

RESEARCH AND EXPERIMENTAL DEVELOPMENT

*BUSINESSES
AUSTRALIA*

EMBARGO: 11.30AM (CANBERRA TIME) THURS 7 AUG 2003

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

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).

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 movement statistics. Where revisions have been applied, the estimate is annotated with an 'r'.

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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
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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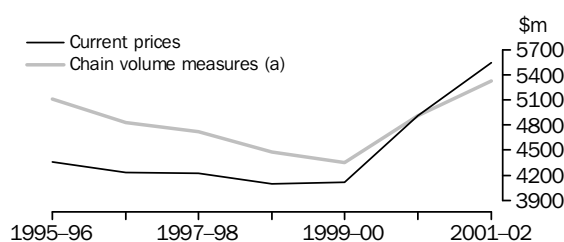
MAIN FEATURES

EXPENDITURE ON R&D

In 2001–02, Business Expenditure on R&D (BERD) was estimated to be \$5,546m at current prices, 13% higher than that recorded in 2000–01. This is the highest level recorded and is the second successive year of significant 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 8% compared with 2000–01. The 2001–02 expenditure in volume terms is 4% above the previous peak level of 1995–96.

EXPENDITURE ON R&D



(a) Reference year for chain volume measures is 2000–01.
See paragraph 20 of the Explanatory Notes for details.

The Mining industry recorded a 16% increase in R&D expenditure while expenditure by the Manufacturing industry increased by 10%. The Wholesale and retail trade, the Property and business services and the Scientific research industries recorded increases of 14%, 21% and 27% respectively while the Finance and insurance industry recorded a decrease of 19%.

The change in BERD between 2000–01 and 2001–02 resulted from:

- Approximately 2,800 businesses which undertook expenditure in both years, incurring \$4,527m of R&D expenditure in 2000–01 and \$4,940m in 2001–02, an increase of 9%. Not all businesses increased their expenditure in 2001–02; 45% of continuing R&D performers recorded increases in expenditure of 10% or more, while 33% recorded decreases of 10% or more.
- Approximately 800 businesses which recorded \$391m of R&D expenditure in 2000–01, not reporting any R&D in 2001–02.
- Approximately 1,000 businesses which did not report R&D expenditure in 2000–01, recording \$606m in 2001–02.

HUMAN RESOURCES DEVOTED TO R&D

Human resources devoted to R&D in 2001–02 totaled 30,389 person years, 7% higher than in 2000–01.

RESOURCES DEVOTED TO R&D

	1995–96	1996–97	1997–98	1998–99	1999–2000	2000–01	2001–02
Expenditure							
At current prices (\$m)	4 356.6	4 234.7	r4 221.1	r4 094.7	r4 112.4	r4 917.4	5 545.5
Chain volume measures(a) (\$m)	5 109.6	4 829.6	4 718.0	4 474.2	4 349.7	4 917.4	5 329.6
Human resources (person years)	27 123	26 412	r24 769	r25 109	r26 507	r28 295	30 389

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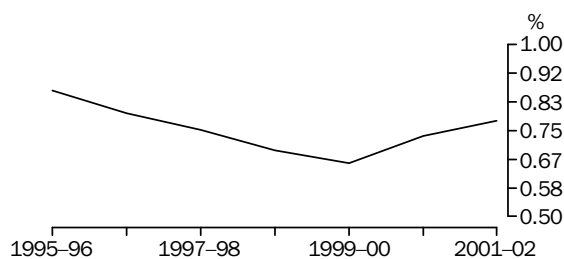
(a) Reference year for chain volume measures is 2000–01. See paragraph 20 of the Explanatory Notes.

COMPARISON WITH GDP

BERD AS A PERCENTAGE OF GDP

Australia's BERD as a percentage of Gross Domestic Product (GDP) increased to 0.78% in 2001–02, the second successive increase following decreases between 1995–96 and 1999–00. The percentage remains well below the high of 0.87% in 1995–96.

BERD AS A PERCENTAGE OF GDP (a)



(a) At current prices.

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

	1999–2000	2000–01	2001–02
	%	%	%
Finland	2.20	2.41	2.42
Japan	2.08	2.11	2.28
Korea	1.76	1.96	2.25
United States of America	1.98	2.04	2.10
Iceland	1.12	1.56	1.80
Germany	1.70	1.75	1.76
France	1.38	1.37	1.37
United Kingdom	1.25	1.21	1.28
Canada	1.06	1.09	1.11
Netherlands	1.14	1.11	1.08
Ireland	0.87	0.83	0.80
Czech Republic	0.78	0.80	0.78
Australia	0.65	0.73	0.78
Italy	0.51	0.53	0.56
Spain	0.46	0.50	0.50
Slovak Republic	0.42	0.44	0.44
Hungary	0.28	0.36	0.38
Portugal	0.17	0.22	0.27
Poland	0.31	0.25	0.24

RESOURCES DEVOTED TO R&D

INDUSTRY COMPARISON

- R&D expenditure by the Mining industry increased by 16% in 2001–02 to \$534m (10% of total R&D expenditure).
- The Manufacturing industry's R&D expenditure increased by 10% to \$2,403m in 2001–02 (43% of total R&D expenditure).
- The Wholesale and retail trade, the Property and business services and the Scientific research industries recorded increases of 14%, 21% and 27% respectively while the Finance and insurance industry recorded a decrease of 19%.

TYPE OF EXPENDITURE

In 2001–02, Labour costs accounted for 43% of total R&D expenditure. Other current expenditure made up 49%, while Capital expenditure accounted for 7%.

Labour costs as a proportion of R&D expenditure was low for the Mining industry (12%) and high for the Wholesale and retail trade industry (58%).

SOURCE OF FUNDS FOR R&D

The business sector provided most of the R&D expenditure funds itself: \$4,782m (86%) was sourced from Own funds and \$136m (2%) from Other businesses. The Commonwealth Government provided \$269m (5%) while \$309m (6%) came from Overseas.

The Scientific research industry provided only 60% of its R&D expenditure funding from Own funds. For this industry, a further 17% was provided by the Commonwealth Government, 9% provided from Overseas and 7% from Other businesses.

STATE COMPARISONS

The leading states in terms of R&D expenditure were New South Wales with \$2,071m and Victoria with \$1,793m, accounting for 37% and 32% of total R&D expenditure respectively. Queensland recorded \$723m (13%), while Western Australia with \$404m (7%) had the next highest R&D expenditure.

When R&D expenditure is expressed as a percentage of Gross State Product (GSP), the leading states were Victoria (0.98%), New South Wales (0.83%), South Australia (0.77%), Queensland (0.60%) and Western Australia (0.52%). For Tasmania, the Northern Territory and the Australian Capital Territory combined, R&D expenditure as a percentage of GSP was only 0.32%.

In the Mining industry, Queensland accounted for \$217m (41%) and Western Australia \$123m (23%).

Major contributors to R&D in the Manufacturing industry were Victoria \$972m (40%) and New South Wales \$800m (33%).

EXPENDITURE BY SIZE OF BUSINESS

The largest businesses, employing 1,000 or more, accounted for 34% of total R&D expenditure (39% in 2000–01). On average, this was more than \$14m for each of the 132 largest businesses.

Businesses employing less than 10 people accounted for 6% of the R&D (6% in 2000–01). This averaged out at approximately \$245,000 for each of the 1,315 businesses employing less than 10 people.

The ABS defines small businesses as those employing less than 20 people. Small businesses accounted for 11% of R&D expenditure in 2001–02; 7% of both Mining and Manufacturing and 16% of all other industries.

RESOURCES DEVOTED TO R&D *continued*

SOCIO-ECONOMIC OBJECTIVE

Most business R&D (\$4,979m or 90%) was directed towards Economic development. Approximately 7% was directed towards Society, 2% towards Defence and 1% towards Environment.

Of the amount directed towards Economic development, \$2,215m (44%) was towards Manufacturing.

RESEARCH FIELDS

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

- computer software, \$764m or 14%
- communications technologies, \$614m or 11%
- automotive engineering, \$467m or 8%
- manufacturing engineering, \$416m or 8%
- other information, computing and communication sciences, \$365m or 7%
- information systems, \$356m or 6%
- medical and health sciences, \$330m or 6%.

EXPECTED R&D EXPENDITURE

Table 8 provides data on both 'actual' and 'expected' R&D expenditure by businesses.

The 'actual' data are the R&D business expenditures reported in the 1999–2000, 2000–01 and 2001–02 surveys.

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 2000–01, 2001–02 and 2002–03 '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.

Businesses reported that they expected BERD to be \$5,266m in 2002–03. This is 5% less than the actual R&D expenditure incurred in 2001–02. It should be noted that for 2000–01 and 2001–02, actual expenditure exceeded expectations by 13% and 11% respectively.

HUMAN RESOURCES BY SIZE OF BUSINESS

R&D performing businesses employing 1,000 or more contributed 25% of human resource effort. However only 1% of their total employment was devoted to R&D.

Businesses with less than 10 employees devoted 48% of their total employment to R&D, although they contributed only 8% of the total resources undertaking R&D.

The ABS defines small businesses as those employing less than 20 people. Small businesses contributed 16% of R&D human resources in 2001–02; 10% of Manufacturing R&D human resources, 15% of Mining and 23% of all other industries.

TYPE OF HUMAN RESOURCES

Researchers comprised 55% of the human resources devoted to R&D, followed by Technicians with 32% and Other supporting staff with 13%. In Mining, Researchers accounted for 41% and Technicians 39%. Researchers made up 54% in Manufacturing with 31% of R&D human resources accounted for by Technicians. The Property and business services industry and the Scientific research industry had high proportions of Researchers with 59% each.

RESOURCES DEVOTED TO R&D continued

TYPE OF HUMAN
RESOURCES continued

Within the Manufacturing industries, the proportion contributed by Researchers ranged from highs of 67% in Printing, publishing and recorded media and 66% in Electronic and electrical equipment and appliance to lows of 40% in both Textiles, clothing, footwear and leather and Wood and paper products.

RESOURCES DEVOTED TO R&D, By industry

	NUMBER OF BUSINESSES			EXPENDITURE ON R&D			HUMAN RESOURCES DEVOTED TO R&D		
	1999-2000	2000-01	2001-02	1999-2000	2000-01	2001-02	1999-2000	2000-01	2001-02
<i>ANZSIC industry</i>	no.	no.	no.	\$m	\$m	\$m	person years	person years	person years
<i>Mining (including services to mining)</i>	r101	r92	108	r291	r462	534	r775	r1 194	819
<i>Manufacturing</i>									
Food, beverages and tobacco	r134	r139	136	r184	r202	214	r1 121	r1 133	1 268
Textiles, clothing, footwear and leather	51	51	43	18	27	22	195	245	165
Wood and paper products	r37	r34	33	r103	r100	82	r365	r342	319
Printing, publishing and recorded media	28	r33	40	15	r17	16	169	r139	135
Petroleum, coal, chemical and associated product	r332	r351	349	r370	r387	417	r2 214	r2 525	2 405
Non-metallic mineral product	49	51	52	47	41	76	338	279	254
Metal product	r180	171	174	r227	r200	235	r1 122	r964	1 035
Motor vehicle and part and other transport equipment	139	r136	127	410	r473	553	3 059	r3 044	3 427
Photographic and scientific equipment	174	r165	138	r127	r184	230	r1 097	r1 431	1 480
Electronic and electrical equipment and appliance	r325	r376	361	r375	r430	412	r3 070	r3 104	3 017
Industrial machinery and equipment	r244	r241	231	r101	r108	128	r960	r883	1 039
Other manufacturing	r85	r83	76	r19	r21	18	r229	r234	160
<i>Total manufacturing</i>	r1 778	r1 831	1 760	r1 996	r2 190	2 403	r13 938	r14 323	14 703
<i>Other industries</i>									
Wholesale and retail trade	r298	r289	334	r384	r370	422	r2 575	r2 521	2 814
Finance and insurance	35	r40	51	138	r278	224	953	r965	770
Property and business services	874	r943	1 041	r750	r867	1 049	r5 991	r6 655	7 508
Scientific research	r153	r166	214	r225	r243	308	r1 331	r1 419	1 705
Other n.e.c.	r194	r193	251	r328	r506	605	r946	r1 219	2 069
<i>Total other industries</i>	r1 554	r1 631	1 891	r1 825	r2 265	2 609	r11 795	r12 778	14 866
Total	r3 433	r3 554	3 759	r4 112	r4 917	5 546	r26 507	r28 295	30 389

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EXPENDITURE, By industry—By type of expenditure

<i>ANZSIC industry</i>	<i>Total</i>	<i>Capital expenditure</i>	<i>Labour costs (a)</i>	<i>Other current expenditure</i>
	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	533 948	34 187	64 492	435 269
<i>Manufacturing</i>				
Food, beverages and tobacco	214 236	19 959	104 695	89 583
Textiles, clothing, footwear and leather	22 427	3 790	9 357	9 281
Wood and paper products	82 040	3 892	25 289	52 859
Printing, publishing and recorded media	16 156	947	8 284	6 925
Petroleum, coal, chemical and associated product	416 623	24 656	175 777	216 190
Non-metallic mineral product	75 960	22 069	20 331	33 560
Metal product	235 067	34 854	80 613	119 600
Motor vehicle and part and other transport equipment	552 692	40 424	254 588	257 680
Photographic and scientific equipment	230 162	14 306	113 609	102 246
Electronic and electrical equipment and appliance	411 508	33 864	213 687	163 957
Industrial machinery and equipment	128 187	14 527	62 904	50 756
Other manufacturing	17 638	2 845	9 018	5 775
<i>Total manufacturing</i>	2 402 696	216 134	1 078 153	1 108 410
<i>Other industries</i>				
Wholesale and retail trade	421 674	19 577	244 627	157 470
Finance and insurance	224 248	16 709	91 770	115 769
Property and business services	1 049 291	46 416	599 915	402 959
Scientific research	308 179	35 040	129 099	144 041
Other n.e.c.	605 498	42 363	189 767	373 368
<i>Total other industries</i>	2 608 890	160 106	1 255 178	1 193 606
Total	5 545 534	410 426	2 397 823	2 737 285

(a) 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.

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>	533 948	520 245	1 871	10 853	np	—	np
<i>Manufacturing</i>							
Food, beverages and tobacco	214 236	206 423	1 986	2 185	978	1 706	958
Textiles, clothing, footwear and leather	22 427	18 331	—	np	np	—	—
Wood and paper products	82 040	81 685	—	np	np	—	—
Printing, publishing and recorded media	16 156	14 421	np	988	—	np	—
Petroleum, coal, chemical and associated product	416 623	371 375	2 895	9 264	np	np	32 762
Non-metallic mineral product	75 960	51 167	np	np	5	np	np
Metal product	235 067	231 789	179	1 527	np	np	—
Motor vehicle and part and other transport equipment	552 692	490 359	np	14 109	—	np	np
Photographic and scientific equipment	230 162	206 068	59	15 275	np	np	7 204
Electronic and electrical equipment and appliance	411 508	373 178	2 765	19 031	np	np	15 703
Industrial machinery and equipment	128 187	116 991	3 532	6 773	np	np	—
Other manufacturing	17 638	16 312	np	1 276	—	np	—
<i>Total manufacturing</i>	2 402 696	2 178 098	50 054	82 016	np	5 039	np
<i>Other industries</i>							
Wholesale and retail trade	421 674	351 805	3 184	np	925	np	np
Finance and insurance	224 248	208 359	np	np	—	—	—
Property and business services	1 049 291	752 643	44 180	108 422	2 880	2 119	139 047
Scientific research	308 179	184 367	20 655	51 528	5 308	19 779	26 542
Other n.e.c.	605 498	586 203	np	8 971	261	np	np
<i>Total other industries</i>	2 608 890	2 083 378	84 202	175 716	9 374	31 273	224 948
Total	5 545 534	4 781 721	136 127	268 585	13 826	36 312	308 964

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

— nil or rounded to zero (including null cells)

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

EXPENDITURE, By industry—By location(a)

							Other states and territories	Overseas
	Total	NSW	Vic.	Qld	SA	WA		
ANZSIC industry	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	533 948	84 623	36 176	216 613	np	122 570	25 206	np
<i>Manufacturing</i>								
Food, beverages and tobacco	214 236	81 056	74 845	28 364	13 360	9 295	5 533	1 783
Textiles, clothing, footwear and leather	22 427	3 711	13 004	np	np	3 850	np	6
Wood and paper products	82 040	9 146	56 387	5 110	5 394	2 282	np	np
Printing, publishing and recorded media	16 156	9 522	3 254	np	364	1 167	np	—
Petroleum, coal, chemical and associated product	416 623	131 485	172 574	55 850	25 892	17 451	8 483	4 888
Non-metallic mineral product	75 960	51 492	7 591	12 663	1 197	2 327	np	np
Metal product	235 067	97 077	28 863	32 808	5 270	68 588	np	np
Motor vehicle and part and other transport equipment	552 692	64 258	409 008	9 539	58 820	9 193	1 150	724
Photographic and scientific equipment	230 162	108 229	64 859	13 266	18 912	11 340	np	np
Electronic and electrical equipment and appliance	411 508	197 001	111 561	32 521	23 402	38 724	7 997	303
Industrial machinery and equipment	128 187	42 114	26 497	27 026	8 551	15 476	8 085	438
Other manufacturing	17 638	5 097	4 040	4 885	2 188	1 181	np	np
<i>Total manufacturing</i>	2 402 696	800 188	972 483	224 943	np	180 874	38 611	np
<i>Other industries</i>								
Wholesale and retail trade	421 674	176 280	141 483	20 199	65 671	8 336	4 316	5 389
Finance and insurance	224 248	149 563	52 826	np	np	np	—	np
Property and business services	1 049 291	448 911	291 908	154 920	41 814	46 529	30 856	34 353
Scientific research	308 179	89 239	110 770	36 652	35 733	15 485	9 278	11 022
Other n.e.c.	605 498	321 804	187 094	np	np	np	6 777	np
<i>Total other industries</i>	2 608 890	1 185 796	784 081	281 334	153 668	100 184	51 227	52 600
Total	5 545 534	2 070 607	1 792 740	722 889	364 216	403 628	115 044	76 411

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.

EXPENDITURE, By industry—By business employment size(a)

	Total	Less than 10	10–19	20–49	50–99	100–199	200–499	500–999	1000 or more
ANZSIC industry	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<i>Mining (including services to mining)</i>	533 948	18 725	19 367	25 162	38 647	25 719	91 710	60 901	253 717
<i>Manufacturing</i>									
Food, beverages and tobacco	214 236	2 249	642	10 126	8 584	6 622	29 156	20 099	136 758
Textiles, clothing, footwear and leather	22 427	609	95	3 479	1 907	4 753	9 168	2 416	—
Wood and paper products	82 040	1 266	np	np	907	574	1 425	np	73 735
Printing, publishing and recorded media	16 156	4 528	2 684	np	3 245	np	364	np	—
Petroleum, coal, chemical and associated product	416 623	8 834	9 342	29 377	28 524	49 134	76 110	104 581	110 721
Non-metallic mineral product	75 960	786	3 139	np	598	2 123	np	25 089	7 284
Metal product	235 067	6 473	2 343	30 449	31 987	6 510	41 387	13 886	102 032
Motor vehicle and part and other transport equipment	552 692	5 697	2 140	5 756	7 208	24 281	25 791	100 527	381 292
Photographic and scientific equipment	230 162	14 879	13 373	39 947	39 814	7 490	np	57 459	np
Electronic and electrical equipment and appliance	411 508	16 919	np	38 298	59 886	35 895	52 290	134 967	np
Industrial machinery and equipment	128 187	13 403	11 912	30 081	26 080	np	19 909	np	—
Other manufacturing	17 638	3 405	4 235	2 945	2 292	3 768	993	—	—
<i>Total manufacturing</i>	2 402 696	79 048	85 069	217 418	211 032	162 976	317 042	471 633	858 478
<i>Other industries</i>									
Wholesale and retail trade	421 674	22 567	19 737	42 074	45 494	19 988	40 879	152 493	78 442
Finance and insurance	224 248	3 562	1 197	8 446	np	np	35 208	10 817	145 442
Property and business services	1 049 291	113 836	103 044	160 363	122 632	138 508	120 145	143 231	147 532
Scientific research	308 179	63 297	64 228	85 869	45 513	49 273	—	—	—
Other n.e.c.	605 498	21 271	12 314	15 696	np	np	46 326	57 892	420 469
<i>Total other industries</i>	2 608 890	224 532	200 520	312 448	235 168	237 346	242 558	364 433	791 885
Total	5 545 534	322 306	304 956	555 028	484 847	426 041	651 310	896 967	1 904 080

— 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 2002.

RESOURCES DEVOTED TO R&D, By socio-economic objective

	TYPE OF EXPENDITURE				
	Total	Capital expenditure	Labour costs(a)	Other current expenditure	Human resources
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	person years
<i>Defence</i>	119 460	2 749	52 116	64 595	741
<i>Economic development</i>					
Plant—production and primary products	64 713	6 183	27 670	30 860	410
Animal—production and primary products	57 597	4 141	22 956	30 500	307
Mineral resources (excl. energy)	319 015	35 029	58 589	225 397	798
Energy resources	192 999	9 147	40 264	143 589	437
Energy supply	118 854	24 592	41 510	52 752	527
Manufacturing	2 215 491	193 353	969 585	1 052 553	13 367
Construction	84 756	6 139	29 946	48 671	431
Transport	120 378	6 025	45 828	68 525	732
Information and communication services	1 596 581	67 938	821 992	706 651	9 151
Commercial services and tourism	197 064	18 237	96 001	82 826	994
Economic framework	11 592	951	6 851	3 790	91
<i>Total economic development</i>	4 979 040	371 735	2 161 192	2 446 114	27 245
<i>Society</i>					
Health	333 677	25 377	138 487	169 814	1 701
Education and training	10 692	502	7 586	2 605	127
Social development and community services	22 600	1 939	13 340	7 321	199
<i>Total society</i>	366 969	27 817	159 412	179 739	2 027
<i>Environment</i>					
Environmental policy frameworks and other aspects	7 647	1 259	3 030	3 359	51
Environmental management	66 173	6 034	18 681	41 457	278
<i>Total environment</i>	73 820	7 293	21 711	44 816	329
<i>Non-oriented research</i>	6 246	832	3 393	2 022	47
Total	5 545 534	410 426	2 397 823	2 737 285	30 389

(a) 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&D, By research field

Research field	TYPE OF EXPENDITURE				
	Total	Capital expenditure	Labour costs (a)	Other current expenditure	Human resources
	\$'000	\$'000	\$'000	\$'000	person years
Mathematical sciences	19 392	538	9 430	9 424	122
Physical sciences	48 659	3 913	24 133	20 613	322
Chemical sciences	160 804	12 143	82 984	65 677	1 176
Earth sciences	139 473	7 150	20 281	112 041	275
Biological sciences	186 630	22 224	70 034	94 371	946
Information systems	356 105	24 974	166 275	164 855	1 798
Computer software	764 396	35 325	495 392	233 680	5 940
Other information, computing and communication sciences	365 161	18 206	160 947	186 009	2 019
Industrial biotechnology and food sciences	143 545	13 839	74 554	55 152	957
Chemical engineering	72 349	22 244	22 216	27 889	284
Manufacturing engineering	416 419	50 865	161 624	203 930	2 370
Automotive engineering	466 722	35 162	225 792	205 768	2 963
Mechanical and industrial engineering	168 042	20 939	69 707	77 396	1 028
Resources engineering	262 185	15 842	47 105	199 238	551
Electrical and electronic engineering	182 611	14 742	93 806	74 063	1 376
Metallurgy	208 200	20 097	42 607	145 497	519
Materials engineering	114 198	9 073	48 386	56 739	631
Communications technologies	614 332	27 471	232 540	354 321	2 550
Other engineering and technology	306 772	18 443	128 005	160 325	1 801
Agricultural, veterinary and environmental sciences	173 680	12 402	67 316	93 963	938
Medical and health sciences	330 292	18 794	130 042	181 456	1 566
Other research fields	45 570	6 041	24 648	14 881	257
Total	5 545 534	410 426	2 397 823	2 737 285	30 388

(a) 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, By industry

	1999-2000	2000-01	2001-02	2002-03		
	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>
<i>ANZSIC industry</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
.....						
<i>Mining (including services to mining)</i>	r291 271	r258 844	r462 423	r365 178	533 948	466 332
<i>Manufacturing</i>						
Food, beverages and tobacco	r183 763	r184 575	r201 682	r207 890	214 236	227 749
Textiles, clothing, footwear and leather	18 233	20 943	26 740	r27 430	22 427	22 539
Wood and paper products	r102 502	r91 507	r100 289	r87 090	82 040	87 253
Printing, publishing and recorded media	15 316	19 605	r17 384	r18 828	16 156	16 862
Petroleum, coal, chemical and associated product	r369 717	r338 742	r387 026	r409 221	416 623	414 016
Non-metallic mineral product	46 804	48 143	40 868	45 978	75 960	61 376
Metal product	r226 744	r195 873	r199 954	r201 075	235 067	202 875
Motor vehicle and part and other transport equipment	409 968	396 346	r473 243	r490 835	552 692	539 705
Photographic and scientific equipment	r127 356	r139 504	r183 802	r230 493	230 162	220 556
Electronic and electrical equipment and appliance	r375 376	r415 662	r430 448	r458 389	411 508	372 373
Industrial machinery and equipment	r100 882	r100 993	r108 155	r116 753	128 187	115 873
Other manufacturing	r19 098	r22 610	r20 675	r22 888	17 638	20 678
<i>Total manufacturing</i>	r1 995 759	r1 974 501	r2 190 266	r2 316 870	2 402 696	2 301 856
<i>Other industries</i>						
Wholesale and retail trade	r383 527	r403 722	r370 294	r379 733	421 674	356 729
Finance and insurance	138 164	294 725	r278 361	r272 697	224 248	196 821
Property and business services	r750 452	r772 927	r866 977	r888 090	1 049 291	1 064 619
Scientific research	r225 405	r250 273	r243 402	r332 880	308 179	357 669
Other n.e.c.	r327 782	r404 525	r505 634	r427 491	605 498	521 704
<i>Total other industries</i>	r1 825 330	r2 126 172	r2 264 668	r2 300 892	2 608 890	2 497 541
Total	r4 112 360	r4 359 517	r4 917 357	r4 982 940	5 545 534	5 265 730

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HUMAN RESOURCES DEVOTED TO R&D, By industry—By business employment size(a)

	Total	Less than 10	10–19	20–49	50–99	100–199	200–499	500–999	1000 or more
ANZSIC industry	person years	person years	person years	person years	person years	person years	person years	person years	person years
<i>Mining (including services to mining)</i>	819	30	90	50	134	31	153	118	215
<i>Manufacturing</i>									
Food, beverages and tobacco	1 268	16	4	76	78	44	207	113	730
Textiles, clothing, footwear and leather	165	4	4	np	18	23	77	np	—
Wood and paper products	319	4	np	np	10	5	9	np	268
Printing, publishing and recorded media	135	30	26	5	23	4	np	np	—
Petroleum, coal, chemical and associated product	2 405	76	101	225	222	282	455	503	540
Non-metallic mineral product	254	6	21	39	6	14	35	100	33
Metal product	1 035	35	24	101	209	60	174	88	343
Motor vehicle and part and other transport equipment	3 427	33	16	54	50	187	305	443	2 340
Photographic and scientific equipment	1 480	117	98	218	231	47	np	334	np
Electronic and electrical equipment and appliance	3 017	191	np	369	382	277	386	777	np
Industrial machinery and equipment	1 039	98	113	258	217	162	np	np	—
Other manufacturing	160	35	41	37	25	8	13	—	—
<i>Total manufacturing</i>	14 703	645	772	1 405	1 471	1 112	2 164	2 477	4 657
<i>Other industries</i>									
Wholesale and retail trade	2 814	208	172	290	248	161	196	1 011	529
Finance and insurance	770	17	12	17	52	np	60	np	519
Property and business services	7 508	1 088	984	1 484	1 009	1 024	835	397	690
Scientific research	1 705	344	365	403	272	322	—	—	—
Other n.e.c.	2 069	168	95	138	56	np	122	np	866
<i>Total other industries</i>	14 866	1 824	1 627	2 331	1 636	1 739	1 212	1 892	2 604
Total	30 389	2 500	2 489	3 786	3 240	2 882	3 529	4 487	7 475

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

— nil or rounded to zero (including null cells)

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

HUMAN RESOURCES DEVOTED TO R&D, By industry—By type of employee

	<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
<i>ANZSIC industry</i>	person years	person years	person years	person years
<i>Mining (including services to mining)</i>	819	335	317	168
<i>Manufacturing</i>				
Food, beverages and tobacco	1 268	640	401	226
Textiles, clothing, footwear and leather	165	66	52	47
Wood and paper products	319	128	139	52
Printing, publishing and recorded media	135	91	36	9
Petroleum, coal, chemical and associated product	2 405	1 345	714	346
Non-metallic mineral product	254	124	70	60
Metal product	1 035	542	292	201
Motor vehicle and part and other transport equipment	3 427	1 672	1 192	564
Photographic and scientific equipment	1 480	822	498	160
Electronic and electrical equipment and appliance	3 017	1 980	708	329
Industrial machinery and equipment	1 039	494	340	205
Other manufacturing	160	81	48	32
<i>Total manufacturing</i>	14 703	7 984	4 489	2 230
<i>Other industries</i>				
Wholesale and retail trade	2 814	1 570	939	305
Finance and insurance	770	386	295	89
Property and business services	7 508	4 455	2 389	665
Scientific research	1 705	1 000	504	201
Other n.e.c.	2 069	904	759	406
<i>Total other industries</i>	14 866	8 314	4 887	1 665
Total	30 389	16 633	9 693	4 063

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 2001–02.

2 For details of R&D statistics available for the General government, Private non-profit and Higher education sectors see paragraph 23.

DATA SOURCES

3 The 2001–02 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 2002. 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 13). The survey was conducted by mailed questionnaires and an 85% response 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 2001–02 reported previously. Where R&D activity had not been previously reported, the non-respondents were deemed to be non-R&D performers for the current year.

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 2003* (cat. no. 5206.0)— and, at current prices, are as follows: \$502,828m (1995–96); \$529,886m (1996–97); \$561,229m (1997–98); \$591,917m (1998–99); \$628,621m (1999–2000); \$669,307m (2000–01) and \$711,943m (2001–02). 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, 2003/1*, OECD, Paris, 2003.

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, 2001–02* (cat. no. 5220.0)— and, at current prices, are as follows: New South Wales \$249,411m; Victoria \$183,426m; Queensland \$120,009m; South Australia \$47,002m; Western Australia \$77,738m and Tasmania, the Northern Territory and the Australian Capital Territory combined \$35,394m.

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 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'.

8 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' 2002)*, OECD, Paris, 2003.

EXPLANATORY NOTES *continued*

SCOPE

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

10 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.

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

COVERAGE

12 The 2001–02 R&D survey comprised a complete enumeration of businesses identified by the ABS as likely to have carried out R&D activity.

13 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).

14 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.

15 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

16 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)*.

17 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.

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

18 Statistics of business R&D classified by Socio-economic 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.

19 For more information on these classifications see the *Australian Standard Research Classification (ASRC), 1998* (cat. no. 1297.0).

EXPLANATORY NOTES *continued*

- CHAIN VOLUME MEASURES** **20** 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 2000–01). 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** **21** 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 socio-economic objectives and research fields. The data presented under these classifications therefore reflect a degree of subjectivity.
- UNPUBLISHED STATISTICS** **22** Limited additional detailed R&D statistics are available at a charge from the ABS.
- RELATED PUBLICATIONS** **23** 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 2002, *Research and Experimental Development, Higher Education Organisations, Australia, 2000*, cat. no. 8111.0, ABS, Canberra
- Organisation for Economic Co-operation and Development 2003, *Main Science and Technology Indicators 2003/1*, OECD, Paris
- Organisation for Economic Co-operation and Development 2003, *The Measurement of Scientific and Technological Activities ('Frascati Manual' 2002)* OECD, Paris.
- 24** 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** **25** Where figures have been rounded, discrepancies may occur between sums of the component items and totals.

GLOSSARY

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 2000–01). 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.
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.
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.
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.
Socio-economic objective	The area of expected national benefit rather than the immediate objectives of the researcher. The Socio-economic 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.

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