

# **RESEARCH AND EXPERIMENTAL DEVELOPMENT**

**AUSTRALIA**

## **ALL SECTOR SUMMARY**

EMBARGO: 11.30AM (CANBERRA TIME) FRI 19 JUL 2002

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■ 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).

### COMPARABILITY

This publication presents summary statistics of expenditure and human resources devoted to R&D carried out in Australia by organisations within the Business, Government and Private non-profit sectors during 2000–01 and the Higher education sector during the 2000 calendar year.

Note that the research classifications used in this publication differ from those used in earlier years. See paragraph 11 of the Explanatory Notes.

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### ABBREVIATIONS

ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
GDP	gross domestic product
GERD	Gross expenditure on R&D
GUF	general university funds
OECD	Organisation for Economic Co-operation and Development
R&D	research and experimental development
SEO	Socio-economic objective

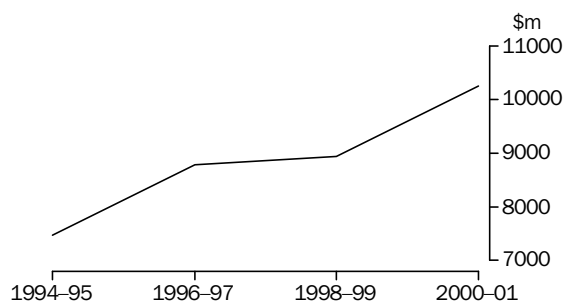
Dennis Trewin  
Australian Statistician

## MAIN FEATURES

### GROSS EXPENDITURE ON R&D (GERD)

After levelling off in the period 1996–97 to 1998–99, gross expenditure on R&D increased by 15% from \$8,936m in 1998–99 to \$10,251m in 2000–01. All sectors showed an increase in R&D expenditure compared with 1998–99.

#### EXPENDITURE ON R&D



### GROSS EXPENDITURE ON R&D

	1994-95	1996-97	1998-99	2000-01
<i>Sector</i>	<i>\$m</i>	<i>\$m</i>	<i>\$m</i>	<i>\$m</i>
Business	3 508.3	r4 234.7	r4 091.2	4 825.3
Government				
Commonwealth	1 193.3	r1 266.6	r1 207.1	1 424.8
State/territory	782.8	r797.7	r862.8	943.6
Higher education	1 829.6	2 307.6	r2 555.1	2 774.6
Private non-profit	152.7	r185.8	r220.1	283.2
<b>Total</b>	<b>7 466.7</b>	<b>r8 792.4</b>	<b>r8 936.4</b>	<b>10 251.4</b>

r revised

In 2000–01, 47% of GERD in current prices was expended in the Business sector, 27% in the Higher education sector, 23% in the Government sector and 3% in the Private non-profit sector. By comparison, in 1998–99, 46%, 29%, 23% and 2% of GERD was expended in these sectors respectively.

### GERD AS A PERCENTAGE OF GDP

GERD as a percentage of GDP has risen from 1.51% in 1998–99 to 1.53% in 2000–01, well below the high of 1.66% in 1996–97.

#### GERD AS A PERCENTAGE OF GDP



## MAIN FEATURES *continued*

Australia's GERD/GDP ratio is low compared with other OECD countries. Australia is ranked well below countries such as Finland, United States of America, Germany and France. Australia's ranking reflects the low R&D expenditure to GDP ratio of the Business sector. However, Australia's Government and Higher education sectors have a high ratio compared with other OECD countries.

### GERD/GDP RATIOS OF OECD COUNTRIES

	1998-99	2000-01
<i>Country</i>	%	%
Finland	2.89	3.31
Japan	2.94	na
United States of America	2.60	2.76
Korea	2.55	na
Germany	2.31	2.46
France	2.17	2.15
Denmark	2.04	na
Iceland	2.04	na
Canada	1.82	1.94
United Kingdom	1.83	na
Austria	1.79	1.80
<b>Australia</b>	<b>1.51</b>	<b>1.53</b>
Czech Republic	1.24	1.35
Italy	0.98	na
Spain	0.90	0.90
Hungary	0.68	0.82
Poland	0.72	0.70

na not available

### HUMAN RESOURCES DEVOTED TO R&D

In 2000-01, 95,254 person years were devoted to R&D, up 4% from 1998-99. The majority of these resources were expended by Higher education organisations (49%), Businesses (29%), and Government organisations (19%). In the period 1994-95 to 2000-01, human resources devoted to R&D increased by 10% or 8,371 person years. Over this period, human resources increased steadily in the Higher education and Private non-profit sectors and fell steadily in the Government sector. In the Business sector, human resources increased between 1994-95 and 1996-97, before falling in 1998-99 and then increasing again in 2000-01.

## MAIN FEATURES *continued*

### HUMAN RESOURCES

#### DEVOTED TO R&D *continued*

### HUMAN RESOURCES DEVOTED TO R&D

	1994-95	1996-97	1998-99	2000-01
Sector	person years	person years	person years	person years
Business	25 812	r26 412	r25 104	27 839
Government				
Commonwealth	10 660	r10 377	r9 516	9 711
State/territory	8 649	r8 813	r9 194	8 697
Higher education	40 096	42 739	45 502	46 287
Private non-profit	1 666	r2 351	r2 468	2 721
<b>Total</b>	<b>86 883</b>	<b>r90 692</b>	<b>r91 784</b>	<b>95 254</b>

r revised

### TYPE OF EXPENDITURE

Current expenditure accounted for 91% of gross R&D expenditure, with capital expenditure accounting for the remaining 9%. Labour costs accounted for 46% of total expenditure.

Other current expenditure was the main component (47%) of expenditure by the Business sector, down from 48% in 1998-99. Labour costs accounted for 44%, up from 41% in 1998-99.

Labour costs continued to be the main component of Government R&D expenditure (51%), down from 52% in 1998-99. Capital expenditure accounted for 9%, up from 8% in 1998-99.

Current expenditure accounted for 92%, down from 93% in 1998-99, of Higher education R&D expenditure. Labour costs accounted for 44% of total expenditure.

### SOURCE OF FUNDS

The major sources of funds for R&D expenditure in Australia in 2000-01 were Business 46% (\$4,702m), the same proportion as in 1998-99, and Commonwealth government 38% (\$3,923m), down from 39% in 1998-99. State/territory/local government as a source of funds provided 8%, the same as in 1998-99. Other Australian sources provided 5%, the same as in 1998-99. Overseas provided 3% of funds, up from 2% in 1998-99. By comparison, in 1990-91 these sectors provided 41%, 44%, 11%, 3% and 1% of funding respectively.

### TYPE OF ACTIVITY

Experimental development remained the predominant activity on which R&D funds were expended, accounting for 38% (\$3,891m) of gross expenditure on R&D, down from 41% in 1998-99. Applied research accounted for 36% of gross R&D expenditure in 2000-01, up from 32% in 1998-99. Strategic basic research accounted for 15%, as it did in 1998-99, and Pure basic research accounted for 10%, down from 11% in 1998-99.

In 2000-01, the Higher education sector accounted for 79% (\$847m) of expenditure on Pure basic research and 42% (\$666m) of expenditure on Strategic basic research, and was the main contributor to each of these activities. The Government sector accounted for 38% (\$1,405m) of expenditure on Applied research and was the major contributor to this activity. The Business sector accounted for 86% of Experimental development activity with expenditure of \$3,333m.

## MAIN FEATURES *continued*

### LOCATION OF EXPENDITURE

The leading states in terms of location of gross R&D expenditure in 2000–01 were New South Wales at \$3,086m and Victoria at \$3,043m, each accounting for 30% of total expenditure on R&D. Next in order were Queensland (13%), Western Australia (9%) and South Australia (8%).

### EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE (SEO)

In 2000–01, 63% (\$6,494m) of R&D expenditure was directed towards Economic development. Society accounted for a further 19% of R&D expenditure, followed by Non-oriented research (7%), Environment (6%) and Defence (4%). Manufacturing accounted for 36% (\$2,323m) of R&D expenditure within Economic development.

Economic development accounted for the majority of expenditure on R&D in the Business sector with 89%, in the Commonwealth government sector with 57%, and in the State/territory government sector with 59%.

Society was the main purpose of R&D expenditure in the Higher education sector with 40% and in the Private non-profit sector with 97%.

### EXPENDITURE BY RESEARCH FIELD

The bulk of the Business sector's R&D expenditure was in Engineering and technology (55%) and Information, computing and communication sciences (26%).

The research fields in which most Commonwealth government expenditure occurred were Engineering and technology (25%), Agricultural, veterinary and environmental sciences (16%), Information, computing and communication sciences (13%) and Earth sciences (13%).

State/territory government expenditure on R&D was mainly in Agricultural, veterinary and environmental sciences (57%), Medical and health sciences (17%) and Biological sciences (11%).

The research fields in which significant Higher education R&D expenditure occurred included Medical and health sciences (24%), Biological sciences (12%) and Engineering and technology (11%).

The majority of the Private non-profit sector's R&D expenditure was in Medical and health sciences (64%) and Biological sciences (27%).

### TYPE OF EMPLOYEE

Total person years of effort for 2000–01 was 95,254, an increase of 3,470 person years on 1998–99. The effort by researchers increased by 4% from 63,043 to 65,805 person years. R&D effort by Technicians and Other supporting staff increased by 2% from 28,741 to 29,450 person years.

Researchers were the predominant type of employee in total person years for all sectors, accounting for approximately 85% of Higher education person years, 57% of Business person years, 49% of Government person years, and 55% of Private non-profit person years of effort.

### HUMAN RESOURCES BY SEO

Of the total person years expended on R&D, Economic development accounted for 50%, Society for 28%, Non-oriented research for 13%, Environment for 7% and Defence for 3%. This pattern is noticeably different to that for expenditure reflecting the fact that average R&D expenditure per person year of effort differs across the sectors. In particular, it is considerably lower for the Higher education sector because a major part

## MAIN FEATURES *continued*

### HUMAN RESOURCES BY SEO *continued*

of the R&D is carried out by postgraduates and the research is generally directed towards objectives requiring less capital.

### HUMAN RESOURCES BY RESEARCH FIELD

The bulk of the Business sector's human resource effort was in Engineering and technology (50%) and Information, computing and communication sciences (30%).

The main research fields that the Commonwealth government sector's human resource effort was directed towards included Engineering and technology (27%) and Agricultural, veterinary and environmental sciences (17%).

State/territory government human resource effort was predominantly expended in Agricultural, veterinary and environmental sciences (51%) and Medical and health sciences (24%).

The significant research fields in which Higher education human resource efforts were expended were Medical and health sciences (19%), Engineering and technology (11%) and Biological sciences (10%).

The majority of the Private non-profit sector's human resource effort was directed towards Medical and health sciences (61%) and Biological sciences (32%).

## EXPENDITURE, By type of expenditure

<i>Sector</i>	<i>Total</i>	<i>Land and buildings</i>	<i>Other capital expenditure</i>	<i>Labour costs(a)</i>	<i>Other current expenditure(b)</i>
	\$'000	\$'000	\$'000	\$'000	\$'000
<b>1998–99</b>					
Business	r4 091 208	r80 300	r373 182	r1 660 333	r1 977 393
Government					
Commonwealth	r1 207 137	r28 771	r73 278	r643 588	r461 499
State/territory	r862 829	r28 888	r29 461	r425 430	r379 050
Higher education	r2 555 117	34 773	145 472	r1 158 993	r1 215 879
Private non-profit	r220 134	r6 753	r16 706	r109 812	r86 863
<b>Total</b>	<b>r8 936 425</b>	<b>r179 485</b>	<b>r638 099</b>	<b>r3 998 156</b>	<b>r4 120 684</b>
<b>2000–01</b>					
Business	4 825 304	39 955	394 955	2 129 736	2 260 658
Government					
Commonwealth	1 424 794	75 059	58 150	734 574	557 012
State/territory	943 573	53 253	25 560	473 151	391 609
Higher education	2 774 564	48 571	165 277	1 214 000	1 346 716
Private non-profit	283 200	25 845	17 032	132 684	107 639
<b>Total</b>	<b>10 251 436</b>	<b>242 683</b>	<b>660 974</b>	<b>4 684 144</b>	<b>4 663 634</b>

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(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.

(b) For Higher education sector, includes scholarships for research higher degrees.



## EXPENDITURE, By source of funds

		Commonwealth government	State and local government	Business	Other Australian(a)	Overseas
<i>Sector</i>	<i>Total</i> \$'000	\$'000	\$'000	\$'000	\$'000	\$'000
1998-99						
Business	r4 091 208	r112 660	r9 060	r3 791 655	r37 337	r140 496
Government						
Commonwealth	r1 207 137	r1 007 758	r24 932	r71 702	76 610	26 135
State/territory	r862 829	r74 483	r604 796	r58 052	r121 269	r4 230
Higher education	r2 555 117	(b)r2 218 409	68 802	135 778	90 907	41 220
Private non-profit	r220 134	r56 058	r28 131	r30 045	r91 845	r14 055
<b>Total</b>	<b>r8 936 425</b>	<b>r3 469 367</b>	<b>r735 721</b>	<b>r4 087 232</b>	<b>r417 968</b>	<b>r226 136</b>
2000-01						
Business	4 825 304	170 736	8 398	4 415 767	22 983	207 419
Government						
Commonwealth	1 424 794	1 213 177	27 491	76 922	73 011	34 194
State/territory	943 573	71 399	650 125	54 508	159 863	7 678
Higher education	2 774 564	(c)2 395 613	87 859	136 221	94 219	60 652
Private non-profit	283 200	72 529	29 774	18 389	136 201	26 308
<b>Total</b>	<b>10 251 436</b>	<b>3 923 455</b>	<b>803 647</b>	<b>4 701 807</b>	<b>486 277</b>	<b>336 250</b>

r revised

(a) Includes funds provided via government levies.

(b) Includes \$1,614m of General University funds (GUF), the majority of which is funding from the Commonwealth government.

(c) Includes \$1,746m of General University funds (GUF), the majority of which is funding from the Commonwealth government.

## EXPENDITURE, By type of activity(a)

	<i>Total</i>	<i>Pure basic research</i>	<i>Strategic basic research</i>	<i>Applied research</i>	<i>Experimental development</i>
<i>Sector</i>	\$'000	\$'000	\$'000	\$'000	\$'000
<b>1998–99</b>					
Business	r4 091 208	20 848	r116 776	r795 360	r3 158 225
Government					
Commonwealth	r1 207 137	64 689	r375 120	r571 130	r196 198
State/territory	r862 829	r29 949	r127 108	r573 302	r132 470
Higher education	r2 555 117	r856 735	r650 031	r892 244	r156 106
Private non-profit	r220 134	r46 709	r94 257	r61 147	r18 021
<b>Total</b>	<b>r8 936 425</b>	<b>r1 018 930</b>	<b>r1 363 292</b>	<b>r2 893 183</b>	<b>r3 661 019</b>
<b>2000–01</b>					
Business	4 825 304	38 213	265 831	1 188 245	3 333 015
Government					
Commonwealth	1 424 794	71 142	416 325	731 625	205 703
State/territory	943 573	36 335	116 779	673 626	116 832
Higher education	2 774 564	847 358	665 769	1 047 741	213 696
Private non-profit	283 200	73 945	121 572	65 438	22 245
<b>Total</b>	<b>10 251 436</b>	<b>1 066 994</b>	<b>1 586 276</b>	<b>3 706 675</b>	<b>3 891 491</b>

r revised

(a) See paragraph 6 of the Explanatory Notes.

## EXPENDITURE, By location

	<i>Aust.</i>	<i>NSW</i>	<i>Vic.</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas.</i>	<i>NT</i>	<i>ACT and Ext. Terr.</i>	<i>Overseas</i>
<i>Sector</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
1998-99										
Business Government	r4 091 208	r1 391 577	r1 445 212	r433 868	r248 516	r440 177	r38 549	16 509	r34 283	r42 517
Commonwealth	r1 207 137	r238 840	r315 595	111 637	177 519	64 263	77 051	14 604	r202 600	5 029
State/territory	r862 829	r246 788	r146 775	r235 454	r86 499	r101 441	11 542	r27 759	r4 013	r2 559
Higher education	r2 555 117	r761 152	557 127	397 671	240 791	225 547	59 417	14 611	298 803	—
Private non-profit	r220 134	r47 724	r144 170	r3 957	r3 273	r12 506	np	r6 184	np	r524
<b>Total</b>	<b>r8 936 425</b>	<b>r2 686 081</b>	<b>r2 608 880</b>	<b>r1 182 586</b>	<b>r756 598</b>	<b>r843 933</b>	np	<b>r79 667</b>	np	<b>r50 627</b>

2000-01										
Business Government	4 825 304	1 698 666	1 685 859	512 073	294 735	472 807	48 850	14 871	34 478	62 965
Commonwealth	1 424 794	246 129	345 430	119 555	192 125	74 210	91 813	16 861	333 592	5 080
State/territory	943 573	274 013	187 697	240 282	95 538	105 480	6 471	28 957	2 270	2 864
Higher education	2 774 564	810 908	630 908	463 559	223 155	245 000	74 456	18 333	308 244	—
Private non-profit	283 200	56 692	192 795	4 516	4 184	16 734	np	4 351	np	969
<b>Total</b>	<b>10 251 436</b>	<b>3 086 408</b>	<b>3 042 689</b>	<b>1 339 985</b>	<b>809 737</b>	<b>914 232</b>	np	<b>83 373</b>	np	<b>71 879</b>

r revised

— nil or rounded to zero (including null cells)

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

## EXPENDITURE, By socio-economic objective(a)

	GOVERNMENT					Private non-profit
	Total	Business	Common-wealth	State/territory	Higher education	
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<i>Defence</i>	360 962	117 936	238 665	—	4 361	—
<i>Economic development</i>						
Plant — production and primary products	np	46 793	117 039	275 445	108 583	np
Animal — production and primary products	417 804	55 453	89 662	208 137	64 496	56
Mineral resources (excl. energy)	441 210	317 217	71 654	10 248	42 091	—
Energy resources	201 269	103 566	59 751	5 514	32 438	—
Energy supply	181 239	121 813	28 307	36	31 083	—
Manufacturing	2 323 226	1 946 957	204 293	28 492	140 674	2 810
Construction	147 409	59 933	30 751	2 489	54 128	108
Transport	123 690	80 569	9 688	10 649	22 783	—
Information and communication services	np	1 368 731	50 468	2 347	127 698	np
Commercial services and tourism	260 860	208 983	10 816	596	40 442	23
Economic framework	297 568	7 815	143 979	14 677	130 927	169
<i>Total economic development</i>	6 493 571	4 317 832	816 407	558 629	795 346	5 359
<i>Society</i>						
Health	1 490 243	276 063	19 233	193 770	744 298	256 879
Education and training	151 114	9 514	2 227	12 541	109 980	16 853
Social development and community services	356 827	24 872	33 834	27 946	268 738	1 437
<i>Total society</i>	1 998 183	310 449	55 294	234 256	1 123 015	275 169
<i>Environment</i>						
Environmental policy frameworks and other aspects	88 274	10 561	17 934	32 481	25 211	2 088
Environmental management	577 924	61 999	271 130	109 773	134 909	113
<i>Total environment</i>	666 199	72 560	289 064	142 254	160 120	2 201
<i>Non-oriented research</i>	732 520	6 528	25 365	8 434	691 722	471
<b>Total</b>	<b>10 251 436</b>	<b>4 825 304</b>	<b>1 424 794</b>	<b>943 573</b>	<b>2 774 564</b>	<b>283 200</b>

— nil or rounded to zero (including null cells)

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

(a) The research classifications used in this publication differ from those used in earlier years. See paragraph 11 of the Explanatory Notes.

## EXPENDITURE, By research field(a)

<i>Research field</i>	GOVERNMENT					<i>Private non-profit</i>
	<i>Total</i>	<i>Business</i>	<i>Common-wealth</i>	<i>State/territory</i>	<i>Higher education</i>	
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Mathematical sciences	116 306	30 660	22 918	2 212	59 393	1 124
Physical sciences	257 296	51 397	92 465	792	112 025	617
Chemical sciences	398 776	173 654	88 409	6 889	127 196	2 628
Earth sciences	360 113	50 376	181 490	33 628	94 619	—
Biological sciences	783 432	122 002	153 268	106 519	324 509	77 133
Information, computing and communication sciences	1 592 170	1 259 291	187 019	29 784	113 136	2 940
Engineering and technology	np	2 653 703	359 357	25 405	309 070	np
Agricultural, veterinary and environmental sciences	np	153 700	233 954	539 309	204 513	np
Medical and health sciences	1 330 642	299 485	25 475	157 190	667 716	180 777
Other research fields	932 226	31 035	80 441	41 845	762 388	16 518
<b>Total</b>	<b>10 251 436</b>	<b>4 825 304</b>	<b>1 424 794</b>	<b>943 573</b>	<b>2 774 564</b>	<b>283 200</b>

— nil or rounded to zero (including null cells)

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

(a) The research classifications used in this publication differ from those used in earlier years. See paragraph 11 of the Explanatory Notes.

## HUMAN RESOURCES, By type of employee

		<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
<i>Sector</i>	person years	person years	person years	person years	person years
1998-99					
Business	r25 104	r14 767	r7 096	r3 240	
Government					
Commonwealth	r9 516	r3 989	r3 537	r1 990	
State/territory	r9 194	r4 768	r3 392	r1 034	
Higher education	45 502	38 137	(a)na	(a)7 365	
Private non-profit	r2 468	r1 382	r793	r294	
<b>Total</b>	<b>r91 784</b>	<b>r63 043</b>	<b>r14 818</b>	<b>r13 923</b>	
2000-01					
Business	27 839	15 830	7 998	4 011	
Government					
Commonwealth	9 711	4 524	3 328	1 859	
State/territory	8 697	4 448	3 156	1 092	
Higher education	46 287	39 507	(a)na	(a)6 780	
Private non-profit	2 721	1 496	935	291	
<b>Total</b>	<b>95 254</b>	<b>65 805</b>	<b>15 418</b>	<b>14 032</b>	

r revised

na not available

(a) Technicians for the Higher education sector are not separately identified. They are included in other supporting staff.

## HUMAN RESOURCES, By socio-economic objective(a)

<i>Socio-economic objective</i>	GOVERNMENT .....					
	<i>Total</i>	<i>Business</i>	<i>Common- wealth</i>	<i>State/ territory</i>	<i>Higher education</i>	<i>Private non- profit</i>
	person years	person years	person years	person years	person years	person years
<i>Defence</i>	2 755	712	1 975	—	68	—
<i>Economic development</i>						
Plant — production and primary products	np	389	906	2 322	1 638	np
Animal — production and primary products	3 450	269	642	1 594	944	1
Mineral resources (excl. energy)	2 192	1 100	478	66	549	—
Energy resources	1 140	332	330	38	439	—
Energy supply	1 275	629	171	1	475	—
Manufacturing	15 861	12 113	1 379	220	2 128	22
Construction	1 666	348	205	14	1 097	1
Transport	1 128	644	58	34	391	—
Information and communication services	np	7 753	380	29	1 976	np
Commercial services and tourism	1 989	1 289	70	7	623	1
Economic framework	3 336	77	779	86	2 392	2
<i>Total economic development</i>	47 446	24 942	5 397	4 410	12 652	45
<i>Society</i>						
Health	16 706	1 461	122	2 438	10 171	2 515
Education and training	3 078	94	18	117	2 741	109
Social development and community services	6 818	198	296	253	6 055	15
<i>Total society</i>	26 602	1 753	436	2 808	18 967	2 639
<i>Environment</i>						
Environmental policy frameworks and other aspects	930	73	130	312	391	25
Environmental management	5 373	304	1 593	1 087	2 386	3
<i>Total environment</i>	6 303	378	1 723	1 399	2 777	28
<i>Non-oriented research</i>	12 147	54	181	80	11 824	9
<b>Total</b>	<b>95 254</b>	<b>27 839</b>	<b>9 711</b>	<b>8 697</b>	<b>46 287</b>	<b>2 721</b>

— nil or rounded to zero (including null cells)

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

(a) The research classifications used in this publication differ from those used in earlier years. See paragraph 11 of the Explanatory Notes.

## HUMAN RESOURCES, By research field(a)

Research field	GOVERNMENT .....					
	<i>Total</i>	<i>Business</i>	<i>Common- wealth</i>	<i>State/ territory</i>	<i>Higher education</i>	<i>Private non- profit</i>
	person years	person years	person years	person years	person years	person years
Mathematical sciences	1 332	245	205	30	844	8
Physical sciences	2 364	408	681	6	1 265	4
Chemical sciences	3 597	1 198	585	65	1 729	21
Earth sciences	3 080	189	1 014	312	1 565	—
Biological sciences	8 255	685	1 032	974	4 680	883
Information, computing and communication sciences	11 470	8 389	1 071	170	1 813	27
Engineering and technology	21 685	13 916	2 611	194	4 961	4
Agricultural, veterinary and environmental sciences	10 115	914	1 652	4 403	3 137	9
Medical and health sciences	14 361	1 632	179	2 116	8 770	1 665
Other research fields	18 994	263	683	426	17 522	101
<b>Total</b>	<b>95 254</b>	<b>27 839</b>	<b>9 711</b>	<b>8 697</b>	<b>46 287</b>	<b>2 721</b>

— nil or rounded to zero (including null cells)

(a) The research classifications used in this publication differ from those used in earlier years. See paragraph 11 of the Explanatory Notes.



## EXPLANATORY NOTES

### INTRODUCTION

**1** This publication presents summary statistics of expenditure and human resources devoted to R&D carried out in Australia by organisations within the Business, Government and Private non-profit sectors during 2000–01 and the Higher education sector during the 2000 calendar year.

**2** The statistics presented in this publication have previously been published (at a more detailed level) on an individual sector basis (see paragraph 14).

### DATA SOURCES

**3** Information relating to data sources is as follows:

- Business — the statistics 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 2001. 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). The survey was conducted by mailed questionnaires and a 92% 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 2000–01 reported previously. Where R&D activity had not been previously reported, the non-respondents were also deemed to be non-R&D performers for the current year.
- Government and Private non-profit — the statistics have been compiled from data collected from Government and Private non-profit organisations in the ABS Survey of Research and Experimental Development in respect of the year ended 30 June 2001. This survey was based on a complete enumeration of Government and Private non-profit organisations identified by the ABS as likely R&D performers. The survey was conducted by mail questionnaire and a 96% response rate was obtained. The ABS believes that the non-respondents were non-R&D performers.
- Higher education — the statistics have been compiled from data collected from universities in the ABS Survey of Research and Experimental Development in respect of the year ended 31 December 2000.

**4** The GDP figures used to derive GERD/GDP ratios are current at the time of manuscript finalisation (*Australian National Accounts: National Income, Expenditure and Product, March Quarter 2002* (cat. no. 5206.0)), and, at current prices, are as follows: \$471,348m (1994–95); \$529,886m (1996–97); \$591,592m (1998–99) and \$672,223m (2000–01). The available GERD/GDP ratios for other OECD countries are current at the time of manuscript finalisation and are sourced from *Main Science and Technology Indicators, 2002/1*, OECD, Paris, 2002.

### DEFINITIONS

**5** 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'.

**6** 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 respondents at the time of reporting, using OECD/ABS definitions. The ABS makes every effort to ensure correct and consistent interpretation and reporting of this data and applies consistent processing methodologies. Analysts using this classification should bear the original subjectivity in mind.

## EXPLANATORY NOTES *continued*

### DEFINITIONS *continued*

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

### SCOPE

**8** The sector classification used in the compilation of these statistics is adapted from the guidelines specified by the OECD for use in the conduct of R&D surveys.

**9** Four sectors are recognised:

- Business — 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 cost of production, and the private non-profit institutions mainly serving them.
  - 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).
- Government — includes all Commonwealth, state and local government departments and authorities.
  - The Government sector for the R&D survey excludes local government organisations because it is considered that their contribution to total R&D activity would be minimal. Public sector organisations mainly engaged in higher education (e.g. universities) are included in the Higher education sector whilst those mainly engaged in trading or financial activities are included in the Business sector.
- Higher education — includes all universities and other institutions of post-secondary education whatever their source of finance or legal status.
  - The Higher education sector for the R&D survey excludes non-university post-secondary education institutions (e.g. Technical and Further Education colleges) because it is considered that their contribution to total R&D activity would be minimal.
- Private non-profit — includes private or semi-public incorporated organisations which are established with the intention of not making a profit.

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

**10** The statistics in this publication are classified by the Socio-economic objective classification and research fields (from the Research fields, courses and disciplines classification). For more information on these classifications see the *Australian Standard Research Classification, 1998* (cat. no. 1297.0).

### COMPARABILITY WITH PREVIOUS STATISTICS

**11** The research classifications used in this publication differ from those used in earlier years. The classifications used in this publication were from the 1998 edition of the Australian Standard Research Classification whereas the 1993 edition was used for previous publications.

### RELIABILITY OF STATISTICS

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

- Many data providers had to make estimates because their accounts do not separately record data on R&D activity

## EXPLANATORY NOTES *continued*

### RELIABILITY OF STATISTICS

*continued*

- The OECD standard definition of R&D used in this survey differs in some respects from what respondents may regard as R&D activity, particularly since the definitions used within the Grants for Industry R&D scheme for the allocation of grants, and the 125% Tax Concession Scheme for tax deductibility for specific R&D activities undertaken within Australia, differ slightly from the R&D survey definition.
- Some data providers had difficulties describing their R&D programs in terms of Socio-economic objectives, Research fields, courses and disciplines and Type of R&D activity. The data presented under these classifications therefore reflect a degree of subjectivity.

### UNPUBLISHED STATISTICS

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

### RELATED PUBLICATIONS

- 14** Users may also wish to refer to the following publications:
- Australian Standard Research Classification (ASRC), 1998* cat. no. 1297.0  
*Main Science and Technology Indicators 2002/1*, OECD, Paris, 2002  
*Research and Experimental Development, Businesses, Australia, 2000–01* cat. no. 8104.0  
*Research and Experimental Development, Government and Private Non-profit Organisations, Australia, 2000–01* cat. no. 8109.0  
*Research and Experimental Development, Higher Education Organisations, Australia, 2000* cat. no. 8111.0  
*The Measurement of Scientific and Technological Activities ('Frascati Manual' 1993)* OECD, Paris, 1994
- 15** 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

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

## GLOSSARY

<b>Applied research</b>	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.
<b>Basic research</b>	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.
<b>Capital expenditure</b>	Expenditure on the acquisition of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment attributable to R&D activity.
<b>Current expenditure</b>	Expenditure on labour costs, materials, fuels, rent, leasing, repairs, maintenance and data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
<b>Experimental development</b>	Systematic work, using existing knowledge gained from research or practical experience, for the purpose of creating new or improved products/processes.
<b>Gross expenditure on R&amp;D</b>	The sum of intramural R&D expenditures incurred by all organisations in the survey.
<b>Human resources devoted to R&amp;D</b>	The effort of researchers, technicians and other staff directly involved with R&D activity. Overhead staff (e.g. administrative and general service employees such as personnel officers, janitors etc.) whose work indirectly supports R&D, are excluded.
<b>Labour costs</b>	Wages and salaries, overtime allowances, penalty rates, leave loadings, bonuses, commission payments, all paid leave, employer contributions to superannuation and pension schemes, payroll tax, fringe benefits tax, payments to contract staff on the payroll, severance, termination and redundancy payments and workers compensation insurance.
<b>Other current expenditure</b>	Expenditure on materials, fuels, rent, hiring, repairs, maintenance and data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
<b>Other supporting staff</b>	Skilled and unskilled craftspersons, secretarial and clerical staff directly associated with R&D activity.
<b>R&amp;D activity</b>	Systematic investigation or experimentation involving innovation or technical risk, the outcome of which is new knowledge, with or without a specific practical application, or new or improved products, processes, materials, devices or services. R&D activity extends to modifications to existing products/processes. R&D activity ceases and pre-production begins when work is no longer experimental.
<b>Research fields, courses and disciplines</b>	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.
<b>Researchers</b>	Those involved with the conception and/or development of new knowledge, products, processes, methods and systems, and in the management of the projects concerned.
<b>Socio-economic objective</b>	The area of expected national benefit rather than the immediate objectives of the researcher. The SEO classification defines the main areas of Australian economic and social activity to which the results of research programs are applied. It describes the purpose of the research; i.e. why the research is being performed.

## GLOSSARY *continued*

Technicians	Those performing technical tasks in support of R&D activity, normally under the direction and supervision of a researcher. These tasks include the preparation of experiments, the taking of records, the preparation of charts and graphs, and the coding of data.
Type of R&D activity	Comprises basic research, applied research and experimental development.





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