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**RESEARCH AND EXPERIMENTAL DEVELOPMENT
BUSINESS ENTERPRISES, AUSTRALIA
1992-93**

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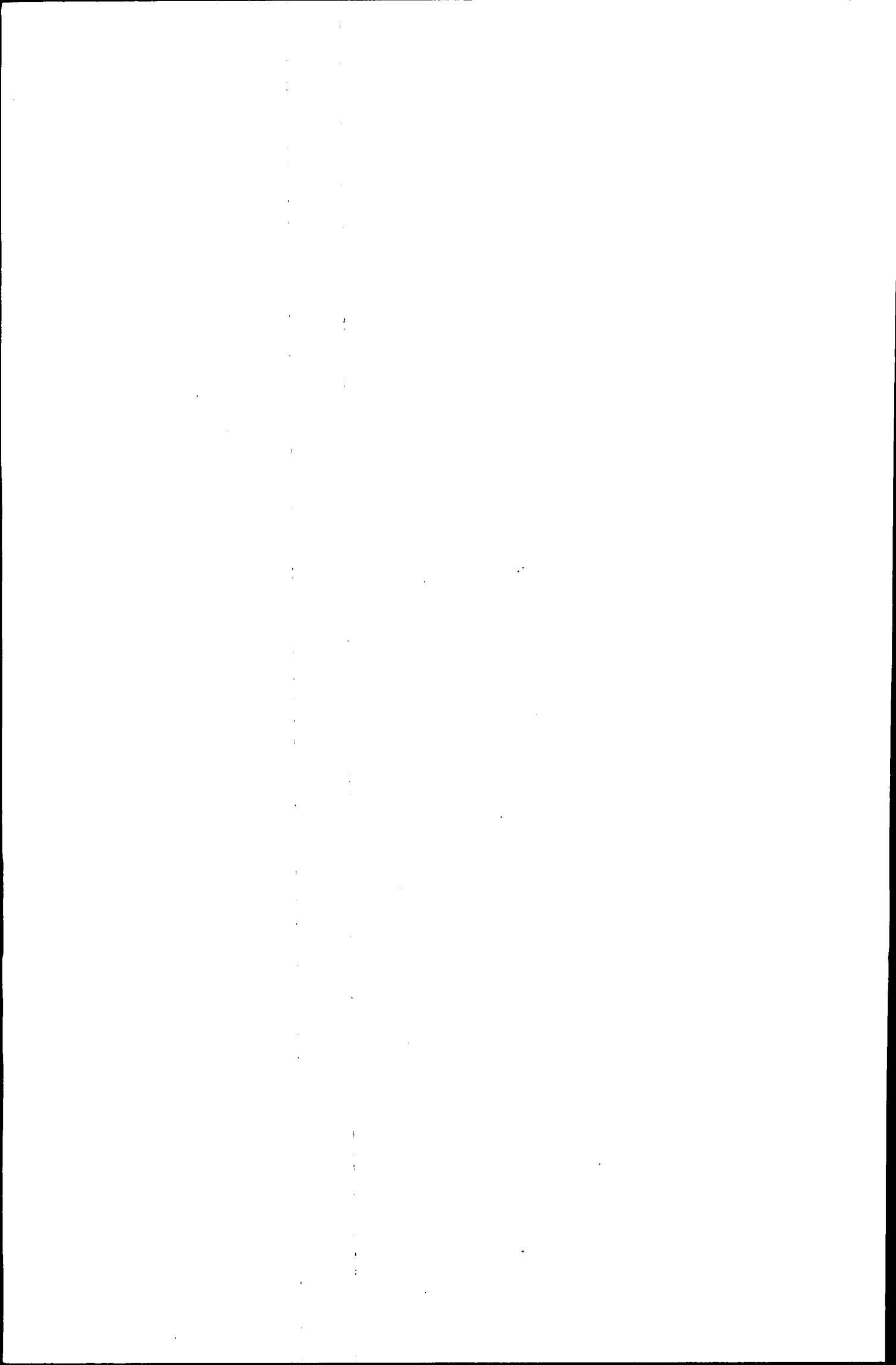
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INQUIRIES

- *for further information about statistics in this publication and the availability of related unpublished statistics, contact Derek Byars on Canberra (06) 252 5627 or any ABS office.*
 - *for further information about constant price estimates contact Paul Curran on Canberra (06) 252 6801.*
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SUMMARY OF FINDINGS

R&D expenditure

Business expenditure on R&D (BERD) carried out in Australia in 1992-93 is estimated to be \$2,788 million at current prices. This represents an increase of 20 per cent compared with 1991-92. At average 1989-90 prices, R&D expenditure is estimated to be \$2,541 million, an increase of 17 per cent compared with 1991-92.

At average 1989-90 prices, private and public sector businesses increased R&D expenditure by 18 per cent and 11 per cent respectively over 1991-92 to the highest levels recorded.

Private sector businesses now account for 91 per cent of R&D expenditure in the business sector. The private sector contribution decreased steadily from 1987-88 to 1990-91, but has increased since then.

Business expenditure on R&D (BERD) represents 0.67 per cent of Gross Domestic Product (GDP). This ratio increased rapidly in the early 1980's, plateaued between 1988-89 and 1990-91, and has increased by 23 per cent over the last two years.

Although the BERD/GDP ratio is now the highest recorded, it remains relatively low when compared with other OECD countries as shown in the table below.

Japan	2.06
United States	1.82
Germany	1.72
France	1.44
United Kingdom	1.33
Finland	1.24
Canada	0.81
Italy	0.78
Ireland	0.69
AUSTRALIA	0.67
Spain	0.47
Iceland	0.31

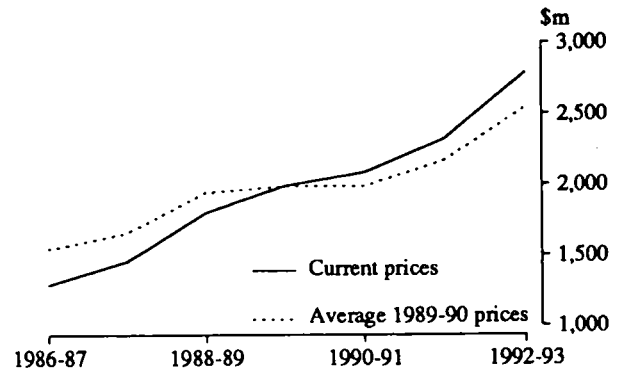
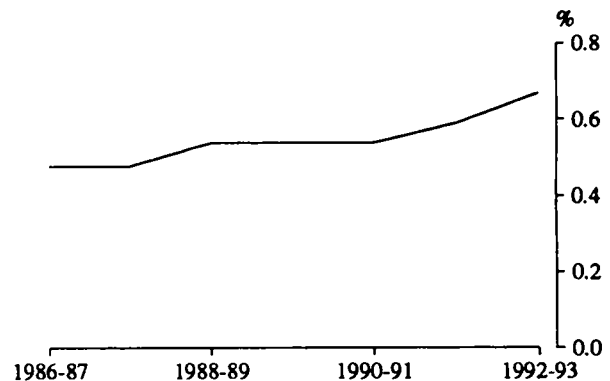
BUSINESS EXPENDITURE ON R&D**BERD AS A PERCENTAGE OF GDP**

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

	1986-87	1987-88	1988-89r	1989-90	1990-91r	1991-92r	1992-93
AT CURRENT PRICES							
Private Sector	1,165.1	1,338.2	1,649.1	1,802.6	1,878.7	2,103.4	2,544.0
Public Sector	123.5	117.6	149.2	187.0	203.6	216.4	243.9
TOTAL BUSINESS ENTERPRISES	1,288.6	1,455.8	1,798.3	1,989.6	2,082.4	2,319.7	2,787.9
AT AVERAGE 1989-90 PRICES							
Private Sector	1,403.2	1,527.0	1,783.2	1,802.6	1,798.1	1,970.9	2,319.2
Public Sector	141.0	129.4	159.6	187.0	191.1	198.7	221.5
TOTAL BUSINESS ENTERPRISES	1,544.2	1,656.4	1,942.8	1,989.6	1,989.2	2,169.6	2,540.7

(a) Excludes enterprises in ANZSIC Division 'A'

Human resources devoted to R&D

Human resources devoted to R&D carried out in Australia in 1992-93 is estimated to be 22,811 person years. This represents an 8 per cent increase over 1991-92. Human resources devoted to research has steadily increased over the years, except for a decline between 1988-89 and 1989-90.

Private sector businesses account for 90 per cent of person years of effort devoted to R&D in the business sector. This is similar to their contribution to expenditure.

Human resource effort devoted to R&D as a percentage of the number of persons employed by those businesses that carried out R&D increased steadily from 1.37 per cent in 1986-87 to 1.62 per cent in 1988-89, 1.79 per cent in 1990-91 and 2.30 per cent in 1991-92, but fell to 2.18 per cent in 1992-93.

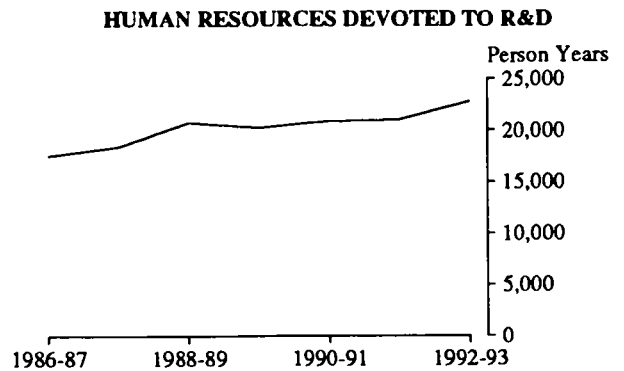


TABLE 2. HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA
(person years)

	1986-87	1987-88	1988-89r	1989-90	1990-91r	1991-92r	1992-93
Private Sector	16,198	16,952	19,206	18,572	19,040	18,979	20,592
Public Sector	1,393	1,527	1,597	1,729	1,867	2,088	2,219
TOTAL BUSINESS ENTERPRISES	17,591	18,479	20,803	20,301	20,907	21,066	22,811

(a) Excludes enterprises in ANZSIC Division 'A'

Industry perspective

This table presents a time series of R&D classified by industry of enterprise in accordance with the 1983 edition of the Australian Standard Industrial Classification (ASIC).

Business expenditure on R&D has increased 20 per cent (\$468m) in current prices over 1991-92. While Mining remained constant, Manufacturing increased 26 per cent (\$339m), Property and business services increased 15 per cent (\$42m), Research and scientific institutions increased 39 per cent (\$25m), Finance increased 27 per cent (\$25m) and Wholesale and retail trade increased 8 per cent (\$16m).

The ASIC has now been replaced by the 1993 edition of the Australian and New Zealand Standard Industrial Classification (ANZSIC). Accordingly, the remaining tables in this publication which show an industry perspective are in accordance with the ANZSIC.

To provide a link between data classified in accordance with the two classifications, the summary data for 1992-93 has been presented in accordance with both classifications (see tables 3 and 4).

For more information on the classifications see paragraphs 21 to 23 of the Explanatory Notes.

EXPENDITURE BY INDUSTRY

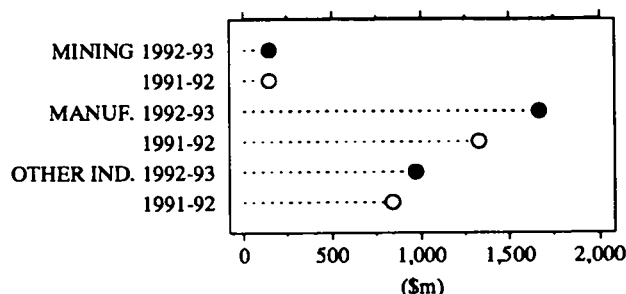


TABLE 3. R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA

Industry of enterprise ASIC Code Description	Enterprises (number)			Expenditure on R & D (\$m)			Person years of effort on R & D		
	1990-91r	1991-92r	1992-93	1990-91r	1991-92r	1992-93	1990-91r	1991-92r	1992-93
11-15 Mining (excluding services to mining)	44	47	60	94.6	149.5	149.6	807	1,010	1,047
Manufacturing —									
21 Food, beverages and tobacco	100	96	120	86.7	110.1	136.2	961	993	1,116
23-24 Textiles, clothing and footwear	33	33	42	15.0	17.2	26.3	113	139	188
25 Wood, wood products and furniture	36	29	30	7.3	16.8	11.0	107	102	108
26 Paper, paper products, printing and publishing	30	27	28	35.9	54.9	43.5	254	249	245
27 Chemical, petroleum and coal products	241	218	235	201.7	201.9	226.3	1,956	1,828	1,801
28 Non-metallic mineral products	32	32	42	17.7	24.6	29.3	165	203	281
29 Basic metal products	60	55	53	174.8	179.5	290.9	1,291	1,235	1,329
31 Fabricated metal products	115	102	133	27.1	26.9	45.2	341	311	463
32 Transport equipment	106	99	110	171.8	223.2	307.3	1,583	1,530	1,689
334 Photographic, professional and scientific equipment	64	59	66	41.9	51.1	53.0	491	522	547
335 Appliances and electrical equipment	530	457	478	265.0	304.0	362.0	3,458	3,306	3,588
336 Industrial machinery and equipment	228	190	249	61.3	67.4	75.4	699	750	931
34 Miscellaneous manufacturing	114	100	123	35.2	50.3	60.5	395	389	452
C Total manufacturing	1,689	1,497	1,709	1,141.5	1,327.7	1,666.9	11,813	11,558	12,737
Other industries —									
F Wholesale and retail trade	258	234	257	184.2	203.6	219.9	1,780	1,677	1,660
61-62 Finance	32	30	28	136.3	94.5	119.9	1,596	1,422	1,468
63 Property and business services	457	406	501	239.7	286.2	328.6	2,479	2,983	3,342
8461 Research and scientific institutions	64	58	65	64.3	65.7	91.0	649	719	894
(b) Other n.e.c.	141	126	146	221.7	192.5	212.1	1,783	1,699	1,663
16, D-L Total other industries	952	854	997	846.3	842.5	971.5	8,287	8,499	9,027
TOTAL ALL INDUSTRIES	2,685	2,398	2,766	2,082.4	2,319.7	2,787.9	20,907	21,066	22,811
Private Sector Contribution	2,633	2,353	2,724	1,878.7	2,103.4	2,544.0	19,040	18,979	20,592
Public Sector Contribution	52	45	42	203.6	216.4	243.9	1,867	2,088	2,219

(a) Excludes enterprises in ASIC Division 'A' (b) ASIC codes 16,D,E,G,H,J,8141-8306,8462-8495,L.

60 per cent (\$1,667m) of total R&D expenditure and 56 per cent (12,747 person years) of human resources devoted to R&D are in manufacturing industries. The major contributors to total manufacturing are Metal product mfg (21% of expenditure, 14% of human resources), Electronic and electrical equipment and appliance mfg (20% of expenditure, 27% of human resources), Motor vehicle and part and other transport equipment mfg (18% of expenditure, 13% of human resources) and Petroleum, coal, chemical and associated product mfg (16% of expenditure, 16% of human resources).

The largest other industries are Property and business services (12% of total expenditure, 15% of total human resources) and Wholesale and retail trade (8% of total expenditure, 7% of total human resources).

Mining industries contribute 6 per cent of total expenditure and 5 per cent of total human resources.

EXPENDITURE BY SELECTED INDUSTRIES

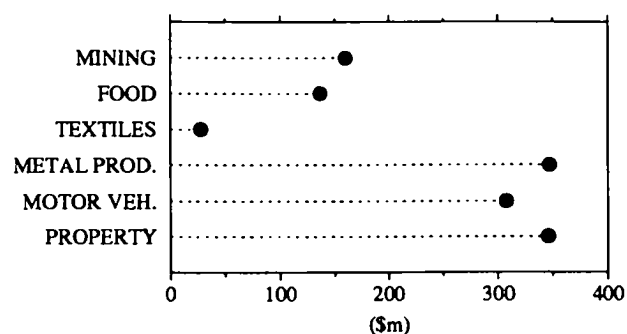


TABLE 4. R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY ANZSIC INDUSTRY OF ENTERPRISE, 1992-93

Industry of enterprise ANZSIC Code Description	Enterprises (number)	Expenditure on R & D (\$m)	Person years of effort on R & D
B Mining (including services to mining)	86	160.0	1,133
Manufacturing —			
21 Food, beverage and tobacco	121	136.9	1,125
22 Textile, clothing, footwear and leather	49	28.4	212
23 Wood and paper product	25	29.4	212
24 Printing, publishing and recorded media	34	14.3	140
25 Petroleum, coal, chemical and associated product	309	269.6	2,042
26 Non-metallic mineral product	47	30.8	298
27 Metal product	175	346.7	1,778
281-282 Motor vehicle and part and other transport equipment	112	307.7	1,694
283 Photographic and scientific equipment	96	96.5	931
284-285 Electronic and electrical equipment and appliance	451	333.8	3,405
286 Industrial machinery and equipment	236	62.9	772
29 Other manufacturing	55	10.4	139
C Total manufacturing	1,710	1,667.3	12,747
Other industries —			
F-G Wholesale and retail trade	255	218.7	1,645
K Finance and insurance	27	119.5	1,458
77,782-786 Property and business services	507	345.9	3,525
781 Scientific research	63	83.1	811
(b) Other n.e.c.	118	193.3	1,492
D-Q Total other industries	970	960.6	8,930
TOTAL ALL INDUSTRIES	2,766	2,787.9	22,811
Private Sector Contribution	2,724	2,544.0	20,592
Public Sector Contribution	42	243.9	2,219

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

Type of expenditure

Labour costs continue to be the main component of R&D expenditure (43%). However, labour costs as a proportion of total R&D costs has fallen after remaining constant for a number of years. The Finance industry has the highest labour costs as a proportion of total R&D expenditure (74%).

Metal product mfg has the highest capital expenditure as a proportion of total R&D expenditure (39%).

Type of activity

69 per cent of business R&D expenditure is directed towards Experimental development, up from 63 per cent in 1990-91.

For the manufacturing sector, 73 per cent of research is on Experimental development and 22 per cent is Applied research. For the mining sector, only 59 per cent is on Experimental development while 37 per cent is Applied research. In the Scientific research industry only 32 per cent is experimental development, with 49 per cent on applied research and 19 per cent on basic research.

TYPE OF EXPENDITURE

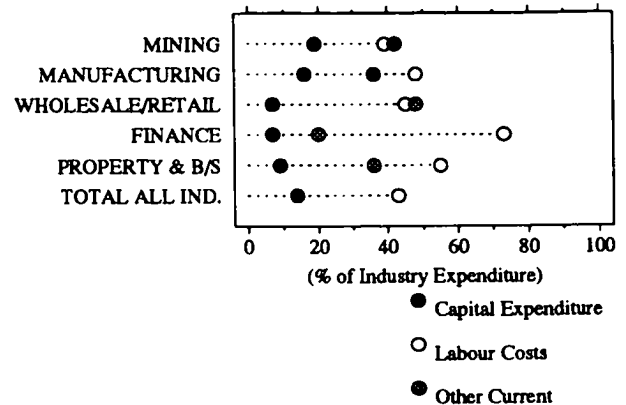


TABLE 5. R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93, BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY (\$'000)

Industry of enterprise ANZSIC Code Description	Type of expenditure				Type of activity(b)		
	Total expenditure	Capital expenditure	Labour costs(c)	Other current expenditure	Basic research	Applied research	Experimental development
B Mining (including services to mining)	160,041	31,070	62,515	66,456	5,636	59,620	94,786
Manufacturing —							
21 Food, beverage and tobacco	136,880	25,837	60,099	50,944	7,664	44,167	85,050
22 Textile, clothing, footwear and leather	28,413	3,367	9,089	15,958	7,441	8,505	12,467
23 Wood and paper product	29,414	2,874	12,190	14,350	1,638	4,315	23,462
24 Printing, publishing and recorded media	14,281	4,107	6,912	3,262	1,546	2,204	10,531
25 Petroleum, coal, chemical and associated product	269,603	30,988	103,348	135,267	10,668	65,989	192,946
26 Non-metallic mineral product	30,791	2,624	15,562	12,605	5,707	6,510	18,575
27 Metal product	346,681	135,838	89,243	121,601	19,419	93,530	233,732
281-282 Motor vehicle and part and other transport equipment	307,667	11,765	87,675	208,228	4,429	49,696	253,542
283 Photographic and scientific equipment	96,478	8,748	48,811	38,919	4,986	16,081	75,411
284-285 Electronic and electrical equipment and appliance	333,825	32,491	169,408	131,926	11,235	62,148	260,442
286 Industrial machinery and equipment	62,905	4,926	31,783	26,196	5,731	13,904	43,270
29 Other manufacturing	10,374	424	5,740	4,210	777	2,808	6,790
C Total manufacturing	1,667,312	263,988	639,861	763,464	81,240	369,857	1,216,216
Other industries —							
F-G Wholesale and retail trade	218,665	16,497	98,218	103,950	16,994	48,570	153,101
K Finance and insurance	119,517	7,681	88,303	23,533	1,806	30,228	87,484
77,782-786 Property and business services	345,943	31,377	190,119	124,448	17,379	94,177	234,387
781 Scientific research	83,111	6,269	37,789	39,052	15,403	40,721	26,987
(d) Other n.e.c.	193,337	23,966	95,112	74,258	23,121	61,839	108,377
D-Q Total other Industries	960,573	85,790	509,542	365,242	74,703	275,535	610,335
TOTAL ALL INDUSTRIES	2,787,926	380,847	1,211,918	1,195,162	161,579	705,011	1,921,337
Private Sector Contribution	2,544,013	355,277	1,071,849	1,116,888	140,052	638,362	1,765,600
Public Sector Contribution	243,913	25,570	140,069	78,274	21,527	66,649	155,737

(a) Excludes enterprises in ANZSIC Division 'A' (b) Data within this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. Analysts using this classification should bear the original subjectivity in mind. See Paragraph 12 of the Explanatory Notes. (c) 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. (d) ANZSIC codes D,E,H-I,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 \$2,624m. The Commonwealth Government provided \$54m in funding, \$13m from the Grants for Industry R&D (GIRD) Scheme and \$40m from Other Commonwealth Government sources. 3 per cent or \$85m was funded from Overseas.

Industries where a significant proportion of funding was other than from Own funds included: Scientific research (51% from Other business enterprises and 11% from the Commonwealth Government); Wholesale and retail trade (28% from Overseas); and Property and business services (19% from Other business enterprises).

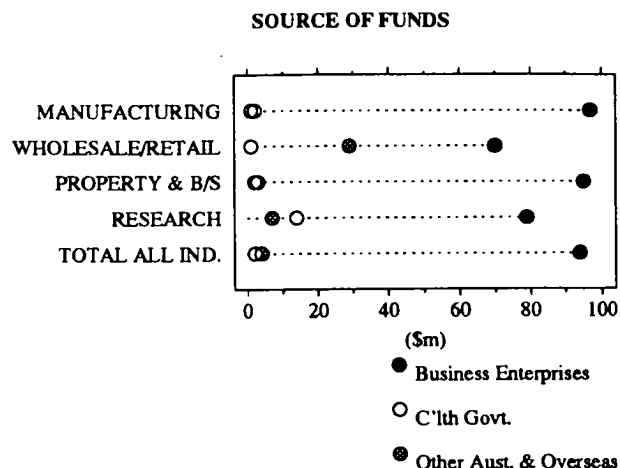


TABLE 6. SOURCE OF FUNDS FOR R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93
(\$'000)

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)	160,041	157,794	n.p.	n.p.	31	—	182	—
Manufacturing —								
21 Food, beverage and tobacco	136,880	133,607	2,795	257	113	n.p.	n.p.	—
22 Textile, clothing, footwear and leather	28,413	27,898	—	n.p.	n.p.	—	—	—
23 Wood and paper product	29,414	29,414	—	—	—	—	—	—
24 Printing, publishing and recorded media	14,281	13,386	n.p.	n.p.	—	—	—	—
25 Petroleum, coal, chemical and associated product	269,603	257,493	6,037	491	1,477	19	n.p.	n.p.
26 Non-metallic mineral product	30,791	30,367	98	102	224	—	—	—
27 Metal product	346,681	340,169	n.p.	643	567	n.p.	247	150
281-282 Motor vehicle and part and other transport equipment	307,667	290,336	n.p.	n.p.	251	117	59	n.p.
283 Photographic and scientific equipment	96,478	78,143	495	1,938	n.p.	68	n.p.	n.p.
284-285 Electronic and electrical equipment and appliance	333,825	288,987	27,599	2,635	11,731	396	452	2,025
286 Industrial machinery and equipment	62,905	58,789	2,956	501	61	n.p.	127	n.p.
29 Other manufacturing	10,374	10,188	—	n.p.	n.p.	—	—	—
C Total manufacturing	1,667,312	1,558,777	56,530	6,924	27,802	805	4,404	12,070
Other industries —								
F-G Wholesale and retail trade	218,665	147,287	6,599	790	1,149	181	655	62,004
K Finance and insurance	119,517	119,086	n.p.	n.p.	—	—	—	n.p.
77,782-786 Property and business services	345,943	263,431	66,535	1,794	3,694	1,280	1,547	7,662
781 Scientific research	83,111	22,642	42,719	3,000	6,170	n.p.	2,852	n.p.
(d) Other n.e.c.	193,337	177,262	n.p.	n.p.	1,501	n.p.	8,251	—
D-Q Total other industries	960,573	729,708	n.p.	n.p.	12,514	7,210	13,304	72,626
TOTAL ALL INDUSTRIES	2,787,926	2,446,280	177,257	13,442	40,347	8,014	17,890	84,696
Private Sector Contribution	2,544,013	2,220,609	173,748	13,442	n.p.	n.p.	10,411	84,696
Public Sector Contribution	243,913	225,671	3,509	—	n.p.	n.p.	7,479	—

(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 \$1,073m and New South Wales at \$1,026m, accounting for 38 per cent and 37 per cent of total expenditure respectively. New South Wales' proportion of total R&D decreased by 2 per cent compared with 1991-92 while Victoria's increased by 1 per cent. Western Australia increased its proportion of total R&D from 7 per cent in 1991-92 to 10 per cent in 1992-93.

The main industries undertaking R&D in Victoria 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. In New South Wales they are Property and business services, Electronic and electrical equipment and appliance mfg and Wholesale and retail trade. The largest R&D expenditure by the Mining industry occurs in Queensland (\$44m or 27% of total R&D expenditure by the industry).

LOCATION OF EXPENDITURE

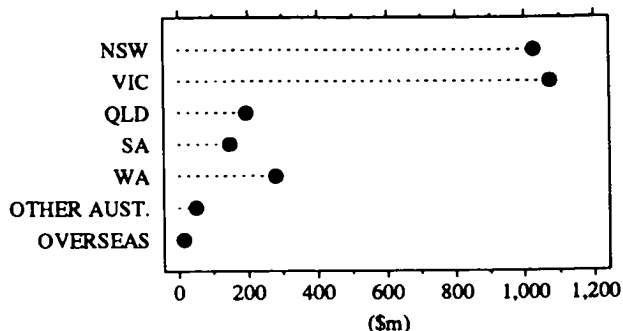


TABLE 7. LOCATION OF R&D EXPENDITURE^(a) BY BUSINESS ENTERPRISES^(b), AUSTRALIA, 1992-93 (\$'000)

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)	160,041	34,364	36,981	43,582	7,486	33,116	3,654	858
Manufacturing —								
21 Food, beverage and tobacco	136,880	70,430	49,428	11,149	2,293	1,741	1,539	301
22 Textile, clothing, footwear and leather	28,413	16,887	4,911	772	3,106	n.p.	n.p.	—
23 Wood and paper product	29,414	4,797	4,523	2,213	n.p.	n.p.	n.p.	11
24 Printing, publishing and recorded media	14,281	8,734	4,360	11	n.p.	n.p.	758	—
25 Petroleum, coal, chemical and associated product	269,603	91,510	126,924	13,545	15,338	17,158	n.p.	n.p.
26 Non-metallic mineral product	30,791	14,812	8,340	4,130	1,501	1,252	n.p.	n.p.
27 Metal product	346,681	95,829	95,883	16,332	4,338	n.p.	5,626	n.p.
281-282 Motor vehicle and part and other transport equipment	307,667	42,622	232,694	3,545	n.p.	5,758	1,162	n.p.
283 Photographic and scientific equipment	96,478	41,323	21,932	4,518	26,884	1,359	n.p.	n.p.
284-285 Electronic and electrical equipment and appliance	333,825	134,759	131,646	12,135	25,242	14,597	n.p.	n.p.
286 Industrial machinery and equipment	62,905	24,300	20,724	8,830	4,934	3,609	n.p.	n.p.
29 Other manufacturing	10,374	4,178	2,876	1,668	408	1,226	18	—
C Total manufacturing	1,667,312	550,179	704,240	78,846	110,130	179,277	33,521	11,119
Other industries —								
F-G Wholesale and retail trade	218,665	119,010	61,155	13,894	5,710	11,845	n.p.	n.p.
K Finance and insurance	119,517	83,035	n.p.	n.p.	—	—	n.p.	212
77,782-786 Property and business services	345,943	137,173	111,339	34,334	7,663	49,678	4,907	849
781 Scientific research	83,111	33,024	n.p.	n.p.	4,907	1,486	587	n.p.
(c) Other n.e.c.	193,337	69,354	93,099	12,423	11,688	5,060	1,513	199
D-Q Total other industries	960,573	441,596	331,586	72,494	29,968	68,069	13,722	3,138
TOTAL ALL INDUSTRIES	2,787,926	1,026,139	1,072,807	194,922	147,584	280,462	50,897	15,115
Private Sector Contribution	2,544,013	918,968	953,873	191,537	138,350	276,751	49,445	15,089
Public Sector Contribution	243,913	107,171	118,934	3,385	9,234	3,711	1,452	26

(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.

Directions of R&D effort

\$635m of R&D effort is directed towards Computer software. Although this is an increase of \$96m over 1990-91, computer software's share of total R&D expenditure has fallen from 26 per cent to 23 per cent. The next largest product areas are Electronic equipment (\$240m, 9 per cent of the total), Motor vehicles and parts (\$166m, 6 per cent), Basic iron and steel (\$145m, 5 per cent), Pharmaceutical and veterinary products (\$136m, 5 per cent) and Mining products (\$133m, 5 per cent).

MAJOR R&D PRODUCTS

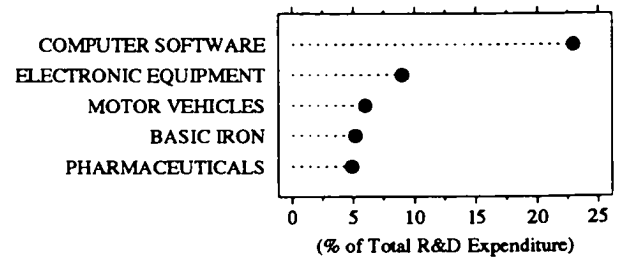


TABLE 8. PRODUCT FIELD(a) OF R&D EXPENDITURE BY BUSINESS ENTERPRISES(b), AUSTRALIA

Industry of product field	Enterprises(c) (number)			R&D expenditure (\$'000)		
	1988-89r	1990-91r	1992-93	1988-89r	1990-91r	1992-93
Agriculture, forestry, fishing and hunting	64	89	121	23,590	32,279	58,002
Mining	89	97	159	106,874	124,584	133,458
Manufacturing —						
Food, beverages and tobacco	146	144	156	75,405	77,786	115,650
Textiles, clothing and footwear	53	46	58	8,427	8,095	12,024
Wood, wood products and furniture	62	48	39	6,176	5,622	10,797
Paper, paper products, printing and publishing	37	61	49	26,231	35,133	40,489
Petroleum refining	16	10	17	6,439	4,922	30,208
Pharmaceutical and veterinary products	117	104	108	104,417	111,134	135,655
Rubber and plastic products	145	135	109	25,039	34,004	70,626
Other industrial chemical products	307	298	180	105,013	127,106	107,618
Non-metallic mineral product	96	86	47	39,540	27,018	34,205
Basic iron and steel	44	44	37	59,699	64,958	145,439
Basic non-ferrous metals	49	54	48	34,287	43,289	97,170
Fabricated metal products	217	239	236	43,173	61,922	102,524
Industrial machinery and equipment	497	387	336	115,226	101,941	92,684
Computer hardware	191	186	199	42,782	41,073	54,978
Electronic equipment	347	292	270	198,108	206,406	239,838
Other electrical appliances, machinery and equipment	236	164	166	51,215	51,853	69,027
Photographic, Professional and scientific equipment	187	145	118	66,992	57,315	47,533
Motor vehicles and parts	119	109	121	158,590	154,995	166,308
Ships and boats	29	18	27	5,435	n.p.	115,830
Railway rolling stock and locomotives	16	12	20	3,430	n.p.	11,586
Aircraft	20	20	26	6,996	14,764	56,881
Other transport equipment	25	34	50	3,721	4,815	13,518
Other manufacturing	74	86	211	14,124	20,132	65,449
Total manufacturing	2,382	2,045	1,994	1,200,463	1,276,805	1,836,037
Other industries —						
Computer software	581	584	749	393,135	539,108	634,655
Construction	28	—	69	2,371	—	13,621
Other n.e.c.	236	282	202	71,902	109,593	112,154
Total other industries	817	823	970	467,407	648,701	760,430
TOTAL ALL INDUSTRIES	3,049	2,685	2,766	1,798,333	2,082,369	2,787,926
Private Sector Contribution	2,992	2,633	2,724	1,649,116	1,878,740	2,544,013
Public Sector Contribution	57	52	42	149,217	203,629	243,913

(a) The industry of product (or process) field towards which the R & D activity was directed. For further explanation see paragraph 24 of the Explanatory Notes. (b) Excludes enterprises in ANZSIC Division 'A'. (c) Where the R & D performed by an enterprise was directed towards more than one product, that enterprise is counted in each of the industries to which its products are coded. Therefore, the enterprise counts shown in this table cannot be summed to aggregates for combinations of industries.

Business size comparison — Expenditure

The largest enterprises, employing 1000 or more, account for 39 per cent of total R&D expenditure. On average this is nearly \$6m 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 \$132,000 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 19 per cent of Manufacturing R&D, an average of \$232,000 per business. Small businesses undertaking R&D in other industries account for 10 per cent or \$197,000 per business.

The major industries in which these small businesses undertake research are Electronic and electrical equipment and appliance mfg and Property and business services.

EMPLOYMENT SIZE COMPARISON

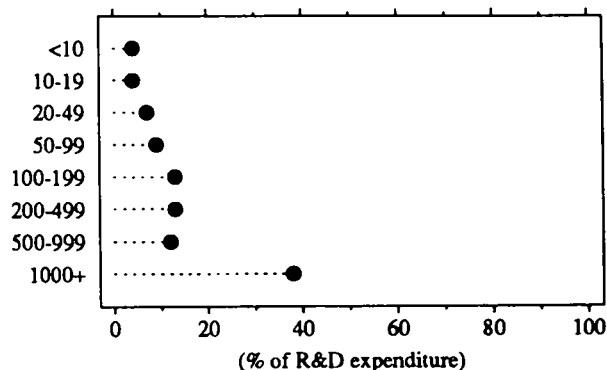


TABLE 9. R&D EXPENDITURE BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93, BY SIZE OF BUSINESS(b) (\$'000)

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)	160,041	3,810	1,493	6,392	n.p.	n.p.	9,466	19,746	94,160
Manufacturing —									
21 Food, beverage and tobacco	136,880	n.p.	n.p.	1,619	17,385	4,850	10,104	16,257	85,402
22 Textile, clothing, footwear and leather	28,413	648	n.p.	1,056	16,482	2,545	2,361	3,952	n.p.
23 Wood and paper product	29,414	67	140	489	n.p.	1,153	n.p.	n.p.	21,438
24 Printing, publishing and recorded media	14,281	671	2,028	4,045	n.p.	n.p.	n.p.	—	5,865
25 Petroleum, coal, chemical and associated product	269,603	6,882	11,713	19,246	13,433	19,300	93,258	28,637	77,133
26 Non-metallic mineral product	30,791	n.p.	251	n.p.	1,126	1,769	3,308	7,530	15,248
27 Metal product	346,681	3,810	n.p.	17,844	8,729	n.p.	50,583	16,818	129,018
281-282 Motor vehicle and part and other transport equipment	307,667	1,398	472	2,986	5,528	13,195	9,812	133,541	140,736
283 Photographic and scientific equipment	96,478	4,051	3,062	n.p.	5,114	4,414	29,126	n.p.	18,571
284-285 Electronic and electrical equipment and appliance	333,825	17,995	21,565	34,486	26,423	40,755	42,119	23,589	126,893
286 Industrial machinery and equipment	62,905	8,367	4,702	13,226	14,534	8,602	11,704	n.p.	n.p.
29 Other manufacturing	10,374	1,953	898	1,378	1,819	2,679	923	664	60
C Total manufacturing	1,667,312	47,801	47,928	102,643	111,801	217,225	254,302	262,928	622,685
Other industries —									
F-G Wholesale and retail trade	218,665	7,417	8,128	12,277	23,411	38,214	31,076	12,296	85,846
K Finance and insurance	119,517	358	807	395	2,720	n.p.	n.p.	n.p.	105,675
77,782-786 Property and business services	345,943	33,482	29,917	51,070	66,465	n.p.	62,299	n.p.	18,503
781 Scientific research	83,111	7,082	5,061	29,457	n.p.	n.p.	—	—	—
(c) Other n.e.c.	193,337	4,359	10,406	3,322	n.p.	2,024	n.p.	7,758	147,847
D-Q Total other industries	960,573	52,697	54,319	96,521	n.p.	n.p.	96,210	56,657	357,871
TOTAL ALL INDUSTRIES	2,787,926	104,308	103,740	205,556	241,799	358,498	359,978	339,331	1,074,716
Private Sector Contribution	2,544,013	104,248	103,740	203,168	n.p.	356,571	358,824	n.p.	874,743
Public Sector Contribution	243,913	60	—	2,388	n.p.	1,927	1,154	n.p.	199,973

(a) Excludes enterprises in ANZSIC Division 'A' (b) Employment size is based on the number of persons employed by the enterprise. (c) ANZSIC Codes 16,D,E,H,J,M,Q.

Business size comparison — Employment

For those businesses undertaking R&D, those employing 1000 or more contribute 36 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 over 38 per cent of their total employment to research, but this contributes only 6 per cent of the total human resources undertaking R&D.

According to the ABS definitions of small business (see page 9) out of businesses undertaking R&D in Manufacturing, small businesses contributed 28 per cent of the human resource effort (representing 11% 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 13 per cent of total human resources (32% of their total employment) while the 87 per cent of human resources contributed by large businesses amounted to less than 2 per cent of their total employment.

TABLE 10. HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93, 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)	1,133	19	n.p.	16	9	n.p.	43	97	771
Manufacturing —									
21 Food, beverage and tobacco	1,125	8	9	28	104	53	92	117	715
22 Textile, clothing, footwear and leather	212	5	n.p.	10	98	27	28	30	n.p.
23 Wood and paper product	212	1	1	n.p.	n.p.	11	n.p.	n.p.	164
24 Printing, publishing and recorded media	140	12	28	48	n.p.	3	n.p.	—	30
25 Petroleum, coal, chemical and associated product	2,042	66	109	183	171	184	648	247	434
26 Non-metallic mineral product	298	15	n.p.	n.p.	16	18	35	75	135
27 Metal product	1,778	40	35	119	83	73	469	129	830
281-282 Motor vehicle and part and other transport equipment	1,694	27	10	48	91	147	138	359	875
283 Photographic and scientific equipment	931	64	45	79	53	63	282	156	190
284-285 Electronic and electrical equipment and appliance	3,405	312	324	373	355	394	336	283	1,028
286 Industrial machinery and equipment	772	99	76	169	181	90	136	n.p.	n.p.
29 Other manufacturing	139	25	13	18	28	34	10	11	1
C Total manufacturing	12,747	672	658	1,081	1,187	1,096	2,190	1,439	4,426
Other industries —									
F-G Wholesale and retail trade	1,645	90	98	156	198	316	241	124	421
K Finance and insurance	1,458	7	n.p.	5	31	n.p.	n.p.	n.p.	1,355
77,782-786 Property and business services	3,525	469	n.p.	579	680	465	588	n.p.	157
781 Scientific research	811	84	73	259	182	n.p.	n.p.	—	—
(c) Other n.e.c.	1,492	45	29	21	99	25	25	63	1,185
D-Q Total other industries	8,930	695	n.p.	1,021	1,189	n.p.	860	452	3,117
TOTAL ALL INDUSTRIES	22,811	1,385	1,236	2,118	2,384	2,294	3,092	1,988	8,314
Private Sector Contribution	20,592	1,383	1,236	2,085	n.p.	2,272	3,082	n.p.	6,412
Public Sector Contribution	2,219	2	—	33	n.p.	22	11	n.p.	1,902

(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 an 8 per cent increase in total human resources devoted to R&D in 1992-93 compared with 1991-92.

The proportion of Researchers to total R&D staff ranged from 85 per cent in Finance and insurance to 38 per cent in Motor vehicle and part and other transport equipment mfg. In total Manufacturing, 57 per cent of the R&D staff were Researchers and 28 per cent were Technicians. This compares with Mining (62% Researchers, 28% Technicians) and Other industries (66% Researchers, 22% Technicians).

RESEARCHER EFFORT BY INDUSTRY

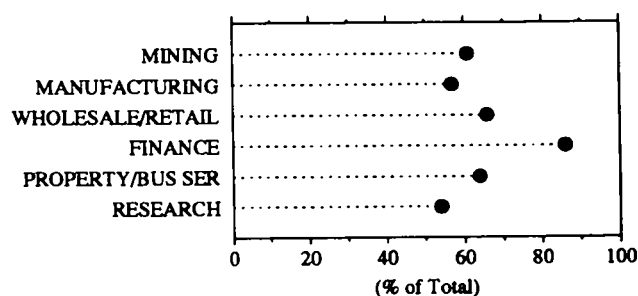


TABLE 11. HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93, BY TYPE OF EMPLOYEE (person-years)

Industry of enterprise ANZSIC Code Description	Type of employee			
	Total	Researchers	Technicians	Other supporting staff
B Mining (including services to mining)	1,133	699	321	113
Manufacturing —				
21 Food, beverage and tobacco	1,125	671	288	166
22 Textile, clothing, footwear and leather	212	105	71	36
23 Wood and paper product	212	100	75	37
24 Printing, publishing and recorded media	140	90	39	12
25 Petroleum, coal, chemical and associated product	2,042	1,190	547	304
26 Non-metallic mineral product	298	135	91	72
27 Metal product	1,778	941	520	316
281-282 Motor vehicle and part and other transport equipment	1,694	643	712	339
283 Photographic and scientific equipment	931	625	221	85
284-285 Electronic and electrical equipment and appliance	3,405	2,316	716	372
286 Industrial machinery and equipment	772	355	258	160
29 Other manufacturing	139	56	49	34
C Total manufacturing	12,747	7,226	3,588	1,933
Other industries —				
F-G Wholesale and retail trade	1,645	1,089	296	260
K Finance and insurance	1,458	1,248	n.p.	n.p.
77,782-786 Property and business services	3,525	2,265	894	366
781 Scientific research	811	441	n.p.	n.p.
(b) Other n.e.c.	1,492	836	405	250
D-Q Total other industries	8,930	5,878	2,008	1,045
TOTAL ALL INDUSTRIES	22,811	13,804	5,917	3,090
Private Sector Contribution	20,592	12,418	5,340	2,835
Public Sector Contribution	2,219	1,386	578	255

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

Extramural R&D

Extramural R&D expenditure (payments to other organisations to undertake R&D projects) is estimated to be \$264m, a decrease of 14 per cent over 1990-91.

Large extramural payments were made by the Mining industry (\$37m), Property and business services (\$31m) and Wholesale and retail trade (\$29m).

Extramural payments are equivalent to 9 per cent of BERD, down from 15 per cent in 1990-91 and 12 per cent in 1988-89.

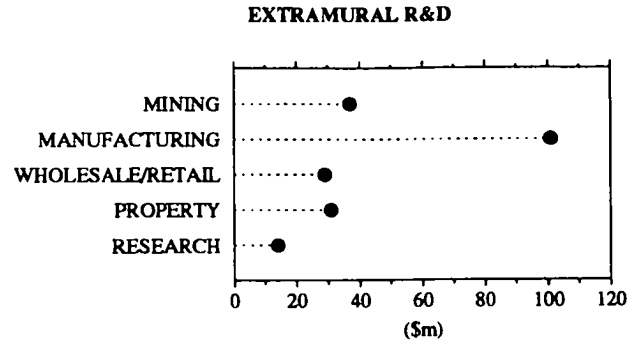


TABLE 12. EXTRAMURAL R&D EXPENDITURE(a) BY BUSINESS ENTERPRISES(b), AUSTRALIA, 1992-93

Industry of enterprise making payment ANZSIC Code Description	Location of recipient					
	Total		Australia		Overseas	
	Enterprises (number)	Payments (\$'000)	Enterprises (number)	Payments (\$'000)	Enterprises (number)	Payments (\$'000)
B Mining (including services to mining)	43	36,920	43	35,036	5	1,884
Manufacturing —						
21 Food, beverage and tobacco	45	16,775	43	9,193	8	7,582
22 Textile, clothing, footwear and leather	7	2,029	5	n.p.	2	n.p.
23 Wood and paper product	5	1,333	5	1,079	2	254
24 Printing, publishing and recorded media	6	441	6	n.p.	2	n.p.
25 Petroleum, coal, chemical and associated product	52	25,974	47	22,547	11	3,427
26 Non-metallic mineral product	13	4,906	13	4,906	—	—
27 Metal product	30	22,246	30	20,241	7	2,004
281-282 Motor vehicle and part and other transport equipment	9	n.p.	7	n.p.	2	n.p.
283 Photographic and scientific equipment	13	n.p.	12	1,786	1	n.p.
284-285 Electronic and electrical equipment and appliance	32	16,976	29	3,839	8	13,137
286 Industrial machinery and equipment	20	1,541	19	n.p.	2	n.p.
29 Other manufacturing	6	179	6	159	1	20
C Total manufacturing	238	101,383	222	74,566	46	26,817
Other industries —						
F-G Wholesale and retail trade	49	29,277	46	25,067	9	4,210
K Finance and insurance	6	9,403	6	9,403	—	—
77,782-786 Property and business services	46	31,194	42	11,796	11	19,398
781 Scientific research	19	13,804	18	n.p.	4	n.p.
(c) Other n.e.c.	35	42,348	34	n.p.	8	n.p.
D-Q Total other industries	155	126,026	146	93,047	32	32,979
TOTAL ALL INDUSTRIES	436	264,329	411	202,649	83	61,680
Private Sector Contribution	409	240,387	384	179,063	78	61,324
Public Sector Contribution	27	23,942	27	23,586	5	356

(a) Expenditure on R & D which is funded by an enterprise but carried out by others. (b) Excludes enterprises in ANZSIC Division 'A'. (c) ANZSIC codes D,E,H-J,M-Q.

Payments and receipts for technical know-how

Payments for technical know-how are estimated to be \$479m while receipts are estimated to be \$276m. These payments and receipts are equivalent to 17 per cent and 10 per cent of BERD, compared with 20 per cent and 10 per cent respectively in 1990-91.

Petroleum, coal, chemical and associated product mfg is the leading industry making payments for technical know-how at \$107m followed by Motor vehicle and part and other transport equipment mfg at \$84m.

Property and business services is the leading industry earning receipts for technical know-how at \$111m followed by Electronic and electrical equipment and appliance mfg at \$53m.

PAYMENTS AND RECEIPTS FOR TECHNICAL KNOW-HOW

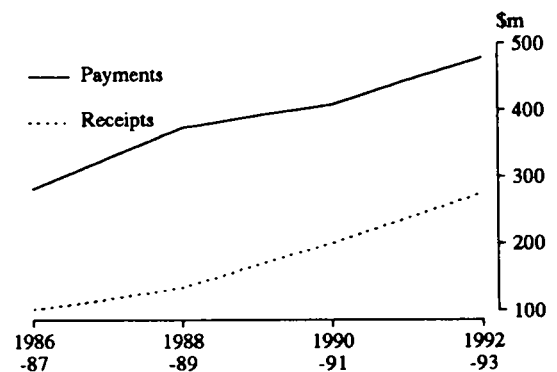


TABLE 13. PAYMENTS AND RECEIPTS FOR TECHNICAL KNOW-HOW BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93 (\$m)

Industry of enterprise ANZSIC Code Description	Payments for technical know-how			Receipts for technical know-how		
	Total	Patent licence fees and royalties	Other technical know-how	Total	Patent licence fees and royalties	Other technical know-how
B Mining (including services to mining)	0.2	—	0.2	n.p.	0.9	n.p.
Manufacturing —						
21 Food, beverage and tobacco	47.2	n.p.	n.p.	2.8	—	2.8
22 Textile, clothing, footwear and leather	21.0	n.p.	n.p.	n.p.	n.p.	—
23 Wood and paper product	n.p.	n.p.	n.p.	n.p.	—	n.p.
24 Printing, publishing and recorded media	n.p.	—	n.p.	n.p.	n.p.	n.p.
25 Petroleum, coal, chemical and associated product	106.6	68.8	37.8	4.9	1.6	3.2
26 Non-metallic mineral product	14.8	11.0	3.8	6.1	—	6.1
27 Metal product	15.3	n.p.	n.p.	4.8	1.1	3.7
281-282 Motor vehicle and part and other transport equipment	84.4	50.1	34.3	6.3	0.8	5.5
283 Photographic and scientific equipment	n.p.	n.p.	n.p.	0.8	0.8	—
284-285 Electronic and electrical equipment and appliance	45.3	29.0	16.3	53.1	8.9	44.2
286 Industrial machinery and equipment	12.0	4.7	7.3	20.6	16.1	4.5
29 Other manufacturing	0.4	n.p.	n.p.	n.p.	n.p.	n.p.
C Total manufacturing	400.7	234.9	165.8	115.2	41.5	73.7
Other industries —						
F-G Wholesale and retail trade	45.5	31.1	14.4	13.2	n.p.	n.p.
K Finance and insurance	n.p.	n.p.	n.p.	9.0	n.p.	n.p.
77,782-786 Property and business services	14.6	4.5	10.1	111.3	28.5	82.8
781 Scientific research	n.p.	n.p.	n.p.	22.3	n.p.	n.p.
(b) Other n.e.c.	4.4	0.4	4.0	n.p.	n.p.	3.9
D-Q Total other industries	77.7	36.4	41.3	n.p.	38.2	n.p.
TOTAL ALL INDUSTRIES	478.5	271.3	207.2	276.4	80.6	195.8
Private Sector Contribution	474.6	271.2	203.4	273.7	80.5	193.2
Public Sector Contribution	3.9	0.1	3.8	2.7	0.1	2.6

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

Patent activity

Businesses with R&D activity during 1992-93 lodged 1,072 patent applications within Australia and 8,025 abroad during the period 1 July 1991 to 30 June 1993. During this period 985 patents were granted in Australia and 1,641 granted abroad.

Please note that, as the questions on patents were revised for the 1992-93 R&D survey, these results may not be comparable with those of earlier years. For further details see paragraph 13 of the Explanatory Notes.

TABLE 14. PATENT ACTIVITY BY BUSINESS ENTERPRISES(a) UNDERTAKING R&D

		July 1991 - June 1993					
		Australia			Overseas		
Industry of enterprise ANZSIC Code Description		Standard patents lodged	Petty patents lodged	Standard patents granted	Petty patents granted	Patents lodged (b)	Patents granted
B	Mining (including services to mining)	29	—	11	—	320	25
	Manufacturing —						
21	Food, beverage and tobacco	19	—	17	—	26	n.p.
22	Textile, clothing, footwear and leather	2	—	9	n.p.	73	18
23	Wood and paper product	14	—	n.p.	—	37	n.p.
24	Printing, publishing and recorded media	—	n.p.	—	n.p.	n.p.	n.p.
25	Petroleum, coal, chemical and associated product	108	11	80	n.p.	927	170
26	Non-metallic mineral product	40	—	32	—	178	n.p.
27	Metal product	147	n.p.	150	5	864	171
281-282	Motor vehicle and part and other transport equipment	27	—	26	n.p.	295	42
283	Photographic and scientific equipment	79	n.p.	34	n.p.	634	126
284-285	Electronic and electrical equipment and appliance	74	23	90	18	499	124
286	Industrial machinery and equipment	65	16	49	6	400	85
29	Other manufacturing	10	n.p.	n.p.	—	n.p.	20
C	Total manufacturing	585	114	506	87	4,136	878
	Other industries —						
F-G	Wholesale and retail trade	145	n.p.	209	n.p.	537	185
K	Finance and insurance	n.p.	—	1	—	n.p.	1
77,782-786	Property and business services	88	6	80	3	928	406
781	Scientific research	55	—	31	—	1,556	99
(c)	Other n.e.c.	n.p.	n.p.	46	n.p.	n.p.	47
D-Q	Total other industries	330	14	367	14	3,569	738
	TOTAL ALL INDUSTRIES	944	128	884	101	8,025	1,641
	Private Sector Contribution	914	128	862	101	7,476	1,626
	Public Sector Contribution	30	—	22	—	549	15

(a) Excludes enterprises in ANZSIC Division 'A'. (b) See paragraph 13 of the Explanatory Notes. (c) 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.

\$2,500m (90%) of business R&D has been directed towards Economic development. Of this, \$1,483m (59%) is towards Manufacturing, \$380m (15%) towards Information and communication services and \$198m (8%) towards Commercial services.

Approximately 5 per cent of business R&D has been directed towards Defence and 2 per cent each towards Society and Environment. Advancement of knowledge receives the remaining 1 per cent.

TABLE 15. RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1992-93, BY SOCIO-ECONOMIC OBJECTIVE

Socio-economic objective	Expenditure (\$'000)				Human Resources (person years)
	Total	Type of expenditure			
		Capital expenditure	Labour costs(b)	Other current expenditure	
Defence	134,725	1,207	18,180	115,337	351
<i>Economic development</i>					
Plant — production and primary products	45,428	7,559	17,652	20,217	388
Animal — production and primary products	25,906	1,506	7,737	16,663	198
Mineral resources (excl. energy)	100,496	18,682	35,895	45,918	675
Energy resources	115,334	11,338	53,216	50,780	996
Energy supply	55,384	5,790	23,177	26,417	413
Manufacturing	1,483,092	255,634	600,772	626,685	11,776
Construction	25,747	2,170	12,249	11,329	269
Transport	65,392	7,098	31,307	26,986	620
Information and communication services	380,306	29,682	203,421	147,203	3,399
Commercial services	198,056	19,351	129,830	48,876	2,240
Economic framework	5,112	318	3,264	1,530	64
Total Economic development	2,500,252	359,128	1,118,521	1,022,604	21,038
<i>Society</i>					
Health	54,801	5,788	25,314	23,699	479
Education and training	4,457	521	2,557	1,378	69
Social development and community services	8,088	1,384	4,597	2,107	107
Total Society	67,345	7,693	32,469	27,184	654
<i>Environment</i>					
Environmental knowledge	12,302	1,858	6,290	4,154	134
Environmental aspects of economic development	20,922	4,387	7,849	8,687	149
Environmental management and other aspects	17,617	2,837	9,506	5,274	136
Total environment	50,841	9,082	23,645	18,115	420
Advancement of knowledge	34,762	3,737	19,103	11,923	349
TOTAL	2,787,926	380,847	1,211,917	1,195,162	22,811

(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

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 1992-93.

2. Statistics also included are extramural R&D activity, payments and receipts for technical know-how and patent activity.

3. Comparable R&D statistics are produced for the General Government, Private Non-Profit and Higher Education sectors (see paragraph 31).

Data sources

4. The 1992-93 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 1993. This survey was based on a complete enumeration of businesses identified by the Australian Bureau of Statistics (ABS) as likely 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 were non-R&D performers.

5. The 1986-87, 1988-89, 1990-91 and 1991-92 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.

6. The GDP(A) 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, March Quarter 1994*, Catalogue No 5206.0) and, at average 1989-90 prices, are as follows: \$325,009m (1986-87); \$341,777m (1987-88); \$357,805m (1988-89); \$369,457m (1989-90); \$367,307m (1990-91); \$369,712m (1991-92) and \$380,724m (1992-93). 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, 1994-1", OECD, Paris, 1994.

Statistical unit

7. 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).

8. 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.

9. For the largest enterprises the management unit has been implemented on the ABS central register of economic units and included in the surveys. For small businesses the statistical unit is still the enterprise.

Definitions

10. 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'.

11. 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" 1980)", OECD, Paris 1981.

12. Type of R&D activity comprises basic research, applied research and experimental development. Data in this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. ABS makes every effort to ensure correct and consistent interpretation and reporting of this data and applies consistent processing methodologies. Analysts using this classification should bear the original subjectivity in mind.

13. The questions on patents have been revised for the 1992-93 survey. In particular, the question relating to lodgement of patent applications overseas now specifically asks for the number of countries in which protection was initially sought. For example, if four countries were designated in an application (a PCT application or a European Patent application) then the business was asked to record the number of patent applications lodged as four. In previous surveys, it is possible that the patent application would have been recorded as only one lodgement. For this reason the number of patent applications lodged overseas shown in Table 14 of this publication is considerably higher than those shown in earlier publications.

Scope

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

15. 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.

16. 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

17. The 1992-93 R&D survey comprised a complete enumeration of business enterprises identified by the ABS as likely to have carried out R&D activity.

18. 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).

19. 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, payments or receipts for technical know-how, or patent 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.

20. 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)

21. The statistics in this publication (except in Table 3) are classified by the industry of enterprise in accordance with the 1993 edition of the ANZSIC.

22. Each 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.

23. The ANZSIC has replaced the Australian Standard Industrial Classification (ASIC) used previously. To provide a link between data classified in accordance with the two classifications, summary data for 1992-93 has been presented in accordance with both classifications (see Tables 3 and 4). Concordances between the two classifications are included in the Australian and New Zealand Standard Industrial Classification, 1993 (1292.0).

Product field

24. Business enterprise sector R&D expenditure presented in Table 8 are classified by product (or process) field. This involved asking each business to apportion its total R&D expenditure towards the products/processes to which it was directed. For example, an enterprise classified as being in mining may have performed R&D activity into a more efficient ore crusher. This R&D expenditure would be classified to the Industrial machinery and equipment product field.

Socio-economic objective classification

25. 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

26. 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.

27. 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.

28. 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

29. 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, receipts and payments for technical know-how or patent 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 deductability for specific R&D activities) are slightly different from the international standard.

Unpublished statistics

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

Related publications

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

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

Research and Experimental Development, Higher Education Organisations, Australia, 1992 (8111.0) (to be released later this year)

Research and Experimental Development, All Sector Summary, Australia, 1992-93 (8112.0) (to be released later this year)

Research and Experimental Development, Business Enterprises (Inter Year Survey), Australia, 1991-92 (8114.0)

Measures of Science and Innovation, Australian Science and Technology Indicators Report, Department of Industry, Technology and Commerce, Canberra, Australia, 1987

Main Science and Technology Indicators 1994-1, OECD, Paris, 1994

The Measurement of Scientific and Technical Activities ("Frascati Manual" 1980) OECD, Paris, 1981

32. Current publications issued by the ABS are listed in the *Catalogue of Publications and Products, 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

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

GLOSSARY

Applied research is original work undertaken in order to acquire new knowledge with a specific application in view. It is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving some specific and pre-determined objectives.

Basic research is experimental and theoretical work undertaken primarily to acquire new knowledge without a specific application in view. It consists of pure basic research and strategic basic research. *Pure* basic research is carried out without looking for long term benefits other than the advancement of knowledge. *Strategic* basic research is directed into specified broad areas in the expectation of useful discoveries. It provides the broad base of knowledge necessary for the solution of recognised practical problems.

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.

Experimental development is systematic work, using existing knowledge gained from research or practical experience for the purpose of creating new or improved products/processes.

Extramural R&D statistics refer to R&D activity funded by an organisation but carried out by other enterprises, organisations, institutions or individuals.

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.

Technical know-how (TKH) is the specialised technical knowledge required to successfully produce a product or implement a process, etc. (e.g. patent licences; technical data and information; scientific, technical or engineering assistance) that increases technical knowledge and understanding in an enterprise. Payments are those made directly to the holders of TKH which is new to a business enterprise. They exclude non-monetary transfers, and costs incurred by an enterprise in obtaining TKH, such as overseas travel costs.

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.

Type of R&D activity comprises basic research, applied research and experimental development.

UNPUBLISHED DATA
BUSINESS ENTERPRISES

A range of additional tables are available from the list set out below for a standard cost of \$20.00 per table.

Further related statistics are available on request subject to conditions of data availability. Contact Derek Byars, Science and Technology Sub-section on Canberra (06) 252 5627 for more information.

A. Intramural research and experimental development (R&D) activity: R&D carried out by business enterprises

R&D expenditure by detailed industry of enterprise:

- by type of expenditure, type of activity and enterprise employment size
- industry of enterprise by R&D expenditure size
- R&D expenditure size
- industry of product field
- industry of product by enterprise employment size

Human resources devoted to R&D by detailed industry of enterprise:

- by type of employee and enterprise broad employment size
- a percentage of enterprise employment by industry of enterprise by enterprise employment size

B. Extramural R&D expenditure: Expenditure by business enterprises on R&D carried out by others

Payments by:

- industry of enterprise making payment by location of recipient
- country of recipient by relationship of recipient to enterprise making payment
- Country of recipient
- enterprise employment size

C. Payments and receipts by business enterprises for technical know-how

Payments:

- details by industry of enterprise
- overseas by industry of enterprise
- by country of recipient
- by industry of enterprise by enterprise employment size
- by enterprise employment size

Receipts:

- by country of recipient
- by industry of enterprise by enterprise employment size
- by enterprise employment size

D. Patent activity by business enterprises

Patent activity by industry of enterprise and number of enterprises