



# **RESEARCH AND EXPERIMENTAL DEVELOPMENT**

**BUSINESSES  
AUSTRALIA**

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## **C O N T E N T S**

	<i>page</i>
Notes .....	2
Main features .....	3
Resources devoted to R&D .....	5

### **TABLES**

<b>1</b> Resources devoted to R&D, by industry, 1997-98 to 1999-2000 . . .	8
<b>2</b> R&D expenditure, by industry, by type of expenditure, 1999-2000 . . .	9
<b>3</b> R&D expenditure, by industry, by source of funds, 1999-2000 . . .	10
<b>4</b> R&D expenditure, by industry, by location of expenditure, 1999-2000 .....	11
<b>5</b> R&D expenditure, by industry, by size of business, 1999-2000 . . .	12
<b>6</b> Resources devoted to R&D, by socio-economic objective, 1999-2000 .....	13
<b>7</b> Resources devoted to R&D, by research fields, courses and disciplines, 1999-2000 .....	14
<b>8</b> Expected and actual R&D expenditure, by industry, 1997-98 to 2000-01 .....	15
<b>9</b> Human resources devoted to R&D, by industry, by size of business, 1999-2000 .....	16
<b>10</b> Human resources devoted to R&D, by industry, by type of employee, 1999-2000 .....	17

### **ADDITIONAL INFORMATION**

Explanatory notes .....	18
Glossary .....	21

- For further information about these and related statistics, contact the National Information Service on 1300 135 070 or Kevin Squair on Canberra 02 6252 5707.

# NOTES

## RESEARCH AND DEVELOPMENT (R&D) GUIDELINES

Australian Bureau of Statistics (ABS) surveys of R&D are conducted in accordance with standard guidelines promulgated by the Organisation for Economic Co-operation and Development (OECD)

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## ABBREVIATIONS

ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
BERD	Business Expenditure on R&D
GDP	Gross Domestic Product
n.e.c.	not elsewhere classified
OECD	Organisation for Economic Co-operation and Development
R&D	Research and experimental development
RFCD	Research fields, courses and disciplines
SEO	Socio-economic objective

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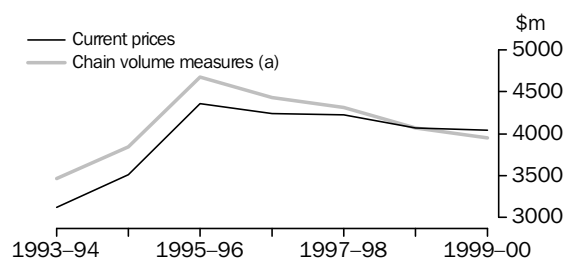
## MAIN FEATURES

### EXPENDITURE ON R&D

In 1999-2000, Business Expenditure on R&D (BERD) was estimated to be \$4,045m at current prices, marginally lower than that recorded in 1998-99.

In volume terms, BERD continued to fall, with 1999-2000 down 3% on 1998-99.

#### EXPENDITURE ON R&D



(a) Reference year for chain volume measures is 1998-99.

R&D Labour costs rose in 1999-2000 (an increase of \$149m compared with 1998-99). Other current expenditure decreased by \$111m, while Capital expenditure on R&D fell by \$61m.

The change in BERD between 1998-99 and 1999-2000 resulted from:

- Approximately 2,500 businesses, which undertook expenditure in both years, incurring \$3,802m of R&D in 1998-99 and \$3,737m in 1999-2000, a fall of 2%. Not all businesses decreased their expenditure in 1999-2000; 43% of continuing R&D performers recorded increases in expenditure of 10% or more, while 34% recorded decreases of 10% or more.
- Approximately 750 businesses which recorded \$266m in 1998-99, not reporting any R&D in 1999-2000.
- Approximately 900 businesses which did not report R&D in 1998-99, recording \$308m in 1999-2000.

The Mining industry recorded a 43% decrease in R&D expenditure, while expenditure by the Manufacturing industry remained about the same. R&D expenditure by Other industries (in total) increased by 12%.

### HUMAN RESOURCES

Human resources devoted to R&D in 1999-2000 were 26,109 person years, 5% higher than in 1998-99.

### RESOURCES DEVOTED TO R&D (a)

	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
Expenditure							
At current prices (\$m)	3 119.2	3 508.3	r4 356.6	r4 237.2	r4 219.1	r4 067.6	4 045.3
Chain volume measures(b) (\$m)	3 465.5	3 845.2	4 675.9	4 427.7	4 315.4	4 067.6	3 945.5
Human resources (person years)	23 742	25 812	r27 123	r26 446	r24 786	r24 974	26 109

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(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Reference year for chain volume measures is 1998-99.

## MAIN FEATURES *continued*

### COMPARISON WITH GDP

Australia's BERD as a percentage of GDP fell to 0.64% in 1999-2000, following decreases in the previous three years. The falls followed significant increases in the five years before the high of 0.86% in 1995-96.

BERD AS A PERCENTAGE OF GDP



Australia's BERD/GDP ratio remains relatively low when compared with other OECD countries as shown in the table below.

### BERD/GDP RATIOS OF OECD COUNTRIES

	1997-98	1998-99	1999-2000
	%	%	%
Finland	1.79	1.94	2.18
Japan	2.09	2.17	2.15
United States of America	1.91	1.94	2.00
Korea	1.95	1.79	1.76
Germany	1.54	1.57	1.69
France	1.39	1.36	1.37
United Kingdom	1.20	1.20	1.27
Denmark	1.19	1.32	1.25
Netherlands	1.11	1.06	1.13
Iceland	0.75	0.75	1.08
Canada	1.01	1.03	0.99
Czech Republic	0.73	0.82	0.81
<b>Australia</b>	<b>0.75</b>	<b>0.68</b>	<b>0.64</b>
Italy	0.52	0.55	0.56
Spain	0.40	0.47	0.46
Poland	0.28	0.30	0.31
Hungary	0.30	0.26	0.28

## RESOURCES DEVOTED TO R&D

INDUSTRY COMPARISON	<p>R&amp;D expenditure by the Mining industry fell by 43% in 1999-2000 to \$273m (7% of total R&amp;D expenditure). The Mining industry's R&amp;D human resources decreased by 23% when compared to 1998-99 whilst accounting for 3% of total R&amp;D human resources. The Manufacturing industry's R&amp;D expenditure was \$2,052m in 1999-2000 (51% of total R&amp;D expenditure), virtually the same as in 1998-99. Human resources devoted to R&amp;D by the Manufacturing industry increased by 5% on 1998-99 and accounted for 54% of total R&amp;D human resources. The Finance and insurance industry recorded an increase in R&amp;D expenditure of 56% in comparison with 1998-99, while the Scientific research industry and the Property and business services industries recorded increases of 30% and 18% respectively.</p>
TYPE OF EXPENDITURE	<p>In 1999-2000, Labour costs accounted for 44% of total R&amp;D expenditure. Other current expenditure made up 46%, while Capital expenditure accounted for 10%.</p> <p>The Mining industry had the lowest labour costs as a proportion of R&amp;D expenditure (22%) and the Printing, publishing and recorded media industry had the highest (64%).</p>
SOURCE OF FUNDS FOR R&D	<p>The business sector provided most of the R&amp;D expenditure funds itself: \$3,546m (88%) was sourced from Own funds and \$141m (3%) from Other businesses. The Commonwealth Government provided \$87m (2%) from Competitive grants for industry R&amp;D and \$40m (1%) from Other Commonwealth Government sources. Funding of \$190m (5%) came from Overseas.</p> <p>The Scientific research industry was the only industry that did not provide the majority of R&amp;D expenditure funding from Own funds (40%). For this industry, a further 25% was provided by Other businesses with the Commonwealth Government providing another 15%.</p>
STATE COMPARISONS	<p>The leading States in terms of R&amp;D expenditure were Victoria with \$1,474m and New South Wales with \$1,414m, accounting for 36% and 35% of total R&amp;D expenditure respectively. Queensland recorded \$438m (11%), while Western Australia with \$342m (8%) had the next highest R&amp;D expenditure.</p> <p>Compared to 1998-99, R&amp;D expenditure increased by \$36m in Victoria and \$27m in New South Wales, while it fell by \$98m in Western Australia.</p> <p>In the Mining industry, Western Australia accounted for \$100m (37%), Queensland \$70m (26%) and New South Wales \$37m (14%).</p> <p>Major contributors to R&amp;D in the Manufacturing industry were Victoria \$805m (39%) and New South Wales \$716m (35%).</p>
EXPENDITURE BY SIZE OF BUSINESS	<p>The largest businesses, employing 1000 or more, accounted for 34% of total R&amp;D expenditure (38% in 1998-99). On average, this was more than \$10m per business undertaking R&amp;D. Businesses employing less than 10 people accounted for only 5% of the R&amp;D (same level as 1998-99). This averaged out at approximately \$194,000 for each business undertaking R&amp;D.</p>

## RESOURCES DEVOTED TO R&D *continued*

EXPENDITURE BY SIZE OF BUSINESS <i>continued</i>	The ABS defines small businesses as those employing less than 20 people. Small businesses accounted for 10% of R&D expenditure in 1999-2000; 4% of Mining R&D, 6% of Manufacturing R&D and 15% of R&D in Other industries.
SOCIO-ECONOMIC OBJECTIVE	Most business R&D (\$3,617m or 89%) was directed towards Economic development. Of this \$1,791m (50%) was directed towards Manufacturing. Approximately 6% was directed towards Society and 4% towards Defence.
RESEARCH FIELDS, COURSES AND DISCIPLINES	Major fields in which business R&D expenditure took place were: <ul style="list-style-type: none"><li>■ Computer software, \$542m or 13%;</li><li>■ Communications technologies, \$356m or 9%;</li><li>■ Manufacturing engineering, \$346m or 9%;</li><li>■ Automotive engineering, \$324m or 8%;</li><li>■ Information systems, \$264m or 7%; and</li><li>■ Medical and health sciences, \$253m or 6%.</li></ul>
EXPECTED R&D EXPENDITURE	<p>Table 8 provides data on both 'actual' and 'expected' R&amp;D expenditure by businesses. The 'actual' data are the R&amp;D business expenditures reported in the 1997-98, 1998-99 and 1999-2000 surveys.</p> <p>In each of these surveys, businesses were also asked to report the level of expenditure they expected to incur in the following 12 months. These estimates are respectively shown as 1998-99, 1999-2000 and 2000-01 'expected' data in the table. These 'expected' estimates should be used with caution because, for many businesses, any forecast expenditure is simply a best guess.</p> <p>Businesses reported that they expected BERD to be \$4,243m in 2000-01. This is 5% higher than the actual R&amp;D expenditure incurred in 1999-2000. It should be noted that for 1998-99 and 1999-2000, actual expenditure exceeded expectations by 9% and 8% respectively.</p>
HUMAN RESOURCES BY SIZE OF BUSINESS	<p>R&amp;D performing businesses employing 1,000 or more contributed 26% of human resource effort. However only 1% of their total employment was devoted to R&amp;D. Businesses with less than 10 employees devoted 42% of their total employment to R&amp;D, although this only contributed 7% of the total resources undertaking R&amp;D.</p> <p>The ABS defines small businesses as those employing less than 20 people. Small businesses contributed 14% of human resources to R&amp;D in 1999-2000; 6% of Mining human resources, 9% of Manufacturing and 21% of Other industries.</p>
TYPE OF HUMAN RESOURCES	Researchers comprised 59% of the human resources devoted to R&D, followed by Technicians with 29% and Other supporting staff with 13%. In Mining, Researchers accounted for 56% and Technicians 34%. Researchers made up 56% in Manufacturing with 29% of R&D human resources accounted for by Technicians. Within the Manufacturing industries, the proportion contributed by Researchers ranged from a high of 69% in Photographic and scientific equipment to a low of 38% in Textiles, clothing, footwear and leather. Other industries had a high proportion of Researchers with 62%.

**RESOURCES DEVOTED TO R&D** *continued*

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TYPE OF HUMAN  
RESOURCES *continued*

Within Other industries, Finance and insurance had 70%, Property and business services  
66%, Scientific research 60%, while Wholesale and Retail trade had 50% Researchers

## RESOURCES DEVOTED TO R&amp;D, by industry of business(a)

ANZSIC	NUMBER OF BUSINESSES . . . . .			EXPENDITURE ON R&D . . . . .			HUMAN RESOURCES DEVOTED TO R&D . . . . .		
	1997- 98	1998- 99	1999- 2000	1997- 98	1998- 99	1999- 2000	1997- 98	1998- 99	1999- 2000
	no.	no.	no.	\$m	\$m	\$m	person years	person years	person years
<b>Mining (including services to mining)</b>	r106	r102	96	r537	478	273	r952	r974	749
<b>Manufacturing</b>									
Food, beverages and tobacco	r149	r148	134	r181	r208	186	r1 057	r1 131	1 118
Textiles, clothing, footwear and leather	r54	54	50	r21	r20	17	r172	r178	171
Wood and paper products	r35	r30	38	117	r86	104	r274	r235	386
Printing, publishing and recorded media	r33	r34	26	r17	r20	15	r163	r164	166
Petroleum, coal, chemical and associated product	r317	r314	334	r328	r351	413	r2 363	r2 290	2 347
Non-metallic mineral product	r60	r59	50	r70	r53	49	r434	r369	352
Metal product	r182	r174	181	r369	r296	227	r1 436	r1 223	1 122
Motor vehicle and part and other transport equipment	r124	r126	139	r441	r380	420	r2 717	r2 773	3 074
Photographic and scientific equipment	r100	r103	172	r95	r107	127	r920	r941	1 104
Electronic and electrical equipment and appliance	r329	r337	322	r427	r400	342	r2 838	r2 877	2 764
Industrial machinery and equipment	r248	r232	244	r126	r115	132	r1 185	r1 100	1 270
Other manufacturing	73	r77	87	36	r19	20	r210	r212	238
<i>Total manufacturing</i>	r1 704	r1 688	1 777	r2 229	r2 055	2 052	r13 768	r13 492	14 111
<b>Other industries</b>									
Wholesale and retail trade	r331	r303	295	r315	r337	352	r2 469	r2 273	2 475
Finance and insurance	r40	r33	34	85	r81	126	430	r664	844
Property and business services	r771	r797	868	r599	r612	720	r5 079	r5 436	5 784
Scientific research	r104	r153	148	r154	r161	210	r1 065	r1 184	1 289
Other n.e.c.	r181	r182	191	r301	r343	313	r1 025	r952	857
<i>Total other industries</i>	r1 427	r1 468	1 536	r1 454	r1 535	1 721	r10 067	r10 508	11 249
<b>TOTAL ALL INDUSTRIES</b>	<b>r3 237</b>	<b>r3 258</b>	<b>3 409</b>	<b>r4 219</b>	<b>r4 068</b>	<b>4 045</b>	<b>r24 786</b>	<b>r24 974</b>	<b>26 109</b>

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(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).



## TYPE OF R&amp;D EXPENDITURE (a)

<i>ANZSIC</i>	<i>Total</i>	<i>Capital expenditure</i>	<i>Labour costs(b)</i>	<i>Other current expenditure</i>
	\$'000	\$'000	\$'000	\$'000
<b>Mining (including services to mining)</b>	272 694	27 817	60 344	184 533
<b>Manufacturing</b>				
Food, beverages and tobacco	186 009	24 810	80 694	80 506
Textiles, clothing, footwear and leather	16 833	1 191	7 970	7 673
Wood and paper products	103 871	13 506	26 097	64 268
Printing, publishing and recorded media	14 726	697	9 426	4 603
Petroleum, coal, chemical and associated product	413 338	75 714	160 302	177 322
Non-metallic mineral product	48 865	5 610	20 009	23 246
Metal product	226 801	14 495	89 425	122 880
Motor vehicle and part and other transport equipment	419 994	23 824	173 915	222 255
Photographic and scientific equipment	127 365	7 407	72 987	46 971
Electronic and electrical equipment and appliance	342 423	21 749	187 338	133 335
Industrial machinery and equipment	131 852	11 851	74 327	45 675
Other manufacturing	19 998	2 795	11 680	5 523
<i>Total manufacturing</i>	2 052 075	203 648	914 170	934 257
<b>Other industries</b>				
Wholesale and retail trade	352 388	36 842	168 963	146 583
Finance and insurance	125 672	np	73 870	np
Property and business services	719 862	42 491	430 462	246 910
Scientific research	210 129	21 287	88 053	100 789
Other n.e.c.	312 484	np	60 831	np
<i>Total other industries</i>	1 720 535	162 427	822 178	735 930
<b>TOTAL ALL INDUSTRIES</b>	<b>4 045 304</b>	<b>393 892</b>	<b>1 796 693</b>	<b>1 854 720</b>

np not available for publication but included in totals where applicable, unless otherwise indicated

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax, 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.

## SOURCE OF FUNDS FOR R&amp;D(a)

ANZSIC	Total \$'000	Own funds \$'000	Other businesses \$'000	Comp- etitive Grants Scheme \$'000	Other Common- wealth govern- ment \$'000	State and local govern- ment \$'000	Other Australian(b) \$'000	Overseas \$'000
<b>Mining (including services to mining)</b>	272 694	265 978	np	1 553	—	np	1 377	np
<b>Manufacturing</b>								
Food, beverages and tobacco	186 009	178 186	np	2 289	np	np	np	np
Textiles, clothing, footwear and leather	16 833	16 563	np	np	np	np	—	—
Wood and paper products	103 871	103 634	np	np	—	—	np	—
Printing, publishing and recorded media	14 726	12 512	np	334	—	np	np	np
Petroleum, coal, chemical and associated product	413 338	381 264	813	4 741	723	np	np	25 062
Non-metallic mineral product	48 865	48 375	np	np	—	np	—	np
Metal product	226 801	220 826	np	1 971	np	np	—	—
Motor vehicle and part and other transport equipment	419 994	383 253	2 870	np	—	np	—	np
Photographic and scientific equipment	127 365	107 882	2 130	5 553	5 922	np	—	np
Electronic and electrical equipment and appliance	342 423	316 190	np	9 881	814	173	np	np
Industrial machinery and equipment	131 852	114 881	4 708	3 905	1 558	np	475	np
Other manufacturing	19 998	18 326	np	1 385	np	np	159	—
<i>Total manufacturing</i>	<i>2 052 075</i>	<i>1 901 893</i>	<i>29 595</i>	<i>34 559</i>	<i>11 020</i>	<i>3 076</i>	<i>2 868</i>	<i>69 065</i>
<b>Other industries</b>								
Wholesale and retail trade	352 388	312 485	5 009	np	530	260	np	28 752
Finance and insurance	125 672	123 647	np	np	—	—	—	—
Property and business services	719 862	554 340	44 805	27 248	11 473	np	np	68 825
Scientific research	210 129	84 239	53 109	16 788	15 571	2 237	17 151	21 033
Other n.e.c.	312 484	303 420	5 293	1 152	906	np	1 184	np
<i>Total other industries</i>	<i>1 720 535</i>	<i>1 378 130</i>	<i>np</i>	<i>50 721</i>	<i>28 480</i>	<i>np</i>	<i>29 442</i>	<i>np</i>
<b>TOTAL ALL INDUSTRIES</b>	<b>4 045 304</b>	<b>3 546 001</b>	<b>140 855</b>	<b>86 833</b>	<b>39 500</b>	<b>8 232</b>	<b>33 687</b>	<b>190 197</b>

np not available for publication but included in totals where applicable, unless otherwise indicated

— nil or rounded to zero (including null cells)

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Includes Higher education and Private non-profit sectors.

## LOCATION OF R&amp;D EXPENDITURE(a)(b)

	Total	NSW	Vic.	Qld	SA	WA	Other States and Territories	Overseas
ANZSIC	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<b>Mining (including services to mining)</b>	272 694	37 265	26 254	70 422	21 959	99 810	13 102	3 882
<b>Manufacturing</b>								
Food, beverages and tobacco	186 009	78 033	73 508	18 040	8 055	6 605	1 342	426
Textiles, clothing, footwear and leather	16 833	4 580	8 519	np	np	np	np	—
Wood and paper products	103 871	18 497	43 527	12 633	2 113	np	np	460
Printing, publishing and recorded media	14 726	6 386	3 955	np	np	1 214	np	np
Petroleum, coal, chemical and associated product	413 338	149 081	183 496	30 367	29 678	13 778	5 009	1 929
Non-metallic mineral product	48 865	25 002	5 361	7 206	np	5 774	np	—
Metal product	226 801	95 086	39 668	41 106	4 706	40 951	5 264	20
Motor vehicle and part and other transport equipment	419 994	34 519	298 682	7 875	28 685	37 228	np	np
Photographic and scientific equipment	127 365	62 653	32 060	7 483	16 245	5 872	np	np
Electronic and electrical equipment and appliance	342 423	182 644	75 766	25 486	21 787	30 833	3 963	1 945
Industrial machinery and equipment	131 852	52 637	34 790	21 517	4 882	12 057	4 691	1 279
Other manufacturing	19 998	6 396	6 080	2 255	2 920	2 102	np	np
<i>Total manufacturing</i>	2 052 075	715 514	805 411	176 352	124 206	163 620	58 005	8 967
<b>Other industries</b>								
Wholesale and retail trade	352 388	103 735	182 096	12 532	42 199	7 370	3 028	1 428
Finance and insurance	125 672	57 203	58 343	557	np	np	np	—
Property and business services	719 862	340 779	158 455	120 535	35 283	36 958	np	np
Scientific research	210 129	72 668	76 142	26 719	16 418	11 045	3 745	3 392
Other n.e.c.	312 484	87 107	167 410	30 716	np	np	4 379	np
<i>Total other industries</i>	1 720 535	661 493	642 446	191 059	99 709	78 712	34 294	12 823
<b>TOTAL ALL INDUSTRIES</b>	<b>4 045 304</b>	<b>1 414 271</b>	<b>1 474 111</b>	<b>437 833</b>	<b>245 874</b>	<b>342 142</b>	<b>105 401</b>	<b>25 672</b>

np not available for publication but included in totals where applicable, unless otherwise indicated

— nil or rounded to zero (including null cells)

(a) This may not be the location of the organisation's head office.

(b) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

## EXPENDITURE ON R&amp;D, by business employment size(a)(b)

ANZSIC	Total	Less than 10	10-19	20-49	50-99	100-199	200-499	500-999	1000 or more
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<b>Mining (including services to mining)</b>	272 694	7 321	4 211	21 554	10 299	39 441	46 753	29 944	113 171
<b>Manufacturing</b>									
Food, beverages and tobacco	186 009	735	2 132	13 772	13 428	6 608	14 273	26 122	108 939
Textiles, clothing, footwear and leather	16 833	np	np	2 408	4 131	4 871	2 517	np	np
Wood and paper products	103 871	395	247	449	1 202	631	9 049	6 879	85 019
Printing, publishing and recorded media	14 726	np	np	2 105	2 278	np	np	np	—
Petroleum, coal, chemical and associated product	413 338	4 495	8 469	36 351	31 656	86 463	54 672	97 286	93 946
Non-metallic mineral product	48 865	1 811	503	2 444	np	np	6 784	6 648	18 142
Metal product	226 801	2 939	1 543	33 689	68 239	7 212	17 392	15 749	80 038
Motor vehicle and part and other transport equipment	419 994	3 379	4 504	19 800	5 980	11 226	57 027	27 813	290 265
Photographic and scientific equipment	127 365	11 036	9 071	14 395	8 335	5 213	58 860	np	np
Electronic and electrical equipment and appliance	342 423	15 482	21 265	28 672	np	17 416	77 677	96 239	np
Industrial machinery and equipment	131 852	12 167	15 960	18 337	17 052	18 684	np	np	29 818
Other manufacturing	19 998	5 372	3 227	4 312	4 469	1 005	np	np	—
<b>Total manufacturing</b>	<b>2 052 075</b>	<b>59 344</b>	<b>68 505</b>	<b>176 734</b>	<b>216 834</b>	<b>170 274</b>	<b>317 106</b>	<b>294 753</b>	<b>748 525</b>
<b>Other industries</b>									
Wholesale and retail trade	352 388	10 603	12 271	33 244	17 538	26 828	75 202	40 146	136 556
Finance and insurance	125 672	1 263	—	np	2 071	—	np	12 224	103 368
Property and business services	719 862	78 279	70 661	131 628	82 118	114 576	np	np	57 024
Scientific research	210 129	42 377	29 274	np	62 291	np	—	—	—
Other n.e.c.	312 484	6 401	9 056	15 730	2 265	np	15 522	np	226 354
<b>Total other industries</b>	<b>1 720 535</b>	<b>138 923</b>	<b>121 261</b>	<b>240 775</b>	<b>166 283</b>	<b>169 759</b>	<b>162 415</b>	<b>197 817</b>	<b>523 302</b>
<b>TOTAL ALL INDUSTRIES</b>	<b>4 045 304</b>	<b>205 588</b>	<b>193 977</b>	<b>439 063</b>	<b>393 416</b>	<b>379 474</b>	<b>526 274</b>	<b>522 514</b>	<b>1 384 998</b>

np not available for publication but included in totals where applicable, unless otherwise indicated

— nil or rounded to zero (including null cells)

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Employment size is based on the number of persons employed by the business.

## RESOURCES DEVOTED TO R&amp;D, by Socio-economic Objective(a)

	TYPE OF EXPENDITURE .....				
	Total	Capital expenditure	Labour costs(b)	Other current expenditure	Human resources
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	person years
<b>Defence</b>	153 991	1 224	70 956	81 810	732
<b>Economic development</b>					
Plant - production and primary products	45 307	5 036	22 773	17 498	400
Animal - production and primary products	43 284	1 662	13 354	28 268	194
Mineral resources (excl. energy)	236 734	26 677	50 889	159 168	718
Energy resources	81 596	4 828	32 980	43 789	380
Energy supply	134 454	28 618	48 318	57 517	714
Manufacturing	1 791 136	193 505	767 431	830 201	12 004
Construction	70 002	8 612	26 765	34 624	417
Transport	130 603	15 881	56 588	58 134	888
Information and communication services	984 741	83 340	519 846	381 556	6 962
Commercial services and tourism	90 142	5 759	58 877	25 507	788
Economic framework	8 942	766	5 856	2 320	85
<i>Total economic development</i>	3 616 940	374 682	1 603 677	1 638 582	23 548
<b>Society</b>					
Health	202 321	11 961	86 398	103 963	1 210
Education and training	6 026	268	4 371	1 387	73
Social development and community services	18 098	363	13 296	4 439	253
<i>Total society</i>	226 445	12 592	104 065	109 788	1 536
<b>Environment</b>					
Environmental policy frameworks and other aspects	12 300	1 145	4 729	6 426	71
Environmental management	31 483	3 564	11 306	16 613	186
<i>Total environment</i>	43 784	4 709	16 036	23 039	257
<b>Non-oriented research</b>	4 145	684	1 959	1 501	36
<b>TOTAL</b>	<b>4 045 304</b>	<b>393 892</b>	<b>1 796 693</b>	<b>1 854 720</b>	<b>26 109</b>

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax, 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.

## RESOURCES DEVOTED TO R&amp;D, by Research Fields, Courses and Disciplines(a)

TYPE OF EXPENDITURE . . . . .

<i>Research field</i>	<i>Total</i>	<i>Capital expenditure</i>	<i>Labour costs(b)</i>	<i>Other current expenditure</i>	<i>Human resources</i>
	\$'000	\$'000	\$'000	\$'000	person years
Mathematical sciences	13 989	492	8 066	5 431	105
Physical sciences	34 326	2 854	18 581	12 890	266
Chemical sciences	180 267	31 040	78 018	71 209	1 082
Earth sciences	60 237	5 626	17 397	37 215	241
Biological sciences	110 350	19 616	45 038	45 696	650
Information systems	264 009	22 898	135 896	105 215	1 753
Computer software	542 213	36 488	363 418	142 307	5 047
Other information, computing and communication sciences	165 903	20 470	80 349	65 084	1 175
Industrial biotechnology and food sciences	122 483	18 113	55 841	48 530	825
Chemical engineering	70 928	13 256	23 475	34 197	309
Manufacturing engineering	346 401	31 428	143 758	171 215	2 373
Automotive engineering	324 370	16 341	134 609	173 420	2 402
Mechanical and industrial engineering	201 367	33 969	80 804	86 595	1 332
Resources engineering	150 428	10 099	48 619	91 710	608
Electrical and electronic engineering	124 828	10 150	59 090	55 587	1 018
Metallurgy	161 193	15 634	40 238	105 321	444
Materials engineering	71 030	6 282	30 545	34 203	503
Communications technologies	356 134	30 145	124 457	201 533	1 708
Other engineering and technology	323 114	27 304	138 771	157 039	1 776
Agricultural, veterinary and environmental sciences	148 621	19 027	56 615	72 979	861
Medical and health sciences	252 584	20 919	100 585	131 081	1 440
Other research fields, courses and disciplines	20 529	1 741	12 524	6 264	190
<b>TOTAL</b>	<b>4 045 304</b>	<b>393 892</b>	<b>1 796 693</b>	<b>1 854 720</b>	<b>26 109</b>

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax, 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.

EXPECTED AND ACTUAL EXPENDITURE ON R&D(a)

ANZSIC	1997-98	1998-99	.....	1999-2000	.....	2000-01
	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<b>Mining (including services to mining)</b>	r536 646	r328 046	r478 242	r313 588	272 694	240 044
<b>Manufacturing</b>						
Food, beverages and tobacco	r181 051	r167 161	r208 160	r177 593	186 009	182 995
Textiles, clothing, footwear and leather	r21 290	r19 722	r20 422	r18 216	16 833	18 495
Wood and paper products	r117 025	r112 047	r85 676	r75 798	103 871	92 077
Printing, publishing and recorded media	r17 252	r16 532	r20 096	r15 746	14 726	18 105
Petroleum, coal, chemical and associated product	r327 900	r291 725	r351 350	r364 561	413 338	366 307
Non-metallic mineral product	r69 804	r50 206	r52 925	r50 632	48 865	50 643
Metal product	r368 481	r274 939	r295 593	r204 890	226 801	195 923
Motor vehicle and part and other transport equipment	r441 320	r396 471	r379 701	r392 592	419 994	394 046
Photographic and scientific equipment	r95 182	r91 823	r106 826	r112 283	127 365	137 854
Electronic and electrical equipment and appliance	r427 150	r403 747	r399 715	r370 783	342 423	380 062
Industrial machinery and equipment	r126 443	r122 667	r115 167	r127 421	131 852	135 793
Other manufacturing	r36 101	r24 962	r19 189	r20 584	19 998	27 260
<i>Total manufacturing</i>	r2 228 999	r1 972 001	r2 054 819	r1 931 101	2 052 075	1 999 558
<b>Other industries</b>						
Wholesale and retail trade	r315 160	r335 714	r337 236	r343 466	352 388	390 378
Finance and insurance	r84 936	r77 615	r81 412	r48 339	125 672	270 825
Property and business services	r598 915	r603 156	r611 798	r602 275	719 862	720 058
Scientific research	r153 974	r181 944	r161 041	r181 069	210 129	234 512
Other n.e.c.	r300 515	r248 664	r343 098	r322 711	312 484	387 373
<i>Total other industries</i>	r1 453 500	r1 447 093	r1 534 584	r1 497 860	1 720 535	2 003 145
<b>TOTAL ALL INDUSTRIES</b>	<b>r4 219 145</b>	<b>r3 747 140</b>	<b>r4 067 645</b>	<b>r3 742 549</b>	<b>4 045 304</b>	<b>4 242 748</b>

r revised

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

## HUMAN RESOURCES DEVOTED TO R&amp;D, by business employment size(a)(b)

ANZSIC	Total	Less than 10	10-19	20-49	50-99	100-199	200-499	500-999	1000 or more
	person years	person years	person years	person years	person years	person years	person years	person years	person years
<b>Mining (including services to mining)</b>	<b>749</b>	<b>13</b>	<b>30</b>	<b>54</b>	<b>10</b>	<b>155</b>	<b>149</b>	<b>80</b>	<b>260</b>
<b>Manufacturing</b>									
Food, beverages and tobacco	1 118	12	19	84	120	51	122	147	563
Textiles, clothing, footwear and leather	171	np	np	27	46	52	26	np	np
Wood and paper products	386	7	np	np	10	6	22	47	286
Printing, publishing and recorded media	166	8	np	26	16	np	2	np	—
Petroleum, coal, chemical and associated product	2 347	45	87	267	216	464	356	502	411
Non-metallic mineral product	352	np	6	np	np	np	27	53	133
Metal product	1 122	30	14	139	289	59	122	138	331
Motor vehicle and part and other transport equipment	3 074	30	31	99	65	82	449	287	2 031
Photographic and scientific equipment	1 104	121	99	120	93	65	442	np	np
Electronic and electrical equipment and appliance	2 764	179	210	310	430	158	472	np	np
Industrial machinery and equipment	1 270	134	134	184	191	175	np	np	276
Other manufacturing	238	60	33	61	np	9	np	np	—
<b>Total manufacturing</b>	<b>14 111</b>	<b>651</b>	<b>661</b>	<b>1 342</b>	<b>1 604</b>	<b>1 231</b>	<b>2 208</b>	<b>1 948</b>	<b>4 466</b>
<b>Other industries</b>									
Wholesale and retail trade	2 475	119	138	279	174	205	572	293	696
Finance and insurance	844	8	—	np	38	—	np	91	661
Property and business services	5 784	813	755	1 256	726	948	480	473	332
Scientific research	1 289	242	184	np	423	np	—	—	—
Other n.e.c.	857	69	80	np	17	np	np	69	358
<b>Total other industries</b>	<b>11 249</b>	<b>1 251</b>	<b>1 157</b>	<b>1 976</b>	<b>1 378</b>	<b>1 356</b>	<b>1 158</b>	<b>927</b>	<b>2 047</b>
<b>TOTAL ALL INDUSTRIES</b>	<b>26 109</b>	<b>1 914</b>	<b>1 848</b>	<b>3 372</b>	<b>2 991</b>	<b>2 742</b>	<b>3 514</b>	<b>2 954</b>	<b>6 773</b>

np not available for publication but included in totals where applicable, unless otherwise indicated

— nil or rounded to zero (including null cells)

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

(b) Employment size is based on the number of persons employed by the business, whereas human resources data are person years of R&D effort.



## HUMAN RESOURCES DEVOTED TO R&amp;D, by type of employee(a)

ANZSIC	Total	Researchers	Technicians	Other supporting staff
	person years	person years	person years	person years
<b>Mining (including services to mining)</b>	749	423	251	76
<b>Manufacturing</b>				
Food, beverages and tobacco	1 118	597	321	199
Textiles, clothing, footwear and leather	171	65	67	39
Wood and paper products	386	217	106	63
Printing, publishing and recorded media	166	104	38	24
Petroleum, coal, chemical and associated product	2 347	1 292	705	350
Non-metallic mineral product	352	187	101	65
Metal product	1 122	565	404	154
Motor vehicle and part and other transport equipment	3 074	1 453	1 042	579
Photographic and scientific equipment	1 104	759	260	85
Electronic and electrical equipment and appliance	2 764	1 851	644	269
Industrial machinery and equipment	1 270	704	304	262
Other manufacturing	238	137	53	48
<b>Total manufacturing</b>	<b>14 111</b>	<b>7 930</b>	<b>4 045</b>	<b>2 136</b>
<b>Other industries</b>				
Wholesale and retail trade	2 475	1 230	939	306
Finance and insurance	844	590	187	67
Property and business services	5 784	3 833	1 454	497
Scientific research	1 289	768	360	161
Other n.e.c.	857	510	236	111
<b>Total other industries</b>	<b>11 249</b>	<b>6 931</b>	<b>3 175</b>	<b>1 143</b>
<b>TOTAL ALL INDUSTRIES</b>	<b>26 109</b>	<b>15 283</b>	<b>7 471</b>	<b>3 354</b>

(a) Excludes businesses in Agriculture, forestry and fishing (i.e. in ANZSIC Division A).

## EXPLANATORY NOTES

### INTRODUCTION

**1** This publication presents statistics on expenditure and human resources devoted to R&D carried out in Australia by the Business sector during 1999-2000.

**2** For details of R&D statistics available for the General government, Private non-profit and Higher education sectors see paragraph 21.

### DATA SOURCES

**3** The 1999-2000 data presented in this publication have been compiled from data collected from businesses in the Survey of Research and Experimental Development in respect of the year ended June 2000. 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 94% response was obtained. The ABS believes that the non-respondents were non-R&D performers.

**4** The GDP figures used to derive BERD/GDP ratios are current at the time of manuscript finalisation (*Australian National Accounts: National Income, Expenditure and Product, March Quarter 2001* (Cat. no. 5206.0)) and, at current prices, are as follows: \$449,416m (1993-94); \$473,381m (1994-95); \$506,975m (1995-96); \$532,170m (1996-97); \$564,653m (1997-98); \$595,417m (1998-99) and \$632,779m (1999-2000). The available BERD/GDP ratios for other OECD countries are current at the time of manuscript finalisation and are sourced from *Main Science and Technology Indicators, 2001-1*, OECD, Paris, 2001.

### STATISTICAL UNIT

**5** For businesses, the unit from which information is generally collected and published is 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 (i.e. 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.

### DEFINITIONS

**6** R&D 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'.

**7** 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.

### SCOPE

**8** The scope of this survey is all businesses within the Business sector of Australia which have undertaken R&D.

**9** The Business sector includes all businesses 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 costs of production, and the private non-profit institutions mainly serving them.

**10** The vast majority of businesses in this sector are private businesses. The remainder are public businesses mainly engaged in trading or financial activities.

### COVERAGE

**11** The 1999-2000 R&D survey comprised a complete enumeration of businesses identified by the ABS as likely to have carried out R&D activity.

## EXPLANATORY NOTES *continued*

### COVERAGE *continued*

**12** The Business sector for the R&D survey excludes businesses mainly engaged in Agriculture, forestry and fishing (i.e. industries in Division A of the *Australian and New Zealand Standard Industrial Classification (ANZSIC), 1993* (Cat. no. 1292.0)), partly because of collection difficulties and partly because such businesses 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).

**13** Within the scope of the survey, businesses were included in the collection if they satisfied any of the following criteria:

- businesses which, in previous R&D surveys, reported R&D activity;
- businesses applying for the 125% Tax Concession and/or grants for Industry R&D; or
- businesses identified from reports in newspapers, industrial journals, research compendia etc. as likely to have R&D activity.

**14** 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.

### INDUSTRY CLASSIFICATION

**15** The statistics in this publication are classified to industry in accordance with the 1993 edition of the *Australian and New Zealand Standard Industrial Classification (ANZSIC)*.

**16** Each management unit 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 to ANZSIC 7810 Scientific research, in accordance with standards laid down in the Frascati Manual.

### SOCIO-ECONOMIC OBJECTIVE AND RESEARCH FIELDS, COURSES AND DISCIPLINES CLASSIFICATIONS

**17** Statistics of business R&D classified by Socio-economic objective (SEO) and Research fields, courses and disciplines (RFCD) have been collected and presented in this publication. Each business undertaking R&D was asked to categorise its R&D activity according to the purpose of its research projects (SEO) and the fields in which its research was undertaken (RFCD). For more information on these classifications see the *Australian Standard Research Classification (ASRC), 1998* (Cat. no. 1297.0).

### CHAIN VOLUME MEASURES

**18** The chain volume measures appearing in this publication are annually reweighted chain Laspeyres indexes referenced to the current price values in a chosen reference year (currently 1998-99). They can be thought of as current price values re-expressed in (i.e. based on) the prices of the previous year and linked together to form continuous time series. They are formed in a multi-stage process of which the major steps are described in Section 15 of the information paper, *Introduction of Chain Volume Measures in the Australian National Accounts* (Cat. no. 5248.0).

### RELIABILITY OF STATISTICS

**19** The statistics in this publication should be used with caution for the following reasons:

- many respondents made estimates because their accounts did not separately record data on R&D activity; and

## EXPLANATORY NOTES *continued*

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### RELIABILITY OF STATISTICS

*continued*

- the OECD standard definition of R&D used in this survey differs in some respects from what data providers may regard as R&D activity. This is because the definitions used within the Competitive Grants for Industry R&D scheme (for the allocation of grants), and the 125% Tax Concession scheme (for tax deductibility for specific R&D activities) are slightly different from the international standard.

### UNPUBLISHED STATISTICS

- 20** Limited additional detailed R&D statistics are available at a charge from the ABS.

### RELATED PUBLICATIONS

- 21** Users may also wish to refer to the following publications:
- Research and Experimental Development, All Sector Summary, Australia, 1998-99* (Cat. no. 8112.0)
  - Research and Experimental Development, Government and Private Non-Profit Organisations, Australia, 1998-99* (Cat. no. 8109.0)
  - Research and Experimental Development, Higher Education Organisations, Australia, 1998* (Cat no. 8111.0)
  - Main Science and Technology Indicators 2001-1*, OECD, Paris, 2001
  - The Measurement of Scientific and Technological Activities (Frascati Manual 1993)* OECD, Paris, 1994

- 22** Current publications issued by the ABS are listed in the *Catalogue of Publications and Products* (Cat. no. 1101.0). The ABS also issues, on Tuesdays and Fridays, a *Release Advice* (Cat. no. 1105.0) which lists publications to be released in the next few days. The Catalogue and Release Advice are available from any ABS office.

### ROUNDING

- 23** Where figures have been rounded, discrepancies may occur between sums of the component items and totals

## GLOSSARY

<b>Capital expenditure</b>	Expenditure on the acquisition (less disposals) of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment attributable to R&D activity.
<b>Human resources devoted to R&amp;D</b>	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.
<b>Labour costs</b>	Wages and salaries, overtime allowances, penalty rates, leave loadings, bonuses, commission payments, all paid leave, employer contributions to superannuation and pension schemes, payroll tax, fringe benefits tax, payments to contract staff on the payroll, severance, termination and redundancy payments and workers compensation insurance.
<b>Other current expenditure</b>	Expenditure on materials, fuels, rent and hiring, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
<b>Other supporting staff</b>	Skilled and unskilled craftpersons, secretarial and clerical staff directly associated with R&D activity.
<b>R&amp;D activity</b>	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.
<b>Researchers</b>	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 executive and directors concerned primarily with budgets and human resources rather than project content.
<b>Research fields, courses and disciplines</b>	Field in which the R&D activity was performed. The RFCD classification is primarily structured around disciplines or activities. It describes what research is being performed.
<b>Socio-economic objective</b>	The area of expected national benefit rather than 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.
<b>Technicians</b>	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





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