

CONTENTS

	<i>page</i>
Notes	2
Main features	3
Comparison with GDP	4
Resources devoted to R&D	5

TABLES

1 Resources devoted to R&D, by industry, 2000–01 to 2002–03	8
2 Expenditure, by industry, by type of expenditure	9
3 Expenditure, by industry, by type of activity	10
4 Expenditure, by industry, by source of funds	11
5 Expenditure, by industry, by location	12
6 Expenditure, by industry, by business employment size	13
7 Resources devoted to R&D, by socioeconomic objective, by type of resource	14
8 Resources devoted to R&D, by research field, by type of resource	15
9 Actual and expected expenditure on R&D, by industry, 2002-03 and 2003-04	16
10 Human resources devoted to R&D, by industry, by business employment size	17
11 Human resources devoted to R&D, by industry, by type of employee	18

ADDITIONAL INFORMATION

Explanatory notes	19
Glossary	22

INQUIRIES

- For further information about these and related statistics, contact the National Information and Referral Service on 1300 135 070 or Derek Byars on Canberra (02) 6252 5627.

NOTES

RESEARCH AND EXPERIMENTAL 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). It should be noted that R&D performed overseas by Australian businesses is included in the data in this publication. The extent to which this impacts on international comparisons is being investigated.

The surveys are based on a complete enumeration of businesses identified by the ABS as likely R&D performers. Businesses mainly engaged in Agriculture, forestry and fishing (i.e. industries in Division A of the Australian and New Zealand Standard Industrial Classification (ANZSIC)) are excluded 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 Division A).

REVISIONS

It should be noted that data presented in this publication may subsequently be revised. Where businesses newly identified as R&D performers indicate that R&D has been undertaken in earlier years, details are collected and used to revise previously released estimates. These revisions are generally small and do not impact significantly on the year to year movements. Where revisions have been applied, the estimate is annotated with an 'r'.



ABBREVIATIONS

\$'000	thousand dollars
\$m	million dollars
ABN	Australian Business Number
ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
ATO	Australian Taxation Office
BERD	business expenditure on R&D
GDP	gross domestic product
GSP	gross state product
n.e.c.	not elsewhere classified
no.	number
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
Qld	Queensland
R&D	research and experimental development
SA	South Australia
TAU	type of activity unit
Vic.	Victoria
WA	Western Australia

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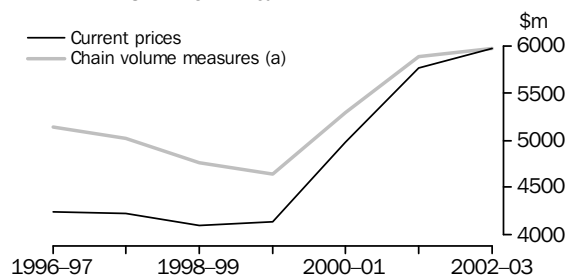
MAIN FEATURES

EXPENDITURE ON R&D

Business expenditure on R&D (BERD) in Australia in 2002–03 was estimated to be \$5,979m at current prices, 3.6% higher than that recorded in 2001–02. This is the highest level recorded and is the third successive year of increase following the declines from 1995–96 to 1998–99 and the levelling off between 1998–99 and 1999–2000.

In volume terms, with the effect of changes in prices and wages and salaries removed, R&D expenditure increased by 1.5% compared with 2001–02.

EXPENDITURE ON R&D



(a) Reference year for chain volume measures is 2002–03. See paragraph 21 of the Explanatory Notes for details.

The Mining industry recorded a 3.0% decrease in R&D expenditure while expenditure by the Manufacturing industry increased by 11.9%. The Finance and insurance and the Scientific research industries recorded increases of 5.9% and 9.1% respectively while the Wholesale and retail trade and the Property and business services industries recorded decreases of 4.1% and 2.2% respectively.

The change in BERD between 2001–02 and 2002–03 resulted from:

- Approximately 3,050 businesses which undertook expenditure in both years, incurring \$5,317m of R&D expenditure in 2001–02 and \$5,494m in 2002–03, an increase of 3.3%. Not all businesses increased their expenditure in 2002–03; 41.8% of continuing R&D performers recorded increases in expenditure of 10% or more, while 36.0% recorded decreases of 10% or more.
- Approximately 750 businesses which recorded \$452m of R&D expenditure in 2001–02, not reporting any R&D in 2002–03.
- Approximately 1,200 businesses which did not report R&D expenditure in 2001–02, recording \$485m in 2002–03.

HUMAN RESOURCES DEVOTED TO R&D

Human resources devoted to R&D in 2002–03 totaled 32,982 person years, 5.9% higher than in 2001–02.

RESOURCES DEVOTED TO R&D

	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03
Expenditure							
At current prices (\$m)	4 234.7	4 221.1	4 094.7	r4 136.7	r4 982.6	r5 769.7	5 978.6
Chain volume measures(a) (\$m)	5 141.3	5 022.4	4 763.0	r4 644.4	r5 290.9	r5 889.7	5 978.6
Human resources (person years)	26 412	24 769	25 109	26 507	r28 391	r31 139	32 982

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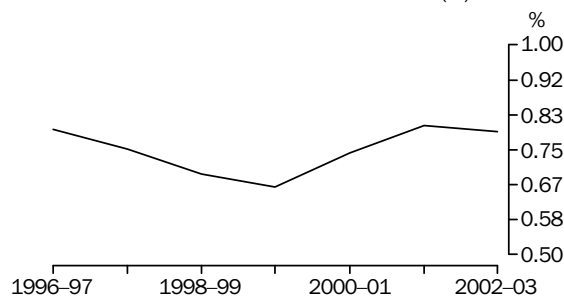
(a) Reference year for chain volume measures is 2002-03. See paragraph 21 of the Explanatory Notes.

COMPARISON WITH GDP

BERD AS A PERCENTAGE OF GDP

Australia's BERD as a percentage of Gross Domestic Product (GDP) decreased to 0.79% in 2002–03, following successive increases between 1999–2000 and 2001–02.

BERD AS A PERCENTAGE OF GDP (a)



(a) At current prices. See paragraph 4 of the Explanatory Notes.

As shown in the table below, Australia's BERD/GDP ratio remains relatively low when compared with other OECD countries for which comparable data are available.

BERD/GDP RATIOS OF OECD COUNTRIES (a)

	2000-01	2001-02	2002-03
	%	%	%
Finland	2.41	2.42	2.41
Japan	2.12	2.26	2.32
Korea	1.96	2.23	2.18
United States of America	2.04	2.00	1.87
Iceland	1.55	1.80	1.77
Germany	1.75	1.75	1.75
Denmark	na	1.65	1.75
Belgium	1.48	1.60	1.64
France	1.36	1.41	1.37
United Kingdom	1.21	1.24	1.26
Canada	1.15	1.21	1.05
Netherlands	1.11	1.10	1.03
Norway	na	0.96	0.96
Australia	0.74	0.81	0.79
Czech Republic	0.80	0.78	0.79
Spain	0.50	0.50	0.56
Italy	0.53	0.55	0.54
Slovak Republic	0.43	0.43	0.37
Hungary	0.35	0.38	0.36
Portugal	0.22	0.27	0.32
Poland	0.24	0.23	0.13

na not available

(a) See paragraph 4 of the Explanatory Notes.

RESOURCES DEVOTED TO R&D

INDUSTRY COMPARISON

- R&D expenditure by the Mining industry decreased by 3.0% in 2002–03 to \$536m (9.0% of total R&D expenditure).
- The Manufacturing industry's R&D expenditure increased by 11.9% to \$2,829m in 2002–03 (47.3% of total R&D expenditure).
- The Finance and insurance and the Scientific research industries recorded increases of 5.9% and 9.1% respectively while the Wholesale and retail trade and the Property and business services industries recorded decreases of 4.1% and 2.2% respectively.

TYPE OF EXPENDITURE

In 2002–03, labour costs accounted for 43.9% of total R&D expenditure. Other current expenditure made up 48.4% while capital expenditure accounted for 7.7%.

Labour costs as a proportion of R&D expenditure was low for the Mining industry (11.3%) and high for the Property and business services industry (61.0%).

SOURCE OF FUNDS FOR R&D

The business sector provided most of the funds for R&D expenditure itself: \$5,207m (87.1%) was sourced from Own funds and \$147m (2.5%) from Other businesses. The Commonwealth government provided \$247m (4.1%) while \$323m (5.4%) came from Overseas.

The Scientific research industry provided only 68.3% of its R&D expenditure funding from Own funds. For this industry, a further 16.1% was provided by the Commonwealth government and 5.8% from Other businesses.

STATE COMPARISONS

The leading states in terms of location of R&D expenditure were New South Wales with \$2,139m and Victoria with \$1,907m, accounting for 35.8% and 31.9% of total R&D expenditure respectively. Queensland recorded \$661m (11.0%), South Australia \$527m (8.8%) and Western Australia \$513m (8.6%).

When R&D expenditure by location is expressed as a percentage of Gross State Product (GSP), the leading states were South Australia (1.08%), Victoria (0.99%) and New South Wales (0.80%). For Western Australia the percentage was 0.62%, Queensland 0.52% and Tasmania, the Northern Territory and the Australian Capital Territory combined, R&D expenditure as a percentage of GSP was 0.36%. See paragraph 5 of the Explanatory Notes for the GSP data.

Western Australia and Queensland were the major contributors to R&D expenditure by the Mining industry accounting for \$154m (28.7%) and \$134m (25.0%) respectively.

Victoria was the major contributor to R&D expenditure by the manufacturing industry with \$1,156m (40.8%) followed by New South Wales with \$836m (29.5%).

EXPENDITURE BY SIZE OF BUSINESS

The largest businesses, employing 1,000 or more people, accounted for 33.8% of total R&D expenditure. On average, this was approximately \$14.9m for each of the 136 largest businesses.

The ABS defines small businesses as those employing less than 20 people. Small businesses accounted for 13.3% of total R&D expenditure in 2002–03. Small businesses accounted for the following proportions of industry expenditure on R&D:

- Mining 8.1% (\$43m)
- Manufacturing 7.2% (\$203m)

RESOURCES DEVOTED TO R&D *continued*

EXPENDITURE BY SIZE OF BUSINESS *continued*

- all other industries 21.0% (\$548m).

Businesses employing less than 10 people accounted for 7.1% of total R&D expenditure. This averaged out at approximately \$266,000 for each of the 1,591 businesses employing less than 10 people.

SOCIOECONOMIC OBJECTIVE

Most business R&D (\$5,382m or 90.0%) was directed towards Economic development. Approximately 7.0% was directed towards Society, 1.8% towards Defence and 1.1% towards Environment.

Of the amount directed towards Economic development, \$2,541m (47.2%) was towards Manufacturing.

RESEARCH FIELDS

Major fields in which business R&D expenditure took place were:

- computer software, \$776m or 13.0%
- automotive engineering, \$634m or 10.6%
- manufacturing engineering, \$483m or 8.1%
- communications technologies, \$398m or 6.7%
- medical and health sciences, \$392m or 6.6%
- other information, computing and communication sciences, \$377m or 6.3%
- resources engineering, \$370m or 6.2%.

EXPECTED R&D EXPENDITURE

Table 9 provides data on both 'actual' and 'expected' R&D expenditure by businesses.

The 'actual' data are the R&D business expenditures reported in the 2002–03 survey.

In this survey, businesses were also asked to report the level of expenditure they expected to incur in the following twelve months. These estimates are shown as 2003–04 'expected' data in the table. These 'expected' estimates should be used with caution because, for many businesses, any forecast expenditure is simply a best estimate at the time.

Businesses reported that they expected BERD to be \$6,475m in 2003–04. This is 8.3% greater than the actual R&D expenditure incurred in 2002–03. It should be noted that for 2001–02 and 2002–03, actual expenditure exceeded expectations by 14.5% and 7.6% respectively.

HUMAN RESOURCES BY SIZE OF BUSINESS

R&D performing businesses employing 1,000 or more people contributed 25.1% of the total human resource effort in terms of person years.

The ABS defines small businesses as those employing less than 20 people. Small businesses contributed 18.3% of total R&D human resources in 2002–03. Small businesses accounted for the following proportions of industry human resource effort on R&D:

- Mining 12.7% (77 person years)
- Manufacturing 10.2% (1,712 person years)
- all other industries 27.3% (4,235 person years).

Businesses with less than 10 employees contributed only 9.2% of the total human resources undertaking R&D.

RESOURCES DEVOTED TO R&D *continued*

TYPE OF HUMAN
RESOURCES

Researchers comprised 57.3% of the human resources devoted to R&D, followed by Technicians with 29.5% and Other supporting staff with 13.2%. In Mining, Researchers accounted for 50.5% and Technicians 37.8%. Researchers made up 54.2% in Manufacturing with 30.1% of R&D human resources accounted for by Technicians. The Wholesale and retail trade industry and the Property and business services industry had high proportions of Researchers with 65.4% and 61.5% respectively.

Within the Manufacturing industries, the proportion of R&D human resource effort contributed by Researchers ranged from highs of 66.1% in Photographic and scientific equipment and 65.5% in Metal product to lows of 40.7% in Printing, publishing and recorded media and 43.2% in Motor vehicle and part and other transport equipment.

RESOURCES DEVOTED TO R&D, by industry

	NUMBER OF BUSINESSES			EXPENDITURE ON R&D			HUMAN RESOURCES DEVOTED TO R&D		
	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03
	no.	no.	no.	\$m	\$m	\$m	person years	person years	person years
<i>ANZSIC industry</i>									
<i>Mining (including services to mining)</i>	92	r119	137	462	r553	536	1 194	r836	608
Manufacturing									
Food, beverages and tobacco	139	r140	157	202	r231	234	1 133	r1 434	1 427
Textiles, clothing, footwear and leather	51	43	45	27	22	28	245	165	195
Wood and paper products	34	r34	45	100	r84	98	342	r323	359
Printing, publishing and recorded media	33	40	43	17	16	15	139	135	150
Petroleum, coal, chemical and associated product	r352	r352	377	r395	r430	492	r2 537	r2 446	2 751
Non-metallic mineral product	51	52	70	41	r74	86	279	r238	375
Metal product	171	r176	174	r221	r257	343	r953	r1 015	1 395
Motor vehicle and part and other transport equipment	136	r129	147	473	r555	731	3 044	r3 453	4 537
Photographic and scientific equipment	165	138	140	r220	r279	304	r1 526	r1 596	1 733
Electronic and electrical equipment and appliance	376	r364	378	430	r423	329	3 104	r3 109	2 520
Industrial machinery and equipment	241	r232	266	108	r134	150	883	r1 065	1 192
Other manufacturing	83	r78	76	21	r22	20	234	r172	224
<i>Total manufacturing</i>	r1 832	r1 778	1 918	r2 255	r2 528	2 829	r14 419	r15 151	16 858
Other industries									
Wholesale and retail trade	289	r339	370	370	r447	429	2 521	r2 916	2 898
Finance and insurance	40	r53	54	278	r225	239	965	r776	787
Property and business services	943	r1 050	1 254	867	r1 068	1 044	6 655	r7 654	7 954
Scientific research	166	r220	240	243	r315	344	1 419	r1 737	1 673
Other n.e.c.	193	r252	287	506	r634	557	1 219	2 069	2 204
<i>Total other industries</i>	1 631	r1 914	2 205	2 265	r2 689	2 613	12 778	r15 152	15 516
Total	r3 555	r3 811	4 260	r4 983	r5 770	5 979	r28 391	r31 139	32 982

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EXPENDITURE, by industry, by type of expenditure

	Total	Capital expenditure	Labour costs (a)	Other current expenditure
<i>ANZSIC industry</i>	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	536 003	50 697	60 797	424 508
Manufacturing				
Food, beverages and tobacco	234 439	18 554	122 412	93 474
Textiles, clothing, footwear and leather	27 760	5 880	13 125	8 755
Wood and paper products	97 730	3 723	25 973	68 034
Printing, publishing and recorded media	14 613	1 303	8 286	5 024
Petroleum, coal, chemical and associated product	492 116	35 651	191 753	264 712
Non-metallic mineral product	86 242	15 344	32 459	38 440
Metal product	342 786	19 710	112 514	210 563
Motor vehicle and part and other transport equipment	731 429	61 128	332 887	337 414
Photographic and scientific equipment	303 511	13 718	161 608	128 185
Electronic and electrical equipment and appliance	328 544	21 124	181 335	126 085
Industrial machinery and equipment	149 831	9 684	75 156	64 991
Other manufacturing	20 453	1 711	11 110	7 632
<i>Total manufacturing</i>	<i>2 829 454</i>	<i>207 529</i>	<i>1 268 616</i>	<i>1 353 309</i>
Other industries				
Wholesale and retail trade	428 975	29 413	225 871	173 692
Finance and insurance	238 770	9 994	101 529	127 247
Property and business services	1 044 103	51 491	636 870	355 741
Scientific research	343 966	36 741	147 685	159 540
Other n.e.c.	557 344	71 944	185 128	300 271
<i>Total other industries</i>	<i>2 613 157</i>	<i>199 582</i>	<i>1 297 084</i>	<i>1 116 492</i>
Total	5 978 614	457 808	2 626 497	2 894 309

(a) See Glossary for definition of labour costs.

EXPENDITURE, by industry, by type of activity(a)

	Total	Basic research	Applied research	Experimental development
ANZSIC industry	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	536 003	44 981	152 631	338 391
Manufacturing				
Food, beverages and tobacco	234 439	18 516	49 351	166 572
Textiles, clothing, footwear and leather	27 760	925	6 784	20 051
Wood and paper products	97 730	np	np	68 267
Printing, publishing and recorded media	14 613	1 641	5 198	7 774
Petroleum, coal, chemical and associated product	492 116	25 421	126 823	339 872
Non-metallic mineral product	86 242	5 665	22 656	57 921
Metal product	342 786	11 535	42 441	288 810
Motor vehicle and part and other transport equipment	731 429	16 950	77 258	637 221
Photographic and scientific equipment	303 511	17 555	82 309	203 647
Electronic and electrical equipment and appliance	328 544	20 323	122 956	185 265
Industrial machinery and equipment	149 831	7 089	27 648	115 094
Other manufacturing	20 453	np	np	13 625
<i>Total manufacturing</i>	2 829 454	133 387	591 948	2 104 119
Other industries				
Wholesale and retail trade	428 975	23 088	99 749	306 138
Finance and insurance	238 770	16 973	111 964	109 833
Property and business services	1 044 103	48 588	338 679	656 836
Scientific research	343 966	46 859	117 793	179 314
Other n.e.c.	557 344	84 525	127 693	345 126
<i>Total other industries</i>	2 613 157	220 033	795 878	1 597 246
Total	5 978 614	398 401	1 540 457	4 039 756

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

(a) See paragraph 8 of the Explanatory Notes.

EXPENDITURE, by industry, by source of funds

	Total	Own funds	Other businesses	Commonwealth government	State and local government	Other Australian (a)	Overseas
ANZSIC industry	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	536 003	526 472	np	8 383	—	np	np
Manufacturing							
Food, beverages and tobacco	234 439	231 307	np	1 637	222	np	np
Textiles, clothing, footwear and leather	27 760	21 058	—	6 276	np	np	—
Wood and paper products	97 730	96 699	np	np	np	—	—
Printing, publishing and recorded media	14 613	14 143	85	235	—	np	np
Petroleum, coal, chemical and associated product	492 116	443 395	np	11 834	208	np	34 929
Non-metallic mineral product	86 242	84 247	np	1 822	np	20	—
Metal product	342 786	340 074	np	702	np	np	—
Motor vehicle and part and other transport equipment	731 429	656 474	19 778	28 404	np	np	26 656
Photographic and scientific equipment	303 511	220 205	np	29 035	474	np	np
Electronic and electrical equipment and appliance	328 544	297 885	4 105	12 908	303	211	13 132
Industrial machinery and equipment	149 831	139 043	2 651	6 935	205	998	—
Other manufacturing	20 453	19 120	np	np	128	—	—
<i>Total manufacturing</i>	<i>2 829 454</i>	<i>2 563 649</i>	<i>30 681</i>	<i>101 756</i>	<i>2 434</i>	<i>2 974</i>	<i>127 960</i>
Other industries							
Wholesale and retail trade	428 975	360 731	4 531	7 654	1 925	np	np
Finance and insurance	238 770	237 593	np	np	—	—	—
Property and business services	1 044 103	763 447	86 713	59 144	2 623	6 206	125 970
Scientific research	343 966	235 080	19 790	55 356	3 760	26 602	3 378
Other n.e.c.	557 344	519 935	3 804	np	732	np	12 081
<i>Total other industries</i>	<i>2 613 157</i>	<i>2 116 785</i>	<i>np</i>	<i>136 692</i>	<i>9 040</i>	<i>np</i>	<i>np</i>
Total	5 978 614	5 206 906	147 184	246 831	11 474	42 838	323 381

— nil or rounded to zero (including null cells)

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

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

EXPENDITURE, by industry, by location(a)

	Total	NSW	Vic.	Qld	SA	WA	Other states and territories	Overseas
ANZSIC industry	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	536 003	117 049	37 132	133 755	np	153 959	24 732	np
Manufacturing								
Food, beverages and tobacco	234 439	81 426	84 362	25 469	17 438	18 753	5 074	1 917
Textiles, clothing, footwear and leather	27 760	6 396	14 686	np	np	4 791	np	—
Wood and paper products	97 730	8 695	64 364	np	5 993	3 844	np	np
Printing, publishing and recorded media	14 613	8 240	2 382	2 241	np	1 258	np	np
Petroleum, coal, chemical and associated product	492 116	155 039	200 484	53 792	26 098	40 132	12 013	4 557
Non-metallic mineral product	86 242	48 976	7 351	10 064	np	9 272	1 717	np
Metal product	342 786	145 296	71 988	50 816	9 543	np	5 514	np
Motor vehicle and part and other transport equipment	731 429	56 644	520 451	15 376	91 468	np	np	np
Photographic and scientific equipment	303 511	110 010	71 282	13 034	np	12 282	np	12 475
Electronic and electrical equipment and appliance	328 544	156 991	72 728	33 354	33 779	26 142	5 320	230
Industrial machinery and equipment	149 831	52 006	42 469	20 541	8 450	17 168	np	np
Other manufacturing	20 453	6 352	3 265	5 746	1 972	1 997	np	np
<i>Total manufacturing</i>	<i>2 829 454</i>	<i>836 072</i>	<i>1 155 812</i>	<i>243 198</i>	<i>281 589</i>	<i>212 853</i>	<i>50 984</i>	<i>48 946</i>
Other industries								
Wholesale and retail trade	428 975	200 110	119 093	32 037	56 697	16 466	2 917	1 655
Finance and insurance	238 770	173 053	27 307	np	np	5 226	np	np
Property and business services	1 044 103	477 227	223 497	154 857	76 827	62 516	29 437	19 742
Scientific research	343 966	115 138	112 176	37 436	36 262	19 367	9 391	14 196
Other n.e.c.	557 344	220 209	231 605	np	16 021	42 674	np	np
<i>Total other industries</i>	<i>2 613 157</i>	<i>1 185 737</i>	<i>713 678</i>	<i>283 595</i>	<i>np</i>	<i>146 249</i>	<i>58 433</i>	<i>np</i>
Total	5 978 614	2 138 858	1 906 622	660 548	527 092	513 062	134 149	98 284

— nil or rounded to zero (including null cells)

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

(a) Location of the R&D expenditure. This may not be the location of the organisation's head office.

EXPENDITURE, by industry, by business employment size(a)

ANZSIC industry	SMALL, LESS THAN 20								1000 or more
	Total	Less than 10	10-19	20-49	50-99	100-199	200-499	500-999	
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	536 003	29 001	14 189	27 223	33 482	50 459	85 093	126 804	169 752
Manufacturing									
Food, beverages and tobacco	234 439	3 991	6 633	7 922	14 368	9 599	54 077	16 677	121 172
Textiles, clothing, footwear and leather	27 760	np	np	4 901	2 825	2 809	12 777	np	—
Wood and paper products	97 730	2 056	np	469	1 113	np	1 380	np	86 848
Printing, publishing and recorded media	14 613	5 591	1 521	1 956	2 694	np	np	np	—
Petroleum, coal, chemical and associated product	492 116	17 768	10 705	34 883	26 306	37 477	114 051	110 425	140 501
Non-metallic mineral product	86 242	np	8 437	2 680	1 050	3 559	21 222	34 254	np
Metal product	342 786	5 475	1 462	21 170	9 803	40 876	34 236	42 163	187 601
Motor vehicle and part and other transport equipment	731 429	4 841	9 946	11 366	5 335	22 175	53 429	85 329	539 008
Photographic and scientific equipment	303 511	9 456	8 184	44 355	25 209	26 922	74 061	np	np
Electronic and electrical equipment and appliance	328 544	23 795	30 643	39 887	55 697	np	50 676	45 161	np
Industrial machinery and equipment	149 831	np	18 678	33 378	26 523	28 004	23 790	np	—
Other manufacturing	20 453	5 693	5 233	2 029	1 965	np	np	—	—
<i>Total manufacturing</i>	<i>2 829 454</i>	<i>99 124</i>	<i>103 705</i>	<i>204 996</i>	<i>172 888</i>	<i>196 161</i>	<i>444 583</i>	<i>383 660</i>	<i>1 224 337</i>
Other industries									
Wholesale and retail trade	428 975	25 283	30 419	37 565	34 143	28 151	80 886	175 667	16 861
Finance and insurance	238 770	5 569	4 068	1 073	11 380	np	1 590	np	200 782
Property and business services	1 044 103	150 333	132 599	166 001	86 401	183 256	120 439	106 935	98 139
Scientific research	343 966	91 815	np	93 851	79 908	np	—	—	—
Other n.e.c.	557 344	22 532	np	35 510	13 506	20 270	42 500	np	310 206
<i>Total other industries</i>	<i>2 613 157</i>	<i>295 531</i>	<i>252 650</i>	<i>334 000</i>	<i>225 338</i>	<i>249 615</i>	<i>245 415</i>	<i>384 620</i>	<i>625 988</i>
Total	5 978 614	423 656	370 544	566 219	431 708	496 235	775 091	895 084	2 020 077

— nil or rounded to zero (including null cells)

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

(a) Employment size is based on the number of persons employed by the business during the last pay period ending in June 2003.

RESOURCES DEVOTED TO R&D, by socioeconomic objective, by type of resource(a)

	TYPE OF EXPENDITURE				
	Total	Capital expenditure	Labour costs(b)	Other current expenditure	Human resources
<i>Socioeconomic objective</i>	\$'000	\$'000	\$'000	\$'000	person years
<i>Defence</i>	108 046	np	45 218	np	636
<i>Economic development</i>					
Plant – production and primary products	75 907	10 357	31 548	34 002	507
Animal – production and primary products	61 761	5 491	23 420	32 850	293
Mineral resources (excl. energy)	436 129	22 831	79 798	333 500	888
Energy resources	177 661	31 789	31 684	114 189	307
Energy supply	154 610	34 649	50 524	69 437	652
Manufacturing	2 541 322	187 611	1 144 797	1 208 914	14 968
Construction	152 107	5 212	57 271	89 624	777
Transport	136 310	16 902	61 067	58 341	1 088
Information and communication services	1 290 962	74 770	687 080	529 112	8 306
Commercial services and tourism	341 766	22 249	182 383	137 134	1 692
Economic framework	13 385	641	8 320	4 425	125
<i>Total economic development</i>	<i>5 381 919</i>	<i>412 502</i>	<i>2 357 891</i>	<i>2 611 526</i>	<i>29 603</i>
<i>Society</i>					
Health	376 351	23 239	171 609	181 504	1 938
Education and training	13 346	588	9 397	3 362	160
Social development and community services	26 185	976	16 864	8 345	233
<i>Total society</i>	<i>415 882</i>	<i>24 803</i>	<i>197 869</i>	<i>193 210</i>	<i>2 331</i>
<i>Environment</i>					
Environmental policy frameworks and other aspects	10 305	1 024	5 162	4 119	97
Environmental management	56 731	5 932	17 324	33 475	271
<i>Total environment</i>	<i>67 036</i>	<i>6 956</i>	<i>22 486</i>	<i>37 594</i>	<i>368</i>
<i>Non-oriented research</i>	<i>5 731</i>	<i>np</i>	<i>3 032</i>	<i>np</i>	<i>44</i>
Total	5 978 614	457 808	2 626 497	2 894 309	32 982

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

(a) See paragraph 19 of the Explanatory Notes.

(b) See Glossary for definition of labour costs.

RESOURCES DEVOTED TO R&D, by research field, by type of resource(a)

<i>Research field</i>	TYPE OF EXPENDITURE				
	<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	30 405	484	13 530	16 391	156
Physical sciences	45 386	2 270	22 790	20 327	291
Chemical sciences	203 889	13 825	89 203	100 861	1 304
Earth sciences	114 203	4 690	16 689	92 824	187
Biological sciences	210 318	20 808	94 009	95 501	1 013
Information systems	287 448	12 641	149 114	125 694	1 786
Computer software	775 936	30 472	515 316	230 149	6 086
Other information, computing and communication sciences	376 541	9 661	156 092	210 788	1 802
Industrial biotechnology and food sciences	147 674	10 741	80 230	56 703	924
Chemical engineering	93 851	7 544	30 870	55 437	408
Manufacturing engineering	483 280	53 327	192 227	237 726	2 744
Automotive engineering	633 606	52 926	284 919	295 760	3 636
Mechanical and industrial engineering	174 660	13 309	79 440	81 911	1 218
Resources engineering	369 825	37 994	61 571	270 260	625
Electrical and electronic engineering	300 709	34 992	145 549	120 168	1 917
Metallurgy	184 062	16 073	43 360	124 629	456
Materials engineering	124 908	13 165	53 394	58 349	720
Communications technologies	397 991	45 929	171 171	180 891	2 143
Other engineering and technology	340 940	36 082	143 190	161 668	2 083
Agricultural, veterinary and environmental sciences	199 937	17 660	76 271	106 006	1 112
Medical and health sciences	391 961	20 752	163 433	207 776	1 891
Other research fields	91 084	2 463	44 129	44 492	481
Total	5 978 614	457 808	2 626 497	2 894 309	32 982

(a) See paragraph 19 of the Explanatory Notes.

(b) See Glossary for definition of labour costs.

ACTUAL AND EXPECTED EXPENDITURE ON R&D, by industry

	2002-03 <i>Actual</i>	2003-04 <i>Expected</i>
<i>ANZSIC industry</i>	\$'000	\$'000
.....		
<i>Mining (including services to mining)</i>	536 003	464 572
Manufacturing		
Food, beverages and tobacco	234 439	229 563
Textiles, clothing, footwear and leather	27 760	24 684
Wood and paper products	97 730	90 919
Printing, publishing and recorded media	14 613	14 664
Petroleum, coal, chemical and associated product	492 116	580 597
Non-metallic mineral product	86 242	98 394
Metal product	342 786	277 500
Motor vehicle and part and other transport equipment	731 429	879 659
Photographic and scientific equipment	303 511	333 423
Electronic and electrical equipment and appliance	328 544	321 270
Industrial machinery and equipment	149 831	154 424
Other manufacturing	20 453	22 867
<i>Total manufacturing</i>	2 829 454	3 027 964
Other industries		
Wholesale and retail trade	428 975	692 799
Finance and insurance	238 770	211 497
Property and business services	1 044 103	1 156 217
Scientific research	343 966	409 522
Other n.e.c.	557 344	512 643
<i>Total other industries</i>	2 613 157	2 982 677
Total	5 978 614	6 475 214
.....		

ANZSIC industry	Total person years	SMALL, LESS THAN 20							1000 or more person years
		Less than 10 person years	10-19 person years	20-49 person years	50-99 person years	100-199 person years	200-499 person years	500-999 person years	
<i>Mining (including services to mining)</i>	608	36	41	25	54	59	90	77	227
Manufacturing									
Food, beverages and tobacco	1 427	16	45	40	96	56	292	111	771
Textiles, clothing, footwear and leather	195	5	np	30	26	20	84	np	—
Wood and paper products	359	11	9	4	np	8	10	np	307
Printing, publishing and recorded media	150	42	21	17	19	np	np	np	—
Petroleum, coal, chemical and associated product	2 751	128	106	345	215	331	520	486	620
Non-metallic mineral product	375	31	25	20	np	29	108	135	np
Metal product	1 395	44	21	77	82	399	137	152	484
Motor vehicle and part and other transport equipment	4 537	48	48	113	34	175	388	509	3 222
Photographic and scientific equipment	1 733	97	74	281	179	124	487	np	np
Electronic and electrical equipment and appliance	2 520	222	np	378	345	153	403	229	np
Industrial machinery and equipment	1 192	119	np	256	224	185	163	np	—
Other manufacturing	224	52	61	61	22	np	np	—	—
Total manufacturing	16 858	815	897	1 620	1 258	1 485	2 622	2 006	6 156
Other industries									
Wholesale and retail trade	2 898	238	239	254	165	255	656	963	129
Finance and insurance	787	28	np	13	29	np	np	np	568
Property and business services	7 954	1 387	1 309	1 528	730	1 215	757	499	530
Scientific research	1 673	357	np	442	431	np	—	—	—
Other n.e.c.	2 204	160	125	238	88	168	np	np	683
Total other industries	15 516	2 171	2 064	2 475	1 442	1 795	1 603	2 056	1 909
Total	32 982	3 021	3 002	4 120	2 754	3 340	4 315	4 139	8 292

— nil or rounded to zero (including null cells)

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

(a) Employment size is based on the number of persons employed by the business during the last pay period ending in June 2003, whereas human resources data are person years of effort for the period 1 July 2002 to 30 June 2003.

<i>ANZSIC industry</i>	<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
	person years	person years	person years	person years
<i>Mining (including services to mining)</i>	608	307	230	71
Manufacturing				
Food, beverages and tobacco	1 427	663	547	216
Textiles, clothing, footwear and leather	195	85	56	54
Wood and paper products	359	166	126	67
Printing, publishing and recorded media	150	61	74	15
Petroleum, coal, chemical and associated product	2 751	1 634	767	350
Non-metallic mineral product	375	179	126	71
Metal product	1 395	914	296	186
Motor vehicle and part and other transport equipment	4 537	1 960	1 583	994
Photographic and scientific equipment	1 733	1 145	445	143
Electronic and electrical equipment and appliance	2 520	1 640	605	275
Industrial machinery and equipment	1 192	563	383	246
Other manufacturing	224	128	60	37
<i>Total manufacturing</i>	<i>16 858</i>	<i>9 137</i>	<i>5 068</i>	<i>2 653</i>
Other industries				
Wholesale and retail trade	2 898	1 895	645	358
Finance and insurance	787	452	239	96
Property and business services	7 954	4 892	2 335	727
Scientific research	1 673	986	508	179
Other n.e.c.	2 204	1 221	700	283
<i>Total other industries</i>	<i>15 516</i>	<i>9 447</i>	<i>4 427</i>	<i>1 642</i>
Total	32 982	18 891	9 725	4 367

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 2002–03.

2 For details of R&D statistics available for the Government, Private non-profit and Higher education sectors see paragraph 24.

DATA SOURCES

3 The 2002–03 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 30 June 2003. This survey was based on a complete enumeration of businesses identified by the Australian Bureau of Statistics (ABS) as likely R&D performers (businesses mainly engaged in Agriculture, forestry and fishing were excluded; see paragraph 14). The survey was conducted by mail questionnaires and an 85% response rate was obtained. For businesses that did not respond to the current survey and had reported R&D activity in the previous survey, data were imputed based on the expected expenditures for 2002–03 reported previously.

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 2004* (cat. no. 5206.0) – and, at current prices, are as follows: \$529,886m (1996–97); \$561,229m (1997–98); \$591,917m (1998–99); \$626,037m (1999–2000); \$671,120m (2000–01); \$714,370m (2001–02) and \$754,120m (2002–03). The available BERD/GDP ratios for other Organisation for Economic Co-operation and Development (OECD) countries are current at the time of manuscript finalisation and are sourced from *Main Science and Technology Indicators, 2004/1*, OECD, Paris, 2004.

5 The GSP figures used to derive R&D expenditure to GSP ratios are current at the time of manuscript finalisation – *Australian National Accounts, State Accounts, 2002–03* (cat. no. 5220.0) – and, at current prices, are as follows: New South Wales \$265,966m; Victoria \$192,407m; Queensland \$126,582m; South Australia \$48,897m; Western Australia \$82,405m and Tasmania, the Northern Territory and the Australian Capital Territory combined \$36,995m.

STATISTICAL UNIT

6 The statistical unit used to represent businesses, and for which statistics are reported, is the Australian Business Number (ABN) unit, in most cases. The ABN unit is the business unit which has registered for an ABN, and thus appears on the Australian Taxation Office (ATO) administered Australian Business Register. This unit is suitable for ABS statistical needs when the business is simple in structure. For more significant and diverse businesses where the ABN unit is not suitable for ABS statistical needs, the statistical unit used is the Type of Activity Unit (TAU). A TAU is comprised of one or more business entities, sub-entities or branches of a business entity within an Enterprise Group that can report production and employment data for similar economic activities. Further details about the ABS economic statistical units used in this survey, and in other ABS economic surveys (both sample surveys and censuses), can be found in Chapter 2 of the *Standard Economic Sector Classifications of Australia (SESCA) 2002* (cat. no. 1218.0).

DEFINITIONS

7 R&D is defined in accordance with the 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'.

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

EXPLANATORY NOTES *continued*

- DEFINITIONS *continued*
- 9** For a more comprehensive interpretation of the definition of R&D activity, see the *Australian Standard Research Classification (ASRC), 1998* (cat. no. 1297.0) or refer to the OECD publication *Proposed Standard Practice for Surveys on Research and Experimental Development ('Frascati Manual' 2002)*, OECD, Paris, 2003.
- SCOPE
- 10** The scope of this survey is all businesses within the Business sector of Australia which have undertaken R&D.
- 11** 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.
- 12** The vast majority of businesses in this sector are private businesses. The remainder are public businesses mainly engaged in trading or financial activities.
- COVERAGE
- 13** The 2002–03 R&D survey comprised a complete enumeration of businesses identified by the ABS as likely to have carried out R&D activity.
- 14** 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).
- 15** 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 R&D Tax Concession and/or grants for industry R&D
 - businesses identified from reports in newspapers, industrial journals, research compendia etc. as likely to have R&D activity
 - businesses which indicated on an exploratory questionnaire that R&D activity had been undertaken.
- 16** 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
- 17** The statistics in this publication are classified to industry in accordance with the *Australian and New Zealand Standard Industrial Classification (ANZSIC), 1993* (cat. no. 1292.0).
- 18** Each ABN unit/TAU is classified by the ABS to the industry in which it mainly operates. 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.
- SOCIOECONOMIC OBJECTIVE AND RESEARCH FIELDS, COURSES AND DISCIPLINES CLASSIFICATIONS
- 19** Statistics of business R&D classified by Socioeconomic objective (purpose of the research) and Research fields, courses and disciplines (fields in which the research was undertaken) have been collected and presented in this publication. Data were subjectively allocated by data providers at the time of reporting, using OECD/ABS definitions. The ABS makes every effort to ensure correct and consistent interpretation and reporting of these data and applies consistent processing methodologies. Analysts using these data should bear the original subjectivity in mind.
- 20** For more information on these classifications see the *Australian Standard Research Classification (ASRC), 1998* (cat. no. 1297.0).

EXPLANATORY NOTES *continued*

- CHAIN VOLUME MEASURES **21** 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 2002–03). 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 **22** The statistics in this publication should be used with caution for the following reasons:
- Many data providers made estimates because their accounts did not separately record data on R&D activity.
 - 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 grants for industry R&D schemes (for the allocation of grants) and the R&D Tax Concession scheme (for tax deductibility for specific R&D activities) are slightly different from the international standard.
 - Some businesses had difficulties describing their R&D programs in terms of socioeconomic objectives, research fields and types of activity. The data presented under these classifications therefore reflect a degree of subjectivity.
- ABS DATA AVAILABLE ON REQUEST **23** As well as the statistics included in this and related publications, the ABS may have other relevant data available on request. Inquiries should be made to the National Information and Referral Service on 1300 135070.
- RELATED PUBLICATIONS **24** Users may also wish to refer to the following publications:
- Australian Bureau of Statistics 1998, *Australian Standard Research Classification (ASRC)*, cat. no. 1297.0, ABS, Canberra
- Australian Bureau of Statistics 2002, *Research and Experimental Development, All Sector Summary, Australia, 2000–01*, cat. no. 8112.0, ABS, Canberra
- Australian Bureau of Statistics 2002, *Research and Experimental Development, Government and Private Non-Profit Organisations, Australia, 2000–01*, cat. no. 8109.0, ABS, Canberra
- Australian Bureau of Statistics 2004, *Research and Experimental Development, Higher Education Organisations, Australia, 2002*, cat. no. 8111.0, ABS, Canberra
- Organisation for Economic Co-operation and Development 2003, *Proposed Standard Practice for Surveys on Research and Experimental Development ('Frascati Manual' 2002)*, OECD, Paris
- 25** Current publications and other products released by the ABS are listed in the *Catalogue of Publications and Products* cat. no. 1101.0. The catalogue is available from any ABS office or the ABS web site <<http://www.abs.gov.au>>. The ABS also issues a daily Release Advice on the web site which details products to be released in the week ahead.
- ROUNDING **26** Where figures have been rounded, discrepancies may occur between sums of the component items and totals.

GLOSSARY

Applied research	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 predetermined objectives.
Basic research	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 for the solution of recognised practical problems.
Capital expenditure	Expenditure on the acquisition of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment attributable to R&D activity.
Chain volume measures	Annually reweighted chain Laspeyres indexes referenced to the current price values in a chosen reference year (currently 2002-03). They are formed in a multi-stage process of which the major steps are described in Section 15 of the <i>Information Paper: Introduction of Chain Volume Measures in the Australian National Accounts</i> (cat. no. 5248.0).
Current expenditure	Expenditure on direct labour costs, 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.
Experimental development	Systematic work, using existing knowledge gained from research or practical experience, for the purpose of creating new or improved products/processes.
Human resources devoted to R&D	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.
Labour costs	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.
Other current expenditure	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.
Other supporting staff	Skilled and unskilled craftpersons, 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.
Research field	Field in which the R&D activity was performed. The Research fields, courses and disciplines classification is primarily structured around disciplines or activities. It describes what research is being performed.
Researchers	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.

GLOSSARY *continued*

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

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