



1995

EMBARGO: 11:30 AM (CANBERRA TIME) FRI 2 MAY 1997

Research and Experimental Development

Higher Education Organisations

Australia

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). These guidelines say that the expenditure on R&D should include both direct expenditure and an estimate for indirect (overhead) expenditure in support of R&D.

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COMPARABILITY

Data on human resources devoted to R&D are not available for 1995 but will be collected again for 1996 and subsequent years. Only data on R&D expenditure are included in this publication.

The 1995 expenditure statistics presented in this publication may not be strictly comparable with those prior to 1994 due to changes in collection methodology. See paragraph 11 of the Explanatory notes.

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SYMBOLS AND OTHER USAGES

-- nil or rounded to zero
n.a. not available

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INQUIRIES

For information about other ABS statistics and services, please refer to the back of this publication.

For further information about statistics in this publication and the availability of related unpublished statistics, contact Derek Byars on Canberra (06) 252 5627 or any ABS office.

For further information about constant price estimates, contact Paul Curran on Canberra (06) 252 6801.

W. McLennan
Australian Statistician

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MAIN FEATURES

EXPENDITURE ON R&D

Higher education expenditure on R&D (HERD) in Australia in 1995 was estimated to be \$2,039m at current prices. This represented an increase of 11% over 1994. Increases of this magnitude were reported by all major universities.

At average 1989-90 prices, R&D expenditure was estimated to be \$1,724m, an increase of 8% compared with 1994.

HERD as a percentage of Gross Domestic Product (GDP) increased from 0.40% in 1994 to 0.42% in 1995.

PURPOSE OF RESEARCH

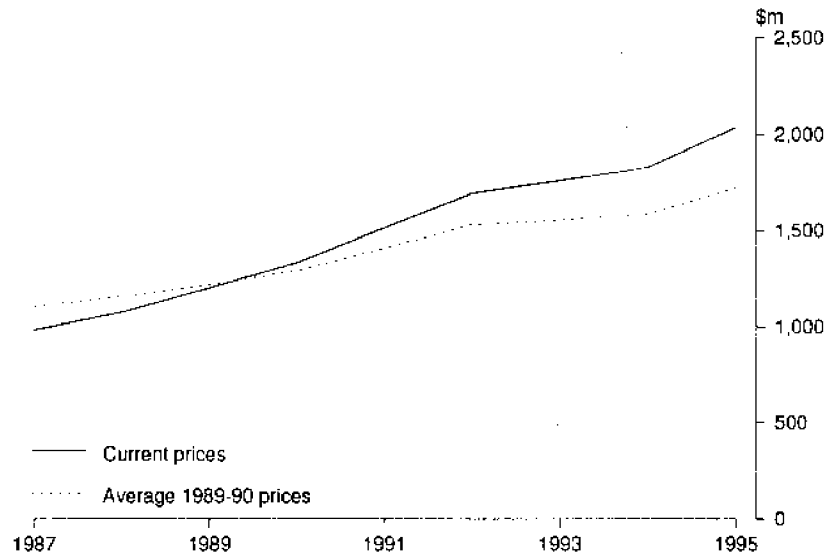
Most R&D expenditure by higher education organisations was directed towards Advancement of knowledge (\$970m or 48%) and Society (\$503m or 25%).

FIELD OF RESEARCH

Medical and health sciences (\$454m or 22%), Biological sciences (\$242m or 12%), Humanities (\$162m or 8%) and General engineering (\$134m or 7%) were the main fields of research by higher education organisations.

EXPENDITURE ON R&D

HERD has steadily increased every year since 1987 in both current prices and average 1989-90 prices. The average annual rate of growth over that period has been 9.5% in current price terms and 5.6% in constant price terms.

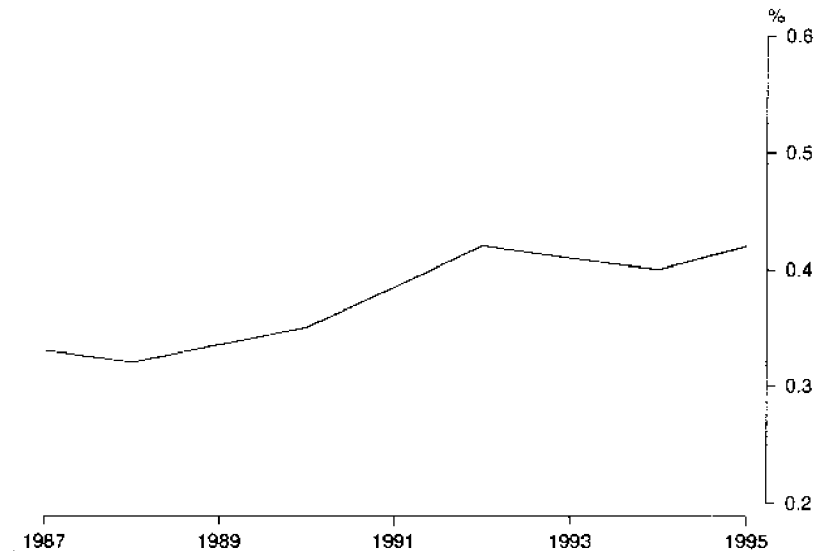


1 EXPENDITURE ON R&D

	1987	1988	1990	1992	1994	1995
	\$m	\$m	\$m	\$m	\$m	\$m
At current prices	983.6	1 076.8	1 332.8	1 695.2	1 829.6	2 039.1
At average 1989-90 prices	1 110.8	1 159.1	1 292.0	1 532.1	1 589.1	1 723.8

COMPARISON WITH GDP

Following a significant increase between 1988 and 1992, HERD as a percentage of GDP fell slightly to 0.40% in 1994 before rising to 0.42% in 1995.



Australia's HERD/GDP ratio compares favourably with those available for other OECD countries, being higher than those for the United States of America, France, Canada and the United Kingdom.

2 HERD/GDP RATIOS OF OECD COUNTRIES

Country	1994	1995
Switzerland	0.66	n.a.
Japan	0.57	n.a.
Norway	n.a.	0.44
Germany	0.44	0.43
Finland	0.44	0.42
Australia	0.40	0.42
United States of America	0.40	0.39
France	0.38	0.38
Canada	0.38	0.37
United Kingdom	0.38	n.a.
Iceland	0.33	0.35
Ireland	0.27	0.28
Turkey	0.24	0.27
Italy	0.27	0.26

SOCIO-ECONOMIC OBJECTIVE

The Socio-economic objectives (SEOs) within the Advancement of knowledge division accounted for the majority of expenditure on higher education R&D in 1995 with 48% of total expenditure, the same as in 1994.

The major type of expenditure was direct labour costs which accounted for 48% of total expenditure.

3 SOCIO-ECONOMIC OBJECTIVE

	TYPE OF EXPENDITURE.....						TYPE OF ACTIVITY(a).....			
	Total	Land and buildings	Other capital expenditure	Direct labour costs(b)	Scholarships(c)	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
Socio-economic objective	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	6 502	123	1 144	2 505	319	2 410	1 719	954	3 115	714
Economic development										
Plant — production and primary products	60 152	635	3 458	26 877	2 649	26 533	10 494	21 926	23 688	4 044
Animal — production and primary products	47 420	1 408	2 096	20 239	2 171	21 506	4 916	15 605	20 997	5 902
Mineral resources (excl. energy)	33 301	538	2 617	10 978	2 005	17 163	4 635	13 927	12 755	1 983
Energy resources	13 320	113	951	5 685	798	5 773	1 333	3 164	7 089	1 735
Energy supply	13 287	113	1 409	5 789	937	5 040	1 575	3 599	6 134	1 979
Manufacturing	95 763	1 141	8 412	40 371	5 497	40 343	14 469	27 832	40 406	13 056
Construction	24 792	223	1 747	11 868	1 301	9 653	3 891	5 272	13 805	1 823
Transport	9 260	229	383	4 615	245	3 788	1 192	1 429	5 925	714
Information and communication services	35 550	552	2 647	17 104	1 273	13 974	6 232	6 930	15 418	6 969
Commercial services	10 594	141	458	5 539	419	4 037	1 480	2 086	6 104	924
Economic framework	70 648	416	2 847	36 200	2 017	29 168	14 751	16 371	37 942	1 584
Total economic development	414 088	5 509	27 024	185 264	19 312	176 979	64 969	118 142	190 263	40 714
Society										
Health	356 870	3 154	13 819	174 381	11 312	154 204	55 907	119 065	156 089	25 810
Education and training	90 456	452	2 102	50 504	1 891	35 507	14 901	16 756	51 327	7 471
Social development and community services	55 550	435	2 087	30 322	1 034	21 672	18 741	10 044	24 119	2 647
Total society	502 877	4 041	18 008	255 207	14 238	211 382	89 549	145 865	231 535	35 928
Environment										
Environmental knowledge	98 192	2 467	6 449	43 045	4 393	41 839	29 591	32 212	29 008	7 381
Environmental aspects of economic development	23 738	137	2 284	10 635	1 036	9 646	4 888	6 493	9 826	2 531
Environmental management and other aspects	23 280	447	1 924	9 508	1 427	9 974	4 305	7 678	9 631	1 667
Total environment	145 211	3 052	10 657	63 188	6 856	61 458	38 784	46 382	48 465	11 580
Advancement of knowledge										
Natural sciences, technologies and engineering	676 227	9 502	51 457	310 987	34 464	269 816	345 461	165 214	136 312	29 240
Social sciences and humanities	294 191	5 701	7 592	159 172	13 190	108 535	213 096	31 437	44 858	4 799
Total advancement of knowledge	970 418	15 204	59 050	470 159	47 654	378 351	558 557	196 652	181 170	34 039
Total	2 039 094	27 928	115 883	976 324	88 380	830 580	753 579	507 995	654 547	122 974

(a) See Paragraph 6 of the Explanatory Notes.

penalty rates, bonuses, commission payments, holiday and sick pay, long service leave payments, employer contributions to superannuation and pension schemes.

(b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax and workers compensation insurance, overtime earnings, shift allowances,

(c) For research higher degrees.

FIELD OF RESEARCH

The Fields of research (FORs) in which most higher education R&D expenditure occurred in 1995 were Medical and health sciences (\$454m), Biological sciences (\$242m), Humanities (\$162m) and General engineering (\$134m).

These fields of research were also the four main fields in 1994.

Approximately 37% of the higher education R&D expenditure was directed towards Pure basic research, up slightly from 36% in 1994. Strategic basic research accounted for 25%, the same as in 1994. Applied research decreased from 33% in 1994 to 32% in 1995.

Experimental development remained steady on approximately 6%.

4 FIELD OF RESEARCH

Field of research	TYPE OF EXPENDITURE.....					TYPE OF ACTIVITY(a).....				
	Total	Land and buildings	Other capital expenditure	Direct labour costs(b)	Scholarships(c)	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering										
Mathematical sciences	57 298	131	2 351	30 309	2 092	22 415	34 846	8 406	10 576	3 470
Physical sciences	94 811	505	6 552	45 886	3 242	38 625	60 275	15 575	13 105	5 856
Chemical sciences	98 367	555	9 780	43 567	5 729	38 737	49 019	27 097	16 934	5 317
Earth sciences	98 669	1 951	7 655	40 504	5 021	43 539	34 905	31 314	26 361	6 089
Information, computers and communication technologies	105 705	2 530	9 144	47 565	5 044	41 422	32 155	22 438	38 473	12 639
Applied sciences and technologies	80 954	1 094	8 022	33 195	5 823	32 820	14 705	24 064	34 054	8 130
General engineering	133 549	3 453	12 595	54 415	9 628	53 459	25 680	35 184	57 574	15 111
Biological sciences	241 848	4 144	16 785	110 326	10 439	100 153	104 404	77 573	50 262	9 609
Agricultural sciences	123 427	2 793	7 388	52 513	6 976	53 758	17 838	42 524	51 159	11 906
Medical and health sciences	453 795	3 731	19 115	221 799	14 757	194 392	106 255	138 174	181 714	27 652
Total natural sciences, technologies and engineering	1 488 423	20 886	99 387	680 079	68 751	619 321	480 083	422 350	480 213	105 778
Social sciences and humanities										
Accounting and finance	20 625	60	815	11 784	200	7 766	6 248	3 801	9 910	666
Economics	59 920	163	1 699	31 006	1 884	25 167	19 199	9 140	30 605	976
Political sciences	30 388	113	611	15 547	1 320	12 798	17 920	5 795	6 178	495
Sociology	20 800	119	575	11 188	830	8 088	11 281	4 767	4 405	347
Law	35 035	464	895	19 368	337	13 971	19 277	6 640	8 439	679
Psychology	39 966	234	1 779	22 586	1 495	13 873	16 498	10 562	10 987	1 919
Education	81 990	506	1 872	46 793	1 946	30 873	16 264	15 401	43 884	6 441
Other social sciences	99 593	692	3 510	52 435	3 982	38 975	40 003	19 030	37 903	2 657
Humanities	162 353	4 691	4 741	85 537	7 635	59 748	126 806	10 509	22 023	3 015
Total social sciences and humanities	550 671	7 041	16 497	296 245	19 629	211 259	273 496	85 645	174 335	17 196
Total	2 039 094	27 928	115 883	976 324	88 380	830 580	753 579	507 995	654 547	122 974

(a) See Paragraph 6 of the Explanatory Notes.

(b) Includes wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefits tax and workers compensation insurance, overtime earnings, shift allowances, penalty rates, bonuses, commission payments, holiday and sick pay, long service leave payments, employer contributions to superannuation and pension schemes.

(c) For research higher degrees.

SOURCE OF FUNDS FOR R&D

General university funds were the source of funding for 66% (\$1,348m) of higher education R&D expenditure in 1995. National Competitive Research Grants provided 17% (\$344m), of which \$328m came from Commonwealth schemes. Other funding from the Commonwealth Government provided a further 7% (\$134m). State and local government provided 2% (\$44m) while Business enterprises provided 5% (\$95m).

Approximately 51% of funding from General university funds was spent on Advancement of knowledge, 24% on Society and 18% on Economic development. There was a similar pattern to spending from National Competitive Research Grants, with 49% spent on Advancement of knowledge, 24% on Society and 20% on Economic development.

Other funding from the Commonwealth Government was spent mainly on Advancement of knowledge, 40%, Economic development, 28%, and Society, 19%.

5 SOURCE OF FUNDS, By Socio-Economic Objective

Socio-economic objective	Total \$'000	NATIONAL COMPETITIVE RESEARCH GRANTS		OTHER.....					
		Common- wealth schemes \$'000	Other schemes \$'000	State & local gov't \$'000	Other Common- wealth \$'000	Business enterprise \$'000	General university funds (GUF) \$'000	Other Australian \$'000	Overseas \$'000
Defence	6 502	809	112	15	969	492	3 907	24	174
Economic development									
Plant — production and primary products	60 152	14 621	70	1 812	7 412	2 121	33 106	855	154
Animal — production and primary products	47 420	11 580	565	1 001	2 773	2 732	26 878	1 643	249
Mineral resources (excl. energy)	33 301	4 401	41	1 260	5 057	5 637	15 614	788	503
Energy resources	13 320	886	324	473	1 821	1 076	8 028	698	14
Energy supply	13 287	1 817	500	697	1 630	937	7 488	194	26
Manufacturing	95 763	16 759	789	1 271	9 584	15 726	48 703	1 985	947
Construction	24 792	2 718	45	932	2 198	1 057	16 777	1 017	48
Transport	9 260	743	24	410	549	916	5 300	114	1 203
Information and communication services	35 550	4 881	365	982	2 336	1 834	24 264	617	270
Commercial services	10 594	1 018	232	307	260	388	8 158	173	58
Economic framework	70 648	6 996	500	1 010	4 496	2 151	53 927	746	823
Total economic development	414 088	66 422	3 453	10 154	38 115	34 574	248 244	8 830	4 296
Society									
Health	356 870	64 985	4 984	16 576	13 900	21 251	210 558	17 775	6 841
Education and training	90 456	7 040	581	2 277	5 840	1 507	71 793	1 265	152
Social development and community services	55 550	3 906	247	1 797	5 997	591	41 696	841	475
Total society	502 877	75 931	5 812	20 651	25 737	23 350	324 048	19 881	7 468
Environment									
Environmental knowledge	98 192	13 757	729	3 355	11 474	3 883	59 963	3 683	1 348
Environmental aspects of economic development	23 738	4 064	469	550	1 469	1 520	15 104	435	127
Environmental management and other aspects	23 280	2 463	262	1 491	2 762	1 479	13 808	471	544
Total environment	145 211	20 285	1 460	5 396	15 705	6 882	88 875	4 589	2 019
Advancement of knowledge									
Natural sciences, technologies and engineering	676 227	138 194	4 819	5 925	36 895	26 092	442 930	13 872	7 500
Social sciences and humanities	294 191	26 013	596	1 964	16 639	3 712	239 609	4 052	1 606
Total advancement of knowledge	970 418	164 207	5 415	7 888	53 534	29 805	682 539	17 924	9 106
Total	2 039 094	327 653	16 252	44 104	134 061	95 102	1 347 613	51 247	23 063

SOURCE OF FUNDS FOR R&D *continued*

Medical and health sciences was the predominant Field of research in which funds were spent for all of the sources of funds except for Other Commonwealth Government. General university funds were mainly directed towards Medical and health sciences (19%), Biological sciences (11%) and Humanities (10%), while National Competitive Research Grants were mainly directed towards Medical and health sciences (28%), Biological sciences (15%) and Agricultural sciences (9%).

6 SOURCE OF FUNDS, By Field of Research

Field of research	Total \$'000	NATIONAL COMPETITIVE RESEARCH GRANTS		OTHER.....					
		Common- wealth schemes \$'000	Other schemes \$'000	State & local govt \$'000	Other Common- wealth \$'000	Business enterprise \$'000	General university funds (GUF) \$'000	Other Australian \$'000	Overseas \$'000
Natural sciences, technologies and engineering									
Mathematical sciences	57 298	9 042	701	747	2 095	757	42 828	349	779
Physical sciences	94 811	17 198	429	111	3 825	1 042	70 397	973	835
Chemical sciences	98 367	18 347	187	501	4 903	8 437	63 483	2 004	505
Earth sciences	98 669	13 217	421	2 773	14 312	5 464	58 368	2 767	1 347
Information, computers and communication technologies	105 705	15 198	1 310	2 035	10 800	5 764	69 441	875	283
Applied sciences and technologies	80 954	16 490	188	863	7 948	8 726	45 083	1 197	459
General engineering	133 549	22 027	1 403	3 414	12 033	12 433	76 429	3 577	2 234
Biological sciences	241 848	49 747	1 562	3 968	17 090	9 122	151 022	4 912	4 424
Agricultural sciences	123 427	29 207	806	3 754	9 739	3 550	73 120	2 907	344
Medical and health sciences	453 795	88 870	6 576	18 791	15 962	31 257	260 844	23 885	7 611
Total natural sciences, technologies and engineering	1 488 423	279 343	13 582	36 957	98 708	86 552	911 014	43 446	18 821
Social sciences and humanities									
Accounting and finance	20 625	1 297	5	54	118	—	18 672	288	192
Economics	59 920	4 551	972	920	6 435	1 850	43 651	907	634
Political sciences	30 388	2 747	13	198	3 234	468	23 221	294	214
Sociology	20 800	1 636	35	706	1 100	455	16 568	142	158
Law	35 035	1 265	79	570	2 038	266	29 455	965	398
Psychology	39 966	6 191	474	581	1 827	554	29 267	307	765
Education	81 990	5 903	566	1 757	4 963	1 169	66 486	976	170
Other social sciences	99 593	8 526	445	1 637	5 866	2 234	77 488	2 387	1 010
Humanities	162 353	16 195	80	724	9 773	1 554	131 792	1 535	701
Total social sciences and humanities	550 671	48 309	2 669	7 147	35 352	8 550	436 600	7 801	4 242
Total	2 039 094	327 653	16 252	44 104	134 061	95 102	1 347 613	51 247	23 063

STATE COMPARISONS

The leading States in terms of location of higher education R&D expenditure in 1995 were New South Wales at \$553m and Victoria at \$444m, accounting for 27% and 22% of total expenditure respectively. Next in order were Queensland (15%), the Australian Capital Territory (14%), Western Australia (10%), South Australia (9%), Tasmania (2%) and the Northern Territory (1%). The ranking was the same as in 1994.

The main SEO division in all States and Territories was Advancement of knowledge. Society was the second largest SEO division in all States other than Tasmania. In Victoria the subdivision of Health accounted for 25% of total expenditure:

7 LOCATION OF EXPENDITURE, By Socio-Economic Objective

	<i>Aust.</i>	<i>NSW(a)</i>	<i>Vic.</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas.</i>	<i>NT</i>	<i>ACT(b)</i>
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Defence	6 502	379	1 859	679	1 328	239	—	136	1 882
Economic development									
Plant — production and primary products	60 152	4 795	8 090	10 721	13 619	10 044	3 662	933	8 287
Animal — production and primary products	47 420	12 438	13 779	9 566	3 356	6 479	933	639	230
Mineral resources (excl. energy)	33 301	5 335	3 311	7 639	2 371	11 016	2 415	—	1 214
Energy resources	13 320	3 572	341	3 726	1 437	4 067	178	—	—
Energy supply	13 287	2 377	4 229	1 868	2 024	954	98	359	1 378
Manufacturing	95 763	32 561	26 507	16 737	8 223	6 227	934	128	4 447
Construction	24 792	7 345	8 267	2 785	813	4 170	556	—	856
Transport	9 260	1 913	2 895	1 537	1 010	616	54	3	1 233
Information and communication services	35 550	10 530	8 737	5 564	4 772	1 479	143	32	4 291
Commercial services	10 594	4 275	2 969	1 572	695	836	21	138	88
Economic framework	70 648	22 881	13 942	10 887	3 132	7 542	1 510	293	10 461
Total economic development	414 088	108 023	93 068	72 602	41 449	53 430	10 505	2 524	32 486
Society									
Health	356 870	74 119	110 757	49 369	41 836	37 668	4 971	316	37 835
Education and training	90 456	23 451	25 285	17 228	5 860	13 081	2 784	1 634	1 132
Social development and community services	55 550	16 484	9 570	7 358	4 949	4 369	2 018	1 720	9 081
Total society	502 877	114 054	145 612	73 956	52 645	55 118	9 773	3 670	48 049
Environment									
Environmental knowledge	98 192	18 749	16 074	16 380	7 794	12 388	4 561	963	21 292
Environmental aspects of economic development	23 738	7 395	4 348	4 307	3 279	1 844	1 143	362	1 059
Environmental management and other aspects	23 280	7 207	3 246	5 235	1 975	2 160	986	733	1 738
Total environment	145 211	33 351	23 667	25 922	13 048	16 392	6 690	2 049	24 090
Advancement of knowledge									
Natural sciences, technologies and engineering	676 227	209 191	124 875	94 869	65 783	54 235	16 262	2 053	108 958
Social sciences and humanities	294 191	88 314	54 939	46 040	11 981	21 191	4 119	3 792	63 814
Total advancement of knowledge	970 418	297 505	179 814	140 909	77 764	75 427	20 381	5 845	172 773
Total	2 039 094	553 312	444 021	314 068	186 234	200 607	47 349	14 224	279 279

(a) Includes Australian Catholic University.

(b) Includes Australian Defence Force Academy.

STATE COMPARISONS *continued*

In New South Wales the predominant FORs were Medical and health sciences (23%) and Humanities (9%). In Victoria, Queensland, South Australia and Western Australia the predominant FORs were Medical and health sciences (27%, 20%, 33% and 24% respectively) and Biological sciences (10%, 15%, 13% and 11% respectively). In the Australian Capital Territory the predominant FORs were Biological sciences (17%) and Physical sciences (14%).

8 LOCATION OF EXPENDITURE, By Field of Research

	<i>Aust.</i>	<i>NSW(a)</i>	<i>Vic.</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas.</i>	<i>NT</i>	<i>ACT(b)</i>
<i>Field of research</i>	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Natural sciences, technologies and engineering									
Mathematical sciences	57 298	18 934	13 706	6 173	6 047	3 645	830	215	7 747
Physical sciences	94 811	24 526	12 017	4 808	7 547	5 253	998	324	39 338
Chemical sciences	98 367	20 630	24 551	17 773	6 985	7 263	2 020	438	18 708
Earth sciences	98 669	18 843	12 541	13 840	8 985	11 533	9 783	132	23 012
Information, computers and communication technologies	105 705	30 997	23 794	17 080	7 687	11 917	1 156	119	12 955
Applied sciences and technologies	80 954	25 631	23 563	9 762	3 733	9 416	232	96	8 522
General engineering	133 549	40 018	31 883	27 736	10 276	15 628	1 120	416	6 473
Biological sciences	241 848	45 890	45 667	47 702	24 084	21 109	6 233	2 998	48 166
Agricultural sciences	123 427	34 072	21 633	18 573	22 931	17 289	6 312	1 228	1 389
Medical and health sciences	453 795	128 615	120 799	63 967	61 143	48 359	7 055	223	23 635
<i>Total natural sciences, technologies and engineering</i>	1 488 423	388 155	330 155	227 412	159 417	151 410	35 740	6 189	189 945
Social sciences and humanities									
Accounting and finance	20 625	10 589	2 756	2 512	453	2 939	403	—	974
Economics	59 920	16 529	10 792	5 121	2 526	4 735	1 064	448	18 705
Political sciences	30 388	6 530	4 704	1 387	1 632	3 162	867	717	11 388
Sociology	20 800	5 621	4 915	3 512	1 369	566	630	222	3 966
Law	35 035	10 948	5 141	5 208	884	3 347	783	937	7 786
Psychology	39 966	13 479	7 998	9 809	2 134	4 546	460	233	1 308
Education	81 990	23 515	21 015	18 772	4 168	9 985	1 866	1 403	1 266
Other social sciences	99 593	28 367	20 734	19 962	6 361	7 486	1 517	1 863	13 302
Humanities	162 353	49 579	35 811	20 372	7 290	12 432	4 020	2 211	30 639
<i>Total social sciences and humanities</i>	550 671	165 157	113 866	86 655	26 818	49 197	11 609	8 035	89 334
Total	2 039 094	553 312	444 021	314 068	186 234	200 607	47 349	14 224	279 279

(a) Includes Australian Catholic University.

(b) Includes Australian Defence Force Academy.

EXPLANATORY NOTES

INTRODUCTION

- 1** This publication presents estimates of expenditure on R&D carried out by organisations in the Higher education sector during 1995.
- 2** For details of R&D statistics available for the Business enterprise and General government and Private non-profit sectors see paragraph 20.

DATA SOURCES

- 3** The 1995 statistics presented in this publication 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 1995.
- 4** The GDP(T) figures used to derive higher education expenditure on R&D/GDP ratios are current at the time of manuscript finalisation (*National Income, Expenditure and Product, December Quarter 1996*, (Cat. no. 5206.0)), and, at current prices, are as follows: \$299,341m (1987-88); \$339,276m (1988-89); \$378,716m (1990-91); \$404,798m (1992-93); \$457,667m (1994-95); and \$488,967m (1995-96). The available higher education 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, 1996-2*, OECD, Paris, 1997.

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 (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.
- 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 AND COVERAGE

- 8** The Higher education sector is defined by OECD as including all universities and other institutions of post-secondary education whatever their source of finance or legal status.
- 9** For the ABS R&D surveys of this sector, only universities are surveyed. The universities are asked to include R&D carried out by them as participants in unincorporated Cooperative Research Centres (CRCs), but to exclude any R&D for incorporated CRCs as they are included in the Business enterprise sector. Other institutions (e.g. Technical and Further Education colleges) are excluded because it is considered that their contribution to total R&D activity would be minimal.

SOCIO-ECONOMIC OBJECTIVE AND FIELD OF RESEARCH CLASSIFICATIONS

- 10** 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).

EXPLANATORY NOTES *continued*

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COMPARABILITY WITH PREVIOUS STATISTICS

11 The 1995 statistics presented in this publication may not be strictly comparable with those for previous years due to changes in collection methodology. The 1994 and 1995 statistics were compiled from data collected by the ABS, whereas both the 1990 and 1992 statistics were compiled from data collected from universities by the Department of Employment, Education, Training and Youth Affairs (DEETYA). Statistics for earlier years were derived from ABS Research and Development Surveys in conjunction with general expenditure estimates obtained from DEETYA.

METHODOLOGY FOR DERIVING UNIVERSITY R&D EXPENDITURE ESTIMATES

12 Universities were asked to provide the ABS with the direct expenditure on R&D; i.e. the expenses directly attributable to research projects.

13 An estimate for indirect (overhead) expenditure was then added to the direct expenditure on R&D to obtain an estimate of the total cost of the R&D undertaken.

14 The following approach to estimating overhead R&D expenditure was adopted in the 1995 data collection:

- in cases where an allowance for overheads had already been included in the data reported by a university, no adjustments were made to the data; and
- where an allowance had not been included, either:
 - the university identified overhead costs and estimated the R&D part to be apportioned across relevant projects, etc.; or
 - the ABS applied agreed factors to the reported data.

CONSTANT PRICE ESTIMATES

15 Estimates of total R&D expenditure are shown at average 1989–90 prices in Table 1. 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.

16 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. This represents a departure from the methodology used in previous issues of this publication and has resulted in revisions to the estimates for earlier years. 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.

17 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

18 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*

- The OECD standard definition of R&D used in this survey differs in some respects from what data providers may regard as R&D activity.
- Some data providers had difficulties describing their R&D programs in terms of SEO, FOR and TOA. The data presented under these classifications therefore reflect a degree of subjectivity.
- The estimation of overhead R&D expenditure was subjective and varied across universities.

UNPUBLISHED STATISTICS

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

RELATED PUBLICATIONS

20 Users may also wish to refer to the following publications:

Australian Standard Research Classification (ASRC), 1993 (Cat. no. 1297.0)

Main Science and Technology Indicators 1996-2, OECD, Paris, 1997

Research and Experimental Development, All Sector Summary, Australia, 1994-95 (Cat. no. 8112.0)

Research and Experimental Development, Business Enterprises, Australia, 1995-96 (Cat. no. 8104.0) (to be released shortly).

Research and Experimental Development, General Government and Private Non-profit Organisations, Australia, 1994-95 (Cat. no. 8109.0)

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

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

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

GLOSSARY

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Applied research	Original work undertaken in order to acquire new knowledge with a specific application in view. It is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving some specific and predetermined objectives.
Basic research	Experimental and theoretical work undertaken primarily to acquire new knowledge without a specific application in view. It consists of pure basic research and strategic basic research. Pure basic research is carried out without looking for long-term benefits other than the advancement of knowledge. Strategic basic research is directed into specified broad areas in the expectation of useful discoveries. It provides the broad base of knowledge for the solution of recognised practical problems.
Capital expenditure	Expenditure on the acquisition of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment attributable to R&D activity.
Direct labour costs	Wages and salaries, overtime allowances, penalty rates, leave loadings, bonuses, commission payments, all paid leave, employer contributions to superannuation and pension schemes, payroll tax, fringe benefits tax, payments to contract staff on the payroll, severance, termination and redundancy payments and workers compensation insurance.
Experimental development	Systematic work, using existing knowledge gained from research or practical experience for the purpose of creating new or improved products/processes.
Field of research	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.
FOR	Field of research.
GDP	Gross Domestic Product.
HERD	Higher education expenditure on R&D.
OECD	Organisation for Economic Co-operation and Development.
Other current expenditure	Expenditure on materials, fuels, rent and hiring, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
R&D activity	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.
SEO	Socio-economic objective.
Socio-economic objective	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*

TOA Type of R&D activity.

Type of R&D activity Comprises basic research, applied research and experimental development.



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Client Services, ABS, PO Box 10, Belconnen ACT 2616

Produced by the Australian Government Publishing Service
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Recommended retail price: \$14.00



2811100001952

ISSN 0729-171X