



**Australian
Bureau of
Statistics**

**1993-94
Research and
Experimental Development
Business Enterprises
(Inter Year Survey)
Australia**

Catalogue No. 8114.0

EMBARGOED UNTIL 11.30 A.M. 8 JUNE 1995

**RESEARCH AND EXPERIMENTAL DEVELOPMENT
BUSINESS ENTERPRISES
(INTER YEAR SURVEY)
AUSTRALIA
1993-94**

**W. McLennan
Australian Statistician**

AUSTRALIAN BUREAU OF STATISTICS

CATALOGUE NO. 8114.0

© Commonwealth of Australia 1995

CONTENTS

<i>Table</i>	<i>Page</i>
Research and experimental development (R&D) activity: R&D carried out by business enterprises	
1. R&D expenditure, 1987-88, 1988-89, 1989-90, 1990-91, 1991-92, 1992-93 and 1993-94 at current and average 1989-90 prices	1
2. Human resources devoted to R&D, 1987-88, 1988-89, 1989-90, 1990-91, 1991-92, 1992-93 and 1993-94	2
3. Resources devoted to R&D by industry 1992-93 and 1993-94	3
4. R&D expenditure by industry by type of expenditure	4
5. R&D expenditure by industry by source of funds	5
6. R&D expenditure by industry by location of expenditure	6
7. R&D expenditure by industry by size of business	7
8. Actual and expected R&D expenditure by industry	8
9. Human resources devoted to R&D by industry by size of business	9
10. Human resources devoted to R&D by industry by type of employee	10
11. Resources devoted to R&D by socio-economic objective	11

APPENDIXES

1.	Explanatory Notes	12
2.	Glossary	15

INQUIRIES	<ul style="list-style-type: none"> • <i>for further information about statistics in this publication and the availability of related unpublished statistics, contact Derek Byars on Canberra (06) 252 5627 or any ABS Office.</i> • <i>for further information about constant price estimates contact Paul Curran on Canberra (06) 252 6801.</i> • <i>for information about other ABS statistics and services please refer to the back page of this publication.</i>
------------------	---

R&D expenditure

Business expenditure on R&D (BERD) carried out in Australia in 1993-94 is estimated to be \$3,028 million at *current prices*. This represents an increase of 6 per cent compared with 1992-93. At *average 1989-90 prices*, R&D expenditure is estimated to be \$2,667 million, an increase of 4 per cent compared with 1992-93.

At *average 1989-90 prices*, private sector businesses increased R&D expenditure by 5 per cent while public businesses decreased 6 per cent.

Private sector businesses account for 92 per cent of R&D expenditure in the business sector, up 1 per cent on each of the previous 2 years.

Business expenditure on R&D (BERD) represents 0.71 per cent of Gross Domestic Product (GDP), a slight increase over 1992-93. After plateauing between 1988-89 and 1990-91, this ratio increased by 27 per cent in the next two years, before levelling off in 1993-94.

Although the BERD/GDP ratio is now the highest recorded, it remains relatively low when compared with other OECD countries, for which ratios are available for this period, as shown in the table below.

Sweden	2.14
United States	1.80
Germany	1.66
France	1.50
Norway	0.89
Canada	0.82
Italy	0.75
AUSTRALIA	0.71
Spain	0.45

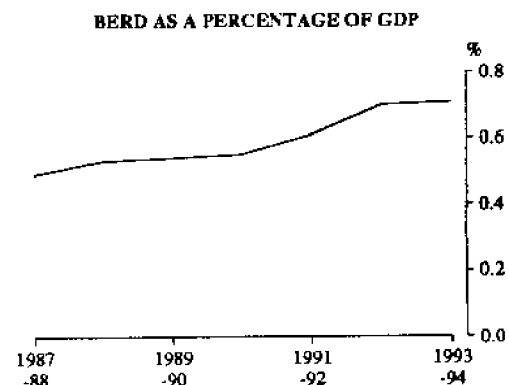
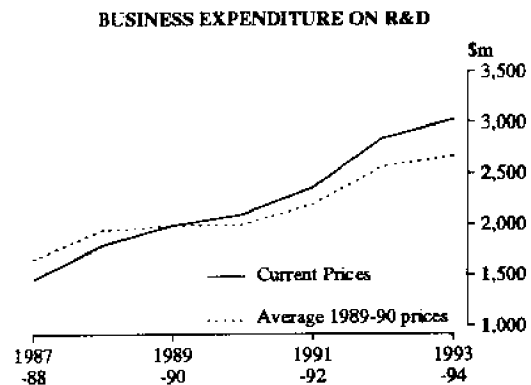


TABLE 1. EXPENDITURE ON R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA
(\$m)

	1987-88	1988-89	1989-90	1990-91r	1991-92r	1992-93r	1993-94
AT CURRENT PRICES							
Private Sector	1,338.2	1,649.1	1,802.6	1,898.6	2,145.3	2,598.8	2,794.9
Public Sector	117.6	149.2	187.0	203.6	216.4	244.8	233.3
TOTAL BUSINESS ENTERPRISES	1,455.8	1,798.3	1,989.6	2,102.2	2,361.7	2,843.6	3,028.2
AT AVERAGE 1989-90 PRICES							
Private Sector	1,530.0	1,785.2	1,802.6	1,813.6	2,000.4	2,347.3	2,459.6
Public Sector	129.6	159.7	187.0	190.8	198.0	221.4	207.7
TOTAL BUSINESS ENTERPRISES	1,659.6	1,944.9	1,989.6	2,004.4	2,198.4	2,568.7	2,667.3

(a) Excludes enterprises in ANZSIC Division 'A'

Human resources devoted to R&D

Human resources devoted to R&D carried out in Australia in 1993-94 is estimated to be 23,210 person years. This represents a 2 per cent increase over 1992-93. Human resources devoted to research has steadily increased over the years.

Private sector businesses account for 91 per cent of person years of effort devoted to R&D in the business sector. This is similar to their contribution to expenditure.

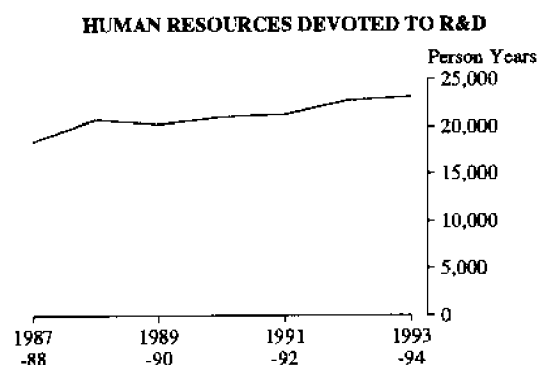


TABLE 2. HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA
(person years)

	1987-88	1988-89	1989-90	1990-91r	1991-92r	1992-93r	1993-94
Private Sector	16,952	19,206	18,572	19,184	19,185	20,625	21,105
Public Sector	1,527	1,597	1,729	1,867	2,088	2,219	2,105
TOTAL BUSINESS ENTERPRISES	18,479	20,803	20,301	21,051	21,273	22,844	23,210

(a) Excludes enterprises in ANZSIC Division 'A'

Industry perspective

56 per cent (\$1,687m) of total R&D expenditure and 58 per cent (13,447 person years) of human resources devoted to R&D are in manufacturing industries. The major contributors to total manufacturing are Electronic and electrical equipment and appliance mfg (21% of expenditure, 27% of human resources), Metal product mfg (17% of expenditure, 13% of human resources), Motor vehicle and part and other transport equipment mfg (16% of expenditure, 14% of human resources) and Petroleum, coal, chemical and associated product mfg (15% of expenditure, 15% of human resources).

The largest other industries are Property and business services (14% of total expenditure, 17% of total human resources), Mining (10% of total expenditure, 3% of total human resources) and Wholesale and retail trade (7% of total expenditure, 7% of total human resources).

Expenditure on R&D by Mining increased 80 per cent (\$138m) in current prices over 1992-93, while expenditure by Property and business services increased 20 per cent (\$73m). Expenditure by Manufacturing remained virtually unchanged, while Finance and insurance fell by 6 per

cent (\$8m), Wholesale and retail trade fell by 1 per cent (\$2m) and Scientific research also fell 1 per cent (\$1m).

EXPENDITURE BY INDUSTRY

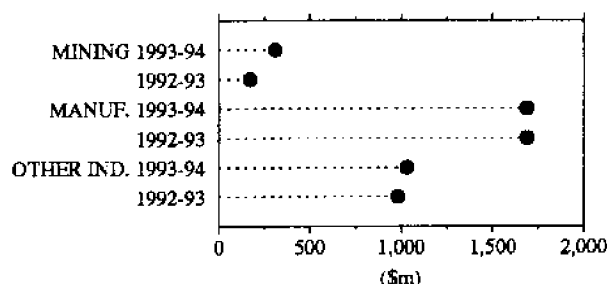


TABLE 3. R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY INDUSTRY OF ENTERPRISE

Industry of enterprise ANZSIC Code Description	Enterprises (number)		Expenditure on R & D (\$m)		Person years of effort on R & D	
	1992-93r	1993-94	1992-93r	1993-94	1992-93r	1993-94
B Mining (including services to mining)	90	81	171.5	309.4	840	798
Manufacturing —						
21 Food, beverage and tobacco	125	129	136.1	139.8	1,141	1,155
22 Textile, clothing, footwear and leather	51	49	28.8	36.6	221	244
23 Wood and paper product	29	31	44.4	103.0	249	224
24 Printing, publishing and recorded media	35	35	15.3	12.1	148	131
25 Petroleum, coal, chemical and associated product	316	303	279.6	252.2	2,073	2,077
26 Non-metallic mineral product	48	50	30.9	30.8	300	274
27 Metal product	177	174	335.7	292.8	1,767	1,748
281-282 Motor vehicle and part and other transport equipment	112	125	307.7	269.8	1,694	1,918
283 Photographic and scientific equipment	96	108	96.5	102.6	931	989
284-285 Electronic and electrical equipment and appliance	453	438	336.8	360.0	3,431	3,694
286 Industrial machinery and equipment	241	249	65.2	72.2	786	835
29 Other manufacturing	58	62	10.9	14.6	147	158
C Total manufacturing	1,741	1,753	1688.0	1686.6	12,887	13,447
Other industries —						
F-G Wholesale and retail trade	258	260	223.4	221.4	1,704	1,737
K Finance and insurance	27	27	119.7	112.0	1,463	1,155
77,782-786 Property and business services	525	566	363.4	435.9	3,648	3,957
781 Scientific research	65	67	83.8	83.0	808	775
(b) Other n.e.c.	120	111	193.7	180.0	1,494	1,342
D-Q Total other industries	995	1,031	984.0	1032.3	9,116	8,965
TOTAL ALL INDUSTRIES	2,826	2,865	2843.6	3028.2	22,844	23,210
Private Sector Contribution	2,783	2,830	2,598.8	2,794.9	20,625	21,105
Public Sector Contribution	43	35	244.8	233.3	2,219	2,105

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H,J,M-Q

Type of expenditure

Capital expenditure accounted for 14 per cent of total R&D expenditure, Labour costs accounted for 42 per cent and Other current expenditure for 44 per cent.

Labour costs as a proportion of total R&D costs was constant for a number of years, fell in 1992-93 to 43 per cent and has now fallen to 42 per cent in 1993-94. The Finance and insurance industry has the highest labour costs as a proportion of total R&D expenditure (68%) and Wood and paper product mfg the lowest (12%).

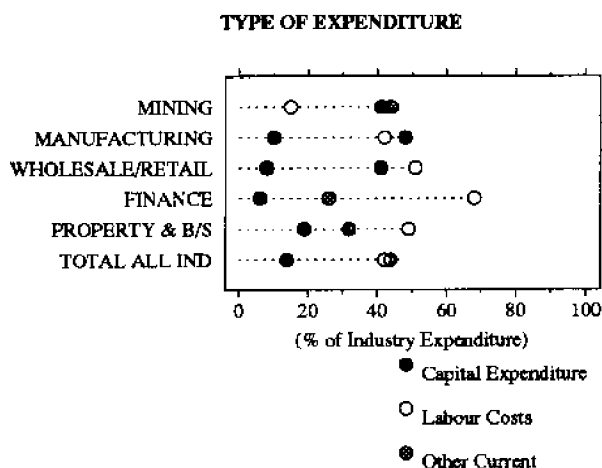


TABLE 4. R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1993-94, BY TYPE OF EXPENDITURE (\$'000)

Industry of enterprise ANZSIC Code Description		Type of expenditure			
		Total	Capital expenditure	Labour costs(b)	Other current expenditure
B	Mining (including services to mining)	309,399	128,237	47,159	134,004
	Manufacturing —				
21	Food, beverage and tobacco	139,772	13,958	64,851	60,963
22	Textile, clothing, footwear and leather	36,625	2,715	12,408	21,502
23	Wood and paper product	103,020	n.p.	12,520	n.p.
24	Printing, publishing and recorded media	12,138	n.p.	6,356	n.p.
25	Petroleum, coal, chemical and associated product	252,219	23,298	106,424	122,497
26	Non-metallic mineral product	30,799	4,645	12,847	13,308
27	Metal product	292,790	60,264	93,577	138,949
281-282	Motor vehicle and part and other transport equipment	269,815	11,970	105,819	152,026
283	Photographic and scientific equipment	102,628	8,185	53,442	41,001
284-285	Electronic and electrical equipment and appliance	359,978	27,845	190,155	141,978
286	Industrial machinery and equipment	72,187	5,235	35,661	31,291
29	Other manufacturing	14,590	1,911	7,072	5,606
C	Total manufacturing	1,686,560	171,082	701,132	814,346
	Other industries —				
F-G	Wholesale and retail trade	221,411	17,722	113,924	89,766
K	Finance and insurance	111,998	7,240	75,872	28,886
77,782-786	Property and business services	435,913	81,726	207,989	146,198
781	Scientific research	82,983	5,813	38,548	38,622
(c)	Other n.e.c.	179,953	23,296	86,653	70,004
D-Q	Total other industries	1,032,257	135,796	522,985	373,476
	TOTAL ALL INDUSTRIES	3,028,216	435,115	1,271,276	1,321,825
	Private sector contribution to 'Total all industries' —	2,794,914	417,382	1,143,886	1,233,647

(a) Excludes enterprises in ANZSIC Division 'A' (b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax and workers compensation insurance, overtime earnings, shift allowances, penalty rates, bonuses, commission payments, holiday pay, long service leave payments, sick pay, employer contributions to superannuation and pension schemes. (c) ANZSIC codes D,E,H,J,M,Q

Source of funds for R&D

Most of the funding for R&D expenditure came from the business sector itself: 88 per cent from Own funds and 6 per cent from Other business enterprises, totalling \$2,837m. The Commonwealth Government provided \$58m (2%) in funding, \$17m from the Grants for Industry R&D (GIRD) Scheme and \$41m from Other Commonwealth Government sources. 3 per cent or \$89m was funded from Overseas.

Industries where a significant proportion of funding was other than from Own funds included: Scientific research (31% from Other business enterprises, 13% from the Commonwealth Government and 13% from Other Australian); and Wholesale and retail trade (25% from Overseas).

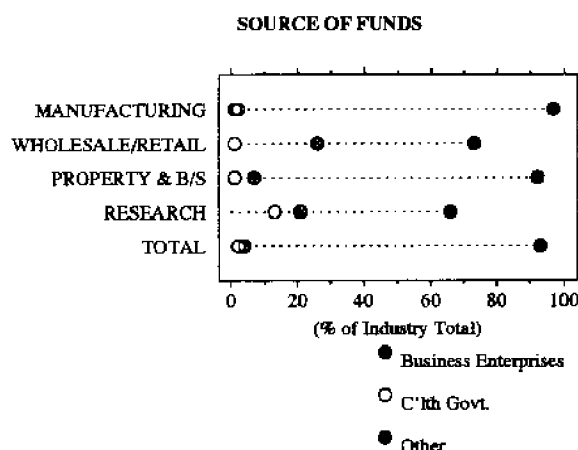


TABLE 5. SOURCE OF FUNDS FOR R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1993-94
(\$'000)

Industry of enterprise ANZSIC Code Description		Source of funds							
		Total	Own funds	Other business enterprises	GIRD Scheme(b)	Other C'wealth Gov't	State and Local Gov't	Other Aust(c)	Overseas
B	Mining (including services to mining)	309,399	306,151	n.p.	750	—	16	n.p.	—
	Manufacturing —								
21	Food, beverage and tobacco	139,772	134,774	4,105	527	n.p.	n.p.	163	—
22	Textile, clothing, footwear and leather	36,625	34,189	n.p.	n.p.	n.p.	—	40	—
23	Wood and paper product	103,020	102,989	—	n.p.	—	—	n.p.	—
24	Printing, publishing and recorded media	12,138	n.p.	—	n.p.	—	—	—	—
25	Petroleum, coal, chemical and associated product	252,219	242,252	5,035	390	2,395	n.p.	285	n.p.
26	Non-metallic mineral product	30,799	29,808	n.p.	106	283	n.p.	—	—
27	Metal product	292,790	285,285	4,604	469	1,251	n.p.	—	n.p.
281-282	Motor vehicle and part and other transport equipment	269,815	248,174	n.p.	n.p.	56	n.p.	86	n.p.
283	Photographic and scientific equipment	102,628	84,693	784	1,295	n.p.	134	n.p.	n.p.
284-285	Electronic and electrical equipment and appliance	359,978	310,447	37,023	2,979	5,754	810	1,927	1,039
286	Industrial machinery and equipment	72,187	66,604	4,600	623	228	57	76	—
29	Other manufacturing	14,590	n.p.	n.p.	n.p.	20	—	—	—
C	Total manufacturing	1,686,560	1,564,832	65,714	7,193	25,676	2,262	2,806	18,076
	Other industries —								
F-G	Wholesale and retail trade	221,411	151,030	10,182	836	1,883	n.p.	n.p.	56,321
K	Finance and insurance	111,998	111,438	n.p.	—	—	—	—	n.p.
77,782-786	Property and business services	435,913	354,397	47,069	3,444	2,682	n.p.	n.p.	12,148
781	Scientific research	82,983	29,392	25,556	4,195	6,753	n.p.	11,161	n.p.
(d)	Other n.e.c.	179,953	151,576	18,541	711	3,711	n.p.	n.p.	n.p.
D-Q	Total other industries	1,032,257	797,832	n.p.	9,186	15,028	13,275	n.p.	71,057
	TOTAL ALL INDUSTRIES	3,028,216	2,668,816	168,066	17,129	40,704	15,553	28,815	89,133
	Private sector contribution to 'Total all industries' —	2,794,914	2,462,145	150,381	16,563	37,381	n.p.	n.p.	89,133

(a) Excludes enterprises in ANZSIC Division 'A' (b) Grants for Industry R & D Scheme. (c) Includes Higher Education and Private Non-profit sectors. (d) ANZSIC codes D,E,H,J,M-Q

State comparisons

The leading states in terms of R&D expenditure are Victoria at \$1,138m and New South Wales at \$1,094m, accounting for 38 per cent and 36 per cent of total expenditure respectively. Victoria's proportion of total R&D was unchanged compared with 1992-93, while New South Wales' decreased by 1 per cent.

The main industries undertaking R&D in New South Wales are Property and business services, Electronic and electrical equipment and appliance mfg and Wholesale and retail trade. In Victoria they are Motor vehicle and part and other transport equipment mfg, Electronic and electrical equipment and appliance mfg and Petroleum, coal, chemical and associated product mfg.

The largest R&D expenditure by the Mining industry occurs in Western Australia (\$114m or 37% of total R&D expenditure by the industry).

LOCATION OF EXPENDITURE

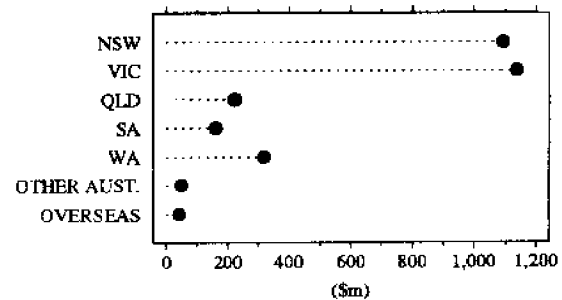


TABLE 6. LOCATION OF R&D EXPENDITURE^(a) BY BUSINESS ENTERPRISES^(b), AUSTRALIA, 1993-94
(\$'000)

Industry of enterprise ANZSIC Code Description		Location of expenditure							
		Total	NSW	Vic.	Qld	SA	WA	Other Australian states and territories	Overseas
B	Mining (including services to mining)	309,399	14,962	84,666	65,218	2,284	113,944	n.p.	n.p.
	Manufacturing —								
21	Food, beverage and tobacco	139,772	68,194	46,916	16,004	3,007	3,936	1,663	52
22	Textile, clothing, footwear and leather	36,625	24,632	7,036	n.p.	2,312	926	943	n.p.
23	Wood and paper product	103,020	6,540	n.p.	n.p.	n.p.	n.p.	n.p.	218
24	Printing, publishing and recorded media	12,138	7,341	3,488	30	n.p.	516	n.p.	—
25	Petroleum, coal, chemical and associated product	252,219	87,587	114,519	12,014	19,798	11,218	3,060	4,023
26	Non-metallic mineral product	30,799	13,875	8,931	3,991	n.p.	2,159	n.p.	—
27	Metal product	292,790	93,719	98,140	17,282	n.p.	n.p.	5,280	—
281-282	Motor vehicle and part and other transport equipment	269,815	36,860	189,287	4,514	n.p.	5,441	656	n.p.
283	Photographic and scientific equipment	102,628	45,127	21,651	6,658	27,354	1,361	n.p.	n.p.
284-285	Electronic and electrical equipment and appliance	359,978	137,883	149,733	11,968	27,888	18,378	4,877	9,251
286	Industrial machinery and equipment	72,187	26,133	21,947	12,033	6,451	4,267	n.p.	n.p.
29	Other manufacturing	14,590	6,186	n.p.	1,874	310	1,366	n.p.	n.p.
C	Total manufacturing	1,686,560	554,076	733,624	103,248	126,181	125,477	25,535	18,418
	Other industries —								
F-G	Wholesale and retail trade	221,411	125,259	62,096	13,632	5,348	9,980	4,724	372
K	Finance and insurance	111,998	96,753	14,514	n.p.	—	—	n.p.	n.p.
77,782-786	Property and business services	435,913	222,459	111,548	28,100	8,117	56,694	7,611	1,384
781	Scientific research	82,983	32,334	29,231	n.p.	9,388	1,385	1,431	n.p.
(c)	Other n.e.c.	179,953	48,619	102,016	4,810	10,598	11,525	2,295	90
D-Q	Total other industries	1,032,257	525,423	319,406	55,338	33,450	79,584	n.p.	n.p.
	TOTAL ALL INDUSTRIES	3,028,216	1,094,461	1,137,696	223,804	161,916	319,005	49,527	41,807
	Private sector contribution to 'Total all industries' —	2,794,914	999,815	1,018,579	220,437	154,986	n.p.	47,935	n.p.

(a) Location of the expenditure. This may not be the location of the organisations head office. (b) Excludes enterprises in ANZSIC Division 'A' (c) ANZSIC codes D,E,H-J,M-Q

Business size comparison - Expenditure

The largest enterprises, employing 1000 or more, account for 42 per cent of total R&D expenditure. On average this is more than \$8m per business undertaking R&D. Businesses employing less than 10 people account for only 4 per cent of the R&D. This averages out at about \$153,000 for each business undertaking R&D.

The ABS defines small business as those employing less than 100 in Manufacturing industries and less than 20 in other industries. Out of those businesses undertaking R&D, small manufacturers account for 20 per cent of Manufacturing R&D, an average of \$283,000 per business. Small businesses undertaking R&D in other industries account for 9 per cent or \$198,000 per business.

The Manufacturing industries where small businesses account for the largest percentages of R&D are Textile, clothing, footwear and leather mfg (75%), Printing, publishing and recorded media (73%) and Industrial machinery and equipment mfg (67%). For other industries,

small businesses account for the largest percentage of R&D in Property and business services (17%).

EMPLOYMENT SIZE COMPARISON

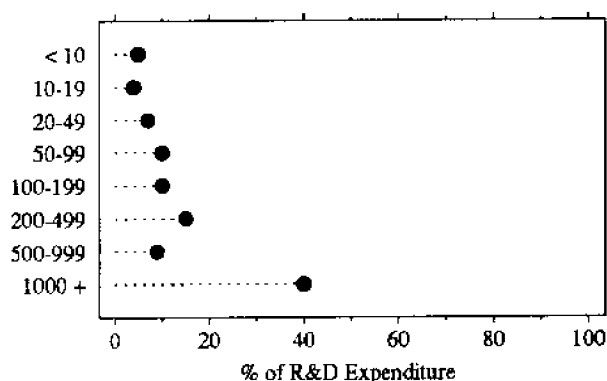


TABLE 7. R&D EXPENDITURE BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1993-94, BY SIZE OF BUSINESS(b)
(\$'000)

Industry of enterprise ANZSIC Code Description	Enterprise employment size (persons)								
	Total	Less than 10	10 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 to 999	1000 or more
B Mining (including services to mining)	309,399	1,718	n.p.	1,692	1,294	2,995	n.p.	32,947	171,677
Manufacturing —									
21 Food, beverage and tobacco	139,772	1,401	745	5,527	9,924	4,959	12,137	26,122	78,957
22 Textile, clothing, footwear and leather	36,625	1,996	n.p.	1,706	n.p.	2,559	3,863	n.p.	n.p.
23 Wood and paper product	103,020	455	210	1,147	n.p.	922	622	8,925	n.p.
24 Printing, publishing and recorded media	12,138	793	1,336	5,666	1,080	n.p.	800	—	n.p.
25 Petroleum, coal, chemical and associated product	252,219	7,830	13,086	22,047	20,868	16,292	66,175	31,619	74,302
26 Non-metallic mineral product	30,799	1,839	597	1,159	912	2,701	4,189	7,710	11,693
27 Metal product	292,790	2,782	4,022	11,918	7,434	n.p.	n.p.	13,096	140,050
281-282 Motor vehicle and part and other transport equipment	269,815	2,252	1,562	3,610	4,680	7,651	13,927	37,711	198,422
283 Photographic and scientific equipment	102,628	3,051	n.p.	6,140	6,367	4,403	n.p.	32,154	16,394
284-285 Electronic and electrical equipment and appliance	359,978	22,946	23,236	31,135	22,526	33,249	54,259	31,530	141,098
286 Industrial machinery and equipment	72,187	9,395	6,746	16,520	15,761	8,032	14,023	n.p.	n.p.
29 Other manufacturing	14,590	2,581	n.p.	1,412	2,105	3,004	2,723	n.p.	—
C Total manufacturing	1,686,560	57,320	60,039	107,986	115,461	143,497	254,316	192,451	755,490
Other industries —									
F-G Wholesale and retail trade	221,411	7,645	9,236	15,798	29,044	33,174	29,935	14,682	81,897
K Finance and insurance	111,998	610	604	n.p.	n.p.	n.p.	n.p.	n.p.	93,307
77,782-786 Property and business services	435,913	44,612	29,279	66,878	135,480	33,535	56,385	44,953	24,791
781 Scientific research	82,983	9,673	n.p.	31,970	24,168	2,134	n.p.	—	—
(c) Other n.e.c.	179,953	4,879	3,483	n.p.	n.p.	n.p.	3,243	n.p.	133,243
D-Q Total other industries	1,032,257	67,419	n.p.	124,269	206,973	70,482	n.p.	79,752	333,238
TOTAL ALL INDUSTRIES	3,028,216	126,457	112,091	233,947	323,727	216,974	448,464	305,150	1,260,405
Private sector contribution to 'Total all industries' —	2,794,914	126,395	112,091	233,947	307,507	215,522	447,339	273,726	1,078,387

(a) Excludes enterprises in ANZSIC Division 'A' (b) Employment size is based on the number of persons employed by the enterprise. (c) ANZSIC codes D,E,H-J,M-Q

Expected R&D Expenditure

The 1992-93 and 1993-94 'actual' data in the table below are the business expenditures reported in the 1992-93 and 1993-94 surveys.

In each of these surveys, businesses were asked to report the level of expenditure they expected to incur in the following twelve months. These estimates are respectively the 1993-94 and 1994-95 'expected' data in the table below.

This is published for the first time and should be used with caution because:

- Only some businesses have long term R&D projects and can provide a fairly accurate forecast.

- Many businesses perform R&D on a 'needs be' basis or have projects nearing completion. In such cases funding for future projects is uncertain and any forecast expenditure is only a best guess.

The survey showed that expected expenditure in 1994-95 is estimated to be \$2,872m, or 5 per cent lower than actually recorded in 1993-94. However the comparable expenditure estimate for 1993-94 understated the figure finally recorded, also by about 5 per cent. One possible interpretation of this 1994-95 expected expenditure figure is therefore that actual R&D expenditure in 1994-95 could be similar to that recorded for 1993-94.

TABLE 8. R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, EXPECTED AND ACTUAL EXPENDITURE (\$m)

		1992-93		1993-94		1994-95	
<i>Industry of enterprise</i>		<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>
<i>ANZSIC</i>	<i>Code Description</i>						
B	Mining (including services to mining)	171,527	185,733	309,399	156,221		
	Manufacturing —						
21	Food, beverage and tobacco	136,137	132,811	139,772	130,712		
22	Textile, clothing, footwear and leather	28,793	33,157	36,625	35,097		
23	Wood and paper product	44,447	33,804	103,020	49,804		
24	Printing, publishing and recorded media	15,281	13,095	12,138	10,555		
25	Petroleum, coal, chemical and associated product	279,603	262,387	252,219	259,946		
26	Non-metallic mineral product	30,941	27,917	30,799	29,500		
27	Metal product	335,738	263,902	292,790	283,390		
281-282	Motor vehicle and part and other transport equipment	307,673	295,455	269,815	281,738		
283	Photographic and scientific equipment	96,478	109,717	102,628	107,434		
284-285	Electronic and electrical equipment and appliance	336,840	341,749	359,978	393,287		
286	Industrial machinery and equipment	65,206	68,582	72,187	68,220		
29	Other manufacturing	10,858	12,027	14,590	17,277		
C	Total manufacturing	1,687,995	1,594,603	1,686,560	1,666,961		
	Other industries —						
F-G	Wholesale and retail trade	223,433	325,166	221,411	228,304		
K	Finance and insurance	119,738	115,306	111,998	103,488		
77,782-786	Property and business services	363,377	391,567	435,913	457,222		
781	Scientific research	83,752	96,396	82,983	86,495		
(b)	Other n.e.c.	193,747	164,033	179,953	173,557		
D-Q	Total other industries	984,047	1,092,467	1,032,257	1,049,066		
	TOTAL ALL INDUSTRIES	2,843,569	2,872,803	3,028,216	2,872,248		
	Private sector contribution to 'Total all industries' —	2,598,798	2,583,984	2,794,914	2,641,732		

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H-J,M-Q

Business size comparison - Human resources

For those businesses undertaking R&D, those employing 1000 or more contribute 34 per cent of the human resource effort. However only 1 per cent of their total employment is devoted to R&D. On the other hand, businesses in the smallest size category (less than 10 employees) devote 43 per cent of their total employment to research, but this contributes only 7 per cent of the total human resources undertaking R&D.

Using the ABS definitions of small business (see page 7) undertaking R&D in Manufacturing, small businesses contributed 28 per cent of the human resource effort (representing 12% of their total employment). The 72 per cent contributed by large manufacturers represents 2 per cent of their total employment. In other industries, small businesses contributed 15 per cent of total human resources (35% of their total employment) while the 85 per cent of human resources contributed by large businesses amounted to 2 per cent of their total employment.

EMPLOYMENT SIZE COMPARISON

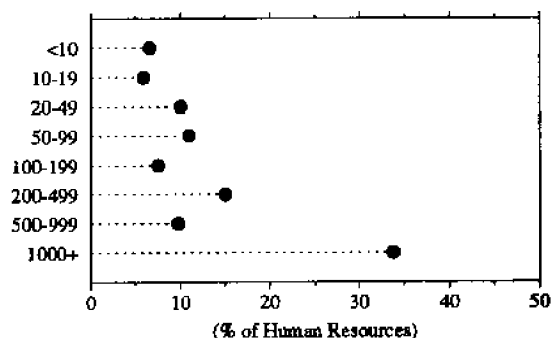


TABLE 9. HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1993-94,
BY SIZE OF BUSINESS(b)
(person years)

Industry of enterprise ANZSIC Code Description	Enterprise employment size (persons)								
	Total	Less than 10	10 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 to 999	1000 or more
B Mining (including services to mining)	798	14	21	12	7	n.p.	n.p.	118	320
Manufacturing —									
21 Food, beverage and tobacco	1,155	18	9	24	98	51	113	175	667
22 Textile, clothing, footwear and leather	244	11	n.p.	21	105	34	45	18	n.p.
23 Wood and paper product	224	3	n.p.	9	n.p.	10	n.p.	47	n.p.
24 Printing, publishing and recorded media	131	13	18	58	n.p.	n.p.	14	—	n.p.
25 Petroleum, coal, chemical and associated product	2,077	65	95	251	196	176	503	283	507
26 Non-metallic mineral product	274	14	11	13	18	26	39	60	93
27 Metal product	1,748	39	47	76	84	114	449	109	831
281-282 Motor vehicle and part and other transport equipment	1,918	37	24	60	93	118	194	290	1,103
283 Photographic and scientific equipment	989	62	81	77	60	65	n.p.	207	n.p.
284-285 Electronic and electrical equipment and appliance	3,694	334	320	348	257	386	494	345	1,209
286 Industrial machinery and equipment	835	83	98	186	183	86	175	n.p.	n.p.
29 Other manufacturing	158	20	24	29	32	n.p.	16	n.p.	—
C Total manufacturing	13,447	699	735	1,151	1,138	1,093	2,294	1,554	4,782
Other industries —									
F-G Wholesale and retail trade	1,737	99	121	203	260	249	226	107	473
K Finance and insurance	1,155	10	8	n.p.	n.p.	n.p.	n.p.	n.p.	1,056
77,782-786 Property and business services	3,957	587	389	651	792	318	571	411	238
781 Scientific research	775	88	46	285	249	n.p.	n.p.	—	—
(c) Other n.e.c.	1,342	57	42	n.p.	n.p.	13	20	n.p.	982
D-Q Total other industries	8,965	842	606	1,184	1,457	n.p.	n.p.	607	2,749
TOTAL ALL INDUSTRIES	23,210	1,554	1,362	2,348	2,603	1,719	3,495	2,280	7,851
Private sector contribution to 'Total all industries' —	21,105	n.p.	1,362	2,348	n.p.	1,703	n.p.	n.p.	6,107

(a) Excludes enterprises in ANZSIC Division 'A' (b) Employment size is based on the number of persons employed by the enterprise, whereas human resources data are person years of R & D effort (c) ANZSIC codes D,E,H-J,M-Q

Type of R&D staff

There was a 2 per cent increase in total human resources devoted to R&D in 1993-94 compared with 1992-93.

The proportion of Researchers to total R&D staff ranged from 74 per cent in Finance and insurance to 38 per cent in Wood and paper product mfg. In total Manufacturing, 56 per cent of the R&D staff were Researchers and 29 per cent were Technicians. This compares with Mining (60% Researchers, 23% Technicians) and Other industries (67% Researchers, 21% Technicians).

RESEARCHER EFFORT BY INDUSTRY

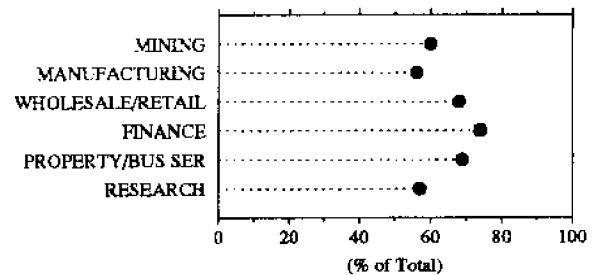


TABLE 10. HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1993-94, BY TYPE OF EMPLOYEE (person-years)

Industry of enterprise ANZSIC Code Description		Type of employee			
		Total	Researchers	Technicians	Other supporting staff
B	Mining (including services to mining)	798	477	181	140
	Manufacturing —				
21	Food, beverage and tobacco	1,155	648	294	213
22	Textile, clothing, footwear and leather	244	111	82	51
23	Wood and paper product	224	85	121	18
24	Printing, publishing and recorded media	131	88	23	20
25	Petroleum, coal, chemical and associated product	2,077	1,200	563	314
26	Non-metallic mineral product	274	109	97	68
27	Metal product	1,748	896	532	320
281-282	Motor vehicle and part and other transport equipment	1,918	754	739	425
283	Photographic and scientific equipment	989	659	238	92
284-285	Electronic and electrical equipment and appliance	3,694	2,492	847	355
286	Industrial machinery and equipment	835	388	262	185
29	Other manufacturing	158	72	59	27
C	Total manufacturing	13,447	7,502	3,857	2,087
	Other industries —				
F-G	Wholesale and retail trade	1,737	1,184	314	239
K	Finance and insurance	1,155	858	149	148
77,782-786	Property and business services	3,957	2,739	837	381
781	Scientific research	775	441	238	96
(b)	Other n.e.c.	1,342	774	353	215
D-Q	Total other industries	8,965	5,996	1,891	1,078
	TOTAL ALL INDUSTRIES	23,210	13,976	5,929	3,305
	Private sector contribution to 'Total all industries' —	21,105	12,584	5,510	3,011

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H-J,M-Q

Purpose of research

Businesses were asked to classify their R&D expenditure according to the Socio-Economic Objective classification (SEO). This requires the businesses undertaking R&D to categorise expenditure according to the purpose of their research projects.

\$2,750m (91%) of business R&D has been directed towards Economic development. Approximately 3 per cent

of business R&D has been directed towards Defence, 2 per cent towards Society, 2 per cent towards Environment and 1 per cent towards Advancement of knowledge.

Of the expenditure directed towards Economic development, \$1,674m (61%) is towards Manufacturing, \$378m (14%) towards Information and communication services and \$179m (7%) towards Commercial services.

TABLE 11. RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1993-94, BY SOCIO-ECONOMIC OBJECTIVE

Socio-economic objective	Expenditure (\$'000)				
	Type of expenditure				Human Resources (person years)
	Total	Capital expenditure	Labour costs(b)	Other current expenditure	
Defence	99,723	3,703	30,685	65,335	468
<i>Economic development</i>					
Plant — production and primary products	27,513	2,100	14,125	11,288	311
Animal — production and primary products	29,642	780	11,651	17,212	234
Mineral resources (excl. energy)	137,421	30,312	35,097	72,011	623
Energy resources	157,400	46,448	29,851	81,100	467
Energy supply	62,920	9,129	30,272	23,519	491
Manufacturing	1,674,459	278,579	657,571	738,308	12,635
Construction	29,948	3,337	14,420	12,191	304
Transport	67,275	4,498	34,330	28,448	619
Information and communication services	377,979	26,699	210,998	140,282	3,510
Commercial services	179,142	10,432	117,275	51,434	1,902
Economic framework	6,487	473	3,912	2,103	64
Total Economic development	2,750,185	412,787	1,159,503	1,177,895	21,159
<i>Society</i>					
Health	62,240	4,207	28,924	29,110	552
Education and training	5,956	512	4,095	1,349	75
Social development and community services	2,978	398	1,958	622	43
Total Society	71,174	5,116	34,976	31,081	670
<i>Environment</i>					
Environmental knowledge	23,042	3,153	9,914	9,974	198
Environmental aspects of economic development	34,491	4,894	12,834	16,762	236
Environmental management and other aspects	7,537	1,251	3,087	3,199	65
Total environment	65,070	9,299	25,836	29,935	499
Advancement of knowledge	42,064	4,209	20,276	17,579	414
TOTAL	3,028,216	435,115	1,271,276	1,321,825	23,210

(a) Excludes enterprises in ANZSIC Division 'A' (b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax and workers compensation insurance, overtime earnings, shift allowances, penalty rates, bonuses, commission payments, holiday pay, long service leave payments, sick pay, employer contributions to superannuation and pension schemes.

EXPLANATORY NOTES

Introduction

1. This publication presents statistics on expenditure and human resources devoted to R&D carried out in Australia by enterprises within the Business Enterprise sector during 1993-94.

Data sources

2. The 1993-94 data presented in this publication have been compiled from data collected from business enterprises in the Survey of Research and Experimental Development in respect of the year ended June 1994. This survey was based on a complete enumeration of businesses identified by the Australian Bureau of Statistics (ABS) as potential R&D performers. The survey was conducted by mailed questionnaires and a 91 per cent response was obtained. The ABS believes that the non-respondents did not perform R&D.

3. The 1988-89, 1990-91, 1991-92 and 1992-93 statistics in this publication were derived from similar surveys. The 1987-88 and 1989-90 statistics were derived from a stratified random sample of businesses identified as likely R&D performers.

4. The GDP(I) figures used to derive BERD/GDP ratios quoted in the Summary of Findings are current at time of manuscript finalisation (National Income, Expenditure and Product, December Quarter 1994, Catalogue No 5206.0) and, at current prices are as follows: \$299,629m (1987-88); \$339,927m (1988-89); \$371,051m (1989-90); \$379,069m (1990-91); \$386,958m (1991-92); \$404,007m (1992-93) and \$428,588m (1993-94). The available BERD/GDP ratios for other OECD countries are current at time of manuscript finalisation and are sourced from "Main Science and Technology Indicators, 1994-2", OECD, Paris, 1994.

Statistical Unit

5. Prior to the 1988-89 survey the organisational unit for the collection of R&D statistics had been the enterprise. An enterprise is defined broadly as the unit comprising all the operations in Australia of a single operating legal entity (e.g. company, partnership or sole proprietor).

6. From the beginning of 1989, the ABS has introduced a new statistical unit known as the management unit. The management unit is the highest-level accounting unit within a business, having regard for industry homogeneity, for which accounts are maintained; in nearly all cases it coincides with the legal entity owning the business (ie company, partnership, trust, sole operator, etc). In the case of large diversified businesses, however, there may be more than one management unit, each coinciding with a 'division' or 'line of business'. A division or line of business is recognised where separate and comprehensive accounts are compiled for it.

7. For the largest enterprises the management unit has been implemented on the ABS central register of eco-

nomic units and included in the surveys. For small businesses the statistical unit is still the enterprise.

Definitions

8. Research and Experimental Development is defined in accordance with the Organisation for Economic Co-operation and Development (OECD) standard as comprising 'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications'.

9. For a more comprehensive interpretation of the definition of R&D activity, contact the ABS or refer to the OECD publication, "The Measurement of Scientific and Technical Activities ("Frascati Manual" 1993)", OECD, Paris 1994.

10. The R&D statistics presented in this publication refer to intramural R&D activity.

Scope

11. The scope of this survey is all enterprises within the Business Enterprise Sector of Australia which have undertaken R&D.

12. The Business Enterprise sector includes all enterprises whose primary activity is the production of goods or services for sale to the general public at a price intended to cover at least the cost of production, and the private non-profit institutions mainly serving them.

13. The vast majority of enterprises in this sector are private businesses. The remainder are public business enterprises mainly engaged in trading or financial activities.

Coverage

14. The 1993-94 R&D survey comprised a complete enumeration of business enterprises identified by the ABS as likely to have carried out R&D activity.

15. The business enterprise sector for the R&D survey excludes enterprises mainly engaged in agriculture, forestry and fishing (i.e. industries in Division A of the Australian and New Zealand Standard Industrial Classification (ANZSIC), 1993), partly because of collection difficulties and partly because such enterprises are believed to have very low R&D activity (agricultural R&D activity is generally carried out by specialised research institutes not included in ANZSIC Division A).

16. Within the scope of the survey, enterprises were included in the collection if they satisfied any of the following criteria:

(a) Enterprises which, in previous R&D surveys, reported R&D activity.

(b) Units applying for the 150% Tax Concession Scheme and the Grants for Industry R&D Scheme.

(c) Enterprises identified from reports in newspapers, industrial journals, research compendia etc. as likely to have R&D activity.

17. The ABS continues to investigate enhancement of the above criteria, or the introduction of additional criteria, with the aim of further improving the coverage of the R&D survey.

Australian and New Zealand Standard Industrial Classification (ANZSIC)

18. The statistics in this publication are classified to industry in accordance with the 1993 edition of the ANZSIC.

19. Each management unit or enterprise is classified by the ABS to the industry in which it mainly operates even though one or more of its component establishments (factories, shops, etc.) may be classified to other industries. In cases where an enterprise group sets up a dedicated research unit, that unit is classified to the predominant industry of the group rather than research, in accordance with standards laid down in the Frascati Manual.

Socio-economic objective classification

20. Statistics of business enterprise R&D classified by Socio-economic objective (SEO) have been collected and presented in this publication. Each business undertaking R&D was asked to categorise its R&D expenditure according to the purpose of its research projects. For more information on this classification see the Australian Standard Research Classification, 1993 (1297.0)

Constant price estimates

21. Estimates of total R&D expenditure are shown at average 1989-90 prices in Table 1. In concept, constant price estimates are measures from which direct effects of price change have been eliminated. Although expressed in monetary terms, the constant price measures shown vary only with changes in the underlying quantities of inputs purchased (including labour). In effect, quantities of broadly defined categories of inputs are weighted by their prices in the base year (1989-90). Because the measures relate to input quantities, they do not reflect changes in the efficiency with which labour, capital and other inputs are used.

22. The estimate of the labour costs component was obtained by multiplying each broad category of labour used in each period by the relevant average labour costs in the base year (1989-90). The non-labour costs components were estimated by deflating each by a composite price index of relevant materials or capital expenditure items. In revaluing R&D non-labour expenditure, extensive use has been made of price series used in deriving constant price national accounts estimates.

23. For a more comprehensive description of constant price concepts and estimation procedures see Australian National Accounts: Concepts, Sources and Methods (5216.0).

Reliability of statistics

24. The statistics in this publication must be interpreted with caution for the following reasons:

(a) Many respondents had to make estimates because their accounts do not separately record data on R&D activity.

(b) The OECD standard definition of R&D used in this survey differs in some respects from what respondents may regard as R&D activity. This is because the definitions used within the Grants for Industry R&D scheme (for the allocation of grants), and the 150 per cent Tax Concession Scheme (for tax deductibility for specific R&D activities) are slightly different from the international standard.

Unpublished statistics

25. Limited additional detailed R&D statistics will be available at a charge from the ABS when compiled.

Related publications

26. Users may also wish to refer to the following publications:

Research and Experimental Development, Business Enterprises, Australia, 1992-93 (8104.0)

Research and Experimental Development, General Government and Private Non-Profit Organisations, Australia, 1992-93 (8109.0)

Research and Experimental Development, Higher Education Organisations, Australia, 1992 (8111.0)

Research and Experimental Development, All Sector Summary, Australia, 1992-93 (8112.0)

Australian Standard Research Classification 1993 (1297.0)

Main Science and Technology Indicators 1994-2, OECD, Paris, 1994

Australian Science and Innovation Resources Brief 1994, Measures of Science and Innovation, Department of Industry, Science and Technology, 1994

The Measurement of Scientific and Technical Activities ("Frascati Manual" 1993) OECD, Paris, 1994

27. Current publications issued by the ABS are listed in the Catalogue of Publications, Australia (1101.0). The ABS also issues, on Tuesdays and Fridays, a Publications Advice (1105.0) which lists publications to be released in the next few days. The Catalogue and Publications advice are available from any ABS office.

Symbols and other usages

n.e.c. not elsewhere classified

n.p. not available for separate publication
(but included in totals where applicable)

- nil or rounded to zero

r revised since previous issue

28. Where figures have been rounded, discrepancies may occur between sums of the component items and totals.

GLOSSARY

BERD - Business expenditure on R&D is the sum of intramural R&D expenditures incurred by all organisations in the survey.

Capital expenditure is expenditure on the acquisition (less disposals) of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment attributable to R&D activity.

GIRD - Grants for Industry R&D Scheme.

Human resources devoted to R&D measures the effort of researchers, technicians and other staff directly involved with R&D activity. *Overhead staff* (e.g. administrative and general service employees such as personnel officers, janitors, etc.) whose work indirectly supports R&D, are excluded.

Intramural R&D activity is R&D carried out by an organisation on its own behalf or on behalf of other organisations, institutions or individuals.

Labour costs include wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax and workers compensation payments, sick pay, and employer contributions to superannuation and pension schemes.

Other current expenditure is expenditure on materials, fuels, rent and leasing, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.

Other supporting staff are those skilled and unskilled craftspersons, secretarial and clerical staff directly associated with R&D activity.

R&D activity in the business context is systematic investigation or experimentation involving innovation or technical risk, the outcome of which is *new knowledge*, with or without a specific practical application or *new or improved* products, processes, materials, devices or services. R&D activity extends to modifications to existing products/processes. R&D activity ceases and pre-production begins when work is no longer experimental.

Researchers are those involved with the conception and/or development of new products/processes e.g. executives and directors involved in the planning or management of scientific and technical aspects of R&D projects, and software developers/programmers. They exclude executives and directors concerned primarily with budgets and human resources rather than project content.

Socio-economic objective (SEO) refers to the area of expected national benefit rather than to the immediate objectives of the researcher. The SEO classification defines the main areas of Australian economic and social activity to which the results of research programs are applied. It describes the purpose of the research; i.e. 'why' the research is being performed.

Technicians are those performing technical tasks in support of R&D activity, normally under the direction and supervision of a researcher. These tasks include preparation of experiments, taking records, preparation of charts and graphs and coding computer programs.



For more information ...

The ABS publishes a wide range of statistics and other information on Australia's economic and social conditions. Details of what is available in various publications and other products can be found in the *ABS Catalogue of Publications and Products* available at all ABS Offices (see below for contact details).

Information Consultancy Service

Information tailored to special needs of clients can be obtained from the Information Consultancy Service available at ABS Offices (see Information Inquiries below for contact details).

National Dial-a-Statistic Line

0055 86 400

(Steadycom P/L: premium rate 25c/21.4 secs.)

This number gives 24-hour access, 365 days a year, for a range of statistics.

Electronic Data Services

A large range of data is available via on-line services, diskette, magnetic tape, tape cartridge and CD ROM. For more details about these electronic data services, contact any ABS Office (see below).

Bookshops and Subscriptions

There is a large number of ABS publications available from ABS bookshops (see below Bookshop Sales for contact details). The ABS also provides a subscription service through which nominated publications are supplied by mail on a regular basis (telephone Subscription Service toll free on 008 02 0608 Australia wide).

Sales and Inquiries

Regional Offices	Information Inquiries	Bookshop Sales
SYDNEY (02)	268 4611	268 4620
MELBOURNE (03)	615 7000	615 7829
BRISBANE (07)	222 6351	222 6350
PERTH (09)	360 5140	360 5307
ADELAIDE (08)	237 7100	237 7582
HOBART (002)	20 5800	20 5800
CANBERRA (06)	252 6627	207 0326
DARWIN (089)	43 2111	43 2111
National Office		
ACT (06)	252 6007	008 020 608

ABS E-mail Addresses

Keylink	STAT.INFO/ABS
X.400	(C:AU,A:TELMEMO,O:ABS,SN:INFO,FN:STAT)
Internet	STAT.INFO@ABS. TELEMEMO.AU



Information Services, ABS, PO Box 10, Belconnen ACT 2616



2811400007937