



RESEARCH AND EXPERIMENTAL DEVELOPMENT

# **GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS**

**AUSTRALIA**

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## NOTES

RESEARCH AND  
DEVELOPMENT (R&D)  
GUIDELINES

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

SYMBOLS AND OTHER  
USAGES

n.a. not available  
r revised since previous issue  
— nil or rounded to zero

W. McLennan  
Australian Statistician

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## MAIN FEATURES

### EXPENDITURE ON R&D

Expenditure on R&D carried out by Government organisations (GOVERD) in Australia in 1996–97 was estimated to be \$2,090m at current prices. This represented an increase of 5% over the two years since 1994–95. At average 1989–90 prices, R&D expenditure was estimated to be \$1,739m, an increase of 1% compared with 1994–95.

GOVERD represented 0.40% of Gross Domestic Product (GDP), down slightly from 0.43% in 1994–95.

Expenditure on R&D carried out by Private non-profit organisations in Australia in 1996–97 was estimated to be \$171m at current prices. This represented an increase of 10% compared with 1994–95. At average 1989–90 prices, R&D expenditure was estimated to be \$139m, an increase of 2% compared with 1994–95.

### HUMAN RESOURCES DEVOTED TO R&D

Human resources devoted to R&D in Australia by Government organisations in 1996–97 was estimated to be 19,518 person years. This represents a 1% increase over 1994–95.

Human resources devoted to R&D in Australia by Private non-profit organisations in 1996–97 was estimated to be 2,124 person years. This represents a 25% increase over 1994–95.

### PURPOSE OF RESEARCH

Most expenditure on R&D by Government organisations was directed towards Economic development (\$1,132m or 54%), up slightly from 53% in 1994–95. Expenditure on the Environment increased from \$370m or 19% in 1994–95 to \$412m or 20% in 1996–97.

Private non-profit organisations continued to mainly direct their R&D towards Health (\$138m or 80%).

## SECTION 1

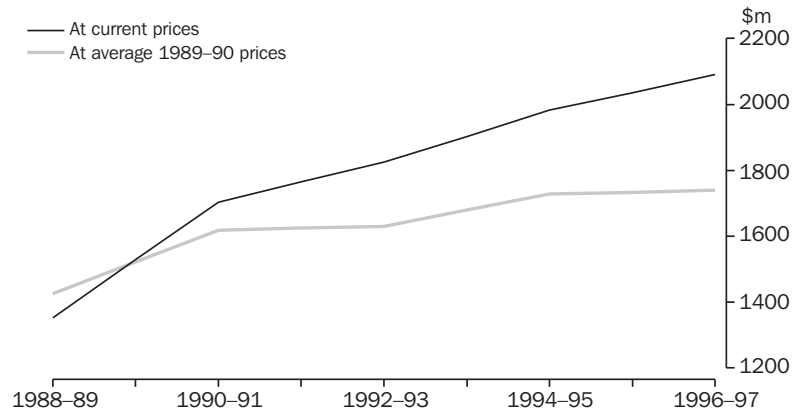
## GENERAL GOVERNMENT INTRAMURAL R&D

### EXPENDITURE ON R&D

GOVERD has increased every year since 1988–89 in both current prices and average 1989–90 prices.

Commonwealth government organisations in 1996–97 accounted for 61% of R&D expenditure in the Government sector.

#### 1.1 EXPENDITURE ON R&D



## 1.2

### EXPENDITURE ON R&D

	1988-89	1990-91	1992-93 <i>r</i>	1994-95 <i>r</i>	1996-97
	\$m	\$m	\$m	\$m	\$m
AT CURRENT PRICES					
Government organisations					
Commonwealth	869.6	1 034.0	1 155.4	1 196.7	1 265.6
State	482.7	670.0	668.5	785.9	824.6
<b>Total</b>	<b>1 352.3</b>	<b>1 704.0</b>	<b>1 823.9</b>	<b>1 982.6</b>	<b>2 090.2</b>
AT AVERAGE 1989-90 PRICES					
Government organisations					
Commonwealth	914.4	989.2	1 039.6	1 045.9	1 062.3
State	510.9	630.0	591.1	681.3	676.5
<b>Total</b>	<b>1 425.3</b>	<b>1 619.2</b>	<b>1 630.7</b>	<b>1 727.2</b>	<b>1 738.8</b>

### GOVERD AS A PERCENTAGE OF GDP

GOVERD as a percentage of GDP was 0.40% in 1988–89, rose to 0.45% in 1990–91 and 1992–93 before falling to 0.43% in 1994–95 and 0.40% in 1996–97.

### 1.3 GOVERD AS A PERCENTAGE OF GDP



Australia has a high GOVERD/GDP ratio when compared with other Organisation for Economic Co-operation and Development (OECD) countries for which comparable data are available.

### 1.4 GOVERD/GDP RATIOS OF OECD COUNTRIES

Country	1994-95	1996-97
Iceland	0.57	0.62
France	0.49	0.47
Finland	0.44	0.41
<b>Australia</b>	<b>0.43</b>	<b>0.40</b>
Germany	0.35	0.36
Czech Republic	0.32	0.33
United Kingdom	0.31	0.28
Japan	0.26	0.27
Canada	0.27	0.25
Poland	0.29	0.24
United States	0.25	0.23
Italy	0.23	0.22
Spain	0.17	0.16

### HUMAN RESOURCES DEVOTED TO R&D

Human resources devoted to research by Government organisations steadily increased over the years to peak in 1992-93 at 19,804 person years, before falling 2% to 19,360 person years in 1994-95. It has since risen slightly to 19,518 person years in 1996-97.

### 1.5 HUMAN RESOURCES DEVOTED TO R&D

	1988-89	1990-91	1992-93 <i>r</i>	1994-95 <i>r</i>	1996-97
	<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>
Government organisations					
Commonwealth	10 863	10 670	11 019	10 665	10 342
State	8 335	8 990	8 785	8 695	9 176
<b>Total</b>	<b>19 198</b>	<b>19 660</b>	<b>19 804</b>	<b>19 360</b>	<b>19 518</b>

## TYPE OF EXPENDITURE

Labour costs continued to be the main component of General government R&D expenditure (49%), up from 46% in 1994–95. Capital expenditure remained at 13% of R&D expenditure.

Purpose of research Socio-economic objectives (SEO's) on which most General government R&D expenditure occurred were: Economic development (\$1,132m), Environment (\$412m) and Society (\$249m). Within Economic development, the main objectives were Plant production and primary products (\$294m), Animal production and primary products (\$280m) and Manufacturing (\$212m).

**1.6**

## EXPENDITURE, BY SOCIO-ECONOMIC OBJECTIVE—TYPE OF EXPENDITURE

	Total	Land and buildings	Other capital expenditure	Labour costs(a)	Other current expenditure
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	234 004	8 893	24 970	120 468	79 674
<b>Economic development</b>					
Plant—production and primary products	293 824	18 458	10 438	150 883	114 044
Animal—production and primary products	280 218	17 252	11 500	135 308	116 158
Mineral resources (excl. energy)	83 000	10 571	4 068	38 131	30 230
Energy resources	93 798	30 559	2 621	24 712	35 907
Energy supply	23 954	2 089	1 018	12 756	8 091
Manufacturing	211 789	11 753	11 490	113 331	75 215
Construction	35 876	1 668	1 719	19 870	12 619
Transport	15 653	592	975	7 949	6 136
Information and communication services	44 702	3 310	3 569	23 043	14 780
Commercial services	10 668	567	856	5 712	3 533
Economic framework	38 550	599	1 411	22 769	13 772
<i>Total</i>	<b>1 132 033</b>	<b>97 418</b>	<b>49 665</b>	<b>554 463</b>	<b>430 486</b>
<b>Society</b>					
Health	199 245	3 996	11 539	112 995	70 715
Education and training	13 601	252	1 128	7 024	5 197
Social development and community services	36 409	3 017	966	21 050	11 376
<i>Total</i>	<b>249 256</b>	<b>7 265</b>	<b>13 633</b>	<b>141 069</b>	<b>87 288</b>
<b>Environment</b>					
Environmental knowledge	280 784	28 780	12 099	114 506	125 399
Environmental aspects of economic development	94 157	6 110	4 418	46 981	36 648
Environmental management and other aspects	37 412	4 650	2 094	16 252	14 416
<i>Total</i>	<b>412 353</b>	<b>39 540</b>	<b>18 611</b>	<b>177 739</b>	<b>176 463</b>
<b>Advancement of knowledge</b>					
Natural sciences, technologies and engineering	56 108	6 587	7 433	23 545	18 543
Social sciences and humanities	6 437	698	171	3 374	2 193
<i>Total</i>	<b>62 545</b>	<b>7 285</b>	<b>7 604</b>	<b>26 919</b>	<b>20 736</b>
<b>Total</b>	<b>2 090 191</b>	<b>160 402</b>	<b>114 483</b>	<b>1 020 658</b>	<b>794 647</b>
Commonwealth contribution	1 265 578	110 763	76 559	616 700	461 556
State contribution	824 614	49 639	37 925	403 959	333 091

(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.



Field of research (FOR) The FOR's in which most General government R&D expenditure occurred were: Agricultural sciences (\$617m); Earth sciences (\$260m) and Biological Sciences (\$240m).

## 1.7 EXPENDITURE, BY FIELD OF RESEARCH—TYPE OF EXPENDITURE

<i>Field of research</i>	<i>Total</i>	<i>Land and buildings</i>	<i>Other capital expenditure</i>	<i>Labour costs(a)</i>	<i>Other current expenditure</i>
	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Natural sciences, technologies and engineering					
Mathematical sciences	33 047	853	976	22 324	8 893
Physical sciences	88 598	3 849	11 923	43 883	28 943
Chemical sciences	80 779	3 449	4 675	42 948	29 708
Earth sciences	260 416	60 414	10 198	85 522	104 282
Information, computers and communication technologies	178 420	8 502	16 123	93 267	60 528
Applied sciences and technologies	190 595	10 874	14 036	99 679	66 006
General engineering	119 550	5 703	7 928	63 640	42 280
Biological sciences	239 756	16 645	10 864	113 196	99 051
Agricultural sciences	616 812	39 794	23 297	298 278	255 442
Medical and health sciences	191 099	4 450	10 973	108 065	67 612
<i>Total</i>	<i>1 999 072</i>	<i>154 532</i>	<i>110 992</i>	<i>970 803</i>	<i>762 746</i>
Social sciences and humanities					
Accounting and finance	98	—	—	94	4
Economics	34 745	1 554	1 007	19 195	12 989
Political sciences	3 254	—	71	1 907	1 276
Sociology	5 758	632	162	3 090	1 874
Law	5 553	40	42	3 468	2 003
Psychology	6 395	284	507	3 355	2 249
Education	9 072	106	1 023	4 808	3 134
Other social sciences	21 130	2 399	451	11 870	6 410
Humanities	5 114	854	228	2 068	1 963
<i>Total</i>	<i>91 119</i>	<i>5 870</i>	<i>3 492</i>	<i>49 856</i>	<i>31 901</i>
<b>Total</b>	<b>2 090 191</b>	<b>160 402</b>	<b>114 483</b>	<b>1 020 658</b>	<b>794 647</b>
Commonwealth contribution	1 265 578	110 763	76 559	616 700	461 556
State contribution	824 614	49 639	37 925	403 959	333 091

(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 superannation and pension schemes.

## TYPE OF ACTIVITY

Applied research was 59% of government R&D expenditure, up from 57% in 1994–95. Pure basic research has remained steady at around 5% of R&D expenditure. Strategic basic research accounted for 23% and Experimental development 13%.

## Purpose of research

Applied research was the main type of activity in Defence, Economic development, Society and Environment accounting for 55%, 66%, 46% and 54% respectively.

**1.8**

## EXPENDITURE, BY SOCIO-ECONOMIC OBJECTIVE—TYPE OF ACTIVITY(a)

	Total	Pure basic research	Strategic basic research	Applied research	Experimental development
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	234 004	12 138	51 891	129 660	40 315
Economic development					
Plant—production and primary products	293 824	923	37 310	196 419	59 172
Animal—production and primary products	280 218	786	37 849	212 395	29 188
Mineral resources (excl. energy)	83 000	4 495	30 161	42 753	5 591
Energy resources	93 798	357	12 818	78 037	2 586
Energy supply	23 954	587	6 450	13 085	3 832
Manufacturing	211 789	3 000	60 325	112 659	35 805
Construction	35 876	31	7 132	22 730	5 984
Transport	15 653	106	1 705	9 015	4 827
Information and communication services	44 702	256	10 252	21 987	12 207
Commercial services	10 668	11	1 843	7 535	1 279
Economic framework	38 550	84	4 058	28 953	5 455
Total	1 132 033	10 634	209 903	745 568	165 928
Society					
Health	199 245	31 868	59 126	91 679	16 572
Education and training	13 601	700	4 204	6 331	2 367
Social development and community services	36 409	2 215	11 088	17 833	5 274
Total	249 256	34 782	74 418	115 843	24 213
Environment					
Environmental knowledge	280 784	15 119	109 555	140 559	15 551
Environmental aspects of economic development	94 157	1 535	28 032	54 980	9 610
Environmental management and other aspects	37 412	843	6 638	27 461	2 470
Total	412 353	17 497	144 226	223 000	27 631
Advancement of knowledge					
Natural sciences, technologies and engineering	56 108	28 124	9 764	14 901	3 320
Social sciences and humanities	6 437	4 847	538	917	135
Total	62 545	32 971	10 302	15 817	3 455
<b>Total</b>	<b>2 090 191</b>	<b>108 022</b>	<b>490 740</b>	<b>1 229 888</b>	<b>261 541</b>
Commonwealth contribution	1 265 578	57 811	391 433	671 277	145 057
State Contribution	824 614	50 211	99 308	558 611	116 484

(a) Data within this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. Analysts using this classification should bear the original subjectivity in mind. See Paragraph 8 of the Explanatory Notes.

## Field of research

Agricultural sciences had the highest percentage of Applied research (73%) while Humanities had the highest percentage of Pure basic research (69%).

# 1.9

## EXPENDITURE, BY FIELD OF RESEARCH—TYPE OF ACTIVITY(a)

<i>Field of research</i>	<i>Total</i>	<i>Pure basic research</i>	<i>Strategic basic research</i>	<i>Applied research</i>	<i>Experimental development</i>
	\$'000	\$'000	\$'000	\$'000	\$'000
<b>Natural sciences, technologies and engineering</b>					
Mathematical sciences	33 047	1 309	4 824	19 712	7 202
Physical sciences	88 598	24 058	17 702	34 419	12 420
Chemical sciences	80 779	2 465	26 038	37 060	15 216
Earth sciences	260 416	7 602	90 503	148 378	13 933
Information, computers and communication technologies	178 420	2 747	38 752	112 802	24 118
Applied sciences and technologies	190 595	5 550	43 496	98 737	42 813
General engineering	119 550	6 591	30 286	61 716	20 957
Biological sciences	239 756	18 204	80 523	127 076	13 953
Agricultural sciences	616 812	2 345	74 995	451 779	87 693
Medical and health sciences	191 099	30 219	56 248	89 139	15 493
<i>Total</i>	<i>1 999 072</i>	<i>101 090</i>	<i>463 366</i>	<i>1 180 818</i>	<i>253 799</i>
<b>Social sciences and humanities</b>					
Accounting and finance	98	—	10	—	88
Economics	34 745	177	11 186	22 672	710
Political sciences	3 254	—	602	2 309	343
Sociology	5 758	709	3 400	1 434	216
Law	5 553	1	4 505	707	340
Psychology	6 395	426	2 495	2 328	1 147
Education	9 072	11	2 209	4 766	2 085
Other social sciences	21 130	2 096	2 832	13 421	2 780
Humanities	5 114	3 513	136	1 432	33
<i>Total</i>	<i>91 119</i>	<i>6 932</i>	<i>27 375</i>	<i>49 070</i>	<i>7 742</i>
<b>Total</b>	<b>2 090 191</b>	<b>108 022</b>	<b>490 740</b>	<b>1 229 888</b>	<b>261 541</b>
Commonwealth contribution	1 265 578	57 811	391 433	671 277	145 057
State contribution	824 614	50 211	99 308	558 611	116 484

(a) Data within this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. Analysts using this classification should bear the original subjectivity in mind. See paragraph 8 of the Explanatory Notes.

SOURCE OF FUNDS FOR R&D

Most of the funding for General government R&D came from the government sector itself: 76% from within the organisation performing the R&D (own funds), 7% from other Commonwealth organisations and 2% from other State government organisations, totalling \$1,776m. The next major sources of funds were from joint government/business (\$130m, or 6%) and private businesses (\$110m, or 5%).

## 1.10 SOURCE OF FUNDS, BY SOCIO-ECONOMIC OBJECTIVE

Socio-economic objective	Total	Own funds		Commonwealth government	State and local government
		Commonwealth	State		
	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	234 004	227 675	1 828	3 531	—
Economic development					
Plant—production and primary products	293 824	55 973	153 720	14 209	5 361
Animal—production and primary products	280 218	67 794	143 997	19 050	2 434
Mineral resources (excl. energy)	83 000	56 579	6 986	4 109	593
Energy resources	93 798	76 978	2 754	2 684	319
Energy supply	23 954	16 235	1 631	1 248	297
Manufacturing	211 789	139 745	9 926	12 460	1 527
Construction	35 876	21 214	6 795	1 339	259
Transport	15 653	5 842	6 792	1 090	1 411
Information and communication services	44 702	26 333	9 839	2 084	776
Commercial services	10 668	7 498	1 235	558	65
Economic framework	38 550	32 227	1 960	1 363	971
Total	1 132 033	506 419	345 637	60 194	14 014
Society					
Health	199 245	13 923	70 798	34 001	19 896
Education and training	13 601	2 247	6 641	1 651	2 139
Social development and community services	36 409	19 084	10 818	2 370	2 560
Total	249 256	35 255	88 257	38 021	24 596
Environment					
Environmental knowledge	280 784	150 206	76 190	26 937	5 670
Environmental aspects of economic development	94 157	55 007	15 283	9 391	1 182
Environmental management and other aspects	37 412	14 052	16 353	2 680	531
Total	412 353	219 265	107 826	39 008	7 383
Advancement of knowledge					
Natural sciences, technologies and engineering	56 108	34 161	11 399	3 451	1 417
Social sciences and humanities	6 437	2 661	3 343	278	32
Total	62 545	36 822	14 742	3 729	1 448
<b>Total</b>	<b>2 090 191</b>	<b>1 025 437</b>	<b>558 290</b>	<b>144 484</b>	<b>47 441</b>
Commonwealth contribution	1 265 578	1 025 437	—	79 766	9 100
State contribution	824 614	—	558 290	64 718	38 341

...continued

## 1.10 SOURCE OF FUNDS, BY SOCIO-ECONOMIC OBJECTIVE—continued

<i>Socio-economic objective</i>	<i>Private businesses</i>	<i>Government owned businesses</i>	<i>Joint government/business(a)</i>	<i>Universities</i>	<i>Private non-profit and other Australian</i>	<i>Overseas</i>
	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Defence	581	202	—	—	62	125
Economic development						
Plant—production and primary products	12 696	712	49 589	296	320	946
Animal—production and primary products	6 772	43	36 799	71	2 695	563
Mineral resources (excl. energy)	12 443	9	878	450	68	884
Energy resources	8 988	85	1 442	114	288	146
Energy supply	3 608	173	173	13	371	204
Manufacturing	21 076	1 177	17 375	103	5 269	3 132
Construction	5 492	39	169	30	18	522
Transport	251	102	83	6	73	3
Information and communication services	2 324	371	2 579	48	70	277
Commercial services	795	194	89	7	148	79
Economic framework	1 108	482	—	—	108	331
<i>Total</i>	75 553	3 388	109 177	1 136	9 428	7 088
Society						
Health	21 895	1 131	1 415	6 163	25 125	4 898
Education and training	136	461	64	160	89	13
Social development and community services	166	48	781	256	310	17
<i>Total</i>	22 197	1 640	2 259	6 579	25 523	4 929
Environment						
Environmental knowledge	5 204	2 357	10 153	221	1 917	1 929
Environmental aspects of economic development	4 397	799	6 456	96	818	728
Environmental management and other aspects	429	780	2 065	12	140	370
<i>Total</i>	10 030	3 935	18 675	328	2 874	3 028
Advancement of knowledge						
Natural sciences, technologies and engineering	1 108	186	134	82	584	3 586
Social sciences and humanities	113	—	—	—	10	—
<i>Total</i>	1 221	186	134	82	595	3 586
<b>Total</b>	<b>109 582</b>	<b>9 351</b>	<b>130 245</b>	<b>8 126</b>	<b>38 482</b>	<b>18 755</b>
Commonwealth contribution	71 800	4 836	48 094	1 646	11 843	13 057
State contribution	37 782	4 515	82 151	6 480	26 639	5 698

(a) Includes funds provided via government levies.

## 1.11 SOURCE OF FUNDS, BY FIELD OF RESEARCH

<i>Field of research</i>	<i>Own funds</i>				
	<i>Total</i>	<i>Commonwealth</i>	<i>State</i>	<i>Commonwealth government</i>	<i>State and local government</i>
	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Natural sciences, technologies and engineering					
Mathematical sciences	33 047	27 015	1 309	2 649	217
Physical sciences	88 598	76 452	451	2 994	195
Chemical sciences	80 779	56 107	6 786	4 118	1 119
Earth sciences	260 416	198 587	23 931	13 111	2 122
Information, computers and communication technologies	178 420	149 276	13 124	4 538	1 039
Applied sciences and technologies	190 595	138 237	6 609	10 863	488
General engineering	119 550	77 440	12 125	5 528	2 753
Biological sciences	239 756	116 414	58 682	29 929	7 070
Agricultural sciences	616 812	115 795	345 930	34 187	7 918
Medical and health sciences	191 099	18 952	63 944	30 886	18 997
<i>Total</i>	<i>1 999 072</i>	<i>974 275</i>	<i>532 889</i>	<i>138 804</i>	<i>41 918</i>
Social sciences and humanities					
Accounting and finance	98	—	10	—	—
Economics	34 745	28 210	2 168	1 556	1 339
Political sciences	3 254	1 975	937	153	187
Sociology	5 758	3 070	1 889	438	292
Law	5 553	4 544	400	140	434
Psychology	6 395	4 327	896	421	197
Education	9 072	—	5 469	1 368	1 786
Other social sciences	21 130	7 525	11 041	1 283	684
Humanities	5 114	1 510	2 590	320	603
<i>Total</i>	<i>91 119</i>	<i>51 161</i>	<i>25 400</i>	<i>5 679</i>	<i>5 522</i>
<b>Total</b>	<b>2 090 191</b>	<b>1 025 437</b>	<b>558 290</b>	<b>144 484</b>	<b>47 441</b>
Commonwealth contribution	1 265 578	1 025 437	—	79 766	9 100
State contribution	824 614	—	558 290	64 718	38 341

...continued

## 1.11 SOURCE OF FUNDS, BY FIELD OF RESEARCH—continued

<i>Field of research</i>	<i>Private businesses</i>	<i>Government owned business enterprises</i>	<i>Joint government/business(a)</i>	<i>Universities</i>	<i>Private non-profit and other Australian</i>	<i>Overseas</i>
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering						
Mathematical sciences	1 193	19	207	91	181	165
Physical sciences	3 040	869	150	22	489	3 936
Chemical sciences	7 913	200	2 324	138	1 018	1 057
Earth sciences	12 344	1 181	5 205	429	1 030	2 478
Information, computers and communication technologies	5 691	1 106	2 223	98	561	764
Applied sciences and technologies	12 975	321	16 260	102	2 848	1 892
General engineering	17 975	380	792	209	1 827	520
Biological sciences	7 486	513	11 983	620	4 482	2 578
Agricultural sciences	17 628	3 166	88 168	315	2 260	1 444
Medical and health sciences	21 960	1 046	2 160	5 692	23 661	3 802
<i>Total</i>	<i>108 206</i>	<i>8 801</i>	<i>129 471</i>	<i>7 715</i>	<i>38 356</i>	<i>18 636</i>
Social sciences and humanities						
Accounting and finance	—	88	—	—	—	—
Economics	682	85	572	78	38	15
Political sciences	—	2	—	—	—	—
Sociology	19	—	—	44	1	4
Law	—	—	—	35	1	—
Psychology	231	—	79	118	56	70
Education	14	373	34	18	9	—
Other social sciences	352	2	89	117	7	30
Humanities	77	—	—	—	14	—
<i>Total</i>	<i>1 376</i>	<i>550</i>	<i>774</i>	<i>411</i>	<i>126</i>	<i>119</i>
<b>Total</b>	<b>109 582</b>	<b>9 351</b>	<b>130 245</b>	<b>8 126</b>	<b>38 482</b>	<b>18 755</b>
Commonwealth contribution	71 800	4 836	48 094	1 646	11 843	13 057
State contribution	37 782	4 515	82 151	6 480	26 639	5 698

(a) Includes funds provided via government levies.

### STATE COMPARISONS

The leading States in terms of location of General government R&D expenditure were Victoria at \$478m and New South Wales at \$467m, accounting for 23% and 22% of total expenditure respectively. Next in order were Queensland (15%), the Australian Capital Territory (14%), South Australia (12%), and Western Australia (8%). The ranking was similar to 1994–95 although Victoria has replaced New South Wales as the leading location for R&D.

Of the \$825m State government R&D, most was carried out in New South Wales (28%), Queensland(25%) and Victoria(20%).

Purpose of research Economic development was the predominant SEO of R&D expenditure in all States, except for South Australia where most expenditure was directed towards Defence, and Tasmania and the Northern Territory where Environment was the major objective.

## 1.12 LOCATION OF EXPENDITURE, BY SOCIO-ECONOMIC OBJECTIVE

	Total	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Other(a)
<i>Socio-economic objective</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Defence	234 004	13 307	76 419	381	133 407	1 796	1 071	—	7 625	—
Economic development										
Plant-production and primary products	293 824	46 745	52 349	88 988	18 787	38 328	4 071	3 626	38 416	2 514
Animal-production and primary products	280 218	71 759	63 373	62 476	14 312	27 238	16 452	5 862	18 245	500
Mineral resources (excl. energy)	83 000	17 314	18 890	15 744	369	14 075	681	156	15 123	648
Energy resources	93 798	14 831	6 254	4 982	68	17 917	5 947	—	39 894	3 906
Energy supply	23 954	11 217	5 671	1 566	80	599	38	587	4 127	69
Manufacturing	211 789	60 170	93 768	22 851	15 818	4 009	1 350	56	13 212	555
Construction	35 876	11 375	18 335	1 433	1 864	520	217	38	1 984	109
Transport	15 653	3 180	4 616	3 395	336	639	280	478	2 640	87
Information and communication services	44 702	10 607	4 125	3 452	626	8 178	193	64	17 260	196
Commercial services	10 668	6 972	1 166	142	404	953	—	86	946	—
Economic framework	38 550	12 236	7 905	1 569	223	584	—	115	15 756	162
<b>Total</b>	<b>1 132 033</b>	<b>266 406</b>	<b>276 452</b>	<b>206 597</b>	<b>52 890</b>	<b>113 039</b>	<b>29 230</b>	<b>11 068</b>	<b>167 603</b>	<b>8 747</b>
Society										
Health	199 245	59 259	54 375	34 763	27 471	8 731	1 889	8 940	3 634	184
Education and training	13 601	3 684	1 542	2 248	2 227	642	593	1 450	1 172	43
Social development and community services	36 409	12 073	6 926	2 476	2 273	993	853	256	10 339	219
<b>Total</b>	<b>249 256</b>	<b>75 017</b>	<b>62 843</b>	<b>39 487</b>	<b>31 972</b>	<b>10 365</b>	<b>3 335</b>	<b>10 646</b>	<b>15 146</b>	<b>445</b>
Environment										
Environmental knowledge	280 784	50 646	42 144	38 963	16 984	24 394	45 787	11 098	49 856	912
Environmental aspects of economic development	94 157	20 742	11 512	17 876	6 886	6 771	4 747	2 839	22 105	679
Environmental management and other aspects	37 412	8 807	4 014	7 353	660	1 100	3 925	1 976	9 132	444
<b>Total</b>	<b>412 353</b>	<b>80 195</b>	<b>57 670</b>	<b>64 192</b>	<b>24 530</b>	<b>32 266</b>	<b>54 459</b>	<b>15 913</b>	<b>81 093</b>	<b>2 035</b>
Advancement of knowledge										
Natural sciences, technologies and engineering	56 108	30 592	3 640	4 363	2 281	1 184	3 490	878	9 286	393
Social sciences and humanities	6 437	1 511	578	105	7	552	41	744	2 794	104
<b>Total</b>	<b>62 545</b>	<b>32 103</b>	<b>4 218</b>	<b>4 469</b>	<b>2 289</b>	<b>1 736</b>	<b>3 532</b>	<b>1 622</b>	<b>12 080</b>	<b>498</b>
<b>Total</b>	<b>2 090 191</b>	<b>467 027</b>	<b>477 602</b>	<b>315 126</b>	<b>245 087</b>	<b>159 202</b>	<b>91 626</b>	<b>39 250</b>	<b>283 546</b>	<b>11 725</b>
Commonwealth contribution	1 265 578	232 846	311 018	112 212	167 441	63 700	76 205	12 828	280 518	8 810
State contribution	824 614	234 181	166 584	202 915	77 647	95 502	15 421	26 421	3 027	2 916

(a) Includes Australian External Territories and overseas.



Field of research (FOR) In New South Wales, Victoria, Queensland and Western Australia, the major FOR was Agricultural sciences. In South Australia the major FOR was Information, computers and communication technologies, in the Northern Territory, Biological sciences and in all other States the leading FOR was Earth sciences.

The Australian Capital Territory accounted for 36% of the R&D expenditure on Social sciences and humanities.

## 1.13 LOCATION OF EXPENDITURE, BY FIELD OF RESEARCH

<i>Field of research</i>	<i>Total</i>	<i>NSW</i>	<i>Vic.</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas.</i>	<i>NT</i>	<i>ACT</i>	<i>Other(a)</i>
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering										
Mathematical sciences	33 047	5 498	4 991	1 461	3 825	2 383	1 089	653	13 058	89
Physical sciences	88 598	42 903	17 954	711	21 769	1 028	979	642	2 579	33
Chemical sciences	80 779	21 282	32 490	8 553	5 214	3 650	2 509	1 477	5 437	166
Earth sciences	260 416	32 187	29 503	33 138	5 025	32 510	33 823	2 532	86 235	5 462
Information, computers and communication technologies	178 420	30 685	21 431	4 765	80 654	10 969	1 053	742	27 758	364
Applied sciences and technologies	190 595	38 805	96 336	11 782	27 729	1 647	933	589	12 191	583
General engineering	119 550	30 909	52 861	14 067	8 692	9 740	271	1 120	1 710	182
Biological sciences	239 756	44 429	42 013	45 906	10 025	15 575	26 503	11 334	42 238	1 732
Agricultural sciences	616 812	147 386	114 336	156 006	41 204	69 390	20 884	10 079	54 597	2 930
Medical and health sciences	191 099	56 169	45 458	30 430	35 428	8 926	3 096	6 965	4 562	64
<b>Total</b>	<b>1 999 072</b>	<b>450 253</b>	<b>457 374</b>	<b>306 820</b>	<b>239 565</b>	<b>155 818</b>	<b>91 140</b>	<b>36 133</b>	<b>250 364</b>	<b>11 605</b>
Social sciences and humanities										
Accounting and finance	98	10	88	—	—	—	—	—	—	—
Economics	34 745	1 004	6 577	2 163	360	750	187	782	22 894	27
Political sciences	3 254	9	551	97	634	—	—	248	1 716	—
Sociology	5 758	1 378	1 625	217	92	83	32	133	2 197	1
Law	5 553	4 071	823	629	—	—	—	—	30	—
Psychology	6 395	1 186	2 757	261	838	596	23	1	726	7
Education	9 072	2 913	1 377	1 585	1 984	324	8	881	—	—
Other social sciences	21 130	5 886	4 948	3 323	1 425	849	218	529	3 890	61
Humanities	5 114	315	1 483	31	189	782	19	541	1 729	24
<b>Total</b>	<b>91 119</b>	<b>16 774</b>	<b>20 228</b>	<b>8 306</b>	<b>5 523</b>	<b>3 383</b>	<b>486</b>	<b>3 117</b>	<b>33 182</b>	<b>120</b>
<b>Total</b>	<b>2 090 191</b>	<b>467 027</b>	<b>477 602</b>	<b>315 126</b>	<b>245 087</b>	<b>159 202</b>	<b>91 626</b>	<b>39 250</b>	<b>283 546</b>	<b>11 725</b>
Commonwealth contribution	1 265 578	232 846	311 018	112 212	167 441	63 700	76 205	12 828	280 518	8 810
State contribution	824 614	234 181	166 584	202 915	77 647	95 502	15 421	26 421	3 027	2 916

(a) Includes Australian External Territories and overseas.

TYPE OF R&D STAFF

Total human resource effort devoted to R&D by General government organisations has increased slightly since 1994–95. While the research effort of researchers increased by 4% or 342 person years to 9,171, that of Technicians and Other supporting staff decreased by 2% and 1% respectively.

Researchers accounted for 47% of the total research effort, up from 46% in 1994–95.

## 1.14 HUMAN RESOURCES DEVOTED TO R&D, BY SOCIO-ECONOMIC OBJECTIVE

	<i>Type of employee</i>			
	<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
<i>Socio-economic objective</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>
Defence	2 006	1 284	474	248
Economic development				
Plant—production and primary products	3 107	1 292	1 299	516
Animal—production and primary products	2 766	1 114	1 055	597
Mineral resources (excl. energy)	619	241	204	174
Energy resources	391	185	130	76
Energy supply	201	76	69	56
Manufacturing	1 922	619	733	570
Construction	314	113	117	83
Transport	116	75	21	19
Information and communication services	345	203	61	81
Commercial services	91	46	28	16
Economic framework	413	294	58	61
<i>Total</i>	10 284	4 257	3 778	2 249
Society				
Health	2 967	1 609	1 020	337
Education and training	142	105	21	17
Social development and community services	394	256	72	66
<i>Total</i>	3 503	1 970	1 112	420
Environment				
Environmental knowledge	2 072	956	743	372
Environmental aspects of economic development	821	272	341	208
Environmental management and other aspects	302	160	98	44
<i>Total</i>	3 195	1 389	1 182	624
Advancement of knowledge				
Natural sciences, technologies and engineering	475	225	155	95
Social sciences and humanities	55	46	6	3
<i>Total</i>	530	271	161	98
<b>Total</b>	<b>19 518</b>	<b>9 171</b>	<b>6 707</b>	<b>3 640</b>
Commonwealth contribution	10 342	4 516	3 257	2 570
State contribution	9 176	4 655	3 450	1 071

## 1.15 HUMAN RESOURCES DEVOTED TO R&D, BY FIELD OF RESEARCH

<i>Field of research</i>	<i>Type of employee</i>			
	<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
	<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>
<i>Natural sciences, technologies and engineering</i>				
Mathematical sciences	390	271	61	59
Physical sciences	762	342	230	190
Chemical sciences	741	336	252	153
Earth sciences	1 391	719	394	277
Information, computers and communication technologies	1 541	872	330	339
Applied sciences and technologies	1 665	663	617	385
General engineering	1 015	411	361	243
Biological sciences	2 161	845	829	487
Agricultural sciences	6 123	2 546	2 516	1 061
Medical and health sciences	2 799	1 510	986	302
<i>Total</i>	<i>18 588</i>	<i>8 516</i>	<i>6 577</i>	<i>3 495</i>
<i>Social sciences and humanities</i>				
Accounting and finance	1	1	—	—
Economics	353	268	40	44
Political sciences	35	29	1	5
Sociology	65	41	6	18
Law	49	25	8	16
Psychology	58	29	18	11
Education	105	80	11	15
Other social sciences	227	153	42	32
Humanities	39	30	4	5
<i>Total</i>	<i>930</i>	<i>655</i>	<i>130</i>	<i>145</i>
<b>Total</b>	<b>19 518</b>	<b>9 171</b>	<b>6 707</b>	<b>3 640</b>
Commonwealth contribution	10 342	4 516	3 257	2 570
State contribution	9 176	4 655	3 450	1 071

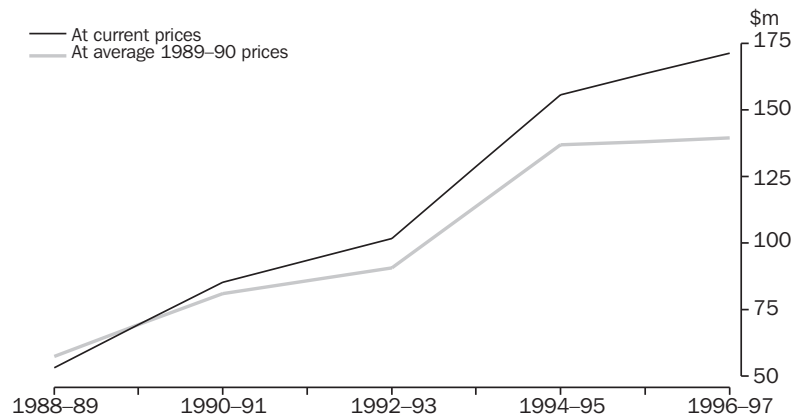
## SECTION 2

## PRIVATE NON-PROFIT INTRAMURAL R&D

### EXPENDITURE ON R&D

Private non-profit R&D has increased each year since 1988–89 in both current and average 1989–90 prices. Expenditure in current prices in 1996–97 was 10% higher than in 1994–95.

#### 2.1 EXPENDITURE ON R&D



### HUMAN RESOURCES DEVOTED TO R&D

Human resources devoted to R&D by Private non-profit organisations has increased steadily over the years, reaching 2,124 person years in 1996–97. This represented a 25% increase over 1994–95.

## 2.2

### RESOURCES DEVOTED TO R&D

	1988-89	1990-91	1992-93 <i>r</i>	1994-95 <i>r</i>	1996-97
Expenditure at current prices (\$m)	53.3	85.4	101.9	155.7	171.4
Expenditure at average 1989-90 prices (\$m)	57.5	81.2	90.7	136.9	139.4
Human resources devoted to R&D (person years)	1 023	1 282	1 369	1 703	2 124

### TYPE OF EXPENDITURE

Labour costs continued to be the main component of R&D expenditure (51%), up from 45% in 1994–95. Capital expenditure accounted for 12% of research expenditure by Private non-profit organisations.

#### Purpose of research

In the Private non-profit sector, Health remained the leading SEO, accounting for 80% or \$138m of total R&D expenditure. Advancement of knowledge accounted for \$15m (9%), while \$7m (4%) was directed towards Education and training.

## 2.3

### EXPENDITURE, BY SOCIO-ECONOMIC OBJECTIVE—TYPE OF EXPENDITURE

	Total	Land and buildings	Other capital expenditure	Labour costs(a)	Other current expenditure
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	—	—	—	—	—
Economic development	6 020	194	283	3 377	2 166
Society					
Health	137 861	7 726	11 037	69 960	49 138
Education and training	7 249	81	290	3 604	3 274
Social development and community services	2 349	1	61	1 191	1 097
Total	147 459	7 808	11 388	74 755	53 508
Environment	2 531	23	64	1 458	985
Advancement of knowledge	15 359	199	1 339	8 039	5 783
<b>Total</b>	<b>171 370</b>	<b>8 224</b>	<b>13 074</b>	<b>87 629</b>	<b>62 443</b>

(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.

Field of research (FOR) In the Private non-profit sector, Medical and health sciences (\$122m) and Biological sciences (\$32m) remained the leading FOR's in terms of R&D expenditure.

## 2.4

### EXPENDITURE, BY FIELD OF RESEARCH—TYPE OF EXPENDITURE

	Total	Land and buildings	Other capital expenditure	Labour costs(a)	Other current expenditure
<i>Field of research</i>	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering					
Physical sciences	1 436	—	29	907	500
Earth sciences	1 637	29	79	1 005	524
General engineering	1 459	153	88	544	673
Biological sciences	31 618	2 214	2 062	15 779	11 563
Medical and health sciences	121 683	5 741	10 373	62 339	43 230
Other natural sciences, technologies and engineering	2 662	4	82	1 582	994
Total	160 494	8 142	12 714	82 156	57 483
Social sciences and humanities					
Education	7 000	79	278	3 488	3 155
Other social sciences	2 396	3	57	1 428	909
Humanities	1 479	—	25	558	896
Total	10 875	82	360	5 474	4 960
<b>Total</b>	<b>171 370</b>	<b>8 224</b>	<b>13 074</b>	<b>87 629</b>	<b>62 443</b>

(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.

## TYPE OF ACTIVITY

Most R&D expenditure in the Private non-profit sector was directed towards Strategic basic research (\$68m or 39%). Applied research increased its share of total research, up from 20% in 1994–95 to 28% in 1996–97.

## 2.5

## EXPENDITURE, BY SOCIO-ECONOMIC OBJECTIVE—TYPE OF ACTIVITY(a)

	Total	Pure basic research	Strategic basic research	Applied research	Experimental development
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	—	—	—	—	—
Economic development	6 020	661	1 441	3 242	677
Society					
Health	137 861	32 743	55 314	35 283	14 520
Education and training	7 249	316	1 124	3 676	2 134
Social development and community services	2 349	294	785	793	478
Total	147 459	33 353	57 224	39 751	17 132
Environment	2 531	291	328	1 802	111
Advancement of knowledge	15 359	3 476	8 582	2 749	552
<b>Total</b>	<b>171 370</b>	<b>37 780</b>	<b>67 574</b>	<b>47 544</b>	<b>18 471</b>

(a) Data within this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. Analysts using this classification should bear the original subjectivity in mind. See paragraph 8 of the Explanatory Notes.

## 2.6

## EXPENDITURE, BY FIELD OF RESEARCH—TYPE OF ACTIVITY(a)

	Total	Pure basic research	Strategic basic research	Applied research	Experimental development
<i>Field of research</i>	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering					
Physical sciences	1 436	5	289	714	428
Earth sciences	1 637	307	279	928	122
General engineering	1 459	480	325	549	104
Biological sciences	31 618	8 677	13 526	8 441	973
Medical and health sciences	121 683	27 307	50 323	30 444	13 609
Other natural sciences, technologies and engineering	2 662	196	702	1 214	550
Total	160 494	36 972	65 446	42 290	15 786
Social sciences and humanities					
Education	7 000	300	1 013	3 521	2 166
Other social sciences	2 396	179	758	1 259	200
Humanities	1 479	330	357	474	318
Total	10 875	809	2 128	5 254	2 684
<b>Total</b>	<b>171 370</b>	<b>37 780</b>	<b>67 574</b>	<b>47 544</b>	<b>18 471</b>

(a) Data within this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. Analysts using this classification should bear the original subjectivity in mind. See Paragraph 8 of the Explanatory Notes.

SOURCE OF FUNDS

The main source of funding for Private non-profit R&D expenditure was the Commonwealth government which provided \$49m (29%), while State and local government provided a further \$18m (11%). Own funding of research accounted for \$41m (24%).

**2.7** SOURCE OF FUNDS, BY SOCIO-ECONOMIC OBJECTIVE

	<i>Own funds</i>	<i>Commonwealth government</i>	<i>State and local government</i>	<i>Private businesses</i>	<i>Government owned businesses</i>
<i>Socio-economic objective</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Defence	—	—	—	—	—
Economic development	1 876	719	337	1 492	139
Society					
Health	31 979	40 956	14 782	23 050	634
Education and training	1 915	2 074	2 119	11	—
Social development and community services	1 116	211	48	340	3
<i>Total</i>	<i>35 010</i>	<i>43 241</i>	<i>16 950</i>	<i>23 401</i>	<i>637</i>
Environment	520	305	317	163	63
Advancement of knowledge	3 300	4 700	501	3 933	71
<b>Total</b>	<b>40 707</b>	<b>48 964</b>	<b>18 105</b>	<b>28 988</b>	<b>911</b>

	<i>Joint government/business(a)</i>	<i>Universities</i>	<i>Private non-profit and other Australian</i>	<i>Overseas</i>	<i>Total</i>
<i>Socio-economic objective</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>	<i>\$'000</i>
Defence	—	—	—	—	—
Economic development	9	199	60	1 190	6 020
Society					
Health	395	2 172	19 709	4 183	137 861
Education and training	—	65	1 065	—	7 249
Social development and community services	30	16	585	—	2 349
<i>Total</i>	<i>425</i>	<i>2 253</i>	<i>21 359</i>	<i>4 183</i>	<i>147 459</i>
Environment	—	212	537	414	2 531
Advancement of knowledge	—	153	2 021	681	15 359
<b>Total</b>	<b>434</b>	<b>2 817</b>	<b>23 977</b>	<b>6 467</b>	<b>171 370</b>

(a) Includes funds provided via government levies.

## 2.8

### SOURCE OF FUNDS, BY FIELD OF RESEARCH

<i>Field of research</i>	<i>Own funds</i>	<i>Commonwealth government</i>	<i>State and local government</i>	<i>Private businesses</i>	<i>Government owned businesses</i>
	\$'000	\$'000	\$'000	\$'000	\$'000
<b>Natural sciences, technologies and engineering</b>					
Physical sciences	293	166	16	923	—
Earth sciences	454	—	121	172	81
General engineering	261	52	35	87	23
Biological sciences	11 144	8 827	3 378	3 193	116
Medical and health sciences	24 387	36 790	12 054	22 933	618
Other natural sciences, technologies and engineering	643	573	70	1 135	20
<i>Total</i>	<b>37 182</b>	<b>46 407</b>	<b>15 673</b>	<b>28 443</b>	<b>858</b>
<b>Social sciences and humanities</b>					
Education	1 877	1 987	2 076	10	—
Other social sciences	732	445	343	251	54
Humanities	916	125	12	285	—
<i>Total</i>	<b>3 525</b>	<b>2 557</b>	<b>2 432</b>	<b>545</b>	<b>54</b>
<b>Total</b>	<b>40 707</b>	<b>48 964</b>	<b>18 105</b>	<b>28 988</b>	<b>911</b>

<i>Field of research</i>	<i>Joint government/business(a)</i>	<i>Universities</i>	<i>Private non-profit and other Australian</i>	<i>Overseas</i>	<i>Total</i>
	\$'000	\$'000	\$'000	\$'000	\$'000
<b>Natural sciences, technologies and engineering</b>					
Physical sciences	—	—	—	38	1 436
Earth sciences	—	270	14	526	1 637
General engineering	—	77	41	884	1 459
Biological sciences	—	364	3 663	933	31 618
Medical and health sciences	425	1 945	18 561	3 969	121 683
Other natural sciences, technologies and engineering	9	72	25	116	2 662
<i>Total</i>	<b>434</b>	<b>2 727</b>	<b>22 304</b>	<b>6 467</b>	<b>160 494</b>
<b>Social sciences and humanities</b>					
Education	—	59	991	—	7 000
Other social sciences	—	27	545	—	2 396
Humanities	—	4	137	—	1 479
<i>Total</i>	—	90	1 673	—	10 875
<b>Total</b>	<b>434</b>	<b>2 817</b>	<b>23 977</b>	<b>6 467</b>	<b>171 370</b>

(a) Includes funds provided via government levies.

#### STATE COMPARISONS

The leading States in terms of the location of Private non-profit R&D expenditure were Victoria at \$102m, New South Wales at \$44m and Western Australia at \$12m, accounting for 60%, 26% and 7% of total expenditure respectively.

#### Purpose of research

In Victoria the predominant SEO's were Health, Advancement of knowledge and Education and training, accounting for 80%, 10% and 7% respectively. In New South Wales and Western Australia, Health was also the predominant SEO accounting for 90% and 76% of total State R&D expenditure respectively.



## 2.9

### LOCATION OF EXPENDITURE, BY SOCIO-ECONOMIC OBJECTIVE

	Total	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Other(a)
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	—	—	—	—	—	—	—	—	—	—
Economic development	6 020	1 310	1 970	122	38	1 879	50	24	144	484
Society										
Health	137 861	39 776	82 095	4 954	890	9 224	—	—	789	133
Education and training	7 249	143	7 074	32	—	—	—	—	—	—
Social development and community services	2 349	835	300	139	99	—	—	—	975	1
Total	147 459	40 755	89 468	5 125	989	9 224	—	—	1 765	134
Environment	2 531	616	826	153	167	118	32	27	—	592
Advancement of knowledge	15 359	1 747	10 190	3	2 451	940	—	—	—	29
<b>Total</b>	<b>171 370</b>	<b>44 428</b>	<b>102 454</b>	<b>5 404</b>	<b>3 644</b>	<b>12 161</b>	<b>82</b>	<b>51</b>	<b>1 908</b>	<b>1 238</b>

(a) Includes Australian External Territories and overseas.

Field of research In Victoria, New South Wales, Queensland, South Australia and Western Australia the predominant FOR was Medical and health sciences.

Victoria accounted for 63% (\$77m) of the Private non-profit sectors' expenditure on Medical and health sciences, 54% (\$17m) of that on Biological sciences and 99% (\$7m) of expenditure on Education.

New South Wales accounted for 24% (\$29m) of the expenditure on Medical and health sciences and 41% (\$13m) of that on Biological sciences.

## 2.10

### LOCATION OF EXPENDITURE, BY FIELD OF RESEARCH

	Total	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Other(a)
<i>Field of research</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering										
Physical sciences	1 436	—	—	—	—	1 436	—	—	—	—
Earth sciences	1 637	578	69	131	—	71	—	34	—	753
General engineering	1 459	565	329	174	95	20	—	10	50	215
Biological sciences	31 618	13 079	17 045	187	156	1 091	32	—	—	30
Medical and health sciences	121 683	28 666	76 937	4 589	3 337	8 022	—	—	—	132
Other natural sciences, technologies and engineering	2 662	112	498	60	25	1 514	50	7	289	108
Total	160 494	42 999	94 878	5 141	3 613	12 154	82	51	339	1 238
Social sciences and humanities										
Education	7 000	60	6 904	36	—	—	—	—	—	—
Other social sciences	2 396	1 175	661	93	32	7	—	—	429	—
Humanities	1 479	194	11	134	—	—	—	—	1 140	—
Total	10 875	1 429	7 576	262	32	7	—	—	1 569	—
<b>Total</b>	<b>171 370</b>	<b>44 428</b>	<b>102 454</b>	<b>5 404</b>	<b>3 644</b>	<b>12 161</b>	<b>82</b>	<b>51</b>	<b>1 908</b>	<b>1 238</b>

(a) Includes Australian External Territories and overseas.

## TYPE OF R&amp;D STAFF

The total human resource effort of Private non-profit organisations in 1996–97 was estimated to be 25% greater than in 1994–95. Researchers accounted for 56% of the total research effort, Technicians 31% and Other supporting staff 13%.

## 2.11 HUMAN RESOURCES DEVOTED TO R&D, BY SOCIO-ECONOMIC OBJECTIVE

<i>Socio-economic objective</i>	<i>Total</i>	<i>Type of employee</i>		
		<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
	<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>
Defence	—	—	—	—
Economic development	72	48	13	11
Society				
Health	1739	960	550	229
Education and training	55	38	9	8
Social development and community services	22	17	2	3
<i>Total</i>	<i>1816</i>	<i>1015</i>	<i>561</i>	<i>240</i>
Environment	47	41	1	5
Advancement of knowledge	188	90	80	17
<b>Total</b>	<b>2124</b>	<b>1193</b>	<b>657</b>	<b>274</b>

## 2.12 HUMAN RESOURCES DEVOTED TO R&D, BY FIELD OF RESEARCH

<i>Field of research</i>	<i>Total</i>	<i>Type of employee</i>		
		<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
	<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>
Natural sciences, technologies and engineering				
Physical sciences	14	12	2	1
Earth sciences	24	16	2	6
General engineering	12	10	1	2
Biological sciences	412	207	159	45
Medical and health sciences	1544	866	476	203
Other natural sciences, technologies and engineering	30	22	5	3
<i>Total</i>	<i>2037</i>	<i>1132</i>	<i>644</i>	<i>261</i>
Social sciences and humanities				
Education	53	37	8	8
Other social sciences	25	18	3	4
Humanities	9	7	1	1
<i>Total</i>	<i>87</i>	<i>61</i>	<i>13</i>	<i>13</i>
<b>Total</b>	<b>2124</b>	<b>1193</b>	<b>657</b>	<b>274</b>

## SECTION 3

## EXTRAMURAL R&D

General government extramural R&D expenditure (payments to other organisations to undertake R&D projects) was estimated to be \$1,468m, an increase of 28% over 1994–95. Most of these payments were by the Commonwealth Government (\$1,399m).

Extramural payments were equivalent to 70% of General government intramural R&D expenditure, up from 58% in 1994–95.

Only \$40m (3%) of General government extramural payments were to organisations outside Australia.

Private non-profit extramural R&D expenditure was estimated to be \$40m, an increase of 39% over 1994–95. Extramural payments were equivalent to 23% of Private non-profit intramural R&D expenditure, up from 18% in 1994–95.

### 3.1 EXTRAMURAL R&D EXPENDITURE(a), BY LOCATION OF RECIPIENT

Type of organisation	Total payments \$'000	Location of recipient									
		Australia \$'000	Africa \$'000	Asia \$'000	Canada \$'000	Europe \$'000	New Zealand \$'000	Oceania \$'000	U.K. \$'000	U.S.A. \$'000	Other Countries \$'000
<b>General government</b>											
Commonwealth	1 398 868	1 360 004	3 735	21 915	126	139	1 606	3 804	854	847	5 838
State	69 093	68 400	—	—	20	206	5	—	50	382	30
Total											
<b>1996–97</b>	<b>1 467 961</b>	<b>1 428 404</b>	<b>3 735</b>	<b>21 915</b>	<b>146</b>	<b>345</b>	<b>1 611</b>	<b>3 804</b>	<b>904</b>	<b>1 229</b>	<b>5 868</b>
1994–95 r	1 143 699	1 128 548	991	4 994	105	2 136	2 351	496	640	475	2 963
<b>Private non-profit</b>											
<b>1996–97</b>	<b>39 580</b>	<b>38 967</b>	<b>25</b>	<b>—</b>	<b>—</b>	<b>20</b>	<b>44</b>	<b>—</b>	<b>135</b>	<b>274</b>	<b>115</b>
1994–95 r	28 508	28 182	—	—	—	—	63	—	10	207	46

(a) Expenditure on R&D which is funded by an organisation but carried out by other organisations.

## SECTION 4

## TECHNICAL KNOW-HOW

PAYMENTS FOR TECHNICAL KNOW-HOW (TKH)

General government payments for TKH in 1996–97 were estimated to be \$5.5m, with 96% being payments within Australia.

Private non-profit payments for TKH were estimated to be \$0.2m, of which 77% were payments within Australia.

### 4.1 PAYMENTS FOR TECHNICAL KNOW-HOW, BY TYPE

<i>Type of organisation</i>	<i>Total payments</i>	<i>Patent licence fees and royalties</i>	<i>Other technical know-how</i>
	\$'000	\$'000	\$'000
<b>General government</b>			
Commonwealth	1581	491	1090
State	3956	1687	2269
<i>Total</i>			
<b>1996–97</b>	<b>5537</b>	<b>2178</b>	<b>3359</b>
1994–95	4668	523	4145
<b>Private non-profit</b>			
<b>1996–97</b>	<b>191</b>	<b>168</b>	<b>23</b>
1994–95 r	108	32	76

### 4.2 PAYMENTS FOR TECHNICAL KNOW-HOW, BY LOCATION

<i>Type of organisation</i>	<i>Australia</i>	<i>Africa</i>	<i>Asia</i>	<i>Canada</i>	<i>Europe</i>	<i>New Zealand</i>	<i>Oceania</i>	<i>U.K.</i>	<i>U.S.A.</i>	<i>Other countries</i>
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<b>General government</b>										
Commonwealth	1485	—	73	1	12	6	—	2	1	1
State	3806	—	—	130	5	1	—	3	5	6
<i>Total</i>										
<b>1996–97</b>	<b>5291</b>	<b>—</b>	<b>73</b>	<b>131</b>	<b>17</b>	<b>7</b>	<b>—</b>	<b>5</b>	<b>6</b>	<b>7</b>
1994–95	4362	3	229	14	17	—	33	10	—	—
<b>Private non-profit</b>										
<b>1996–97</b>	<b>147</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>44</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>
1994–95 r	105	—	—	—	—	—	—	—	3	—

## RECEIPTS FOR TKH

Receipts for TKH by General government organisations in 1996–97 were estimated to be \$20m, of which 87% were receipts from Australian organisations.

Receipts for TKH by the Private non-profit sector were estimated to be \$0.1m, of which 62% were receipts from Australian organisations.

### 4.3 RECEIPTS FOR TECHNICAL KNOW-HOW, BY TYPE

<i>Type of organisation</i>	<i>Total receipts</i>	<i>Patent licence fees and royalties</i>	<i>Other technical know-how</i>
	\$'000	\$'000	\$'000
<b>General government</b>			
Commonwealth	15766	7417	8349
State	4254	560	3694
<i>Total</i>			
<b>1996–97</b>	<b>20020</b>	<b>7977</b>	<b>12043</b>
1994–95	6543	1789	4754
<b>Private non-profit</b>			
<b>1996–97</b>	<b>146</b>	<b>135</b>	<b>11</b>
1994–95 r	248	210	38

### 4.4 RECEIPTS FOR TECHNICAL KNOW-HOW, BY LOCATION

<i>Type of organisation</i>	<i>Australia</i>	<i>Africa</i>	<i>Asia</i>	<i>Canada</i>	<i>Europe</i>	<i>New Zealand</i>	<i>Oceania</i>	<i>U.K.</i>	<i>U.S.A.</i>	<i>Other countries</i>
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
<b>General government</b>										
Commonwealth	13644	22	426	—	620	48	—	391	615	—
State	3868	—	35	—	25	9	—	78	238	1
<i>Total</i>										
<b>1996–97</b>	<b>17512</b>	<b>22</b>	<b>461</b>	<b>—</b>	<b>645</b>	<b>57</b>	<b>—</b>	<b>469</b>	<b>853</b>	<b>1</b>
1994–95	4883	—	233	—	4	—	291	558	573	1
<b>Private non-profit</b>										
<b>1996–97</b>	<b>90</b>	<b>—</b>	<b>—</b>	<b>6</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>50</b>	<b>—</b>
1994–95 r	248	—	—	—	—	—	—	—	—	—

## SECTION 5

## PATENT ACTIVITY

General government organisations with R&D activity during 1996–97 lodged 148 patent applications within Australia and 707 abroad, designating 10,617 countries, during the period 1 July 1995 to 30 June 1997. During this period 113 patents were granted in Australia and 382 granted abroad.

The Private non-profit sector lodged 10 patents in Australia and 73 overseas, designating 672 countries, during the period 1 July 1995 to 30 June 1997. During this period 9 patents were granted in Australia and 22 overseas.

### 5.1 PATENT ACTIVITY BY ORGANISATIONS UNDERTAKING R&D

Type of organisation	Australia		Overseas		
			Patents lodged		Patents granted
	Patents lodged	Patents granted	Applications	Countries designated(a)	
	no.	no.	no.	no.	no.
<b>General government</b>					
Commonwealth	141	97	676	10 040	374
State	7	16	31	577	8
<i>Total</i>					
<b>July 1995 to June 1997</b>	<b>148</b>	<b>113</b>	<b>707</b>	<b>10 617</b>	<b>382</b>
July 1993 to June 1995	145	96	n.a.	9 353	361
<b>Private non-profit</b>					
<b>July 1995 to June 1997</b>	<b>10</b>	<b>9</b>	<b>73</b>	<b>672</b>	<b>22</b>
July 1993 to June 1995	17	14	n.a.	330	56

(a) The number of countries in which protection initially sought. See paragraph 10 of the Explanatory Notes.

## EXPLANATORY NOTES

### INTRODUCTION

- 1** This publication presents estimates of expenditure and human resources devoted to R&D carried out by General government and Private non-profit organisations during 1996–97.
- 2** Statistics are included for extramural R&D activity, payments and receipts for technical know-how and patent activity.
- 3** Comparable R&D statistics are produced for the Business Enterprise and Higher Education sectors (see paragraph 22).

### DATA SOURCES

- 4** The 1996–97 statistics presented in this publication have been compiled from data collected from General government and Private non-profit organisations in the ABS Survey of Research and Experimental Development in respect of the year ended 30 June 1997. This survey was based on a complete enumeration of General government and Private non-profit organisations identified by the ABS as likely R&D performers. The survey was conducted by mail questionnaire and a 98% response rate was obtained. The ABS believes that the non-respondents were non-R&D performers.
- 5** Statistics for earlier years were derived from similar surveys. A number of revisions have been made to previous statistics.
- 6** The Gross Domestic Product (GDP)(I) figures used to derive General government expenditure on R&D/GDP ratios are current at the time of manuscript finalisation (National Income, Expenditure and Product, March Quarter 1998, (5206.0)), and, at current prices, are as follows: \$339,881m (1988–89); \$380,761m (1990–91); \$407,952m (1992–93); \$460,292m (1994–95); and \$517,401m (1996–97)). The available General government expenditure on R&D/GDP ratios for other OECD countries are current at time of manuscript finalisation and are sourced from Main Science and Technology Indicators, 1998–1, OECD, Paris, 1998

### 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 (TOA) 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.

DEFINITIONS *continued*

**9** 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.

**10** The questions relating to lodgement of patent applications overseas specifically asks for both the number of applications and countries in which protection was initially sought. For example, if four countries were designated in an application (a Patent Co-operation Treaty application or a European patent application) then the General government or Private non-profit organisation was asked to record this as one patent application with four countries designated.

SCOPE

**11** The General government sector includes all Commonwealth, State and local government departments and authorities.

**12** The Private non-profit sector includes private or semi-public incorporated organisations which are established with the intention of not making a profit.

**13** If an organisation is considered as Private non-profit but was established to serve the Business Enterprise sector then it is included in the Business Enterprise sector.

COVERAGE

**14** Local government organisations are excluded from this survey 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 Enterprise sector.

SEO AND FOR  
CLASSIFICATIONS

**15** The statistics in this publication are classified by Socio-economic objective (SEO) and Field of research (FOR). For more information on these classifications see the *Australian Standard Research Classification, 1993* (Cat. no. 1297.0).

**16** Respondents are asked to classify each of their R&D programs or projects to a SEO and a FOR. Two reporting possibilities exist. The first possibility allows for reporting of an obviously predominant SEO and FOR. The second allows for reporting at program level of several SEOs and FORs, where there was no obvious single predominant classification for either or both SEO and FOR. In these instances the ABS distributes the reported data to R&D projects, with relevant SEOs and FORs according to classifications and estimated percentage splits provided by respondents. Most of the data has been reported on the second basis.



CONSTANT PRICE  
ESTIMATES

**17** Estimates of total R&D expenditure are shown at average 1989–90 prices in Tables 1.2 and 2.2. In concept, constant price estimates are measures from which direct effects of price change have been eliminated. Although expressed in monetary terms, the constant price measures shown vary only with changes in the underlying quantities of inputs purchased (including labour). In effect, quantities of broadly defined categories of inputs are weighted by their prices in the base year (1989–90). Because the measures relate to input quantities, they do not reflect changes in the efficiency with which labour, capital and other inputs are used.

**18** In revaluing R&D expenditure, extensive use has been made of price series used in deriving constant price national accounts estimates. The constant price estimate for the labour costs component was obtained by deflating by a wage rate index. Constant price estimates for the non-labour costs components were derived by deflating each by a composite price index of relevant materials or capital expenditure items.

**19** For a more comprehensive description of constant price concepts and estimation procedures see *Australian National Accounts: Concepts, Sources and Methods* (Cat. no. 5216.0).

RELIABILITY OF STATISTICS

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

- many respondents had to make estimates because their accounts did not separately record data on R&D activity, receipts and payments for technical know-how or patent activity; and
- the OECD standard definition of R&D used in this survey differs in some respects from what respondents may regard as R&D activity.

UNPUBLISHED STATISTICS

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

RELATED PUBLICATIONS

**22** Users may also wish to refer to the following publications:

*Research and Experimental Development, Business Enterprises, Australia, 1996–97* (Cat. no. 8104.0)

*Research and Experimental Development, Higher Education Organisations, Australia, 1996* (Cat. no. 8111.0)

*Research and Experimental Development, All Sector Summary, Australia, 1996–97* (Cat. no. 8112.0) (to be released later this year)

*Main Science and Technology Indicators 1998–1*, OECD, Paris, 1998

*The Measurement of Scientific and Technological Activities ('Frascati Manual' 1993)* OECD, Paris, 1994

RELATED PUBLICATIONS  
*continued*

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**24** 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>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>Extramural R&amp;D</b>	R&D activity funded by an organisation but carried out by other enterprises, organisations, institutions or individuals.
<b>Field of research</b>	Field in which the R&D activity was performed. The FOR classification is primarily structured around disciplines or activities. It describes what research is being performed.
<b>FOR</b>	Field of research.
<b>GDP</b>	Gross Domestic Product.
<b>GOVERNMENT—Government expenditure on R&amp;D</b>	The sum of all intramural R&D expenditure incurred by all Government 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>Intramural R&amp;D</b>	R&D carried out by an organisation on its own behalf or on behalf of other organisations, institutions or individuals.
<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>OECD</b>	Organisation for Economic Co-operation and Development.

<b>Other current expenditure</b>	Expenditure on materials, fuels, rent and hiring, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
<b>Other supporting staff</b>	Skilled and unskilled craftpersons, secretarial and clerical staff directly associated with R&D activity.
<b>R&amp;D activity</b>	Systematic investigation or experimentation involving innovation or technical risk, the outcome of which is new knowledge, with or without a specific practical application, or new or improved products, processes, materials, devices or services. R&D activity extends to modifications to existing products/processes. R&D activity ceases and pre-production begins when work is no longer experimental.
<b>Researchers</b>	Those involved with the conception and/or development of new knowledge/products 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.
<b>SEO</b>	Socio-economic objective.
<b>Socio-economic objective</b>	The area of expected national benefit rather than the immediate objectives of the researcher. The SEO classification defines the main areas of Australian economic and social activity to which the results of research programs are applied. It describes the purpose of the research; i.e. why the research is being performed.
<b>Technical know-how (TKH)</b>	Specialised technical knowledge required to successfully produce a product or implement a process, etc. (e.g. patent licences; technical data and information; scientific, technical or engineering assistance) that increases technical knowledge and understanding in an organisation. Payments are those made directly to the holders of TKH which is new to an organisation. They exclude non-monetary transfers, and costs incurred by an organisation in obtaining TKH such as overseas travel costs.
<b>Technicians</b>	Those performing technical tasks in support of R&D activity, normally under the direction and supervision of a researcher. These tasks include preparation of experiments, taking records, preparation of charts and graphs and coding data.
<b>TOA</b>	Type of R&D activity.
<b>Type of R&amp;D activity</b>	Comprises basic research, applied research and experimental development.







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