



1988
**Research and Experimental
Development**

Higher Education Organisations
Australia

Catalogue No. 8111.0

At the bottom of the page, there are two thick, black horizontal bars, similar to the ones at the top, which are slightly offset to the right.

EMBARGOED UNTIL 11.30 A.M. 25 OCTOBER 1990

**RESEARCH AND EXPERIMENTAL DEVELOPMENT
HIGHER EDUCATION ORGANISATIONS
AUSTRALIA
1988**

W. McLENNAN
Acting Australian Statistician

AUSTRALIAN BUREAU OF STATISTICS

CATALOGUE NO. 8111.0

© Commonwealth of Australia 1990

PHONE INQUIRIES	<ul style="list-style-type: none"> • about these statistics and the availability of related unpublished statistics—contact Mr Trevor Germyn on Canberra (06) 252 5627 or any ABS State office. • about other statistics and ABS services—contact Information Services on Canberra (06) 252 6007, 252 6627, 252 5402 or any ABS State office.
MAIL INQUIRIES	<ul style="list-style-type: none"> • write to Information Services, ABS, PO Box 10, Belconnen, ACT 2616 or any ABS State office.
ELECTRONIC SERVICES	<ul style="list-style-type: none"> • on DISCOVERY —key *656#. • on AUSSTATS — phone (06) 252 6017 • on TELESTATS — phone (06) 252 5404 Foreign Trade statistics inquiries, (06) 252 5405 Main Economic Indicator inquiries.

CONTENTS

<i>Table</i>	<i>Page</i>
Summary of Findings	1
Research and experimental development (R&D) carried out by higher education organisations	
1. R&D expenditure, 1984, 1985, 1986, 1987 and 1988 at current and average 1984-85 prices	3
2. Human resources devoted to R&D, 1984, 1985, 1986, 1987 and 1988	3
3. Details of resources devoted to R&D by socio-economic objective, 1984, 1986 and 1988	4
4. Details of resources devoted to R&D by field of science, 1984, 1986 and 1988	5
5. Details of resources devoted to R&D by state, 1984, 1986 and 1988	6
6. R&D expenditure by source of funds, 1984, 1986 and 1988	6
7. R&D expenditure by socio-economic objective by type of expenditure and type of activity	7
8. R&D expenditure by socio-economic objective by source of funds	8
9. R&D expenditure by socio-economic objective by field of science	9
10. R&D expenditure by socio-economic objective by state	10
11. Human resources devoted to R&D by socio-economic objective by type of employee and type of researcher	11
12. Human resources devoted to R&D by socio-economic objective by field of science	12
13. Human resources devoted to R&D by socio-economic objective by state	13
14. R&D expenditure by field of science by type of expenditure and type of activity	14
15. R&D expenditure by field of science by source of funds	15
16. R&D expenditure by field of science by state	16
17. Human resources devoted to R&D by field of science by type of employee and type of researcher	17
18. Human resources devoted to R&D by field of science by state	18
Research and experimental development carried out by universities	
19. R&D expenditure by socio-economic objective by type of expenditure and type of activity	19
20. R&D expenditure by socio-economic objective by source of funds	20
21. R&D expenditure by socio-economic objective by field of science	21
22. Human resources devoted to R&D by socio-economic objective by type of employee and type of researcher	22
23. Human resources devoted to R&D by socio-economic objective by field of science	23
24. R&D expenditure by field of science by type of expenditure and type of activity	24
25. R&D expenditure by field of science by source of funds	25
26. Human resources devoted to R&D by field of science by type of employee and type of researcher	26
Research and experimental development carried out by colleges of advanced education	
27. R&D expenditure by socio-economic objective by type of expenditure and type of activity	27
28. R&D expenditure by socio-economic objective by source of funds	28
29. R&D expenditure by socio-economic objective by field of science	29
30. Human resources devoted to R&D by socio-economic objective by type of employee and type of researcher	30
31. Human resources devoted to R&D by socio-economic objective by field of science	31
32. R&D expenditure by field of science by type of expenditure and type of activity	32

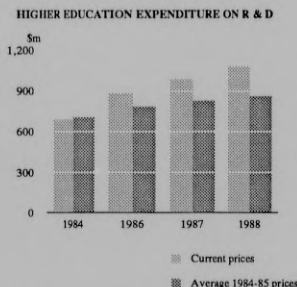
CONTENTS—continued

<i>Table</i>		<i>Page</i>
33.	R&D expenditure by field of science by source of funds	33
34.	Human resources devoted to R&D by field of science by type of employee and type of researcher	34
	Energy R&D carried out by higher education organisations	
35.	R&D expenditure by energy objective code by source of funds, 1986 and 1988	35
..	Explanatory Notes	37
..	Glossary	40

SUMMARY OF FINDINGS

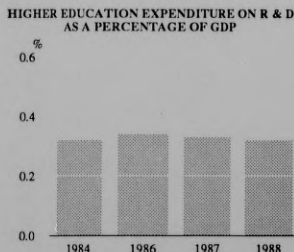
Higher Education expenditure on R&D

Higher Education expenditure on R&D carried out in Australia in 1988 is estimated to be \$1,077 million at *current* prices. This represents an increase of 9 per cent over 1987. At *average* 1984-85 prices, Higher Education R&D expenditure is estimated to have increased 4 per cent over this period. However, at average 1984-85 prices Higher Education R&D expenditure is estimated to have increased 22 per cent over the four year period from 1984-85.



At *average* 1984-85 prices, Universities increased R&D expenditure 4 per cent over 1987, while Colleges of Advanced Education increased R&D expenditure 2 per cent over this period. Universities' share of R&D expenditure in the Higher Education sector has decreased to 95 per cent from 96 per cent in 1987.

Higher Education expenditure on R&D carried out as a percentage of Gross Domestic Product (GDP) was 0.32 per cent in 1988. This is a small decline from the 1987 level and is similar to that recorded in 1984.



This ratio may be compared with that for some other OECD countries for which this ratio is available, e.g. Japan (0.55%), United States (0.42%), Germany (0.40%), Finland (0.37%), Switzerland (0.37%), Denmark (0.34%), United Kingdom (0.32%), Canada (0.30%), Italy (0.25%), Ireland (0.15%), Spain (0.11%).

Most of the funding (\$983 million or 91%) for Higher Education R&D expenditure came from the Commonwealth Government.

Human resources devoted to R&D

Human resources devoted to R&D carried out in Australia by Higher Education organisations is estimated to be 24,902 person years. This represents an increase of 2 per cent over 1987-88.

Universities account for 92 per cent of person years effort devoted to R&D in the Higher Education sector.

Human resources devoted to R&D by Universities increased 504 person years, up from 22,435 person years to 22,939 person years. For Colleges of Advanced Education the increase was 75 person years, up from 1,888 person years to 1,963 person years. These movements represent increases of 2 per cent and 4 per cent respectively over 1987.

Other features of interest in the breakdown of Higher Education R&D expenditure include:

- *General Advancement of Knowledge* (\$418m), *Health* (\$226m), *Agriculture* (\$86m) and *Earth, Ocean and Atmosphere* (\$51m) remain the leading Socio-Economic Objectives (SEOs) in terms of R&D expenditure.
- *Medical sciences* (\$179m), *Biological sciences* (\$154m), *Engineering sciences* (\$147m) and *Humanities* (\$125m) remain the leading Fields Of Science (FOS) in terms of R&D expenditure.
- New South Wales (\$349m), Victoria (\$230m) and the Australian Capital Territory (\$161m) remain the leading locations of R&D expenditure.
- Labour costs remain the major expense in performing R&D, even though as a percentage of total R&D expenditure it has decreased from 71 per cent in 1987 to 69 per cent in 1988.
- While most R&D expenditure is directed towards Pure Basic Research (\$409m or 38%), Higher Education organisations are directing relatively more of their research expenditure towards Applied Research, up from 30 per cent in 1986 to 31 per cent in 1988.

Other features of interest in the breakdown of Universities R&D expenditure include:

- *General Advancement of Knowledge* (\$411m), *Health* (\$216m), *Agriculture* (\$82m) and *Earth, Ocean and Atmosphere* (\$50m) remain the leading SEOs in terms of R&D expenditure.
- *Medical sciences* (\$172m), *Biological sciences* (\$150m), *Engineering sciences* (\$132m) and *Humanities* (\$123m) remain the leading FOSs in terms of R&D expenditure.
- New South Wales (\$339m), Victoria (\$213m) and the Australian Capital Territory (\$159m) remain the leading locations of R&D expenditure.
- While most R&D expenditure is directed towards Pure Basic Research (\$403m or 39 per cent), Universities are directing relatively more of their research expenditure towards Applied Research, up from 28 per cent in 1986 to 29 per cent in 1988.

Other features of interest in the breakdown of Colleges of Advanced Education R&D expenditure include:

- *Health* (\$10m), *Manufacturing* (\$7m) and *Education* (\$7m) are the leading SEOs in terms of R&D expenditure.

- *Engineering and Applied sciences* (\$15m), *Medical sciences* (\$7m) and *Education* (\$6m) remain the leading FOSs in terms of R&D expenditure.
- Victoria (\$16m), New South Wales (\$11m) and Western Australia (\$8m) remain the leading locations of R&D expenditure.
- Most R&D expenditure is directed towards Applied Research (\$32m or 59%). Strategic Basic Research is the only type of R&D activity not increasing its relative share of R&D activity, down from 14 per cent in 1986 to 12 per cent in 1988.

Energy R&D

Energy R&D carried out by Higher Education organisations in Australia in 1988 is estimated to be \$36m, an increase of \$4m from that of 1986. This level of expenditure is equivalent to 3 per cent of Higher Education expenditure on R&D, down from 4 per cent in 1986.

Government (including higher education sector) funding for energy R&D has declined in percentage share terms, down from 94 per cent in 1986 to 93 per cent in 1988.

TABLE 1. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
R & D EXPENDITURE AT CURRENT AND AVERAGE 1984-85 PRICES
(\$m)

	1984	1985	1986r	1987	1988
AT CURRENT PRICES					
Universities	663.1	707.6	844.9	929.8	1,022.3
CAE's	22.7	(a)	36.7	53.8	54.5
TOTAL	685.7	(a)	881.7	983.6	1,076.8
AT AVERAGE 1984-85 PRICES					
Universities	679.8	700.7	750.8	788.7	819.7
CAE's	23.3	(a)	32.2	40.3	41.0
TOTAL	703.2	(a)	783.0	828.9	860.8

(a) Estimates for Colleges of Advanced Education were not collected for this year.

TABLE 2. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
HUMAN RESOURCES DEVOTED TO R & D
(person years)

	1984	1985	1986r	1987	1988
Universities	19,814	20,143	21,690	22,435	22,939
CAE's	1,030	(a)	1,529	1,888	1,963
TOTAL	20,844	(a)	23,218	24,323	24,902

(a) Estimates for Colleges of Advanced Education were not collected for this year.

TABLE 3. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
DETAILS OF RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE

	Expenditure on R & D (\$m)									Person years of effort on R & D								
	1984			1986r			1988			1984		1986r		1988				
	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs			
<i>Socio-economic objective</i>																		
National security (defence)	1.2	1.2	—	1.9	1.7	0.2	2.5	2.2	0.2	29	28	1	52	39	13	42	36	6
<i>Economic development</i>																		
Agriculture	58.9	57.3	1.5	74.2	72.0	2.1	85.5	81.5	4.0	1,922	1,863	59	2,012	1,949	63	2,174	2,045	129
Forestry and fisheries	8.2	8.0	0.2	8.9	8.6	0.4	12.0	11.2	0.8	282	265	17	256	237	19	260	224	35
Mining (prospecting)																		
Energy sources	1.8	1.7	0.1	4.1	3.7	0.3	3.6	3.3	0.4	71	56	15	112	95	17	105	85	20
Other	3.4	3.2	0.1	7.2	7.0	0.2	6.2	5.5	0.7	108	96	12	206	194	12	163	131	32
Mining (extraction)																		
Energy sources	1.0	1.0	0.1	1.3	1.2	0.1	2.8	2.5	0.3	34	33	1	40	37	2	75	63	12
Other	3.6	3.3	0.3	6.8	5.6	1.2	8.3	6.8	1.5	128	110	18	194	156	38	213	163	51
Manufacturing	18.6	16.1	2.4	28.9	24.1	4.8	46.1	39.4	6.8	625	522	103	896	682	215	1,233	949	284
Construction	7.2	6.9	0.3	9.1	8.2	0.8	12.5	11.2	1.4	225	210	15	226	201	25	269	233	36
Energy	25.4	23.7	1.7	27.3	25.4	1.9	29.9	27.4	2.5	769	706	64	719	643	76	695	602	93
Transport	3.7	3.2	0.5	4.7	4.2	0.5	4.9	4.5	0.4	129	108	22	137	109	28	116	97	19
Communications	6.0	5.5	0.4	8.2	7.2	1.0	10.3	8.9	1.4	196	175	21	258	200	58	245	196	49
Economic services n.e.c.	18.6	17.5	1.1	36.1	33.3	2.8	49.7	46.4	3.3	443	399	45	805	700	105	989	853	136
Total economic development	156.4	147.6	8.8	216.6	200.6	16.1	271.9	248.6	23.4	4,933	4,542	391	5,861	5,202	659	6,536	5,640	896
<i>Community welfare</i>																		
Urban and regional planning	4.3	4.1	0.2	6.0	5.6	0.4	7.0	6.2	0.8	116	107	9	150	134	16	144	119	25
Environment	12.6	11.5	1.0	17.2	15.7	1.4	28.4	25.8	2.6	422	377	45	493	427	66	646	554	92
Health	139.8	134.8	5.0	187.6	180.8	6.8	226.2	216.3	9.9	4,140	3,902	238	4,809	4,526	283	5,221	4,894	327
Education	26.6	23.6	3.0	36.7	32.9	3.8	41.9	35.1	6.8	891	767	124	984	843	140	1,062	824	239
Welfare	8.3	8.0	0.3	10.0	9.1	0.9	8.6	7.9	0.7	245	232	13	269	229	41	199	171	29
Community services n.e.c.	13.3	12.5	0.8	18.8	17.0	1.7	21.9	19.8	2.1	337	304	33	454	379	76	463	401	62
Total community welfare	204.8	194.5	10.4	276.2	261.1	15.0	334.1	311.0	23.0	6,151	5,688	462	7,159	6,538	621	7,735	6,962	773
<i>Advancement of knowledge</i>																		
Earth, ocean and atmosphere n.e.c.	42.3	41.8	0.6	50.4	49.9	0.6	50.7	49.5	1.2	1,135	1,097	38	1,207	1,181	26	1,076	1,036	40
General advancement of knowledge	281.0	278.1	2.9	336.6	331.7	4.9	417.6	410.9	6.7	8,597	8,458	139	8,939	8,730	210	9,514	9,265	249
Total advancement of knowledge	323.3	319.9	3.5	387.0	381.6	5.4	468.3	460.4	7.9	9,732	9,556	179	10,147	9,911	236	10,590	10,301	289
TOTAL	685.7	663.1	22.7	881.7	844.9	36.7	1,076.8	1,022.3	54.5	20,844	19,814	1,030	23,218	21,690	1,529	24,902	22,939	1,963

TABLE 4. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
DETAILS OF RESOURCES DEVOTED TO R & D BY FIELD OF SCIENCE

Field of science	Expenditure on R & D (\$m)									Person years of effort on R & D								
	1984			1986r			1988			1984		1986r		1988				
	Total	Univer- sities	CAEs	Total	Univer- sities	CAEs	Total	Univer- sities	CAEs	Total	Univer- sities	CAEs	Total	Univer- sities	CAEs			
<i>Natural sciences</i>																		
Physical sciences	65.4	64.3	1.1	75.3	72.7	2.6	92.2	89.6	2.5	1,668	1,619	49	1,657	1,551	106	1,788	1,684	104
Chemical sciences	43.4	42.0	1.4	54.2	52.2	2.0	64.2	60.6	3.6	1,350	1,288	62	1,453	1,369	83	1,495	1,377	119
Biological sciences	105.8	103.6	2.1	128.3	125.7	2.6	154.4	150.1	4.4	3,299	3,187	112	3,430	3,309	122	3,433	3,282	151
Earth sciences	33.9	33.0	0.8	48.8	47.6	1.2	53.5	51.2	2.3	1,026	963	63	1,297	1,231	66	1,214	1,115	99
Engineering and applied sciences	79.3	73.1	6.1	112.7	100.4	12.3	147.1	131.8	15.3	2,533	2,247	286	3,192	2,650	542	3,425	2,885	540
Agricultural sciences and forestry	42.1	40.7	1.4	58.0	56.2	1.8	66.4	62.8	3.6	1,439	1,392	47	1,604	1,554	50	1,714	1,597	117
Medical sciences	104.6	101.3	3.3	135.9	131.3	4.6	179.3	172.4	6.9	3,023	2,855	168	3,443	3,249	193	4,133	3,896	238
Total natural sciences	474.4	458.1	16.3	613.2	586.0	27.2	757.1	718.5	38.6	14,337	13,550	787	16,076	14,915	1,161	17,202	15,836	1,367
<i>Social sciences and humanities</i>																		
Economics	29.3	28.8	0.6	36.8	35.4	1.3	41.4	39.7	1.7	659	638	22	768	723	45	778	725	53
Education	24.5	22.3	2.1	25.4	22.6	2.8	36.6	30.5	6.2	861	782	80	728	624	104	955	738	218
Management	4.6	4.0	0.6	5.4	4.9	0.5	5.4	4.4	0.9	91	76	15	128	106	22	156	87	69
Political science	11.5	11.4	0.2	17.6	17.3	0.3	21.9	21.3	0.5	338	331	7	457	447	10	497	486	11
Sociology	8.0	7.9	0.1	9.6	9.2	0.4	12.1	11.5	0.6	258	252	6	246	230	16	290	270	20
Information science	1.8	1.5	0.3	3.3	2.9	0.4	4.3	3.9	0.4	63	54	9	115	96	18	150	127	22
Other social sciences	56.7	55.0	1.7	68.3	65.5	2.8	73.3	69.7	3.5	1,723	1,655	68	1,852	1,738	114	1,779	1,650	129
Humanities	74.9	74.2	0.8	102.2	101.3	0.9	124.7	122.8	1.9	2,514	2,477	36	2,849	2,812	37	3,094	3,019	74
Total social sciences and humanities	211.3	204.9	6.4	268.5	259.0	9.5	319.7	303.8	15.9	6,507	6,264	243	7,142	6,775	367	7,700	7,103	596
TOTAL	685.7	663.1	22.7	881.7	844.9	36.7	1076.8	1022.3	54.5	20,844	19,814	1,030	23,218	21,690	1,529	24,902	22,939	1,963

TABLE 5. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
DETAILS OF RESOURCES DEVOTED TO R & D BY STATE

State	Expenditure on R & D (\$m)									Person years of effort on R & D								
	1984			1986r			1988			1984		1986r		1988				
	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs			
NSW	200.2	196.8	3.4	272.5	266.2	6.2	349.3	338.7	10.6	5,988	5,806	182	6,798	6,535	264	7,638	7,322	316
Vic.	157.0	147.4	9.6	201.8	188.0	13.8	229.9	213.5	16.5	5,594	5,184	411	6,246	5,667	579	6,451	5,828	623
Qld	73.2	70.1	3.1	94.5	89.9	4.6	134.3	126.6	7.7	2,484	2,354	129	2,803	2,597	205	3,353	3,048	305
SA	63.3	60.6	2.7	80.1	75.6	4.5	90.1	81.8	8.3	1,867	1,748	119	2,133	1,974	160	2,248	2,047	201
WA	52.8	50.0	2.8	73.6	67.4	6.2	86.0	77.5	8.5	1,688	1,529	159	1,989	1,713	275	2,065	1,680	384
Tas.	16.3	16.3	0.1	20.9	20.7	0.2	25.1	25.0	0.1	413	411	2	486	481	5	434	431	4
NT	—	—	—	—	—	—	1.1	—	1.1	—	—	—	—	—	—	26	—	26
ACT	122.8	121.9	0.9	138.3	137.1	1.2	161.0	159.3	1.7	2,810	2,782	28	2,763	2,723	41	2,687	2,583	104
TOTAL	685.7	663.1	22.7	881.7	844.9	36.7	1076.8	1022.3	54.5	20,844	19,814	1,030	23,218	21,690	1,529	24,902	22,939	1,963

TABLE 6. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
R & D EXPENDITURE BY SOURCE OF FUNDS (\$m)

Source of funds	1984			1986r			1988		
	Total	Universities	CAEs	Total	Universities	CAEs	Total	Universities	CAEs
Commonwealth government	641.7	625.0	16.7	821.5	797.9	23.6	983.2	944.0	39.3
State and local government	8.4	6.5	1.9	12.0	9.0	3.0	16.6	11.9	4.8
Business enterprises	11.0	8.2	2.9	18.5	9.7	8.8	27.6	18.7	8.9
Private non-profit and other Australian	19.1	18.3	0.9	23.3	22.1	1.2	42.1	41.0	1.2
Overseas sources	5.4	5.1	0.3	6.4	6.2	0.2	7.2	6.8	0.4
TOTAL	685.7	663.1	22.7	881.7	844.9	36.7	1,076.8	1,022.3	54.5

TABLE 7. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
(\$'000)

Socio-economic objective	Type of expenditure					Type of activity(a)			
	Total	Land and buildings	Other capital expenditure	Labour costs	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
National security (defence)	2,476	46	227	1,680	524	137	429	1,726	183
<i>Economic development</i>									
Agriculture	85,508	1,745	6,108	56,626	21,029	9,728	28,567	40,990	6,223
Forestry and fisheries	12,025	1,453	1,138	6,964	2,469	2,078	3,113	5,930	903
Mining (prospecting)									
Energy sources	3,617	125	399	2,291	802	785	1,071	1,576	185
Other	6,211	157	737	3,790	1,527	985	1,532	3,014	679
Mining (extraction)									
Energy sources	2,792	31	392	1,737	632	106	197	2,015	473
Other	8,292	304	833	5,384	1,771	441	1,328	5,911	612
Manufacturing	46,136	1,616	5,108	30,457	8,956	4,668	12,807	21,269	7,392
Construction	12,529	322	1,211	8,683	2,313	771	2,684	6,796	2,277
Energy	29,910	1,216	3,783	19,088	5,824	4,009	8,684	12,897	4,321
Transport	4,866	172	435	3,347	911	84	996	2,935	852
Communications	10,344	316	1,310	6,696	2,022	681	2,274	5,678	1,711
Economic services n.e.c.	49,688	1,764	4,302	34,438	9,183	4,936	13,288	26,536	4,929
Total economic development	271,919	9,220	25,757	179,502	57,439	29,272	76,543	135,547	30,557
<i>Community welfare</i>									
Urban and regional planning	7,014	331	488	4,923	1,272	770	1,913	3,742	589
Environment	28,437	1,116	2,699	18,541	6,081	4,770	9,516	12,034	2,117
Health	226,206	4,417	16,738	159,504	45,547	36,544	79,831	91,357	18,475
Education	41,853	1,063	1,733	31,983	7,075	4,479	8,621	22,670	6,083
Welfare	8,599	293	358	6,431	1,516	743	1,584	5,754	518
Community services n.e.c.	21,943	553	1,083	16,562	3,745	3,714	6,766	10,307	1,155
Total community welfare	334,052	7,773	23,098	237,945	65,236	51,020	108,231	145,864	28,937
<i>Advancement of knowledge</i>									
Earth, ocean and atmosphere n.e.c.	50,711	1,933	5,542	32,762	10,475	31,746	9,772	6,870	2,324
General advancement of knowledge	417,635	14,435	34,388	289,197	79,615	297,300	68,706	43,303	8,326
Total advancement of knowledge	468,346	16,368	39,929	321,959	90,090	329,046	78,478	50,173	10,650
TOTAL	1,076,793	33,407	89,011	741,086	213,289	409,475	263,681	333,310	70,326
Universities' contribution	1,022,275	32,407	83,617	699,794	206,456	402,867	257,276	300,984	61,148
CAEs' contribution	54,518	1,000	5,394	41,291	6,833	6,608	6,405	32,326	9,179

(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 13 of the Explanatory Notes.

TABLE 8. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY SOURCE OF FUNDS
(\$'000)

Socio-economic objective	Source of funds					
	Total	Commonwealth government	State and Local government	Business enterprises	Private non-profit and other Australian	Overseas sources
National security (defence)	2,476	2,280	19	30	45	103
<i>Economic development</i>						
Agriculture	85,508	74,065	4,355	3,157	3,263	668
Forestry and fisheries	12,025	10,982	403	336	232	72
Mining (prospecting)						
Energy sources	3,617	3,265	70	251	26	6
Other	6,211	5,352	139	328	350	42
Mining (extraction)						
Energy sources	2,792	2,473	73	190	52	4
Other	8,292	5,672	164	2,181	210	65
Manufacturing	46,136	41,576	596	2,977	780	208
Construction	12,529	11,077	265	422	669	97
Energy	29,910	26,486	493	1,544	823	564
Transport	4,866	4,425	87	128	113	112
Communications	10,344	9,539	165	327	305	8
Economic services n.e.c.	49,688	46,672	521	1,006	1,155	335
Total economic development	271,919	241,584	7,329	12,846	7,979	2,180
<i>Community welfare</i>						
Urban and regional planning	7,014	6,429	151	179	239	16
Environment	28,437	25,537	1,064	991	769	77
Health	226,206	194,018	3,348	6,288	20,491	2,061
Education	41,853	39,477	1,109	181	955	132
Welfare	8,599	8,266	98	75	155	5
Community services n.e.c.	21,943	20,897	499	162	323	62
Total community welfare	334,052	294,624	6,268	7,876	22,931	2,352
<i>Advancement of knowledge</i>						
Earth, ocean and atmosphere n.e.c.	50,711	47,135	513	1,057	1,031	976
General advancement of knowledge	417,635	397,620	2,506	5,772	10,155	1,581
Total advancement of knowledge	468,346	444,755	3,019	6,830	11,185	2,557
TOTAL	1,076,793	983,243	16,635	27,582	42,140	7,193
Universities' contribution	1,022,275	943,958	11,856	18,676	40,961	6,824
CAEs' contribution	54,518	39,285	4,779	8,906	1,180	369

TABLE 9. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY FIELD OF SCIENCE
(\$'000)

Socio-economic objective	Field of science									
	Total	Physical	Chemical	Biological	Earth	Engineering	Agricultural	Medical	Social	Humanities
National security (defence)	2,476	266	63	—	—	560	—	13	1,429	145
<i>Economic development</i>										
Agriculture	85,508	336	750	26,360	623	1,861	53,583	498	1,497	—
Forestry and fisheries	12,025	20	117	5,782	210	231	5,571	—	91	3
Mining (prospecting)										
Energy sources	3,617	111	32	—	3,031	444	—	—	—	—
Other	6,211	84	—	—	5,665	455	—	—	7	—
Mining (extraction)										
Energy sources	2,792	—	—	127	769	1,896	—	—	—	—
Other	8,292	8	968	155	129	7,032	—	—	—	—
Manufacturing	46,136	4,510	3,596	2,802	119	33,164	—	—	—	—
Construction	12,529	8	—	—	308	12,088	—	443	1,503	—
Energy	29,910	5,378	2,848	139	1,417	19,268	169	—	74	50
Transport	4,866	23	—	—	69	4,057	—	13	703	—
Communications	10,344	865	—	—	214	8,641	—	31	382	211
Economic services n.e.c.	49,688	247	136	12	36	16,432	604	24	32,053	144
Total economic development	271,919	11,590	8,448	35,377	12,589	105,569	59,927	1,010	37,002	408
<i>Community welfare</i>										
Urban and regional planning	7,014	—	154	10	490	1,282	12	—	5,050	17
Environment	28,437	292	2,727	10,193	7,807	5,205	803	260	1,087	64
Health	226,206	1,358	4,555	34,866	151	3,423	1,955	170,882	8,661	356
Education	41,853	225	131	—	1	669	—	902	36,881	3,044
Welfare	8,599	—	—	—	—	244	—	66	8,020	269
Community services n.e.c.	21,943	84	125	124	37	555	387	586	18,887	1,156
Total community welfare	334,052	1,958	7,691	45,192	8,486	11,378	3,157	172,696	78,587	4,906
<i>Advancement of knowledge</i>										
Earth, ocean and atmosphere n.e.c.	50,711	13,229	1,802	2,273	29,060	3,909	291	—	42	106
General advancement of knowledge	417,635	65,136	46,159	71,588	3,397	25,726	3,044	5,556	77,848	119,182
Total advancement of knowledge	468,346	78,365	47,961	73,861	32,456	29,634	3,335	5,556	77,890	119,287
TOTAL	1,076,793	92,180	64,162	154,430	53,531	147,141	66,419	179,275	194,908	124,747
Universities' contribution	1,022,275	89,648	60,583	150,050	51,219	131,850	62,774	172,380	180,936	122,835
CABs' contribution	54,518	2,531	3,580	4,380	2,312	15,291	3,645	6,895	13,972	1,912

TABLE 10. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY STATE
(\$'000)

Socio-economic objective	Total	State							
		NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
National security (defence)	2,476	596	105	268	69	26	31	—	1,381
<i>Economic development</i>									
Agriculture	85,508	23,517	11,416	17,167	12,895	11,739	1,708	—	7,066
Forestry and fisheries	12,025	1,557	1,650	1,599	76	1,397	2,633	—	3,113
Mining (prospecting)									
Energy sources	3,617	1,796	8	—	678	680	161	—	294
Other	6,211	2,050	646	1,033	666	1,180	565	—	72
Mining (extraction)									
Energy sources	2,792	2,198	151	2	57	234	—	—	150
Other	8,292	1,954	1,701	2,523	640	1,452	21	—	—
Manufacturing	46,136	16,591	13,362	8,019	2,011	1,921	275	—	3,958
Construction	12,529	7,635	1,371	1,264	439	1,495	304	—	21
Energy	29,910	14,420	3,678	3,216	2,127	2,840	567	—	3,064
Transport	4,866	2,600	1,761	198	42	96	65	—	103
Communications	10,344	4,402	1,971	1,329	1,257	472	28	—	886
Economic services n.e.c.	49,688	17,141	9,285	9,333	2,023	3,061	646	10	8,189
Total economic development	271,919	95,860	47,000	45,682	22,912	26,567	6,972	10	26,916
<i>Community welfare</i>									
Urban and regional planning	7,014	2,376	1,457	432	424	436	187	—	1,702
Environment	28,437	8,032	4,064	4,717	894	5,524	445	—	4,760
Health	226,206	73,421	64,493	19,268	22,840	22,249	4,123	93	19,720
Education	41,853	19,086	8,187	5,495	3,111	4,078	1,101	23	772
Welfare	8,599	4,122	2,531	861	341	210	39	5	489
Community services n.e.c.	21,943	7,623	3,487	2,442	1,708	1,427	669	28	4,559
Total community welfare	334,052	114,660	84,218	33,216	29,320	33,924	6,564	149	32,002
<i>Advancement of knowledge</i>									
Earth, ocean and atmosphere n.e.c.	50,711	13,839	8,129	5,201	3,633	1,381	1,578	36	16,915
General advancement of knowledge	417,635	124,337	90,498	49,920	34,130	24,070	9,943	901	83,836
Total advancement of knowledge	468,346	138,175	98,627	55,121	37,763	25,451	11,521	937	100,751
TOTAL	1,076,793	349,291	229,950	134,286	90,063	85,968	25,089	1,096	161,050
Universities' contribution	1,022,275	338,685	213,459	126,555	81,759	77,491	25,013	—	159,312
CAEs' contribution	54,518	10,606	16,491	7,731	8,304	8,477	76	1,096	1,737

TABLE II. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EMPLOYEE AND TYPE OF RESEARCHER
(person years)

Socio-economic objective	Type of employee				Type of researcher	
	Total	Researchers	Technicians	Other supporting staff	Academic staff	Post-graduates
National security (defence)	42	33	4	5	19	14
<i>Economic development</i>						
Agriculture	2,174	1,567	515	91	583	985
Forestry and fisheries	260	196	56	8	72	123
Mining (prospecting)						
Energy sources	105	87	15	3	29	58
Other	163	139	20	4	51	89
Mining (extraction)						
Energy sources	75	64	10	1	17	47
Other	213	165	39	9	51	114
Manufacturing	1,233	953	221	60	331	622
Construction	269	197	58	14	92	106
Energy	695	518	149	28	201	317
Transport	116	96	17	3	45	50
Communications	245	197	39	9	68	129
Economic services n.e.c.	989	824	82	83	486	337
Total economic development	6,536	5,002	1,220	314	2,026	2,976
<i>Community welfare</i>						
Urban and regional planning	144	119	14	11	67	52
Environment	646	492	123	31	193	299
Health	5,221	3,502	1,360	358	1,885	1,617
Education	1,062	911	62	89	454	457
Welfare	199	175	8	17	106	69
Community services n.e.c.	463	397	19	47	218	178
Total community welfare	7,735	5,595	1,586	553	2,923	2,672
<i>Advancement of knowledge</i>						
Earth, ocean and atmosphere n.e.c.	1,076	796	236	44	338	457
General advancement of knowledge	9,514	7,892	1,070	552	3,135	4,757
Total advancement of knowledge	10,590	8,688	1,306	596	3,473	5,214
TOTAL	24,902	19,318	4,117	1,467	8,442	10,876
Universities' contribution	22,939	17,685	3,882	1,372	7,481	10,203
CAEs' contribution	1,963	1,633	235	95	960	673

TABLE 12. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY FIELD OF SCIENCE
(person years)

Socio-economic objective	Field of science									
	Total	Physical	Chemical	Biological	Earth	Engineering	Agricultural	Medical	Social	Humanities
National security (defence)	42	6	2	—	—	12	—	—	20	2
<i>Economic development</i>										
Agriculture	2,174	11	21	622	15	49	1,414	14	27	—
Forestry and fisheries	260	—	2	105	6	5	139	—	2	—
Mining (prospecting)										
Energy sources	105	1	1	—	90	12	—	—	—	—
Other	163	2	—	—	149	11	—	—	—	—
Mining (extraction)										
Energy sources	75	—	—	6	22	47	—	—	—	—
Other	213	—	30	6	3	174	—	—	—	—
Manufacturing	1,233	112	92	84	4	893	—	6	42	—
Construction	269	—	—	—	10	254	—	—	1	3
Energy	695	100	70	4	37	467	5	—	13	—
Transport	116	—	—	—	—	98	—	—	15	—
Communications	245	14	—	—	3	203	—	1	11	10
Economic services n.e.c.	989	4	2	—	—	338	15	1	626	3
Total economic development	6,536	246	218	829	346	2,551	1,573	21	737	15
<i>Community welfare</i>										
Urban and regional planning	144	—	4	—	10	24	1	—	105	—
Environment	646	5	73	251	170	97	20	5	23	1
Health	5,221	32	107	792	4	87	44	3,946	199	11
Education	1,062	4	4	—	1	16	—	21	937	79
Welfare	199	—	—	—	—	3	—	1	187	8
Community services n.e.c.	463	2	2	4	2	12	6	13	390	32
Total community welfare	7,735	43	190	1,047	187	239	71	3,987	1,840	131
<i>Advancement of knowledge</i>										
Earth, ocean and atmosphere n.e.c.	1,076	271	40	54	614	87	8	—	1	1
General advancement of knowledge	9,514	1,223	1,046	1,503	67	536	62	124	2,008	2,945
Total advancement of knowledge	10,590	1,494	1,086	1,557	681	623	70	124	2,009	2,946
TOTAL	24,902	1,788	1,495	3,433	1,214	3,425	1,714	4,133	4,606	3,094
Universities' contribution	22,939	1,684	1,377	3,282	1,115	2,885	1,597	3,896	4,084	3,019
CAEs' contribution	1,963	104	119	151	99	540	117	238	522	74

TABLE 13. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY STATE
(person years)

Socio-economic objective	Total	State							ACT
		NSW	Vic.	Qld	SA	WA	Tas.	NT	
National security (defence)	42	14	3	6	1	—	1	—	17
<i>Economic development</i>									
Agriculture	2,174	592	310	526	294	291	31	—	130
Forestry and fisheries	260	36	40	54	1	37	25	—	67
Mining (prospecting)									
Energy sources	105	48	—	—	22	25	4	—	5
Other	163	49	12	31	21	37	12	—	1
Mining (extraction)									
Energy sources	75	56	4	—	2	6	—	—	7
Other	213	55	45	53	18	41	—	—	—
Manufacturing	1,233	427	427	211	58	50	6	—	54
Construction	269	168	32	34	10	17	6	—	1
Energy	695	320	110	90	49	59	14	—	55
Transport	116	48	54	5	1	3	2	—	3
Communications	245	88	64	37	31	13	1	—	13
Economic services n.e.c.	989	304	247	175	48	70	11	—	134
Total economic development	6,536	2,190	1,345	1,216	554	649	113	—	469
<i>Community welfare</i>									
Urban and regional planning	144	44	37	12	11	5	5	—	31
Environment	646	179	117	125	16	116	12	—	81
Health	5,221	1,490	1,693	485	626	506	72	2	345
Education	1,062	426	261	133	75	98	20	1	48
Welfare	199	86	73	20	9	3	1	—	9
Community services n.e.c.	463	157	89	57	37	35	17	1	70
Total community welfare	7,735	2,381	2,270	831	774	763	127	4	585
<i>Advancement of knowledge</i>									
Earth, ocean and atmosphere n.e.c.	1,076	299	222	123	83	44	32	1	273
General advancement of knowledge	9,514	2,755	2,612	1,177	836	609	162	21	1,343
Total advancement of knowledge	10,590	3,053	2,833	1,300	919	653	194	22	1,616
TOTAL	24,902	7,638	6,451	3,353	2,248	2,065	434	26	2,687
Universities' contribution	22,939	7,322	5,828	3,048	2,047	1,680	431	—	2,583
CAEs' contribution	1,963	316	623	305	201	384	4	26	104

TABLE 14. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
(\$'000)

Field of science	Type of expenditure					Type of activity(a)			
	Total	Land and buildings	Other capital expenditure	Labour costs	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
<i>Natural sciences</i>									
Physical sciences	92,180	1,403	13,623	59,958	17,196	58,387	18,357	11,060	4,377
Chemical sciences	64,162	1,046	6,552	43,082	13,482	30,039	21,418	10,848	1,858
Biological sciences	154,430	8,507	13,217	100,333	32,373	76,875	48,065	24,764	4,726
Earth sciences	53,531	2,370	5,203	34,586	11,373	22,233	13,514	14,621	3,163
Engineering and applied sciences	147,141	6,897	17,576	94,605	28,062	17,586	34,936	71,253	23,366
Agricultural sciences and forestry	66,419	1,104	4,908	43,415	16,992	5,623	18,352	36,943	5,501
Medical sciences	179,275	3,698	12,803	127,166	35,608	27,278	59,948	76,939	15,110
Total natural sciences	757,138	25,026	73,881	503,145	155,087	238,021	214,589	246,428	58,100
<i>Social sciences and humanities</i>									
Economics	41,382	976	2,252	30,374	7,779	9,201	7,791	22,916	1,473
Education	36,631	941	1,499	27,972	6,219	4,998	7,006	19,256	5,371
Management	5,369	150	264	4,062	893	339	796	3,404	830
Political science	21,856	398	1,160	16,196	4,103	11,064	4,673	5,346	774
Sociology	12,102	287	571	9,089	2,154	5,460	2,742	3,497	402
Information science	4,305	77	148	3,298	781	1,769	1,060	1,304	172
Other social sciences	73,264	2,069	3,832	54,152	13,271	27,911	19,005	24,286	2,061
Humanities	124,747	3,543	5,403	92,798	23,003	110,712	6,019	6,874	1,143
Total social sciences and humanities	319,655	8,381	15,130	237,941	58,203	171,454	49,092	86,882	12,227
TOTAL	1,076,793	33,407	89,011	741,086	213,289	409,475	263,681	333,310	70,326
Universities' contribution	1,022,275	32,407	83,617	699,794	206,456	402,867	257,276	300,984	61,148
CAEs' contribution	54,518	1,000	5,394	41,291	6,833	6,608	6,405	32,326	9,179

(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 13 of the Explanatory Notes.

TABLE 15. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY SOURCE OF FUNDS
(\$'000)

Field of science	Source of funds					Overseas sources
	Total	Commonwealth government	State and Local government	Business enterprises	Private non-profit and other Australian	
<i>Natural sciences</i>						
Physical sciences	92,180	83,906	449	1,853	4,722	1,249
Chemical sciences	64,162	59,418	297	2,931	1,343	173
Biological sciences	154,430	143,282	2,401	3,060	5,132	555
Earth sciences	53,531	49,298	702	1,723	1,444	365
Engineering and applied sciences	147,141	130,789	2,401	9,430	3,711	810
Agricultural sciences and forestry	66,419	55,614	4,100	2,613	3,458	634
Medical sciences	179,275	152,239	3,034	4,693	17,509	1,800
Total natural sciences	757,138	674,546	13,385	26,303	37,318	5,587
<i>Social sciences and humanities</i>						
Economics	41,382	39,134	442	350	1,144	312
Education	36,631	34,551	980	146	854	100
Management	5,369	4,956	87	263	47	17
Political science	21,856	21,233	299	9	190	125
Sociology	12,102	11,725	156	12	190	18
Information science	4,305	4,189	59	8	42	6
Other social sciences	73,264	69,632	924	293	1,455	960
Humanities	124,747	123,277	303	197	902	68
Total social sciences and humanities	319,655	308,697	3,250	1,279	4,823	1,606
TOTAL	1,076,793	983,243	16,635	27,582	42,140	7,193
Universities' contribution	1,022,275	943,958	11,856	18,676	40,961	6,824
CAEs' contribution	54,518	39,285	4,779	8,906	1,180	369

TABLE 16. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY STATE
(\$'000)

Field of science	State								
	Total	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
<i>Natural sciences</i>									
Physical sciences	92,180	27,083	15,104	6,895	7,076	5,650	1,511	181	28,680
Chemical sciences	64,162	19,849	12,547	8,349	5,046	4,276	1,352	72	12,672
Biological sciences	154,430	33,668	31,110	21,378	17,087	10,018	7,293	708	33,167
Earth sciences	53,531	12,901	8,299	6,216	5,309	3,992	2,177	—	14,637
Engineering and applied sciences	147,141	64,147	29,467	25,097	7,992	12,081	1,761	10	6,586
Agricultural sciences and forestry	66,419	17,880	12,204	14,684	7,577	9,532	1,668	—	2,875
Medical sciences	179,275	61,590	51,160	14,937	18,549	19,901	2,175	49	10,914
Total natural sciences	757,138	237,118	159,891	97,556	68,635	65,450	17,936	1,020	109,532
<i>Social sciences and humanities</i>									
Economics	41,382	16,301	7,236	4,293	2,265	1,768	666	—	8,852
Education	36,631	16,812	7,938	5,455	2,548	2,203	1,075	35	564
Management	5,369	2,174	1,177	627	135	1,220	36	—	—
Political science	21,856	5,023	2,920	2,626	3,278	887	480	8	6,636
Sociology	12,102	4,873	2,365	2,000	294	250	319	—	2,001
Information science	4,305	1,372	1,788	454	98	286	126	—	182
Other social sciences	73,264	22,983	17,802	7,414	5,123	6,440	1,734	33	11,735
Humanities	124,747	42,635	28,835	13,862	7,686	7,464	2,716	—	21,549
Total social sciences and humanities	319,655	112,173	70,059	36,730	21,428	20,518	7,153	76	51,518
TOTAL	1,076,793	349,291	229,950	134,286	90,063	85,968	25,089	1,096	161,050
Universities' contribution	1,022,275	338,685	213,459	126,555	81,759	77,491	25,013	—	159,312
CAEs' contribution	54,518	10,606	16,491	7,731	8,304	8,477	76	1,096	1,737

TABLE 17. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY FIELD OF SCIENCE BY TYPE OF EMPLOYEE AND TYPE OF RESEARCHER
(person years)

Field of science	Type of employee				Type of researcher	
	Total	Researchers	Technicians	Other supporting staff	Academic staff	Post-graduates
<i>Natural sciences</i>						
Physical sciences	1,788	1,311	367	111	653	658
Chemical sciences	1,495	1,162	270	63	460	701
Biological sciences	3,433	2,477	802	155	1,054	1,422
Earth sciences	1,214	927	229	58	387	540
Engineering and applied sciences	3,425	2,651	620	145	982	1,669
Agricultural sciences and forestry	1,714	1,256	389	68	466	790
Medical sciences	4,133	2,740	1,099	294	1,511	1,229
Total natural sciences	17,202	12,524	3,785	894	5,514	7,010
<i>Social sciences and humanities</i>						
Economics	778	651	38	89	448	203
Education	955	823	48	84	395	428
Management	156	143	4	9	57	86
Political science	497	414	37	47	170	243
Sociology	290	260	11	18	127	133
Information science	150	142	3	4	38	104
Other social sciences	1,779	1,496	128	154	667	829
Humanities	3,094	2,864	62	168	1,024	1,840
Total social sciences and humanities	7,700	6,794	332	573	2,928	3,866
TOTAL	24,902	19,318	4,117	1,467	8,442	10,876
Universities' contribution	22,939	17,685	3,882	1,372	7,481	10,203
CAEs' contribution	1,963	1,633	235	95	960	673

TABLE 18. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY FIELD OF SCIENCE BY STATE
(person years)

Field of science	Total	State							
		NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
<i>Natural sciences</i>									
Physical sciences	1,788	469	444	141	144	114	30	4	443
Chemical sciences	1,495	471	365	200	122	101	25	2	211
Biological sciences	3,433	764	818	539	415	251	86	16	544
Earth sciences	1,214	298	216	158	132	126	47	—	237
Engineering and applied sciences	3,425	1,433	852	584	199	236	36	—	85
Agricultural sciences and forestry	1,714	451	302	463	161	243	31	—	62
Medical sciences	4,133	1,224	1,341	361	522	451	35	1	197
Total natural sciences	17,202	5,110	4,337	2,445	1,695	1,522	291	24	1,779
<i>Social sciences and humanities</i>									
Economics	778	280	178	87	47	41	11	—	133
Education	955	377	266	132	58	55	19	1	46
Management	156	37	71	15	3	30	—	—	—
Political science	497	108	96	65	97	17	11	—	102
Sociology	290	119	64	60	7	5	6	—	29
Information science	150	35	83	9	2	16	1	—	4
Other social sciences	1,779	494	562	183	140	158	39	1	202
Humanities	3,094	1,078	795	357	197	221	55	—	391
Total social sciences and humanities	7,700	2,528	2,115	908	552	543	143	3	907
TOTAL	24,902	7,638	6,451	3,353	2,248	2,065	434	26	2,687
Universities' contribution	22,939	7,322	5,828	3,048	2,047	1,680	431	—	2,583
CAEs' contribution	1,963	316	623	305	201	384	4	26	104

TABLE 19. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
(\$'000)

Socio-economic objective	Type of expenditure					Type of activity(a)			
	Total	Land and buildings	Other capital expenditure	Labour costs	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
National security (defence)	2,250	46	191	1,515	497	137	417	1,578	118
<i>Economic development</i>									
Agriculture	81,502	1,660	5,757	54,051	20,034	9,662	28,316	38,539	4,984
Forestry and fisheries	11,228	1,446	1,054	6,410	2,318	2,008	3,049	5,351	820
Mining (prospecting)									
Energy sources	3,257	123	359	2,023	752	756	1,048	1,318	135
Other	5,527	152	544	3,430	1,401	912	1,431	2,514	669
Mining (extraction)									
Energy sources	2,510	30	373	1,506	601	68	159	1,873	410
Other	6,757	299	606	4,315	1,537	292	1,202	4,791	472
Manufacturing	39,375	1,500	4,388	25,494	7,993	4,507	11,946	17,414	5,507
Construction	11,173	309	1,019	7,714	2,131	771	2,564	5,773	2,065
Energy	27,397	1,211	3,539	17,128	5,519	3,922	8,550	11,352	3,573
Transport	4,501	172	399	3,048	882	69	971	2,733	728
Communications	8,919	315	1,167	5,594	1,842	653	2,218	4,813	1,235
Economic services n.e.c.	46,411	1,681	4,033	31,736	8,961	4,828	12,837	24,218	4,528
Total economic development	248,557	8,898	23,239	162,449	53,971	28,451	74,290	120,690	25,127
<i>Community welfare</i>									
Urban and regional planning	6,217	331	430	4,295	1,161	763	1,885	3,279	290
Environment	25,792	1,006	2,431	16,650	5,706	4,637	9,010	10,500	1,646
Health	216,264	4,323	15,510	152,407	44,025	35,466	77,456	85,610	17,732
Education	35,060	1,028	1,383	26,049	6,599	4,314	8,256	17,507	4,983
Welfare	7,864	293	325	5,772	1,473	714	1,535	5,239	375
Community services n.e.c.	19,831	537	1,034	14,664	3,597	3,616	6,433	8,818	964
Total community welfare	311,029	7,517	21,113	219,837	62,561	49,510	104,575	130,954	25,990
<i>Advancement of knowledge</i>									
Earth, ocean and atmosphere n.e.c.	49,530	1,802	5,266	32,078	10,384	31,453	9,670	6,426	1,981
General advancement of knowledge	410,909	14,145	33,807	283,915	79,042	293,317	68,324	41,335	7,932
Total advancement of knowledge	460,438	15,946	39,073	315,993	89,427	324,770	77,994	47,761	9,913
TOTAL	1,022,275	32,407	83,617	699,794	206,456	402,867	257,276	300,984	61,148

(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 13 of the Explanatory Notes.

TABLE 20. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY SOURCE OF FUNDS
(\$'000)

<i>Socio-economic objective</i>	<i>Total</i>	<i>Source of funds</i>				<i>Overseas sources</i>
		<i>Commonwealth government</i>	<i>State and Local government</i>	<i>Business enterprises</i>	<i>Private non-profit and other Australian</i>	
National security (defence)	2,250	2,087	12	4	43	103
<i>Economic development</i>						
Agriculture	81,502	71,767	3,389	2,510	3,195	641
Forestry and fisheries	11,228	10,503	272	163	219	71
Mining (prospecting)						
Energy sources	3,257	3,133	16	80	22	6
Other	5,527	4,905	89	179	330	24
Mining (extraction)						
Energy sources	2,510	2,290	58	114	45	4
Other	6,757	4,962	72	1,458	203	63
Manufacturing	39,375	37,030	289	1,156	715	185
Construction	11,173	10,120	177	236	637	3
Energy	27,397	24,867	255	925	813	536
Transport	4,501	4,178	43	70	110	100
Communications	8,919	8,477	95	47	293	7
Economic services n.e.c.	46,411	44,288	346	402	1,053	322
Total economic development	248,557	226,519	5,101	7,340	7,635	1,962
<i>Community welfare</i>						
Urban and regional planning	6,217	5,899	68	24	214	12
Environment	25,792	23,697	836	469	721	70
Health	216,264	186,665	2,601	4,761	20,231	2,006
Education	35,060	33,664	514	73	698	112
Welfare	7,864	7,621	74	32	133	4
Community services n.e.c.	19,831	19,119	334	28	293	56
Total community welfare	311,029	276,665	4,426	5,387	22,290	2,261
<i>Advancement of knowledge</i>						
Earth, ocean and atmosphere n.e.c.	49,530	46,417	180	935	1,022	975
General advancement of knowledge	410,909	392,269	2,137	5,009	9,970	1,524
Total advancement of knowledge	460,438	438,686	2,317	5,944	10,993	2,499
TOTAL	1,022,275	943,958	11,856	18,676	40,961	6,824

TABLE 21. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY FIELD OF SCIENCE
(\$'000)

Socio-economic objective	Field of science									
	Total	Physical	Chemical	Biological	Earth	Engineering	Agricultural	Medical	Social	Humanities
National security (defence)	2,250	266	—	—	—	402	—	13	1,423	145
<i>Economic development</i>										
Agriculture	81,502	319	659	25,650	605	1,593	50,796	466	1,414	—
Forestry and fisheries	11,228	14	117	5,616	164	190	5,036	—	91	—
Mining (prospecting)										
Energy sources	3,257	111	32	—	2,671	444	—	—	—	—
Other	5,527	50	—	—	5,221	249	—	—	7	—
Mining (extraction)										
Energy sources	2,510	—	—	—	734	1,776	—	—	—	—
Other	6,757	8	502	155	107	5,985	—	—	—	—
Manufacturing	39,375	3,769	3,086	2,702	99	27,870	—	443	1,407	—
Construction	11,173	8	—	—	287	10,828	—	—	—	50
Energy	27,397	5,312	2,774	98	1,226	17,305	—	—	681	—
Transport	4,501	23	—	—	18	3,756	—	13	691	—
Communications	8,919	653	—	—	214	7,648	—	31	252	121
Economic services n.e.c.	46,411	240	136	12	36	15,413	581	—	29,850	144
Total economic development	248,557	10,507	7,306	34,233	11,381	93,056	56,413	954	34,393	315
<i>Community welfare</i>										
Urban and regional planning	6,217	—	—	10	429	1,028	—	—	4,734	17
Environment	25,792	238	2,176	9,477	7,192	4,687	772	260	926	64
Health	216,264	983	3,708	34,192	143	3,010	1,955	164,127	7,803	343
Education	35,060	213	129	—	—	655	—	900	30,518	2,644
Welfare	7,864	—	—	—	—	158	—	43	7,394	269
Community services n.e.c.	19,831	76	125	124	12	421	330	538	17,301	904
Total community welfare	311,029	1,511	6,138	43,804	7,776	9,959	3,058	165,868	68,676	4,240
<i>Advancement of knowledge</i>										
Earth, ocean and atmosphere n.e.c.	49,530	13,043	1,795	2,224	28,723	3,343	265	—	31	105
General advancement of knowledge	410,909	64,321	45,343	69,790	3,339	25,090	3,039	5,545	76,412	118,029
Total advancement of knowledge	460,438	77,365	47,138	72,014	32,062	28,433	3,304	5,545	76,443	118,134
TOTAL	1,022,275	89,648	60,583	150,050	51,219	131,850	62,774	172,380	180,936	122,835

TABLE 22. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1968
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EMPLOYEE AND TYPE OF RESEARCHER
(person years)

<i>Socio-economic objective</i>	<i>Type of employee</i>				<i>Type of researcher</i>	
	<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>	<i>Academic staff</i>	<i>Post-graduates</i>
National security (defence)	36	28	3	5	17	11
<i>Economic development</i>						
Agriculture	2,045	1,476	482	87	527	949
Forestry and fisheries	224	169	48	7	60	110
Mining (prospecting)						
Energy sources	85	70	13	2	19	51
Other	131	113	15	3	40	73
Mining (extraction)						
Energy sources	63	53	9	1	10	43
Other	163	125	30	7	34	92
Manufacturing	949	734	169	46	227	508
Construction	233	171	51	11	77	94
Energy	602	442	136	25	154	287
Transport	97	79	15	3	36	43
Communications	196	156	33	7	47	109
Economic services n.e.c.	853	694	78	80	411	283
Total economic development	5,640	4,283	1,078	279	1,642	2,641
<i>Community welfare</i>						
Urban and regional planning	119	98	12	10	53	45
Environment	554	420	108	26	154	266
Health	4,894	3,230	1,322	342	1,729	1,501
Education	824	700	54	70	293	407
Welfare	171	149	7	15	89	60
Community services n.e.c.	401	342	16	42	177	165
Total community welfare	6,962	4,938	1,519	505	2,495	2,443
<i>Advancement of knowledge</i>						
Earth, ocean and atmosphere n.e.c.	1,036	760	233	43	317	443
General advancement of knowledge	9,265	7,675	1,049	541	3,011	4,664
Total advancement of knowledge	10,301	8,436	1,281	584	3,328	5,108
TOTAL	22,939	17,685	3,882	1,372	7,481	10,203

TABLE 23. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY FIELD OF SCIENCE
(person years)

Socio-economic objective	Field of science									
	Total	Physical	Chemical	Biological	Earth	Engineering	Agricultural	Medical	Social	Humanities
National security (defence)	36	6	—	—	—	8	—	—	20	2
<i>Economic development</i>										
Agriculture	2,045	11	16	597	14	37	1,333	13	24	—
Forestry and fisheries	224	—	2	99	4	3	115	—	2	—
Mining (prospecting)	85	1	1	—	70	12	—	—	—	—
Energy sources	131	—	—	—	126	5	—	—	—	—
Mining (extraction)	63	—	—	—	20	42	—	—	—	—
Energy sources	163	—	12	6	3	142	—	—	—	—
Other	949	79	74	80	3	677	—	6	30	—
Manufacturing	233	—	—	—	8	222	—	—	—	3
Construction	602	98	67	3	31	391	—	—	12	—
Energy	97	—	—	—	—	82	—	—	14	—
Transport	196	8	—	—	7	171	—	1	5	4
Communications	853	4	2	—	—	304	14	—	526	3
Economic services n.e.c.										
Total economic development	5,640	202	174	785	286	2,090	1,461	19	613	9
<i>Community welfare</i>										
Urban and regional planning	119	—	—	—	9	17	—	—	94	—
Environment	554	4	51	219	153	84	19	5	17	1
Health	4,894	19	87	773	3	73	44	3,712	171	10
Education	824	3	4	—	—	16	—	21	716	64
Welfare	171	—	—	—	—	1	—	1	161	8
Community services n.e.c.	401	2	2	4	1	8	4	12	344	25
Total community welfare	6,962	28	144	996	166	198	67	3,752	1,503	108
<i>Advancement of knowledge</i>										
Earth, ocean and atmosphere n.e.c.	1,036	261	39	52	600	75	6	—	—	1
General advancement of knowledge	9,265	1,187	1,020	1,448	64	514	62	124	1,948	2,899
Total advancement of knowledge	10,301	1,448	1,059	1,500	663	589	68	124	1,948	2,901
TOTAL	22,939	1,684	1,377	3,282	1,115	2,885	1,597	3,896	4,084	3,019

TABLE 24. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
(\$'000)

Field of science	Type of expenditure					Type of activity(a)			
	Total	Land and buildings	Other capital expenditure	Labour costs	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
<i>Natural sciences</i>									
Physical sciences	89,648	1,310	13,327	58,124	16,888	57,898	17,846	9,866	4,038
Chemical sciences	60,583	1,002	6,151	40,573	12,857	29,381	20,710	9,061	1,430
Biological sciences	150,050	8,275	12,796	97,269	31,710	75,264	47,554	22,954	4,278
Earth sciences	51,219	2,312	4,916	33,017	10,974	22,041	13,030	13,323	2,825
Engineering and applied sciences	131,850	6,611	15,356	83,544	26,339	16,699	33,685	62,339	19,127
Agricultural sciences and forestry	62,774	1,042	4,609	41,112	16,010	5,572	18,141	34,646	4,416
Medical sciences	172,380	3,650	11,931	122,208	34,592	26,720	58,467	72,549	14,645
Total natural sciences	718,504	24,202	69,085	475,847	149,370	233,575	209,432	224,739	50,758
<i>Social sciences and humanities</i>									
Economics	39,660	939	2,180	28,933	7,609	9,081	7,644	21,581	1,355
Education	30,450	905	1,160	22,598	5,787	4,753	6,673	14,699	4,325
Management	4,427	147	236	3,191	854	299	738	2,743	647
Political science	21,347	375	1,154	15,741	4,078	10,956	4,493	5,148	750
Sociology	11,468	287	563	8,491	2,128	5,292	2,678	3,126	372
Information science	3,864	77	148	2,875	764	1,682	1,007	1,004	172
Other social sciences	69,719	1,933	3,736	51,062	12,988	27,507	18,686	21,833	1,692
Humanities	122,835	3,542	5,357	91,056	22,879	109,722	5,925	6,110	1,077
Total social sciences and humanities	303,771	8,205	14,532	223,948	57,086	169,292	47,844	76,245	10,390
TOTAL	1,022,275	32,407	83,617	699,794	206,456	402,867	257,276	300,984	61,148

(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 13 of the Explanatory Notes.

TABLE 25. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY SOURCE OF FUNDS
(\$'000)

Field of science	Source of funds					Overseas sources
	Total	Commonwealth government	State and Local government	Business enterprises	Private non-profit and other Australian	
<i>Natural sciences</i>						
Physical sciences	89,648	82,012	292	1,422	4,693	1,229
Chemical sciences	60,583	57,261	163	1,656	1,337	166
Biological sciences	150,050	140,271	1,967	2,297	4,988	527
Earth sciences	51,219	47,820	450	1,187	1,421	341
Engineering and applied sciences	131,850	120,823	1,375	5,526	3,498	628
Agricultural sciences and forestry	62,774	53,668	3,106	2,002	3,391	607
Medical sciences	172,380	147,075	2,392	3,838	17,312	1,763
Total natural sciences	718,504	648,930	9,745	17,928	36,639	5,262
<i>Social sciences and humanities</i>						
Economics	39,660	37,773	301	212	1,074	300
Education	30,450	29,245	473	46	607	79
Management	4,427	4,180	47	160	27	14
Political science	21,347	20,763	269	5	184	125
Sociology	11,468	11,142	128	8	171	18
Information science	3,864	3,767	46	4	40	6
Other social sciences	69,719	66,552	680	180	1,354	953
Humanities	122,835	121,606	166	132	864	66
Total social sciences and humanities	303,771	295,028	2,111	747	4,322	1,562
TOTAL	1,022,275	943,958	11,856	18,676	40,961	6,824

TABLE 26. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY UNIVERSITIES, AUSTRALIA, 1988
HUMAN RESOURCES DEVOTED TO R & D BY FIELD OF SCIENCE BY TYPE OF EMPLOYEE AND TYPE OF RESEARCHER
(person years)

Field of science	Type of employee				Type of researcher	
	Total	Researchers	Technicians	Other supporting staff	Academic staff	Post-graduates
<i>Natural sciences</i>						
Physical sciences	1,684	1,220	356	108	607	613
Chemical sciences	1,377	1,069	249	59	416	653
Biological sciences	3,282	2,356	777	149	989	1,366
Earth sciences	1,115	844	217	55	337	507
Engineering and applied sciences	2,885	2,224	540	121	758	1,467
Agricultural sciences and forestry	1,597	1,176	357	64	413	763
Medical sciences	3,896	2,544	1,069	282	1,401	1,143
Total natural sciences	15,836	11,432	3,566	837	4,920	6,512
<i>Social sciences and humanities</i>						
Economics	725	601	37	87	406	195
Education	738	632	39	66	252	380
Management	87	77	3	8	38	39
Political science	486	403	37	46	161	243
Sociology	270	243	11	17	112	131
Information science	127	121	3	3	26	95
Other social sciences	1,650	1,378	125	147	584	794
Humanities	3,019	2,797	61	161	983	1,814
Total social sciences and humanities	7,103	6,253	316	535	2,561	3,692
TOTAL	22,939	17,685	3,882	1,372	7,481	10,203

TABLE 27. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
(\$'000)

Socio-economic objective	Type of expenditure					Type of activity(a)			
	Total	Land and buildings	Other capital expenditure	Labour costs	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
National security (defence)	226	—	35	164	27	—	13	148	66
<i>Economic development</i>									
Agriculture	4,006	85	351	2,575	995	65	251	2,451	1,238
Forestry and fisheries	797	7	84	554	152	69	65	580	83
Mining (prospecting)	360	2	40	268	50	29	23	258	50
Other	684	5	194	360	126	73	101	500	10
Mining (extraction)									
Energy sources	282	1	19	231	31	38	38	142	64
Other	1,535	5	227	1,070	234	149	127	1,120	140
Manufacturing	6,761	116	719	4,963	963	161	861	3,855	1,884
Construction	1,356	13	192	969	182	—	121	1,023	212
Energy	2,513	5	243	1,960	305	87	134	1,544	748
Transport	365	—	36	299	29	15	25	201	124
Communications	1,425	1	142	1,102	179	28	56	865	476
Economic services n.e.c.	3,277	83	269	2,702	223	108	451	2,318	401
Total economic development	23,361	323	2,517	17,054	3,468	821	2,253	14,857	5,430
<i>Community welfare</i>									
Urban and regional planning	796	—	57	628	111	7	28	463	299
Environment	2,644	110	268	1,892	375	133	506	1,534	472
Health	9,942	95	1,228	7,097	1,523	1,078	2,374	5,747	743
Education	6,794	35	350	5,934	475	165	365	5,163	1,100
Welfare	735	—	33	659	42	29	48	515	142
Community services n.e.c.	2,112	16	49	1,898	149	98	334	1,489	190
Total community welfare	23,023	256	1,985	18,107	2,675	1,510	3,655	14,910	2,947
<i>Advancement of knowledge</i>									
Earth, ocean and atmosphere n.e.c.	1,182	131	276	684	91	293	102	443	343
General advancement of knowledge	6,726	291	580	5,282	573	3,983	382	1,968	393
Total advancement of knowledge	7,908	422	856	5,966	664	4,276	484	2,411	736
TOTAL	54,518	1,000	5,394	41,291	6,833	6,608	6,405	32,326	9,179

(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 13 of the Explanatory Notes.

TABLE 28. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1968
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY SOURCE OF FUNDS
(\$'000)

Socio-economic objective	Source of funds					Overseas sources
	Total	Commonwealth government	State and Local government	Business enterprises	Private non-profit and other Australian	
National security (defence)	226	193	6	26	1	—
<i>Economic development</i>	4,006	2,298	966	647	68	26
Agriculture	797	478	131	173	13	1
Forestry and fisheries						
Mining (prospecting)						
Energy sources	360	132	53	171	4	—
Other	684	447	49	149	21	18
Mining (extraction)						
Energy sources	282	184	15	76	7	—
Other	1,535	710	92	723	7	3
Manufacturing	6,761	4,546	306	1,821	66	23
Construction	1,356	957	87	186	32	94
Energy	2,513	1,620	238	618	10	28
Transport	365	247	44	59	3	12
Communications	1,425	1,062	70	280	13	1
Economic services n.e.c.	3,277	2,384	175	604	102	12
Total economic development	23,361	15,065	2,228	5,506	345	218
<i>Community welfare</i>						
Urban and regional planning	796	530	83	155	24	4
Environment	2,644	1,840	228	522	48	7
Health	9,942	7,353	748	1,527	259	55
Education	6,794	5,813	595	109	257	20
Welfare	735	645	24	42	22	—
Community services n.e.c.	2,112	1,777	165	133	30	6
Total community welfare	23,023	17,958	1,843	2,489	641	92
<i>Advancement of knowledge</i>						
Earth, ocean and atmosphere n.e.c.	1,182	718	332	122	8	2
General advancement of knowledge	6,726	5,351	370	764	185	57
Total advancement of knowledge	7,908	6,069	702	886	193	59
TOTAL	54,518	39,285	4,779	8,906	1,180	369

TABLE 29. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1988
R & D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY FIELD OF SCIENCE
(\$'000)

Socio-economic objective	Field of science									
	Total	Physical	Chemical	Biological	Earth	Engineering	Agricultural	Medical	Social	Humanities
National security (defence)	226	—	63	—	—	157	—	—	6	—
<i>Economic development</i>										
Agriculture	4,006	18	91	710	17	268	2,787	31	83	—
Forestry and fisheries	797	6	—	166	46	41	535	—	—	3
Mining (prospecting)	360	—	—	—	360	—	—	—	—	—
Energy sources	684	34	—	—	444	207	—	—	—	—
Other	—	—	—	—	—	—	—	—	—	—
Mining (extraction)	282	—	—	127	35	120	—	—	—	—
Energy sources	1,535	—	467	—	22	1,047	—	—	—	—
Other	6,761	742	510	100	20	5,294	—	—	96	—
Manufacturing	1,356	—	—	—	22	1,260	—	—	74	—
Construction	2,513	65	74	41	192	1,962	169	—	10	—
Energy	365	—	—	—	51	302	—	—	12	—
Transport	1,425	212	—	—	—	992	—	—	131	90
Communications	3,277	7	—	—	—	1,019	23	24	2,203	—
Economic services n.e.c.	23,361	1,084	1,141	1,144	1,208	12,513	3,514	56	2,609	93
Total economic development										
<i>Community welfare</i>										
Urban and regional planning	796	—	154	—	61	254	12	—	316	—
Environment	2,644	53	551	715	615	518	30	—	162	—
Health	9,942	375	846	674	8	413	—	6,755	858	13
Education	6,794	12	2	—	1	14	—	2	6,363	400
Welfare	735	—	—	—	—	86	—	23	626	—
Community services n.e.c.	2,112	8	—	—	25	134	57	49	1,586	252
Total community welfare	23,023	448	1,553	1,389	710	1,419	100	6,828	9,911	666
<i>Advancement of knowledge</i>										
Earth, ocean and atmosphere n.e.c.	1,182	186	7	49	337	566	26	—	11	1
General advancement of knowledge	6,726	814	816	1,799	57	636	5	11	1,435	1,153
Total advancement of knowledge	7,908	1,000	823	1,847	394	1,202	31	11	1,447	1,153
TOTAL	54,518	2,531	3,580	4,380	2,312	15,291	3,645	6,895	13,972	1,912

TABLE 30. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1968
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EMPLOYEE AND TYPE OF RESEARCHER
(person years)

Socio-economic objective	Type of employee				Type of researcher	
	Total	Researchers	Technicians	Other supporting staff	Academic staff	Post-graduates
National security (defence)	6	5	1	—	2	3
<i>Economic development</i>						
Agriculture	129	92	33	4	56	36
Forestry and fisheries	35	26	8	1	13	14
Mining (prospecting)						
Energy sources	20	17	2	1	10	7
Other	32	26	5	1	11	15
Mining (extraction)						
Energy sources	12	11	1	—	7	4
Other	51	40	9	2	17	23
Manufacturing	284	219	52	14	104	115
Construction	36	26	7	2	15	11
Energy	93	76	13	3	47	30
Transport	19	16	2	—	9	7
Communications	49	41	6	3	21	20
Economic services n.e.c.	136	130	3	3	75	55
Total economic development	896	719	142	35	384	335
<i>Community welfare</i>						
Urban and regional planning	25	21	2	2	14	7
Environment	92	73	15	5	40	33
Health	327	272	38	17	156	116
Education	239	211	9	19	161	50
Welfare	29	26	1	2	17	9
Community services n.e.c.	62	55	3	4	41	14
Total community welfare	773	657	68	48	429	229
<i>Advancement of knowledge</i>						
Earth, ocean and atmosphere n.e.c.	40	35	3	1	21	14
General advancement of knowledge	249	217	21	11	124	93
Total advancement of knowledge	289	252	25	12	145	107
TOTAL	1,963	1,633	235	95	960	673

TABLE 31. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1968
HUMAN RESOURCES DEVOTED TO R & D BY SOCIO-ECONOMIC OBJECTIVE BY FIELD OF SCIENCE
(person years)

Socio-economic objective	Field of science									
	Total	Physical	Chemical	Biological	Earth	Engineering	Agricultural	Medical	Social	Humanities
National security (defence)	6	—	2	—	—	4	—	—	—	—
<i>Economic development</i>										
Agriculture	129	1	6	25	1	12	81	1	2	—
Forestry and fisheries	35	—	—	6	2	2	24	—	—	—
Mining (prospecting)										
Energy sources	20	—	—	—	20	—	—	—	—	—
Other	32	2	—	—	23	6	—	—	—	—
Mining (extraction)										
Energy sources	12	—	—	6	1	5	—	—	—	—
Other	51	—	18	—	1	31	—	—	—	—
Manufacturing	284	32	17	5	1	216	—	—	13	—
Construction	36	—	—	—	2	33	—	—	1	—
Energy	93	2	3	1	6	75	5	—	—	—
Transport	19	—	—	—	3	16	—	—	1	—
Communications	49	6	—	—	—	32	—	—	5	6
Economic services n.e.c.	136	—	—	—	—	33	1	1	101	—
Total economic development	896	44	45	44	60	461	111	2	124	6
<i>Community welfare</i>										
Urban and regional planning	25	—	4	—	2	7	1	—	11	—
Environment	92	1	21	32	17	14	1	—	6	—
Health	327	13	20	18	—	14	—	233	28	—
Education	239	1	—	—	1	1	—	—	221	16
Welfare	29	—	—	—	—	2	—	1	26	—
Community services n.e.c.	62	—	—	—	2	4	2	1	46	7
Total community welfare	773	15	46	50	21	41	3	235	337	23
<i>Advancement of knowledge</i>										
Earth, ocean and atmosphere n.e.c.	40	10	—	1	14	12	2	—	—	—
General advancement of knowledge	249	36	26	56	3	22	—	—	60	45
Total advancement of knowledge	289	46	27	57	18	34	2	—	61	45
TOTAL	1,963	104	119	151	99	540	117	238	522	74

TABLE 32. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
(\$'000)

Field of science	Type of expenditure					Type of activity(a)			
	Total	Land and buildings	Other capital expenditure	Labour costs	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
<i>Natural sciences</i>									
Physical sciences	2,531	94	296	1,834	308	489	510	1,193	339
Chemical sciences	3,580	44	401	2,509	625	658	708	1,786	427
Biological sciences	4,380	232	421	3,064	663	1,611	511	1,810	448
Earth sciences	2,312	58	286	1,568	399	192	484	1,298	338
Engineering and applied sciences	15,291	286	2,220	11,061	1,724	887	1,252	8,914	4,239
Agricultural sciences and forestry	3,645	62	299	2,303	981	52	211	2,297	1,085
Medical sciences	6,895	49	873	4,958	1,016	558	1,481	4,391	465
Total natural sciences	38,634	824	4,796	27,298	5,716	4,446	5,157	21,689	7,342
<i>Social sciences and humanities</i>									
Economics	1,721	38	73	1,441	170	120	148	1,335	118
Education	6,181	36	340	5,374	431	245	333	4,557	1,046
Management	942	2	29	871	40	39	58	661	183
Political science	509	23	6	455	25	108	180	197	24
Sociology	634	1	9	598	27	168	64	371	31
Information science	440	—	1	423	16	87	54	300	—
Other social sciences	3,545	76	96	3,091	283	404	319	2,453	369
Humanities	1,912	1	45	1,742	124	990	93	764	65
Total social sciences and humanities	15,884	176	598	13,993	1,116	2,162	1,248	10,637	1,837
TOTAL	54,518	1,000	5,394	41,291	6,833	6,608	6,405	32,326	9,179

(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 13 of the Explanatory Notes.

TABLE 33. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1988
R & D EXPENDITURE BY FIELD OF SCIENCE BY SOURCE OF FUNDS
(\$'000)

Field of science	Source of funds					
	Total	Commonwealth government	State and Local government	Business enterprises	Private non-profit and other Australian	Overseas sources
<i>Natural sciences</i>						
Physical sciences	2,531	1,894	157	431	29	20
Chemical sciences	3,580	2,157	134	1,275	7	7
Biological sciences	4,380	3,011	434	763	144	28
Earth sciences	2,312	1,478	252	536	23	23
Engineering and applied sciences	15,291	9,966	1,026	3,903	213	183
Agricultural sciences and forestry	3,645	1,947	994	611	66	27
Medical sciences	6,895	5,164	642	855	197	37
Total natural sciences	38,634	25,616	3,640	8,374	679	325
<i>Social sciences and humanities</i>						
Economics	1,721	1,361	141	138	70	11
Education	6,181	5,306	506	100	247	21
Management	942	775	40	103	20	3
Political science	509	470	29	4	5	—
Sociology	634	583	28	4	19	—
Information science	440	422	13	4	1	—
Other social sciences	3,545	3,080	244	113	101	7
Humanities	1,912	1,671	137	65	38	2
Total social sciences and humanities	15,884	13,669	1,139	532	501	44
TOTAL	54,518	39,285	4,779	8,906	1,180	369

TABLE 34. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY COLLEGES OF ADVANCED EDUCATION, AUSTRALIA, 1968
HUMAN RESOURCES DEVOTED TO R & D BY FIELD OF SCIENCE BY TYPE OF EMPLOYEE AND TYPE OF RESEARCHER
(person years)

Field of science	Type of employee				Type of researcher	
	Total	Researchers	Technicians	Other supporting staff	Academic staff	Post-graduates
<i>Natural sciences</i>						
Physical sciences	104	91	11	3	46	45
Chemical sciences	119	93	21	4	45	48
Biological sciences	151	121	25	6	65	56
Earth sciences	99	83	12	4	50	34
Engineering and applied sciences	540	427	89	24	224	202
Agricultural sciences and forestry	117	81	32	4	53	28
Medical sciences	238	196	29	12	111	86
Total natural sciences	1,367	1,092	219	57	594	498
<i>Social sciences and humanities</i>						
Economics	53	50	1	2	42	8
Education	218	191	9	18	143	48
Management	69	66	2	2	19	47
Political science	11	10	—	1	10	1
Sociology	20	18	—	2	16	2
Information science	22	21	—	1	13	8
Other social sciences	129	118	3	7	83	35
Humanities	74	67	1	6	41	26
Total social sciences and humanities	596	542	17	38	367	175
TOTAL	1,963	1,633	235	95	960	673

TABLE 35. ENERGY RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
R & D EXPENDITURE BY ENERGY OBJECTIVE CODE BY SOURCE OF FUNDS
(\$'000)

Energy objective code	1986r			1988		
	Total	Source of funds		Total	Source of funds	
		Industry(a)	Government(b)		Industry(a)	Government(b)
<i>Production and utilisation of energy</i>						
<i>Oil and gas</i>						
06003 Mining extraction techniques	384	12	372	990	124	866
10001 Refining, transport and storage	1,853	106	1,748	1,074	89	985
(c) Other	3,935	293	3,642	2,492	225	2,267
(c) Oil shale and tar sands	621	11	610	774	24	750
Total oil and gas	6,794	422	6,372	5,330	462	4,867
<i>Coal</i>						
06002 Mining extraction techniques	901	170	730	1,777	83	1,694
10010 Preparation and transport	963	118	845	1,117	94	1,023
10011 Combustion	897	32	864	2,012	96	1,916
10050 Conversion	1,209	83	1,126	811	60	751
(c) Other	2,071	130	1,941	2,226	155	2,072
Total coal	6,041	534	5,507	7,943	487	7,456
<i>Solar energy</i>						
10015 Heating and cooling	1,914	95	1,819	1,868	82	1,786
10016 Photo-electric	1,018	103	915	2,396	201	2,196
10017 Thermal-electric	1,246	4	1,243	452	6	446
Total solar	4,178	201	3,977	4,717	289	4,428
<i>Nuclear</i>						
<i>Non-breeder</i>						
10020 Light water reactor	—	—	—	—	—	—
10024 Other converter reactor	—	—	—	22	—	22
(c) Fuel cycle	430	11	420	434	16	418
10026 Supporting technologies	312	6	306	286	9	277
10030 Breeder	—	—	—	—	—	—
10035 Fusion	3,019	42	2,977	3,366	62	3,304
Total nuclear	3,761	59	3,702	4,108	88	4,020
<i>Other primary sources</i>						
10040 Wind	674	36	638	350	8	341
10041 Ocean	—	—	—	—	—	—
10042 Geothermal	62	1	61	—	—	—
10052 Biomass	1,100	53	1,047	495	25	470
10049 Other sources and new vectors	628	50	578	297	44	253
Total other primary sources	2,464	140	2,325	1,142	76	1,065
Total production and utilisation of energy	23,238	1,355	21,883	23,239	1,402	21,837

See footnotes at end of table.

TABLE 35. ENERGY RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY HIGHER EDUCATION ORGANISATIONS, AUSTRALIA
R & D EXPENDITURE BY ENERGY OBJECTIVE CODE BY SOURCE OF FUNDS
(\$'000) —continued

Energy objective code	1986r			1988		
	Source of funds			Source of funds		
	Total	Industry(a)	Government(b)	Total	Industry(a)	Government(b)
<i>Conservation of energy</i>						
10060 Industry	1,600	129	1,471	2,794	252	2,542
10062 Residential and commercial	922	70	851	1,452	61	1,391
10064 Transportation	988	60	928	1,150	82	1,068
10069 Other	136	32	105	333	127	206
Total conservation of energy	3,646	291	3,355	5,730	521	5,208
<i>Other energy R & D</i>						
10070 Electric power conversion	1,417	32	1,384	2,103	367	1,736
10072 Electricity transmission and distribution	2,035	64	1,971	3,217	192	3,025
10074 Energy storage n.e.c.	1,003	113	890	824	72	752
10076 Energy systems analysis	967	23	944	963	36	927
10079 Other	342	10	333	244	10	234
Total other energy R & D	5,763	241	5,522	7,351	676	6,675
TOTAL	32,647	1,888	30,759	36,319	2,600	33,719

(a) Includes private and public sector business enterprises and private non-profit enterprises. (b) Includes Commonwealth and State government organisations, universities and colleges of advanced education. (c) Details of energy objective codes included in these categories are available from ABS.

EXPLANATORY NOTES

Introduction

This publication presents estimates of expenditure and human resources devoted to R&D carried out by organisations in the Higher Education sector in Australia during the calendar year 1988.

2. Comparable R&D statistics are also produced for the Business Enterprise, General Government and Private Non-profit sectors. (See paragraph 25).

Data Sources

3. The R&D statistics for universities are derived from data collected biennially from university academic organisational units (AOUs) by the ABS Survey of Research and Experimental Development and from the Department of Employment, Education and Training (DEET) annual statistical collection.

4. R&D statistics for colleges of advanced education (CAEs) are compiled from data collected directly from CAE AOUs or equivalents by the ABS Survey of Research and Experimental Development.

5. The ABS survey was conducted by mailed questionnaires via a university or CAE contact officer and an 89 per cent response was obtained. Details from non-responding R&D performing AOUs were partially imputed.

6. Analysts should note that there were no CAE details for 1985 and only limited details are collected and published for alternate years.

7. Limited additional detailed R&D statistics will be available at a charge from the ABS when compiled. Revised details for previous R&D surveys are also available at a charge.

8. The GDP figures used to derive Higher Education expenditure on R&D / GDP ratios quoted in the Summary of Findings are current at time of manuscript finalisation (National Income and Expenditure, 1989-90, Budget Related Paper No.2) and are as follows: \$214,467m (1984-85); \$238,118m (1985-86); \$261,869m (1986-87); \$296,423m (1987-88); and \$337,592m (1988-89). For further information please see Australian National Accounts, National Income and Expenditure, 1988-1989 (5204.0). 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, 1990:1", OECD, Paris 1990.

Definitions

9. *Research and Experimental Development* is defined in accordance with the Organisation for Economic Cooperation and Development (OECD) standard as comprising 'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and

the use of this stock of knowledge to devise new applications'.

10. The definition of R&D was extended for the 1984 survey, in accordance with a change in OECD standards, to include research into and development (or substantial modification) of computer software such as applications software, new programming languages and new operating systems. Definitions of R&D terminology are provided in the glossary.

11. For a more comprehensive interpretation of the definition of R&D, contact the ABS or refer to the OECD publication *The Measurement of Scientific and Technical Activities* ("Frascati Manual" 1980) OECD, Paris 1981.

12. The R&D statistics presented in this publication refer to R&D activity *carried out* by an organisation on its own behalf or on behalf of other organisations, enterprises or individuals.

13. Type of R&D activity comprises 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. 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.

Scope

14. The Higher Education sector is defined by the OECD as including all universities, CAEs and other institutions of post-secondary education whatever their source of finance or legal status.

Coverage

15. For ABS R&D surveys of this sector, only universities, CAEs and their associated research institutes are surveyed. Bond University details have been excluded from this publication. 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 science classifications

16. The statistics in this publication are classified by Socio-Economic Objective (SEO) and/or Field Of Science (FOS).

17. Respondents are asked to classify each of their R&D programs to a SEO and a FOS.

18. For a more detailed description and explanation of SEO and FOS classifications please contact the ABS.

Methodology for deriving university R&D expenditure estimates

19. The ABS derived 1988 university R&D expenditure estimates by using R&D human resource data (collected in the ABS R&D survey) in conjunction with general expenditure details obtained from the DEET finance collection.

20. In broad terms, the estimation of university R&D expenditure was carried out in the following manner:

- (a) *Direct academic organisational unit (AOU) R&D expenditure.* Expenditure on research-only activities is extracted directly from DEET statistics. The ratio of Teaching and Research (T&R) R&D person years to total T&R person years is calculated from reported data. This ratio is then applied to DEET AOU T&R expenditure statistics to derive the research component. Total AOU R&D expenditure is the sum of the research only expenditure and the calculated research component of T&R expenditure.
- (b) *Direct program R&D expenditure* is then derived by multiplying total AOU R&D expenditure derived in (a) by the ratio of program R&D person years to AOU R&D person years. This ratio is calculated from reported data.
- (c) *Overhead R&D expenditure* is then derived by calculating the ratio of program R&D person years to total university R&D person years. This ratio is then applied to university level overhead expenditure (obtained from DEET), the result being overhead R&D expenditure estimates at program level.
- (d) The sum of R&D expenditure data derived at (b) and (c) forms the basis for expenditure estimates in this publication.

Constant price estimates

21. Estimates of total R&D expenditure are shown at average 1984-85 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 (1984-85). Because the measures relate to input quantities, they do not reflect changes in the efficiency with which labour, capital and other inputs are used.

22. The estimate of the labour costs component was obtained by multiplying each broad category of labour used in each period by the relevant average labour costs in the base year (1984-85). The non-labour costs components were estimated by deflating each by a composite price index of relevant materials or capital expenditure items. In revaluing R&D non-labour expenditure, extensive use has been made of price series

used in deriving constant price national accounts estimates.

23. For a more comprehensive description of constant price concepts and estimation procedures see *Australian National Accounts: Concepts, Sources and Methods* (5216.0).

Reliability of statistics

24. The statistics contained in this publication should be interpreted with caution for the following reasons:

- (a) Many respondents had to make estimates because their records or accounts do not separately identify data on R&D activity.
- (b) The OECD standard definition of R&D differs in some respects from what respondents may regard as R&D activity.
- (c) Some respondents have difficulties describing their R&D programs in terms of SEO, FOS and type of activity. These classifications will therefore reflect a degree of subjectivity.
- (d) Details from non-responding R&D performing AOU's were partially imputed.
- (e) R&D expenditure data for universities are derived indirectly using DEET university expenditure data. (See paragraphs 19 & 20).

Related publications

25. Users may also wish to refer to the following publications:

Research and Experimental Development, Business Enterprises, Australia, 1988-89 (8104.0)

Research and Experimental General Government and Private Non-profit Organisations, Australia, 1988-89 (8109.0)

Research and Experimental Development, All Sector Summary, Australia, 1988-89 (8112.0) (to be released shortly)

Research and Experimental Development, All Sector Summary, Australia, (Inter Year Survey), Australia, 1987-88 (8122.0)

Measures of Science and Innovation, Australian Science and Technology Indicators Report, Department of Industry, Technology and Commerce, Canberra, Australia, 1987

Australian S & T Data Brief 1989-90, Department of Industry, Technology and Commerce, Canberra, Australia, 1990

Main S & T Indicators 1990:1, OECD, Paris, 1990

The Measurement of Scientific and Technical Activities
("Frascati Manual" 1980) OECD, Paris 1981

26. Current publications issued by the ABS are listed in the *Catalogue of Publications, Australia* (1101.0). The ABS also issues, on Tuesdays and Fridays, a *Publications Advice* (1105.0) which lists publications to be released in the next few days. The Catalogue and Publications advice are available from any ABS office.

Symbols and other usages

- n.e.c. not elsewhere classified
- n.p. not available for separate publication
(but included in totals where applicable)
- n.a. not available
- nil or rounded to zero

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

Electronic services

DISCOVERY. Key *656# for selected current economic, social and demographic statistics.

AUSSTATS. Thousands of up-to-date time series are available on this ABS on-line service through PAXUS COMNET. For further information phone the AUSSTATS Help Desk on (06) 252 6017.

TELESTATS. This service provides:

- foreign trade statistics tailored to users' requirements. Further information is available on (06) 252 5404.
- text and tables for selected Main Economic Indicator publications. Further information is available on (06) 252 5405.

Floppy disk service

Selected ABS services are available on floppy disk. Further information is available on (06) 252 6684.

GLOSSARY

Applied research is 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 pre-determined objectives.

Basic research is 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 necessary for the solution of recognised practical problems.

Capital expenditure is expenditure on the acquisition (less disposals) of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment attributable to R&D activity.

Current expenditure is expenditure on labour costs, materials, fuels, rent and leasing, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.

Energy R&D statistics refer to R&D activity directed towards the producing, storing, transmitting, utilising and conserving of energy.

Experimental development is systematic work, using existing knowledge gained from research or practical experience for the purpose of creating new or improved products/processes.

Field of Science (FOS) refers to the field in which the R&D activity was performed rather than the fields used in the research program, e.g. in a program investigating cell membrane structure by electron microscopy, the FOS

would be Cell Structure and Membrane Biology rather than Electronic Engineering.

Human resources devoted to R&D measures 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.

Intramural R&D activity is R&D carried out by an organisation on its own behalf or on behalf of other organisations, institutions or individuals.

Other supporting staff are those skilled and unskilled craftspersons, secretarial and clerical staff directly associated with R&D activity.

Researchers are those involved with the conception and/or development of new products/processes e.g. executives and directors involved in the planning or management of scientific and technical aspects of R&D projects, and software developers/programmers.

Socio-Economic Objective (SEO) refers to the area of expected national benefit rather than to the immediate objectives of the researcher, e.g. overcoming manufacturing difficulties during the development of a new type of rolling stock for the nation's railway system should be classified to Transport rather than to Manufacturing Industry.

Technicians are those performing technical tasks in support of R&D activity, normally under the direction and supervision of a researcher. These tasks include preparation of experiments, taking records, preparation of charts and graphs and coding computer programs.

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

Printed by R.D. RUBIE, Commonwealth Government Printer, Canberra
© Commonwealth of Australia 1990

Recommended retail price: \$8.00



2081110012884

ISSN 0729-171X