7872
Chemicals	2483	2312	2543	2745	2829	2755	2632	2923	2926
Mechanical engineering	685	653	681	761	858	748	709	732	730
Electrical machinery	2017	1612	1477	1585	1373	1364	1394	1220	1320
Transport equipment	799	774	787	820	801	913	1037	998	983
Aerospace	1267	1219	1054	894	970	971	862	922	1039
Other manufacturing	943	851	861	905	891	827	836	804	874
Services	2519	2446	2564	2662	2656	2561	2544	2372	2359
TOTAL	**10714**	**9867**	**9966**	**10372**	**10378**	**10141**	**10013**	**9972**	**10231**

Notes:
1. 1996 & 1997 data have been revised where necessary to take into account misclassification and updated population information.
(r) = revised

Table 9 Expenditure on civil and defence R&D performed by Business Enterprises, 1990 to 1998

(i) in cash terms (£m)

	Civil									Defence								
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996r**	**1997r**	**1998**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996r**	**1997r**	**1998**
All product groups	**6557**	**6669**	**7092**	**7710**	**7770**	**7863**	**8071**	**8214**	**8698**	**1761**	**1466**	**1397**	**1359**	**1433**	**1391**	**1360**	**1443**	**1533**
All manufactured products	4785	4816	5050	5550	5534	5626	5767	6055	6455	1598	1301	1254	1193	1314	1291	1268	1304	1417
Chemicals and pharmaceuticals	2013	1980	2238	2473	2590	2511	2477	2829	2926	14	17	20	26	10	3	2	2	-
Mechanical engineering	237	262	325	398	405	418	395	407	455	277	256	236	246	335	266	273	302	276
Electrical machinery	1040	959	885	999	827	823	896	803	916	516	354	357	377	379	423	417	377	404
Transport equipment	525	548	574	622	661	823	967	955	947	65	59	64	59	14	10	10	11	36
Aerospace	357	477	403	374	380	413	359	412	485	627	525	493	412	481	473	453	481	554
Other manufacturing	613	590	625	684	671	639	673	648	727	100	90	84	73	95	116	113	131	147
Services	1773	1853	2042	2160	2236	2237	2304	2158	2243	163	165	143	166	120	99	92	139	116

(ii) in real terms (£m 1998 prices) (1):

	Civil									Defence								
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996r**	**1997r**	**1998**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996r**	**1997r**	**1998**
All product groups	**8446**	**8089**	**8326**	**8817**	**8761**	**8617**	**8569**	**8482**	**8698**	**2268**	**1778**	**1640**	**1554**	**1616**	**1524**	**1444**	**1490**	**1533**
All manufactured products	6163	5841	5929	6347	6240	6165	6123	6253	6455	2058	1578	1472	1364	1482	1415	1346	1347	1417
Chemicals and pharmaceuticals	2593	2401	2627	2828	2920	2752	2630	2921	2926	18	21	23	30	11	3	2	2	-
Mechanical engineering	305	318	382	455	457	458	419	420	455	357	310	277	281	378	292	290	312	276
Electrical machinery	1340	1163	1039	1142	932	902	951	829	916	665	429	419	431	427	464	443	389	404
Transport equipment	676	665	674	711	745	902	1027	986	947	84	72	75	67	16	11	11	11	36
Aerospace	460	579	473	428	428	453	381	425	485	808	637	579	471	542	518	481	497	554
Other manufacturing	790	716	734	782	757	700	715	669	727	129	109	99	83	107	127	120	135	147
Services	2284	2247	2397	2470	2521	2451	2446	2228	2243	210	200	168	190	135	108	98	144	116

Notes:
1. See table 2 for deflators
(r) = revised

Table 10 Sources of funds for business enterprise R&D in cash terms, 1990 to 1998

£ million, cash terms

		Government	Overseas	Mainly own resources (1)	Total intramural R&D
		£m	£m	£m	£m
1990		**1392**	**1289**	**5638**	**8318**
of which:	**Civil**	428	904	5227	6557
	Defence	964	385	411	1761
1991		**1189**	**1299**	**5647**	**8135**
of which:	**Civil**	479	950	5240	6669
	Defence	710	349	407	1466
1992		**1171**	**1270**	**6048**	**8489**
of which:	**Civil**	478	981	5633	7092
	Defence	693	289	415	1397
1993		**1129**	**1398**	**6542**	**9069**
of which:	**Civil**	390	1103	6217	7710
	Defence	739	295	324	1359
1994		**1088**	**1474**	**6642**	**9204**
of which:	**Civil**	363	1135	6272	7770
	Defence	726	338	370	1433
1995		**1050**	**1748**	**6457**	**9254**
of which:	**Civil**	321	1419	6124	7863
	Defence	729	329	333	1391
1996r		**934**	**2031**	**6466**	**9431**
of which:	**Civil**	242	1728	6102	8071
	Defence	693	303	364	1360
1997r		**1005**	**1811**	**6841**	**9657**
of which:	**Civil**	288	1486	6439	8214
	Defence	717	325	401	1443
1998		**1190**	**2246**	**6795**	**10231**
of which:	**Civil**	403	1865	6430	8698
	Defence	787	381	365	1533
		%	**%**	**%**	**%**
1990		**17**	**15**	**68**	**100**
of which:	**Civil**	7	14	80	100
	Defence	55	22	23	100
1991		**15**	**16**	**69**	**100**
of which:	**Civil**	7	14	79	100
	Defence	48	24	28	100
1992		**14**	**15**	**71**	**100**
of which:	**Civil**	7	14	79	100
	Defence	50	21	30	100
1993		**12**	**15**	**72**	**100**
of which:	**Civil**	5	14	81	100
	Defence	54	22	24	100
1994		**12**	**16**	**72**	**100**
of which:	**Civil**	5	15	81	100
	Defence	51	24	26	100
1995		**11**	**19**	**70**	**100**
of which:	**Civil**	4	18	78	100
	Defence	52	24	24	100
1996		**10**	**22**	**69**	**100**
of which:	**Civil**	3	21	76	100
	Defence	51	22	27	100
1997		**10**	**19**	**71**	**100**
of which:	**Civil**	4	18	78	100
	Defence	50	23	28	100
1998		**12**	**22**	**66**	**100**
of which:	**Civil**	5	21	74	100
	Defence	51	25	24	100

Notes:
1. Mainly own resources includes Other Private sector funds which is shown separately in ONS's First Release for Business Enterprise R&D.
(r) = revised

Table 11 Intramural expenditure on R&D performed in UK businesses: detailed product groups, 1990 to 1998

£ million

	1990	1991	1992	1993	1994	1995	1996r	1997r	1998
Total	**8318**	**8135**	**8489**	**9069**	**9204**	**9254**	**9431**	**9657**	**10231**
Agriculture, hunting and forestry; Fishing	67	76	80	89	80	..	76	84	102
Extractive Industries	115	129	126	62	66	65	64	44	41
Food products and beverages; Tobacco products	196	196	225	191	228	189	198	180	242
Textiles, clothing and leather products	19	23	25	44	22	23	27	33	33
Pulp, paper and paper products; printing and publishing; Wood and straw produ	48	43	44	40	44	39	57	44	49
Refined petroleum products and coke oven products; Processing of nuclear fue	373	369	386	370	354	377	364	349	362
Chemicals, man- made fibres	722	707	720	721	689	701	627	680	688
Pharmaceuticals, medical chemicals and botanical products	1206	1199	1446	1679	1820	1813	1852	2151	2238
Rubber and plastic products	46	35	25	67	72	60	67	60	66
Other non-metallic mineral products	53	44	43	42	56	54	60	47	56
Casting of iron and steel	50	40	43	50	51	46	39	39	47
Non-ferrous metals	31	24	22	16	15	20	15	15	20
Fabricated metal products	52	48	63	72	72	100	91	88	90
Machinery and equipment	480	490	517	593	689	583	577	622	640
Office machinery and computers	471	327	256	252	134	150	161	102	125
Electrical machinery and apparatus	502	518	523	576	567	494	490	424	423
Radio, television and communication equipment	593	484	479	558	517	602	662	655	772
Precision instruments	268	276	283	312	273	303	307	336	340
Motor vehicles and parts	571	605	636	682	669	795	926	924	913
Other transport equipment	16	17	18	17	24	18	30	27	35
Shipbuilding and repairs	33	16	16	18	17	20	20	15	36
Aerospace	984	1005	898	782	860	886	812	893	1039
Furniture; Other manufactured goods	20	20	22	28	28	21	16	25	20
Recycling	1	1	1	1	1	..	1	-	-
Electricity, gas and water supply	188	192	187	214	177	168	148	130	140
Construction	19	19	15	11	11	8	8	38	39
Wholesale and retail trade	4	4	4	5	6	8	4	5	8
Transport and storage	7	8	10	13	8	15	8	12	21
Post and telecommunications	341	317	386	389	408	414	455	496	449
Miscellaneous business activities; Technical testing and analysis	144	146	156	195	181	..	141	142	157
Computer and related activities	435	494	555	635	744	675	749	680	688
Research and development services	244	244	261	329	311	247	369	313	346
Public administration	19	19	18	16	10	14	10	6	8

Notes:

1 .. denotes disclosive figures.

2 - denotes a value less than 0.5

3 1996 & 1997 data have been revised where necessary to take into account misclassification and updated population information.

4 From 1989 to 1992 Furniture; Wood and straw products was included with Pulp, paper and paper products; Printing and publishing.

Table 12 Current and capital expenditure, and as a percentage, on R&D performed in the UK Businesses; detailed product groups, 199

	Total	Capital Total	Current Total	Salaries and wages	Other current	Total	Capital Total	Current Total	Salaries and wages	Other current
	£m	£m	£m	£m	£m	%	%	%	%	%
Total	**10231**	**1041**	**9190**	**4053**	**5137**	**100**	**10**	**90**	**40**	**50**
Agriculture, hunting and forestry; Fishing	102	15	87	52	35	100	15	85	51	34
Extractive Industries	41	1	40	20	20	100	2	98	49	49
Food products and beverages; Tobacco products	242	44	198	109	89	100	18	82	45	37
Textiles, clothing and leather products	33	3	30	18	12	100	9	91	55	36
Pulp, paper and paper products; Printing and publishing; Wood and straw prod	49	2	47	15	33	100	4	96	31	67
Refined petroleum products and coke oven products; Processing of nuclear fue	362	61	301	115	185	100	17	83	32	51
Chemicals, man-made fibres	688	54	634	328	306	100	8	92	48	44
Pharmaceuticals, medical chemicals and botanical products	2238	395	1843	725	1118	100	18	82	32	50
Rubber and plastic products	66	4	62	27	35	100	6	94	41	53
Other non-metallic mineral products	56	6	50	25	25	100	11	89	45	45
Casting of iron and steel	47	1	46	23	23	100	2	98	49	49
Non-ferrous metals	20	4	16	8	8	100	20	80	40	40
Fabricated metal products	90	13	76	31	46	100	14	84	34	51
Machinery equipment	640	21	619	270	349	100	3	97	42	55
Office machinery and computers	125	11	115	40	74	100	9	92	32	59
Electrical machinery and apparatus	423	27	395	171	224	100	6	93	40	53
Radio, television and communication equipment	772	65	707	304	403	100	8	92	39	52
Precision instruments	340	24	317	156	161	100	7	93	46	47
Motor vehicles and parts	913	113	800	376	423	100	12	88	41	46
Other transport equipment	35	1	34	13	22	100	-	97	37	63
Shipbuilding and repairs	36	-	36	17	18	100	-	100	47	50
Aerospace	1039	56	983	336	647	100	5	95	32	62
Furniture; Other manufactured goods	20	2	18	10	7	100	10	90	50	35
Recycling	-	-	-	-	-	-	-	-	-	-
Electricity, gas and water supply	140	6	134	65	69	100	4	96	46	49
Construction	39	1	38	19	19	100	-	97	49	49
Wholesale and retail trades	8	-	8	3	5	100	-	100	38	63
Transport and storage	21	2	19	8	11	100	-	90	38	52
Post and telecommunications	449	15	434	188	246	100	3	97	42	55
Miscellaneous business activities; Technical testing and analysis	157	9	147	77	71	100	6	94	49	45
Computer related activities	688	69	619	320	299	100	10	90	47	43
Research and development services	346	17	328	177	151	100	5	95	51	44
Public administration	8	-	8	7	1	100	-	100	88	13

Notes:

1. - denotes a value less than 0.5

Table 13 Government and business enterprise personnel engaged on R&D in the UK, 1990 to 1998

Full time equivalents, thousands

	1990	1991	1992	1993	1994	1995	1996	1997	1998	% change in 1998 from 1997
PERSONNEL ENGAGED ON R&D										
- Business Enterprise	171	159	159	164	157	146	143	139	150	8
- Research Councils	13	12	13	13	12	12	12	11	11	1
- Government Departments (1	24	24	25	22	20	17	16	15	18	21
Total Civil	**159**	**153**	**157**	**166**	**154**	**144**	**142**	**137**	**147**	8
Total Defence	**49**	**42**	**40**	**33**	**35**	**31**	**29**	**28**	**32**	13
RESEARCHERS										
- Business Enterprise	83	80	82	86	83	83	83	84	92	10
- Research Councils	6	6	6	6	6	6	5	5	5	5
- Government Departments (1	9	9	9	8	8	8	8	7	9	30
Total Civil	**77**	**77**	**79**	**83**	**79**	**80**	**79**	**79**	**88**	11
Total Defence	**21**	**18**	**18**	**17**	**18**	**17**	**17**	**17**	**19**	11
TECHNICIANS										
- Business Enterprise	43	38	38	40	40	33	33	30	32	8
- Research Councils	2	2	2	3	2	2	3	3	3	-14
- Government Departments (1	4	4	4	4	4	4	3	3	4	37
Total Civil	**38**	**35**	**36**	**41**	**38**	**32**	**33**	**30**	**32**	6
Total Defence	**11**	**9**	**8**	**6**	**8**	**7**	**6**	**6**	**7**	20
ADMIN & OTHER STAFF										
- Business Enterprise	45	41	39	37	34	30	27	26	25	-4
- Research Councils	5	5	5	4	4	4	4	3	3	10
- Government Departments (1	11	11	11	9	8	5	5	4	5	21
Total Civil	**44**	**42**	**41**	**40**	**37**	**32**	**30**	**28**	**27**	-2
Total Defence	**17**	**15**	**14**	**10**	**9**	**7**	**6**	**5**	**6**	13

Note:

1. Excludes NHS employment, as these figures were not available.

Table 14 Estimated GOR breakdown of expenditure on Intramural R&D in the Business, Government and Higher Education sectors, 1998 (1)

	R&D performed within business (BERD)		R&D performed within Government Establishments (GOVERD) (2)		R&D performed within Higher Education Institutions (HERD)	
	£m	percentage of regional GDP	£m	percentage of regional GDP	£m	percentage of regional GDP
United Kingdom	**10,231**	**1.22**	**2,073**	**0.25**	**3,040**	**0.36**
North East	178	0.61	3	0.01	105	0.36
North West and Merseyside	1,224	1.42	58	0.07	238	0.28
Yorkshire and the Humber	287	0.46	31	0.05	241	0.38
East Midlands	775	1.38	51	0.09	159	0.28
West Midlands	708	1.02	182	0.26	167	0.24
Eastern	2,367	2.73	255	0.29	211	0.24
London	614	0.46	202	0.15	775	0.58
South East	2,542	1.92	698	0.53	460	0.35
South West	907	1.42	329	0.52	138	0.22
England	**9,601**	**1.34**	**1,809**	**0.25**	**2,494**	**0.35**
Wales	125	0.38	51	0.15	113	0.34
Scotland	424	0.61	200	0.29	375	0.54
Northern Ireland	81	0.45	12	0.07	57	0.31

Note:

1. Regional GDP figures are not available at time of publication and therefore it is not possible to show R&D expenditure as a percentage of regional GDP.
2. Figures include estimates for those areas of Central Government not available from the Government Survey and local authorities.

Table 15 Estimated regional breakdown of personnel engaged on R&D in the Business and Government sectors, 1998 (1)

	R & D performed within business		R&D performed within Government establishments (2)	
	Full time equivalents 000's	% of the regional Labour Force (3) (4)	Full time equivalents 000's	% of the regional Labour Force (3) (4)
United Kingdom	**149.8**	**0.55**	**29.2**	**0.11**
North East	3.3	0.32	0.0	0.00
North West and Merseyside	17.9	0.59	0.8	0.03
Yorkshire and the Humber	6.5	0.29	0.6	0.03
East Midlands	12.0	0.60	0.8	0.04
West Midlands	13.0	0.53	2.3	0.10
Eastern	27.7	1.05	3.9	0.15
London	9.4	0.28	3.0	0.09
South East	34.9	0.86	9.1	0.23
South West	13.1	0.56	4.3	0.18
England	**137.8**	**0.59**	**24.9**	**0.11**
Wales	2.8	0.23	0.7	0.05
Scotland	7.2	0.31	3.5	0.15
Northern Ireland	2.0	0.29	0.2	0.03

Notes:

1. Regional breakdown is based on the GOR (Government Office Region) classification.
2. Government sector covers Central Government only. Local Authorities, NHS and those areas of Central Government not available from the Government survey are excluded
3. Labour Force figure used is a head count. An estimate of the Labour Force in full-time equivalents(FTE) is not available. Using the head count figure gives a lower percentage than a FTE would give.
   Labour Force figures relate to those in employment, rather than all those economically active.
4. Labour Force figures are for Spring 1999.

Table 16 OECD Science and Technology indicators
Gross Expenditure on R&D: International Comparisons, 1990 to 1998

	Year	UK	Germany (1)	France (2)	Italy	Japan (3)	Canada	USA (4)
Gross Domestic Product (GDP) (5)	1990	562.7	698.8	592.8	555.3	1327.6	309.4	3343.6
(£ billion at ppp) (6)	1991	589.8	867.0	661.0	619.6	1507.9	331.0	3626.4
	1992	612.6	916.1	671.6	634.4	1543.3	330.8	3713.1
	1993	647.2	964.2	689.4	646.8	1653.5	362.3	4058.6
	1994	685.8	1045.1	725.6	694.8	1721.1	390.3	4369.9
	1995	722.3	1107.8	767.4	740.3	1858.5	429.9	4575.0
	1996	766.3	1110.9	766.8	757.1	1928.9	434.3	4748.0
	1997	814.7	1177.8	811.2	794.9	2012.8	467.5	5098.6
	1998	856.7	1228.1 (e)	860.6 (e)	827.7 (e)	2005.1 (e)	490.7 (e)	5432.4 (e)
Gross Expenditure on R&D (GERD)	1990	12.0	19.2	14.3	7.2	37.9 (e)	4.5	93.0
(£ billion at ppp) (6)	1991	12.1	22.6	15.9	7.7	42.5 (e)	5.0	102.0
	1992	12.7	22.7	16.3	7.6	42.6 (e)	5.1	101.9
	1993	13.5	23.3	16.9	7.3	44.3 (e)	5.8	106.2
	1994	14.0	24.3	17.2	7.4	45.3 (e)	6.2	110.0
	1995	14.2	25.6	17.9	7.5	51.4 (e)	6.8	119.4
	1996	14.5	25.5	17.8	7.7	54.1 (e)	6.9	126.1
	1997	14.8	27.2	18.1	8.0	58.1 (e)	7.5 (p)	137.8
	1998	15.6	28.5 (e)	18.9 (p)	8.6 (p)	-	7.9 (p)	150.4 (p)
GERD as a percentage of GDP	1990	2.13	2.75	2.41	1.30	2.85 (e)	1.46	2.78
	1991	2.06	2.61	2.41	1.24	2.82 (e)	1.52	2.81
	1992	2.07	2.48	2.42	1.20	2.76 (e)	1.54	2.74
	1993	2.09	2.42	2.45	1.14	2.68 (e)	1.60	2.62
	1994	2.05	2.32	2.38	1.06	2.63 (e)	1.60	2.52
	1995	1.96	2.31	2.34	1.01	2.77 (e)	1.58	2.61
	1996	1.89	2.30	2.32	1.02	2.80 (e)	1.60	2.66
	1997	1.81	2.31	2.24	1.00	2.89 (e)	1.60 (p)	2.70
	1998	1.82	2.32 (e)	2.20 (p)	1.03 (p)	-	1.61 (p)	2.77 (p)
BERD as a percentage of GDP	1990	1.5	2.0	1.5	0.8	2.2	0.8	2.0
	1991	1.4	1.8	1.5	0.7	2.1	0.8	2.1
	1992	1.4	1.7	1.5	0.7	2.0	0.8	2.0
	1993	1.4	1.6	1.5	0.6	1.9	0.9	1.9
	1994	1.3	1.5	1.5	0.6	1.9	0.9	1.8
	1995	1.3	1.5	1.4	0.5	1.9	1.0	1.9
	1996	1.2	1.5	1.4	0.6	2.0	1.0	2.0
	1997	1.2	1.6	1.4	0.5	2.1	1.0 (p)	2.0
	1998	1.2	1.6 (e)	1.4 (p)	0.6 (p)	-	1.0 (p)	2.1 (p)
GOVERD as a percentage of GDP	1990	0.28	0.35	0.58	0.27	0.23	0.29	0.29
	1991	0.30	0.36	0.55	0.28	0.23	0.30	0.28
	1992	0.30	0.35	0.51	0.26	0.25	0.29	0.27
	1993	0.30	0.36	0.52	0.24	0.27	0.28	0.27
	1994	0.30	0.35	0.49	0.23	0.26	0.27	0.25
	1995	0.28	0.36	0.49	0.21	0.29	0.25	0.25
	1996	0.27	0.35	0.47	0.20	0.27	0.25	0.23
	1997	0.25	0.34	0.45	0.21	0.26	0.22 (p)	0.22
	1998	0.24	0.34 (e)	0.43 (p)	0.22 (p)	-	0.22 (p)	0.22 (p)
HERD as a percentage of GDP	1990	0.33	0.41	0.35	0.27	0.35 (e)	0.37	0.43
	1991	0.34	0.43	0.36	0.27	0.34 (e)	0.40	0.40
	1992	0.35	0.43	0.37	0.27	0.35 (e)	0.40	0.40
	1993	0.36	0.44	0.39	0.28	0.38 (e)	0.40	0.41
	1994	0.38	0.43	0.38	0.27	0.37 (e)	0.38	0.40
	1995	0.37	0.42	0.39	0.26	0.40 (e)	0.37	0.40
	1996	0.36	0.42	0.39	0.27	0.39 (e)	0.36	0.39
	1997	0.36	0.41	0.39	0.26	0.39 (e)	0.34 (p)	0.39
	1998	0.35	0.41 (e)	0.38 (p)	0.26 (p)	-	0.35 (p)	0.39 (p)

Source: OECD databank (November 1999)

Notes:
1. There are breaks in series between 1990 and 1991, and 1991 and 1992.
2. For government and business enterprise data there is a break in series between 1991 and 1992.
3. Data for Japan are adjusted by OECD.
4. Excludes most or all capital expenditure. There is a break in series between 1990 and 1991.
5. The measure of GDP used is at market prices, based on the UN definition.
6. Amounts are converted to £ sterling using the purchasing power parities (ppp) developed by the OECD.
(p) = provisional
(e) = estimate

Table 17 International comparison of gross expenditure on R&D by sector of performance and source of funding 1998

Per cent

	UK	Germany (1)	France (p)	Italy (p)	Japan (e) (2)	Canada (p)	USA (p) (3)
Percentage by sector of performance							
Government	13.4	14.6	19.5	21.3	8.9	13.4	7.9
Business enterprise	65.8	67.8	62.0	53.7	72.6	63.8	75.1
Higher education	19.5	17.6	17.1	25.0	13.6	21.6	14.0
Other	1.3	-	1.4	-	4.9	1.2	3.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Percentage by source of funds (4)							
Government	31.1	35.6	40.2	51.1	18.4	31.9	30.6
Business enterprise	47.3	61.7	50.3	43.9	74.8	49.4	65.7
Abroad	16.8	2.4	7.9	5.0	0.3	13.4	-
Other	4.8	0.3	1.6	-	6.5	5.3	3.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: OECD databank (November 1999)

Notes:
1. Data for “other” included elsewhere.
2. Data for Japan are OECD estimates.
3. Excludes most or all capital expenditure.
4. Data for France are for 1997.

(p) = provisional
(e) = estimate

Table 18 R&D performed in the Business Enterprise sector (BERD), 1990 to 1998

£ billion at ppp (1

Year	UK	Germany (2)	France (3)	Italy	Japan (4)	Canada	USA (5)
1990	8.3	13.8	8.6	4.2	28.6	2.4	66.1
1991	8.1	15.7	9.8	4.3	32.1	2.7	74.3
1992	8.5	15.6	10.2	4.2	31.3	2.8	73.4
1993	9.1	15.6	10.4	3.9	31.5	3.3	75.1
1994	9.2	16.1	10.7	3.9	32.2	3.6	77.7
1995	9.3	17.0	10.9	4.0	36.1	4.1	85.9
1996	9.4	16.9	10.9	4.1	38.8	4.2	92.6
1997	9.7	18.4	11.1	4.2	42.2	4.7 (p)	102.4
1998	10.2	19.3 (e)	11.8 (p)	4.6 (p)	-	5.1 (p)	113.1 (p)

Source: OECD databank (November 1999)

Notes:

1. Amounts are converted to £ sterling using the purchasing power parities (ppp) developed by the OECD.
2. There are breaks in series between 1990 and 1991, and 1991 and 1992.
3. There is a break in series between 1991 and 1992.
4. Data for Japan are adjusted by OECD.
5. Excludes most or all capital expenditure. There is a break in series between 1990 and 1991.

(p) = provisional
(e) = estimate

Table 19 International comparison of Government funding of R&D in 1998 by socio-economic objective (percentage distribution)

Per cent

	UK	Germany (p)	France (p)	Italy	Japan (1)	Canada (p)	USA (p) (2)
Agriculture, forestry and fishing	4.5	2.7	3.8	1.9	3.4	14.4	2.4
Industrial development	1.1	12.2	5.7	8.1	6.9	16.3	0.5
Energy	0.5	3.6	5.1	5.0	19.9	7.0	1.6
Infrastructure	1.8	1.7	0.6	0.6	2.8	5.2	2.7
Environmental protection	2.5	3.5	2.2	3.4	0.6	4.0	0.9
Health	14.9	3.2	5.5	5.6	3.6	11.7	18.8
Social development and services	2.7	2.6	1.2	3.6	1.0	4.5	1.0
Earth and atmosphere	1.4	1.9	0.9	1.6	1.3	6.0	1.1
Advancement of knowledge	30.9	55.0	37.5	59.4	49.4	10.3	5.7
Civil space	2.5	4.7	10.9	8.3	6.3	11.3	11.2
Defence	36.8	8.7	24.8	2.6	4.8	6.1	54.1
Not elsewhere classified	0.5	0.2	1.8	-	0.0	3.2	-
%	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total £ million (3)	**5707**	**10329**	**8555**	**4866**	**12278**	**1821**	**48602**

Source: OECD databank (November 1999)

Notes:

1. Data for Japan are OECD estimates.
2. Excludes most or all capital expenditure.
3. Amounts are converted to £ sterling using the purchasing power parities (ppp) developed by the OECD.

(p) = provisional