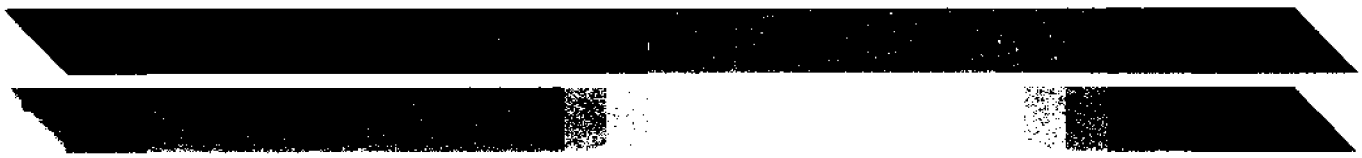
1992-93 Research and Experimental Development

General Government and Private Non-Profit Organisations Australia

Catalogue No. 8109.0



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RESEARCH AND EXPERIMENTAL DEVELOPMENT

GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS AUSTRALIA 1992-93

IAN CASTLES
Australian Statistician

AUSTRALIAN BUREAU OF STATISTICS

CATALOGUE NO. 8109.0

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INQUIRIES

- *for further information about statistics in this publication and the availability of related unpublished statistics*, contact Derek Byars on Canberra (06) 252 5627 or any ABS office.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.
- *for information about other ABS statistics and services* please refer to the back page of this publication.

SUMMARY OF FINDINGS

Government expenditure on R&D (GOVERD)

Government expenditure on R&D (GOVERD) carried out in Australia in 1992-93 is estimated to be $1,744 million at *current* prices. This represents an increase of 5 per cent over the two years since 1990-91. At *average* 1989-90 prices, R&D expenditure is estimated to be $1,532 million. This represents a decrease of 3 per cent compared with 1990-91.

At *average* 1989-90 prices, Commonwealth Government organisations increased R&D expenditure by 1 per cent over 1990-91, while State Government organisations decreased 9 per cent over this period.

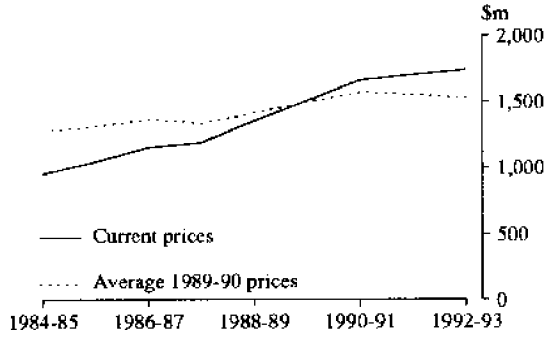
Commonwealth Government organisations now account for 65 per cent of R&D expenditure in the government sector. The commonwealth contribution has increased from 62 per cent in 1990-91 after decreasing steadily over the years from a high of 70 per cent in 1984-85.

Government expenditure on R&D represents 0.43 per cent of Gross Domestic Product (GDP), down from 0.44 per cent in 1990-91.

Australia has a high GOVERD/GDP ratio when compared with the other OECD countries shown in the table below.

Iceland	0.60%
France	0.52%
Finland	0.45%
AUSTRALIA	**0.43%**
Germany	0.38%
United Kingdom	0.34%
Italy	0.33%
United States	0.30%
Canada	0.28%
Japan	0.25%
Spain	0.18%
Ireland	0.14%

GENERAL GOVERNMENT EXPENDITURE ON R&D



GENERAL GOVERNMENT AS A PERCENTAGE OF GDP

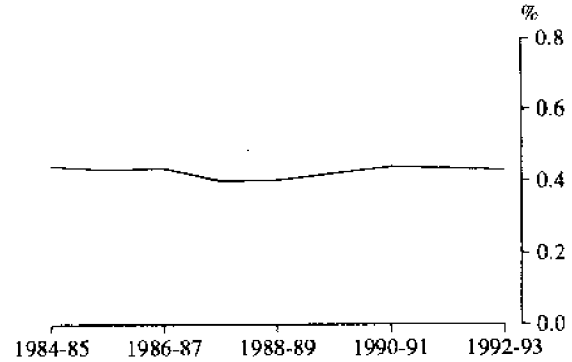


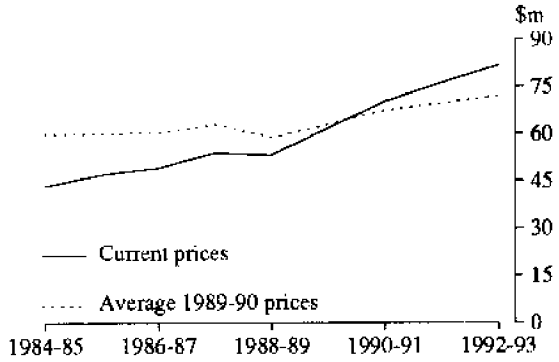
TABLE 1. R&D EXPENDITURE BY GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA
($m)

	1984-85	*1985-86*	*1986-87*	*1987-88*	*1988-89r*	*1990-91r*	*1992-93*
AT CURRENT PRICES							
Government organisations							
Commonwealth	669.4	729.0	786.5	797.0	869.6	1,025.8	1,128.2
State	285.9	315.8	368.4	394.6	482.7	638.5	615.5
Total	**955.3**	**1,044.8**	**1,154.9**	**1,191.7**	**1,352.3**	**1,664.3**	**1,743.8**
Private non-profit organisations	43.5	47.1	49.1	53.9	53.3	70.3	81.9
AVERAGE 1989-90 PRICES							
Government organisations							
Commonwealth	891.2	910.9	925.7	883.3	894.4	956.9	969.7
State	391.3	404.3	438.7	447.9	524.4	615.3	562.1
Total	**1,282.5**	**1,315.2**	**1,364.4**	**1,331.2**	**1,418.8**	**1,572.2**	**1,531.8**
Private non-profit organisations	59.9	60.1	60.6	63.1	58.8	67.4	72.2

Private non-profit expenditure on R&D

Private non-profit expenditure on R&D carried out in Australia in 1992-93 is estimated to be $81.9 million at *current* prices. This represents an increase of 17 per cent compared with 1990-91. At *average* 1989-90 prices, R&D expenditure is estimated to be $72.2 million. This represents an increase of 7 per cent compared with 1990-91.

PRIVATE NON-PROFIT EXPENDITURE ON R&D



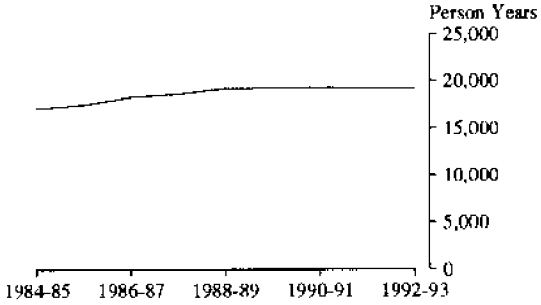
Human resources devoted to R&D

General Government

Human resources devoted to R&D carried out in Australia by Government organisations is estimated to be 19,189 person years. This represents a 0.5 per cent decrease over 1990-91. Human resources devoted to research steadily increased over the years to a peak in 1990-91 (19,284 person years).

Commonwealth organisations account for 57 per cent of person years effort devoted to R&D in the government sector.

GENERAL GOVERNMENT HUMAN RESOURCES DEVOTED TO R&D



Private non-profit

Human resources devoted to R&D carried out in Australia by Private non-profit organisations is estimated to be 1,120 person years. This represents a 4 per cent increase over 1990-91.

PRIVATE NON-PROFIT HUMAN RESOURCES DEVOTED TO R&D

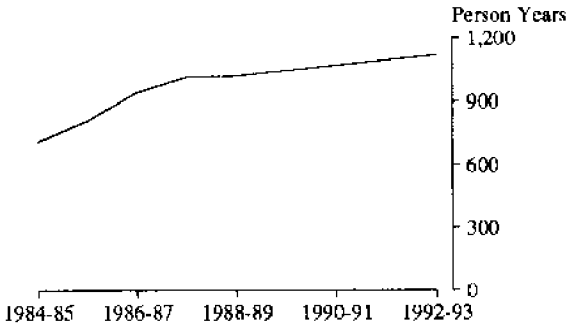


TABLE 2. HUMAN RESOURCES DEVOTED TO R&D BY GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA
(person years)

	1984-85	*1985-86*	*1986-87*	*1987-88*	*1988-89r*	*1990-91r*	*1992-93*
Government organisations							
Commonwealth	11,119	11,182	11,529	11,491	10,863	10,660	10,964
State	6,018	6,337	6,796	7,133	8,335	8,625	8,224
Total	**17,136**	**17,519**	**18,325**	**18,624**	**19,198**	**19,284**	**19,189**
Private non-profit organisations	712	812	945	1,016	1,023	1,072	1,120

General government R&D

Direction of research

Socio-economic Objective (SEO)

The socio-economic objectives in which most government R&D expenditure occurred were: Economic development ($1,006m), Environment ($281m) and Defence ($201m). Within Economic development, the main objectives were Animal production and primary products ($277m), Plant production and primary products ($247m) and Manufacturing ($219m).

These objectives were also the main objectives of government R&D in 1990-91.

Type of expenditure

Labour costs continue to be the main component of R&D expenditure (58%). Labour costs as a proportion of total R&D costs has increased slightly after decreasing for a number of years. Labour costs account for a greater proportion of research expenditure by state government organisations (63%) when compared with commonwealth organisations (55%). Capital expenditure is highest in the Defence objective at $37m (19% of total expenditure).

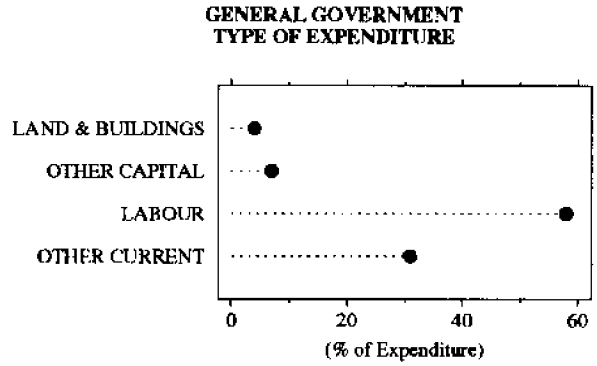


TABLE 3. R&D BY GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93 BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY
($'000)

		Type of expenditure				*Type of activity(a)*			
Socio-economic objective	*Total*	*Land and buildings*	*Other capital expend-iture*	*Labour costs(b)*	*Other current expend-iture*	*Pure basic research*	*Strategic basic research*	*Applied research*	*Experi-mental develop-ment*
Defence	**201,309**	**8,134**	**29,133**	**124,203**	**39,838**	**199**	**6,008**	**55,178**	**139,923**
Economic development									
Plant - production and primary products	247,490	13,620	15,445	151,567	66,859	1,932	34,677	167,862	43,020
Animal - - production and primary products	277,204	14,213	15,509	163,233	84,249	2,284	48,328	188,700	37,892
Mineral resources (excl. energy)	70,652	2,619	4,971	38,670	24,392	1,043	29,092	33,336	7,181
Energy resources	51,973	1,252	2,358	23,878	24,485	593	25,609	22,216	3,555
Energy supply	18,225	690	1,342	10,050	6,143	524	5,826	8,242	3,633
Manufacturing	219,237	9,852	16,663	117,341	75,380	8,418	65,823	104,904	40,091
Construction	38,738	1,334	2,214	23,804	11,386	358	12,643	16,679	9,058
Transport	21,474	420	1,148	13,811	6,095	71	4,684	11,378	5,341
Information and communication services	32,881	1,075	3,153	19,083	9,570	4,375	9,390	10,036	9,080
Commercial services	5,204	230	247	2,952	1,774	280	1,452	2,591	881
Economic framework	22,611	611	1,566	15,537	4,897	1,068	4,876	12,333	4,333
Total Economic development	**1,005,689**	**45,915**	**64,618**	**579,928**	**315,229**	**20,946**	**242,400**	**578,278**	**164,065**
Society									
Health	123,657	2,659	8,209	78,962	33,828	13,891	40,128	53,195	16,443
Education and training	6,906	116	656	4,992	1,141	377	1,758	3,114	1,658
Social development and community services	35,094	1,250	1,148	20,697	12,000	506	15,895	15,773	2,921
Total Society	**165,657**	**4,025**	**10,012**	**104,651**	**46,969**	**14,774**	**57,780**	**72,081**	**21,021**
Environment									
Environmental knowledge	139,978	5,537	8,023	75,911	50,506	3,954	53,256	65,899	16,869
Environmental aspects of economic development	115,465	5,267	6,904	63,053	40,241	1,785	31,991	66,614	15,074
Environmental management and other aspects	25,630	649	1,791	15,012	8,178	305	5,690	14,978	4,657
Total environment	**281,073**	**11,453**	**16,719**	**153,975**	**98,926**	**6,044**	**90,937**	**147,491**	**36,601**
Advancement of knowledge									
Natural sciences, technologies and engineering	88,234	5,402	6,160	43,364	33,309	18,160	44,649	18,284	7,140
Social sciences and humanities	1,791	260	85	965	481	221	1,319	157	94
Total advancement of knowledge	**90,025**	**5,661**	**6,245**	**44,329**	**33,789**	**18,382**	**45,968**	**18,441**	**7,234**
TOTAL	**1,743,752**	**75,189**	**126,726**	**1,007,086**	**534,751**	**60,345**	**443,093**	**871,469**	**368,844**
Commonwealth contribution	1,128,206	46,038	88,807	618,261	375,100	34,521	348,173	485,242	260,270
State contribution	615,546	29,151	37,920	388,825	159,651	25,824	94,920	386,227	108,574

(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 9 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 pay, long service leave payments, sick pay, employer contributions to superannuation and pension schemes.

Direction of research

Field of Research (FOR)

The fields of research in which most government R&D expenditure occurred were:

Agricultural sciences	($539m)
Applied sciences and technologies	($358m)
Earth sciences	($183m)

These fields were also the leading ones in 1990-91.

Type of activity

50 per cent of government R&D expenditure is directed towards Applied research, down from 52 per cent in 1990-91 and 55 per cent in 1988-89. The trend for government organisations to direct relatively less of their research expenditure to pure basic research is continuing. Pure basic research now only accounts for 3 per cent of total R&D, down from 4 per cent in 1990-91, 5 per cent in 1988-89 and 6 per cent in 1986-87. Strategic basic research and Experimental development account for 25 per cent and 21 per cent respectively of government R&D expenditure.

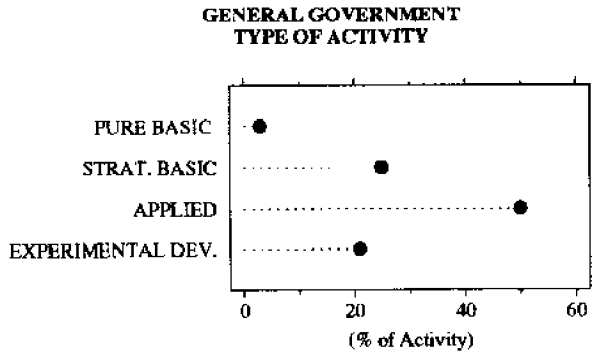


TABLE 4. R&D BY GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93 BY FIELD OF RESEARCH BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY ($'000)

		Type of expenditure				*Type of activity(a)*			
Field of research	*Total*	*Land and buildings*	*Other capital expend-iture*	*Labour costs(b)*	*Other current expend-iture*	*Pure basic research*	*Strategic basic research*	*Applied research*	*Experi-mental develop-ment*
Natural sciences, technologies and engineering									
Mathematical sciences	20,057	530	793	14,070	4,665	1,316	4,719	9,808	4,214
Physical sciences	56,981	1,786	5,268	30,466	19,461	10,674	15,590	19,457	11,261
Chemical sciences	72,239	2,879	4,909	34,812	29,640	2,526	25,717	32,947	11,048
Earth sciences	182,862	6,940	9,323	93,391	73,208	4,150	83,125	81,273	14,315
Information, computers and communication technologies	54,185	1,847	5,540	30,208	16,590	5,895	15,605	18,132	14,553
Applied sciences and technologies	357,936	15,716	42,220	208,226	91,774	3,604	55,365	131,361	167,606
General Engineering	100,687	4,391	7,264	56,278	32,753	1,477	30,998	45,581	22,632
Biological sciences	177,273	9,040	9,061	97,758	61,414	10,637	68,691	80,873	17,072
Agricultural sciences	539,100	27,219	31,460	326,247	154,174	4,326	79,033	369,884	85,856
Medical and health sciences	127,702	3,174	8,196	79,434	36,898	13,625	41,945	56,411	15,721
Total natural sciences, technologies and engineering	**1,689,024**	**73,523**	**124,034**	**970,890**	**520,577**	**58,231**	**420,788**	**845,725**	**364,279**
Social sciences and humanities									
Accounting and finance	12	—	—	9	3	—	5	6	1
Economics	19,085	191	936	14,471	3,487	339	5,111	12,756	879
Political sciences	633	15	42	436	139	40	315	153	125
Sociology	6,153	25	122	3,755	2,252	95	4,663	857	538
Law	4,013	—	1	2,477	1,535	—	3,759	171	84
Psychology	1,584	61	47	775	700	38	552	796	198
Education	4,370	74	538	2,932	827	96	1,250	1,839	1,185
Other social sciences	15,225	823	945	8,907	4,551	457	5,461	8,230	1,077
Humanities	3,653	478	61	2,434	681	1,049	1,190	936	478
Total social sciences and humanities	**54,728**	**1,666**	**2,692**	**36,196**	**14,174**	**2,114**	**22,306**	**25,743**	**4,565**
TOTAL	**1,743,752**	**75,189**	**126,726**	**1,007,086**	**534,751**	**60,345**	**443,093**	**871,469**	**368,844**
Commonwealth contribution	1,128,206	46,038	88,807	618,261	375,100	34,521	348,173	485,242	260,270
State contribution	615,546	29,151	37,920	388,825	159,651	25,824	94,920	386,227	108,574

(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 9 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 pay, long service leave payments, sick pay, employer contributions to superannuation and pension schemes.

Source of funds for R&D

Most of the funding for R&D expenditure came from the government sector itself: 78 per cent from within the organisation performing the R&D (own funds), 6 per cent from other commonwealth organisations and 2 per cent from state government organisations, totalling $1,495m. The next major source of funding was from Joint government/ business (6%) followed by private business (5%).

Funding from external sources ie. not funded by an organisation's own funds is continuing to increase, to be $390m. External funding now accounts for 22 per cent of total R&D funding, up from 20 per cent in 1990-91.

GENERAL GOVERNMENT SOURCE OF FUNDS

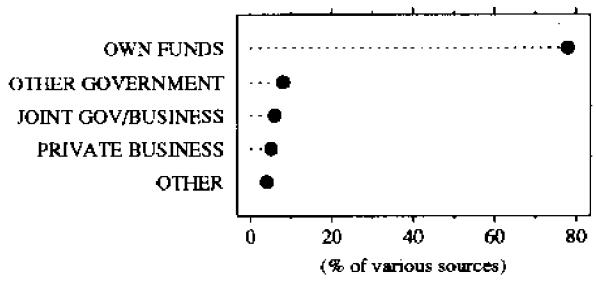


TABLE 5. SOURCE OF FUNDS BY SOCIO-ECONOMIC OBJECTIVE FOR GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93 ($'000)

		Source of funds									
		Own funds									
Socio-economic objective	*Total*	*Commonwealth*	*State*	*Commonwealth government*	*State and local government*	*Private business enterprises*	*Public business enterprises*	*Joint govt/ business (a)*	*Universities and colleges*	*Private non-profit and other Australian*	*Overseas*
Defence	**201,309**	**199,382**	**22**	**146**	**10**	**1,686**	**—**	**8**	**13**	**10**	**31**
Economic development											
Plant — production and primary products	247,490	57,367	130,327	14,971	2,897	3,840	1,020	32,674	510	3,084	800
Animal — production and primary products	277,204	73,134	138,016	15,328	2,752	8,029	1,487	32,979	757	3,799	923
Mineral resources (excl. energy)	70,652	45,994	9,947	3,311	277	8,959	58	644	420	354	689
Energy resources	51,973	44,274	644	1,397	306	4,522	—	101	212	162	357
Energy supply	18,225	12,163	1,148	932	378	2,751	—	322	100	127	305
Manufacturing	219,237	142,766	14,792	12,378	2,015	20,475	386	19,832	897	2,256	3,440
Construction	38,738	21,432	10,144	1,564	128	4,416	4	324	226	179	322
Transport	21,474	4,920	7,919	1,804	2,737	2,274	1,241	59	3	13	506
Information and communication services	32,881	25,561	2,726	1,270	191	2,374	—	178	72	82	426
Commercial services	5,204	3,371	838	368	58	401	—	65	21	13	68
Economic framework	22,611	18,593	955	746	102	1,536	140	73	44	108	315
Total Economic development	**1,005,689**	**449,575**	**317,457**	**54,067**	**11,840**	**59,575**	**4,335**	**87,251**	**3,261**	**10,178**	**8,149**
Society											
Health	123,657	16,093	36,105	22,748	15,769	5,744	1,364	1,947	3,004	17,447	3,437
Education and training	6,906	1,254	4,573	772	234	40	2	20	1	4	6
Social development and community services	35,094	24,579	6,923	1,545	859	334	49	654	34	53	64
Total Society	**165,657**	**41,926**	**47,601**	**25,064**	**16,862**	**6,118**	**1,415**	**2,621**	**3,039**	**17,504**	**3,507**
Environment											
Environmental knowledge	139,978	89,459	24,186	11,154	2,324	5,280	798	4,301	1,045	520	911
Environmental aspects of economic development	115,465	67,127	21,495	7,284	2,117	7,492	443	6,760	502	1,187	1,059
Environmental management and other aspects	25,630	12,365	8,357	2,032	479	742	709	563	39	159	186
Total environment	**281,073**	**168,951**	**54,038**	**20,470**	**4,920**	**13,513**	**1,949**	**11,624**	**1,585**	**1,866**	**2,156**
Advancement of knowledge											
Natural sciences, technologies and engineering	88,234	53,164	20,950	5,286	1,185	1,627	357	580	338	657	4,091
Social sciences and humanities	1,791	35	1,130	541	4	—	—	3	7	71	—
Total advancement of knowledge	**90,025**	**53,199**	**22,080**	**5,827**	**1,189**	**1,627**	**357**	**583**	**344**	**727**	**4,091**
TOTAL	**1,743,752**	**913,033**	**441,199**	**105,574**	**34,821**	**82,519**	**8,056**	**102,087**	**8,243**	**30,285**	**17,935**
Commonwealth contribution	1,128,206	913,033	—	52,442	11,378	73,507	1,148	52,182	4,982	5,563	13,971
State contribution	615,546	—	441,199	53,133	23,443	9,012	6,908	49,905	3,261	24,722	3,963

(a) Includes funds provided via government levies.

TABLE 6. SOURCE OF FUNDS BY FIELD OF RESEARCH FOR GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93 ($'000)

		Source of funds									
		Own funds									
Field of research	*Total*	*Commonwealth*	*State*	*Commonwealth government*	*State and local government*	*Private business enterprises*	*Public business enterprises*	*Joint govt/ business (a)*	*Universities and colleges*	*Private non-profit and other Australian*	*Overseas*
Natural sciences, technologies and engineering											
Mathematical sciences	20,057	16,708	605	826	303	1,095	10	266	45	41	158
Physical sciences	56,981	43,271	336	3,144	325	5,116	157	328	215	130	3,960
Chemical sciences	72,239	50,565	3,572	4,279	1,066	9,067	435	1,102	442	308	1,405
Earth sciences	182,862	134,260	26,091	8,537	1,839	7,024	738	2,035	646	342	1,350
Information, computers and communication technologies	54,185	36,859	9,183	2,412	352	3,833	330	377	148	139	552
Applied sciences and technologies	357,936	305,829	5,889	7,851	969	16,563	82	16,721	776	1,134	2,123
General Engineering	100,687	50,349	20,027	6,505	4,564	13,988	912	1,809	538	427	1,569
Biological sciences	177,273	103,745	28,406	13,788	6,164	7,586	796	10,498	1,274	3,023	1,995
Agricultural sciences	539,100	111,860	301,344	31,728	5,623	10,667	3,240	64,469	1,122	7,611	1,435
Medical and health sciences	127,702	25,058	33,159	23,292	12,443	6,469	1,063	3,504	2,968	16,464	3,283
Total natural sciences, technologies and engineering	**1,689,024**	**878,505**	**428,611**	**102,361**	**33,649**	**81,407**	**7,762**	**101,108**	**8,172**	**29,620**	**17,829**
Social sciences and humanities											
Accounting and finance	12	—	12	—	—	—	—	—	—	—	—
Economics	19,085	15,639	1,681	431	45	360	20	335	17	531	27
Political sciences	633	141	344	—	148	—	—	—	—	—	—
Sociology	6,153	4,646	1,131	291	20	43	—	1	2	1	18
Law	4,013	3,660	317	—	36	—	—	—	—	—	—
Psychology	1,584	982	94	168	28	77	183	32	6	4	11
Education	4,370	228	3,216	586	229	20	63	—	—	24	4
Other social sciences	15,225	8,908	2,766	1,548	651	541	28	609	41	87	47
Humanities	3,653	324	3,026	190	17	72	—	3	4	18	—
Total social sciences and humanities	**54,728**	**34,528**	**12,587**	**3,213**	**1,173**	**1,112**	**294**	**979**	**71**	**665**	**106**
TOTAL	**1,743,752**	**913,033**	**441,199**	**105,574**	**34,821**	**82,519**	**8,056**	**102,087**	**8,243**	**30,285**	**17,935**
Commonwealth contribution	1,128,206	913,033	—	52,442	11,378	73,507	1,148	52,182	4,982	5,563	13,971
State contribution	615,546	—	441,199	53,133	23,443	9,012	6,908	49,905	3,261	24,722	3,963

(a) Includes funds provided via government levies.

State comparisons

The leading states in terms of the location of government R&D expenditure are Victoria at $441m and New South Wales at $355m, accounting for 25 per cent and 20 per cent of total expenditure respectively. Next in order are Queensland (14%), South Australia (12%), ACT (11%) and Western Australia (7%). This ranking is fairly similar to 1990-91; only the order of South Australia and Queensland have reversed.

Of the $1,128m commonwealth government R&D, most is carried out in Victoria (28%), New South Wales (18%), the ACT (18%) and South Australia (13%).

Of the $616m state government R&D, most is carried out in New South Wales (24%), Queensland (24%), Victoria (20%) and Western Australia (13%).

Economic development was the predominant socio-economic objective in all states other than South Australia and Tasmania. In both Victoria and New South Wales, the main objectives within Economic development were Manufacturing, Animal production and primary products and Plant production and primary products. The predominant socio-economic objective in South Australia was Defence.

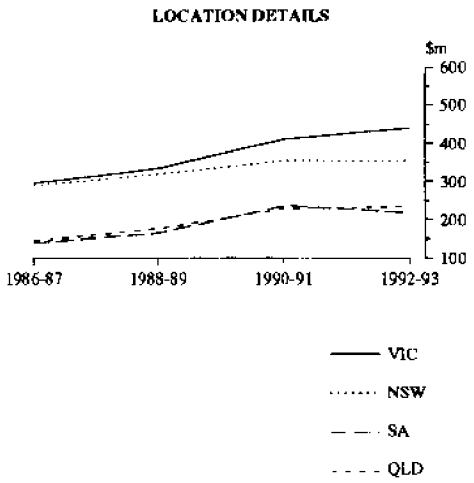


TABLE 7. LOCATION OF R&D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93
($'000)

		Location of expenditure								
Socio-economic objective	*Total*	*NSW*	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Other(a)*
Defence	**201,309**	**10,800**	**66,040**	**2,123**	**111,135**	**196**	**2,011**	**14**	**8,861**	**127**
Economic development										
Plant — production and primary products	247,490	50,523	36,723	61,005	20,845	24,526	11,065	4,598	32,084	6,122
Animal — production and primary products	277,204	51,972	63,543	61,758	20,503	32,895	10,637	8,372	20,057	7,467
Mineral resources (excl. energy)	70,652	18,644	18,500	8,686	980	7,854	1,785	1,500	9,720	2,983
Energy resources	51,973	6,450	10,480	2,995	1,498	4,227	123	89	13,264	12,847
Energy supply	18,225	5,386	7,375	1,110	376	1,234	58	28	1,819	839
Manufacturing	219,237	59,591	88,193	20,787	10,672	3,820	1,751	1,672	19,208	13,543
Construction	38,738	12,841	9,583	4,430	1,400	3,488	339	38	4,907	1,711
Transport	21,474	3,384	12,116	832	258	995	43	10	3,190	644
Information and communication services	32,881	14,722	3,742	689	1,787	644	378	54	9,392	1,473
Commercial services	5,204	1,122	1,412	510	275	497	346	52	774	216
Economic framework	22,611	4,887	6,141	53	883	782	3	193	9,078	592
Total Economic development	**1,005,689**	**229,523**	**257,807**	**162,855**	**59,478**	**80,962**	**26,528**	**16,606**	**123,492**	**48,438**
Society										
Health	123,657	36,188	31,444	14,657	25,671	6,790	1,424	3,258	3,283	943
Education and training	6,906	1,402	1,131	993	212	1,867	5	451	817	27
Social development and community services	35,094	5,281	7,317	899	3,284	3,300	424	494	12,842	1,253
Total Society	**165,657**	**42,872**	**39,892**	**16,549**	**29,167**	**11,957**	**1,853**	**4,203**	**16,942**	**2,222**
Environment										
Environmental knowledge	139,978	18,289	21,788	29,516	5,350	9,739	18,964	5,505	25,331	5,495
Environmental aspects of economic development	115,465	18,629	30,221	12,143	7,868	11,491	5,571	7,065	17,562	4,915
Environmental management and other aspects	25,630	7,274	3,642	4,343	1,508	1,805	2,997	223	3,416	422
Total environment	**281,073**	**44,193**	**55,651**	**46,003**	**14,726**	**23,035**	**27,532**	**12,792**	**46,309**	**10,831**
Advancement of knowledge										
Natural sciences, technologies and engineering	88,234	27,866	21,036	7,945	3,044	1,048	18,678	3,127	4,262	1,228
Social sciences and humanities	1,791	2	455	23	2	636	3	—	601	70
Total advancement of knowledge	**90,025**	**27,868**	**21,491**	**7,968**	**3,046**	**1,685**	**18,680**	**3,127**	**4,863**	**1,297**
TOTAL	**1,743,752**	**355,256**	**440,882**	**235,498**	**217,552**	**117,834**	**76,604**	**36,743**	**200,467**	**62,916**
Commonwealth contribution	1,128,206	206,852	316,144	86,343	148,199	38,374	56,364	13,606	200,360	61,964
State contribution	615,546	148,404	124,737	149,155	69,353	79,460	20,240	23,137	107	953

(a) Includes Australian External Territories and overseas

In both Victoria and South Australia the major Field of research (FOR) is Applied sciences and technologies followed by Agricultural sciences. In New South Wales the major FOR is Agriculture sciences followed by Applied sciences and technologies. In Queensland the main FOR is Agricultural sciences followed by Biological sciences.

The Australian Capital Territory accounts for 41 per cent of the R&D expenditure on Social sciences and humanities.

TABLE 8. LOCATION OF R&D EXPENDITURE BY FIELD OF RESEARCH BY GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93
($'000)

		Location of expenditure								
Field of research	*Total*	*NSW*	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Other(a)*
Natural sciences, technologies and engineering										
Mathematical sciences	20,057	5,136	2,645	481	523	1,250	371	66	8,987	599
Physical sciences	56,981	30,022	14,099	500	1,920	779	1,042	36	5,668	2,914
Chemical sciences	72,239	20,891	26,015	5,606	2,650	5,566	1,278	395	6,064	3,773
Earth sciences	182,862	21,389	40,052	19,025	6,087	11,686	18,518	11,007	37,935	17,162
Information, computers and communication technologies	54,185	20,822	6,612	1,865	5,151	3,035	1,654	214	12,587	2,246
Applied sciences and technologies	357,936	51,199	122,005	20,640	118,734	5,623	4,167	1,486	23,937	10,146
General Engineering	100,687	28,133	38,386	10,920	2,254	8,811	359	93	7,035	4,696
Biological sciences	177,273	25,275	34,202	33,423	12,557	5,732	22,238	6,611	29,329	7,907
Agricultural sciences	539,100	105,043	112,951	126,026	44,387	62,477	22,014	13,121	41,898	11,185
Medical and health sciences	127,702	38,750	34,319	13,688	21,850	7,057	4,153	1,968	4,331	1,586
Total natural sciences, technologies and engineering	**1,689,024**	**346,659**	**431,285**	**232,173**	**216,114**	**112,017**	**75,794**	**34,997**	**177,770**	**62,214**
Social sciences and humanities										
Accounting and finance	12	12	—	—	—	—	—	—	—	—
Economics	19,085	1,258	534	370	140	1,262	292	50	15,009	171
Political sciences	633	8	119	—	209	225	—	—	72	—
Sociology	6,153	402	87	29	17	460	—	383	4,762	14
Law	4,013	3,660	—	229	5	—	56	43	20	—
Psychology	1,584	156	521	116	35	133	253	33	284	53
Education	4,370	1,022	497	1,005	209	1,083	4	447	89	13
Other social sciences	15,225	938	6,810	1,575	637	1,974	204	276	2,426	385
Humanities	3,653	1,142	1,029	—	186	679	2	513	35	67
Total social sciences and humanities	**54,728**	**8,598**	**9,596**	**3,324**	**1,438**	**5,817**	**811**	**1,746**	**22,696**	**703**
TOTAL	**1,743,752**	**355,256**	**440,882**	**235,498**	**217,552**	**117,834**	**76,604**	**36,743**	**200,467**	**62,916**
Commonwealth contribution	1,128,206	206,852	316,144	86,343	148,199	38,374	56,364	13,606	200,360	61,964
State contribution	615,546	148,404	124,737	149,155	69,353	79,460	20,240	23,137	107	953

(a) Includes Australian External Territories and overseas

Type of R&D staff

Total human resource effort of General government organisations has decreased slightly since 1990-91. While the research effort of researchers has increased by 2 per cent or 191 person years to 9,252 and that of technicians has increased by 4 per cent, the research effort of other supporting staff has decreased by 13 per cent.

Researchers now account for 48 per cent of the total research effort, up from 47 per cent in 1990-91.

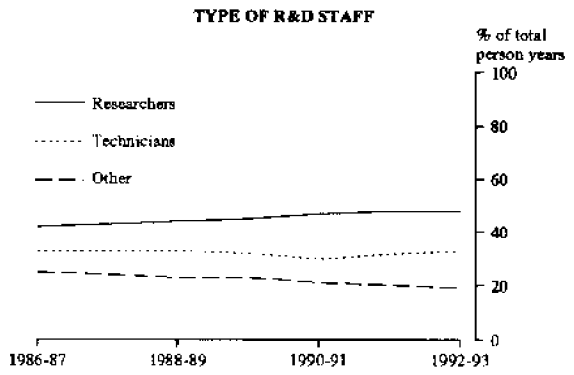


TABLE 9. TYPE OF EMPLOYEE BY SOCIO-ECONOMIC OBJECTIVE BY GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93
(person years)

		Type of employee		
Socio-economic objective	*Total*	*Researchers*	*Technicians*	*Other supporting staff*
Defence	**2,104**	**1,342**	**662**	**100**
Economic development				
Plant — production and primary products	2,918	1,176	1,142	599
Animal — production and primary products	3,207	1,188	1,257	762
Mineral resources (excl. energy)	651	353	157	141
Energy resources	449	192	146	110
Energy supply	172	88	50	34
Manufacturing	2,092	974	617	501
Construction	392	180	114	98
Transport	241	125	54	62
Information and communication services	353	237	44	72
Commercial services	57	31	13	13
Economic framework	321	213	60	49
Total Economic development	**10,853**	**4,757**	**3,655**	**2,441**
Society				
Health	2,097	1,066	815	216
Education and training	109	84	8	16
Social development and community services	381	225	61	95
Total Society	**2,586**	**1,376**	**884**	**327**
Environment				
Environmental knowledge	1,394	653	445	296
Environmental aspects of economic development	1,136	529	360	246
Environmental management and other aspects	299	149	94	56
Total environment	**2,829**	**1,332**	**899**	**598**
Advancement of knowledge				
Natural sciences, technologies and engineering	796	429	247	120
Social sciences and humanities	21	16	3	2
Total advancement of knowledge	**816**	**445**	**250**	**122**
TOTAL	**19,189**	**9,252**	**6,350**	**3,587**
Commonwealth contribution	10,964	5,448	3,257	2,260
State contribution	8,224	3,804	3,093	1,327

TABLE 10. TYPE OF EMPLOYEE BY FIELD OF RESEARCH BY GENERAL GOVERNMENT ORGANISATIONS, AUSTRALIA, 1992-93
(person years)

Field of research	*Total*	*Type of employee*		
		Researchers	*Technicians*	*Other supporting staff*
Natural sciences, technologies and engineering				
Mathematical sciences	293	211	39	44
Physical sciences	532	237	173	123
Chemical sciences	597	315	161	121
Earth sciences	1,702	869	477	356
Information, computers and communication technologies	558	351	88	119
Applied sciences and technologies	3,617	2,019	1,132	467
General Engineering	947	433	279	235
Biological sciences	1,883	862	648	372
Agricultural sciences	6,322	2,517	2,434	1,371
Medical and health sciences	2,049	1,002	825	223
Total natural sciences, technologies and engineering	**18,501**	**8,815**	**6,256**	**3,430**
Social sciences and humanities				
Accounting and finance	—	—	—	—
Economics	268	181	33	54
Political sciences	9	7	1	1
Sociology	47	35	6	7
Law	36	22	3	11
Psychology	15	7	5	4
Education	65	46	7	12
Other social sciences	202	111	26	66
Humanities	45	27	15	3
Total social sciences and humanities	**688**	**437**	**94**	**157**
TOTAL	**19,189**	**9,252**	**6,350**	**3,587**
Commonwealth contribution	10,964	5,448	3,257	2,260
State contribution	8,224	3,804	3,093	1,327

Private non-profit R&D

Direction of research

Socio-economic Objective (SEO)

Health remains the leading SEO in terms of R&D expenditure accounting for 73 per cent or $59m of total R&D expenditure in the Private non-profit sector. The next largest SEO's are Advancement of knowledge-Natural sciences, technologies and engineering (11%) and Education and training (8%).

Type of expenditure

Labour costs continue to be the main component of R&D expenditure (59%). Labour costs as a proportion of total R&D costs has increased 1 per cent since 1990-91. Capital expenditure accounted for only 9 per cent of research expenditure by Private non-profit organisations.

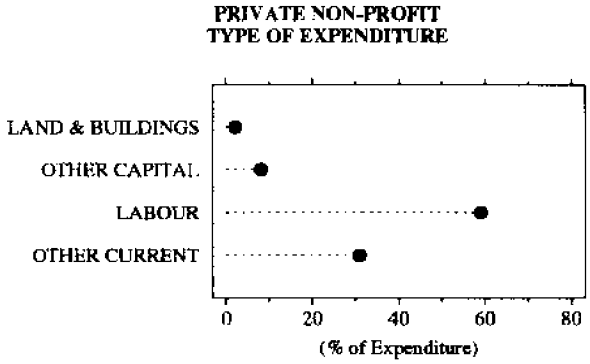


TABLE 11. R&D BY PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93 BY SOCIO-ECONOMIC OBJECTIVE BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY ($'000)

		Type of expenditure				*Type of activity(a)*			
Socio-economic objective	*Total*	*Land and buildings*	*Other capital expend-iture*	*Labour costs(b)*	*Other current expend-iture*	*Pure basic research*	*Strategic basic research*	*Applied research*	*Experi-mental develop-ment*
Defence	—	—	—	—	—	—	—	—	—
Economic development									
Plant — production and primary products	201	—	17	120	64	—	—	76	125
Animal — production and primary products	942	—	141	611	190	—	—	377	565
Mineral resources (excl. energy)	64	—	10	20	33	—	—	64	—
Energy resources	43	—	1	29	13	—	—	43	—
Energy supply	184	—	3	88	94	—	—	184	—
Manufacturing	277	8	31	153	86	45	—	190	43
Construction	325	12	29	100	184	—	—	168	157
Transport	32	—	3	7	22	—	—	6	26
Information and communication services	21	—	3	7	11	—	—	21	—
Commercial services	1,678	—	44	948	687	—	—	914	764
Economic framework	1,244	7	142	727	368	54	120	1,040	30
Total Economic development	**5,011**	**27**	**424**	**2,809**	**1,751**	**99**	**120**	**3,083**	**1,710**
Society									
Health	59,468	1,345	3,974	36,267	17,882	16,353	35,970	6,389	757
Education and training	6,317	—	200	3,166	2,951	363	2,329	1,231	2,393
Social development and community services	1,031	9	147	720	155	278	47	529	176
Total Society	**66,816**	**1,353**	**4,321**	**40,153**	**20,988**	**16,994**	**38,346**	**8,150**	**3,326**
Environment									
Environmental knowledge	873	—	35	492	347	34	470	255	115
Environmental aspects of economic development	10	—	—	8	2	—	—	10	—
Environmental management and other aspects	358	—	11	198	149	17	152	138	51
Total environment	**1,241**	—	**46**	**697**	**498**	**50**	**622**	**403**	**166**
Advancement of knowledge									
Natural sciences, technologies and engineering	8,628	231	1,327	4,794	2,276	2,598	5,155	680	195
Social sciences and humanities	234	—	49	159	26	14	139	80	—
Total advancement of knowledge	**8,862**	**231**	**1,376**	**4,953**	**2,302**	**2,612**	**5,294**	**760**	**195**
TOTAL	**81,929**	**1,611**	**6,166**	**48,613**	**25,539**	**19,755**	**44,382**	**12,396**	**5,396**

(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 9 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 pay, long service leave payments, sick pay, employer contributions to superannuation and pension schemes.

Direction of research

Field of Research (FOR)

Medical and health sciences ($51m) and Biological sciences ($17m) remain the leading FOR'S in terms of R&D expenditure by the Private non-profit sector.

Type of activity

Most R&D expenditure in the Private non-profit sector is still directed towards strategic basic research ($44m or 54 per cent), while organisations are directing relatively more of their research expenditure towards pure basic research, up from 21 per cent in 1990-91 to 24 per cent in 1992-93.

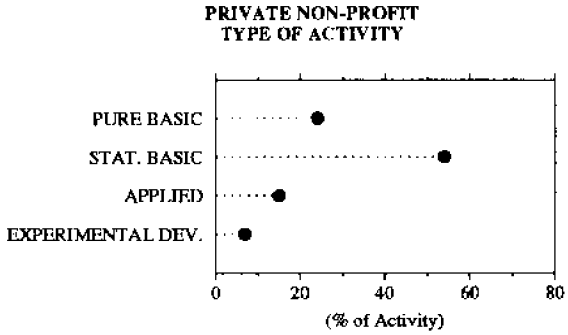


TABLE 12. R&D BY PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93 BY FIELD OF RESEARCH BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY ($'000)

		Type of expenditure				*Type of activity(a)*			
Field of research	*Total*	*Land and buildings*	*Other capital expend-iture*	*Labour costs(b)*	*Other current expend-iture*	*Pure basic research*	*Strategic basic research*	*Applied research*	*Experi-mental develop-ment*
Natural sciences, technologies and engineering									
Mathematical sciences	—	—	—	—	—	—	—	—	—
Physical sciences	1,321	—	472	646	202	5	1,291	20	5
Chemical sciences	442	—	109	220	113	—	199	159	84
Earth sciences	53	—	10	30	13	—	35	18	—
Information, computers and communication technologies	30	—	—	30	—	—	15	15	—
Applied sciences and technologies	1,307	9	157	811	330	8	16	503	780
General Engineering	362	6	21	172	162	8	22	140	192
Biological sciences	16,567	514	899	9,886	5,268	3,586	12,140	672	169
Agricultural sciences	576	—	74	346	156	1	9	280	286
Medical and health sciences	51,090	1,082	4,000	30,988	15,020	15,486	28,167	6,649	788
Total natural sciences, technologies and engineering	**71,747**	**1,611**	**5,742**	**43,129**	**21,264**	**19,094**	**41,894**	**8,456**	**2,302**
Social sciences and humanities									
Accounting and finance	—	—	—	—	—	—	—	—	—
Economics	2,124	—	162	989	973	—	—	1,613	511
Political sciences	68	—	3	50	15	68	—	—	—
Sociology	68	—	3	50	15	68	—	—	—
Law	47	—	—	43	4	1	6	40	—
Psychology	24	—	—	23	1	—	7	10	6
Education	6,352	—	202	3,196	2,955	371	2,352	1,235	2,394
Other social sciences	1,183	—	51	844	287	136	85	780	182
Humanities	318	—	4	289	25	18	38	261	—
Total social sciences and humanities	**10,182**	**—**	**424**	**5,483**	**4,275**	**661**	**2,488**	**3,939**	**3,094**
TOTAL	**81,929**	**1,611**	**6,166**	**48,613**	**25,539**	**19,755**	**44,382**	**12,396**	**5,396**

(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 9 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 pay, long service leave payments, sick pay, employer contributions to superannuation and pension schemes.

Source of funds for R&D

Most of the funding for Private non-profit R&D expenditure came from Commonwealth government organisations and increased from 31% of the total in 1990-91 to 38% in 1992-93. Own funding for research has decreased from 30 percent of the total in 1990-91 to 24 per cent in 1992-93. Funding from private business enterprises is also decreasing. Funding from the government sector has increased from 46 per cent in 1990-91 to 51 per cent in 1992-93.

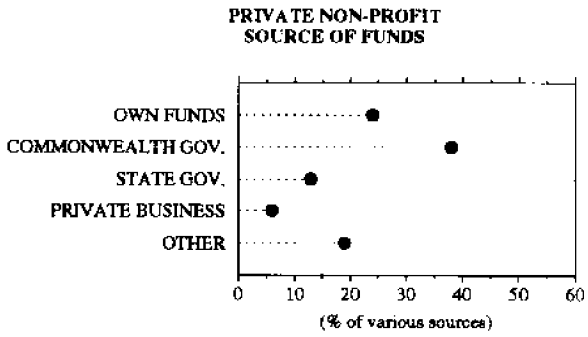


TABLE 13. SOURCE OF FUNDS BY SOCIO-ECONOMIC OBJECTIVE FOR PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93 ($'000)

		Source of funds								
Socio-economic objective	*Total*	*Own funds*	*Commo-nwealth govern-ment*	*State and local govern-ment*	*Private business enter-prises*	*Public business enter-prises*	*Joint govtl business (a)*	*Univer sities and colleges*	*Private non-profit and other Australi-an*	*Overseas*
Defence	—	—	—	—	—	—	—	—	—	—
Economic development										
Plant — production and primary products	201	134	—	—	27	—	—	—	40	—
Animal — production and primary products	942	942	—	—	—	—	—	—	—	—
Mineral resources (excl. energy)	64	8	12	12	18	12	2	—	—	—
Energy resources	43	11	4	—	28	—	—	—	—	—
Energy supply	184	53	4	—	97	30	—	—	—	—
Manufacturing	277	62	24	24	108	24	3	—	32	—
Construction	325	104	14	14	177	14	2	—	—	—
Transport	32	32	—	—	—	—	—	—	—	—
Information and communication services	21	3	4	4	6	4	1	—	—	—
Commercial services	1,678	305	792	309	99	130	4	—	40	—
Economic framework	1,244	158	125	384	344	179	15	25	15	—
Total Economic development	**5,011**	**1,811**	**979**	**747**	**903**	**393**	**25**	**25**	**128**	**—**
Society										
Health	59,468	13,094	24,560	6,398	3,552	5	501	512	8,227	2,619
Education and training	6,317	2,059	1,250	2,550	50	50	—	20	288	50
Social development and community services	1,031	332	168	374	91	22	—	—	44	—
Total Society	**66,816**	**15,485**	**25,978**	**9,322**	**3,693**	**77**	**501**	**532**	**8,558**	**2,669**
Environment										
Environmental knowledge	873	338	137	121	122	—	—	—	155	—
Environmental aspects of economic development	10	10	—	—	—	—	—	—	—	—
Environmental management and other aspects	358	120	59	56	61	—	—	—	63	—
Total environment	**1,241**	**468**	**196**	**177**	**183**	**—**	**—**	**—**	**218**	**—**
Advancement of knowledge										
Natural sciences, technologies and engineering	8,628	1,527	3,726	670	152	5	—	391	1,844	313
Social sciences and humanities	234	27	64	15	27	7	—	29	65	—
Total advancement of knowledge	**8,862**	**1,554**	**3,790**	**685**	**179**	**12**	**—**	**420**	**1,909**	**313**
TOTAL	**81,929**	**19,319**	**30,943**	**10,930**	**4,958**	**482**	**526**	**977**	**10,813**	**2,982**

(a) Includes funds provided via government levies.

TABLE 14. SOURCE OF FUNDS BY FIELD OF RESEARCH FOR PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93 ($'000)

		Source of funds								
Field of research	*Total*	*Own funds*	*Commonwealth government*	*State and local government*	*Private business enterprises*	*Public business enterprises*	*Joint govt/ business (a)*	*Universities and colleges*	*Private non-profit and other Australian*	*Overseas*
Natural sciences, technologies and engineering										
Mathematical sciences	—	—	—	—	—	—	—	—	—	—
Physical sciences	1,321	115	240	—	14	—	—	288	664	—
Chemical sciences	442	94	85	229	—	—	—	—	34	—
Earth sciences	53	27	4	2	—	—	—	—	20	—
Information, computers and communication technologies	30	5	—	—	—	—	—	25	—	—
Applied sciences and technologies	1,307	1,042	—	—	230	—	—	—	35	—
General Engineering	362	253	—	15	78	—	—	—	16	—
Biological sciences	16,567	5,193	5,491	1,762	978	—	376	101	2,611	56
Agricultural sciences	576	284	30	103	74	5	—	—	80	—
Medical and health sciences	51,090	9,580	22,674	5,455	2,816	5	125	543	7,016	2,876
Total natural sciences, technologies and engineering	**71,747**	**16,593**	**28,523**	**7,565**	**4,189**	**10**	**501**	**957**	**10,476**	**2,932**
Social sciences and humanities										
Accounting and finance	—	—	—	—	—	—	—	—	—	—
Economics	2,124	269	802	407	358	264	23	—	—	—
Political sciences	68	58	5	—	—	—	—	—	5	—
Sociology	68	58	5	—	—	—	—	—	5	—
Law	47	3	20	7	14	3	—	—	—	—
Psychology	24	11	10	3	—	—	—	—	—	—
Education	6,352	2,060	1,250	2,568	50	50	—	20	304	50
Other social sciences	1,183	239	198	331	258	132	2	—	23	—
Humanities	318	29	129	48	89	22	—	—	—	—
Total social sciences and humanities	**10,182**	**2,725**	**2,419**	**3,366**	**769**	**472**	**25**	**20**	**337**	**50**
TOTAL	**81,929**	**19,319**	**30,943**	**10,930**	**4,958**	**482**	**526**	**977**	**10,813**	**2,982**

(a) Includes funds provided via government levies.

State comparisons

The leading states in terms of the location of Private non-profit R&D expenditure are Victoria at $56m and New South Wales at $19m, accounting for 68 per cent and 24 per cent of total expenditure respectively. The remaining states account for only $7m of R&D expenditure. Next in order of R&D expenditure are the Australian Capital Territory (3%), Western Australia (2%), Queensland (2%) and South Australia (1%).

In Victoria the predominant SEO's are Health, Education and training and Advancement of knowledge-Natural sciences, technologies and engineering. In New South Wales the predominant SEO's are Health and Advancement of knowledge -Natural sciences, technologies and engineering.

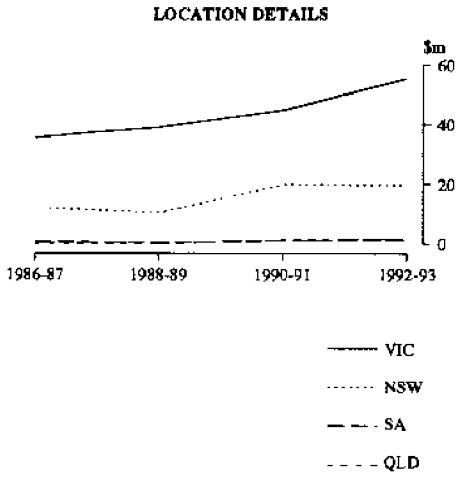


TABLE 15. LOCATION OF R&D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE BY PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93
($'000)

		Location of expenditure								
Socio-economic objective	*Total*	*NSW*	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Other(a)*
Defence	—	—	—	—	—	—	—	—	—	—
Economic development										
Plant — production and primary products	201	196	1	2	1	1	1	—	—	—
Animal — production and primary products	942	942	—	—	—	—	—	—	—	—
Mineral resources (excl. energy)	64	3	57	3	—	—	—	—	—	—
Energy resources	43	—	—	—	—	—	—	—	43	—
Energy supply	184	—	—	—	—	—	—	—	184	—
Manufacturing	277	44	164	42	4	4	—	—	20	—
Construction	325	4	144	4	18	—	—	—	156	—
Transport	32	—	26	—	6	—	—	—	—	—
Information and communication services	21	1	19	1	—	—	—	—	—	—
Commercial services	1,678	239	144	10	1	1	1	—	1,284	—
Economic framework	1,244	532	662	31	—	—	—	—	20	—
Total Economic development	**5,011**	**1,961**	**1,217**	**92**	**29**	**5**	**1**	**—**	**1,705**	**—**
Society										
Health	59,468	15,036	41,593	1,172	423	1,100	77	—	66	—
Education and training	6,317	—	6,317	—	—	—	—	—	—	—
Social development and community services	1,031	37	621	8	45	10	—	—	309	—
Total Society	**66,816**	**15,073**	**48,532**	**1,181**	**468**	**1,110**	**77**	**—**	**375**	**—**
Environment										
Environmental knowledge	873	251	160	38	55	169	61	37	37	64
Environmental aspects of economic development	10	—	—	—	—	—	—	—	10	—
Environmental management and other aspects	358	43	73	19	19	85	31	19	38	32
Total environment	**1,241**	**294**	**234**	**57**	**74**	**254**	**92**	**56**	**85**	**96**
Advancement of knowledge										
Natural sciences, technologies and engineering	8,628	1,998	5,536	160	585	244	10	6	77	11
Social sciences and humanities	234	131	8	—	—	—	—	—	94	—
Total advancement of knowledge	**8,862**	**2,130**	**5,545**	**160**	**585**	**244**	**10**	**6**	**171**	**11**
TOTAL	**81,929**	**19,458**	**55,527**	**1,489**	**1,157**	**1,613**	**180**	**62**	**2,336**	**107**

(a) Includes Australian External Territories and overseas

In Victoria, New South Wales, Western Australia and Queensland the predominant FOR's are Medical and health sciences and Biological sciences.

Victoria accounts for 78 per cent ($40m) of the expenditure on Medical and health sciences, 45 per cent ($7m) of that on Biological sciences and virtually all of the $6m spent on Education.

New South Wales accounts for 16 per cent ($8m) of the expenditure on Medical and health sciences and 49 per cent ($8m) of that on Biological sciences.

TABLE 16. LOCATION OF R&D EXPENDITURE BY FIELD OF RESEARCH BY PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93 ($'000)

		Location of expenditure								
Field of research	*Total*	*NSW*	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Other(a)*
Natural sciences, technologies and engineering										
Mathematical sciences	—	—	—	—	—	—	—	—	—	—
Physical sciences	1,321	1,271	—	—	—	50	—	—	—	—
Chemical sciences	442	—	442	—	—	—	—	—	—	—
Earth sciences	53	35	—	—	18	—	—	—	—	—
Information, computers and communication technologies	30	30	—	—	—	—	—	—	—	—
Applied sciences and technologies	1,307	980	5	35	4	166	—	—	117	—
General Engineering	362	—	160	—	75	—	—	—	127	—
Biological sciences	16,567	8,065	7,439	63	62	605	102	62	62	107
Agricultural sciences	576	393	105	3	1	1	1	—	70	—
Medical and health sciences	51,090	8,099	39,739	1,327	996	790	77	—	60	—
Total natural sciences, technologies and engineering	**71,747**	**18,873**	**47,890**	**1,429**	**1,157**	**1,613**	**180**	**62**	**436**	**107**
Social sciences and humanities										
Accounting and finance	—	—	—	—	—	—	—	—	—	—
Economics	2,124	77	880	49	—	—	—	—	1,119	—
Political sciences	68	—	68	—	—	—	—	—	—	—
Sociology	68	—	68	—	—	—	—	—	—	—
Law	47	—	—	—	—	—	—	—	47	—
Psychology	24	20	—	3	—	—	—	—	—	—
Education	6,352	—	6,349	3	—	—	—	—	—	—
Other social sciences	1,183	484	265	4	—	—	—	—	429	—
Humanities	318	4	8	—	—	—	—	—	305	—
Total social sciences and humanities	**10,182**	**585**	**7,637**	**60**	**—**	**—**	**—**	**—**	**1,900**	**—**
TOTAL	**81,929**	**19,458**	**55,527**	**1,489**	**1,157**	**1,613**	**180**	**62**	**2,336**	**107**

(a) Includes Australian External Territories and overseas

Type of R&D staff

The total human resource effort of Private non-profit organisations is estimated to be 4 per cent greater than in 1990-91. Researchers accounted for 48 per cent of the total research effort, Technicians 31 per cent and Other supporting staff 22 per cent.

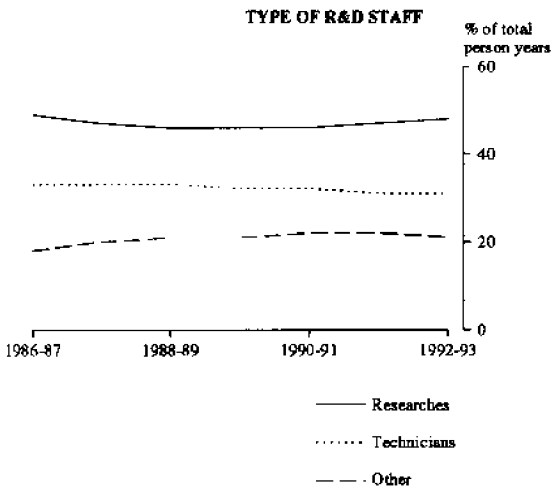


TABLE 17. TYPE OF EMPLOYEE BY SOCIO-ECONOMIC OBJECTIVE BY PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93
(person years)

Socio-economic objective	*Total*	*Type of employee*		
		Researchers	*Technicians*	*Other supporting staff*
Defence	—	—	—	—
Economic development				
Plant — production and primary products	3	2	1	—
Animal — production and primary products	12	10	—	2
Mineral resources (excl. energy)	—	—	—	—
Energy resources	—	—	—	—
Energy supply	2	1	—	—
Manufacturing	3	2	—	1
Construction	2	1	—	1
Transport	—	—	—	—
Information and communication services	—	—	—	—
Commercial services	17	8	4	5
Economic framework	19	17	1	2
Total Economic development	**59**	**43**	**6**	**10**
Society				
Health	865	393	273	198
Education and training	46	24	12	10
Social development and community services	17	12	1	4
Total Society	**927**	**428**	**286**	**212**
Environment				
Environmental knowledge	15	13	—	2
Environmental aspects of economic development	—	—	—	—
Environmental management and other aspects	6	5	—	—
Total environment	**21**	**18**	—	**2**
Advancement of knowledge				
Natural sciences, technologies and engineering	110	45	50	15
Social sciences and humanities	3	2	1	1
Total advancement of knowledge	**113**	**47**	**50**	**16**
TOTAL	**1,120**	**536**	**343**	**241**

TABLE 18. TYPE OF EMPLOYEE BY FIELD OF RESEARCH BY PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA, 1992-93
(person years)

Field of research	*Total*	*Type of employee*		
		Researchers	*Technicians*	*Other supporting staff*
Natural sciences, technologies and engineering				
Mathematical sciences	—	—	—	—
Physical sciences	11	5	3	4
Chemical sciences	5	3	1	1
Earth sciences	1	1	—	—
Information, computers and communication technologies	1	1	—	—
Applied sciences and technologies	15	12	—	3
General Engineering	3	2	1	1
Biological sciences	235	124	77	34
Agricultural sciences	7	5	2	1
Medical and health sciences	744	326	242	176
Total natural sciences, technologies and engineering	**1,024**	**478**	**326**	**219**
Social sciences and humanities				
Accounting and finance	—	—	—	—
Economics	19	10	3	5
Political sciences	1	1	—	1
Sociology	1	1	—	1
Law	1	1	—	—
Psychology	1	—	—	1
Education	47	24	12	10
Other social sciences	21	17	1	3
Humanities	6	4	1	1
Total social sciences and humanities	**96**	**58**	**17**	**21**
TOTAL	**1,120**	**536**	**343**	**241**

Extramural R&D

General government

Extramural R&D expenditure (payments to other organisations to undertake R&D projects) is estimated to be $926m, an increase of 19 per cent over 1990-91. Most ($874m) of these payments are by the Commonwealth government. The increase in extramural payments has been substantial since 1988-89.

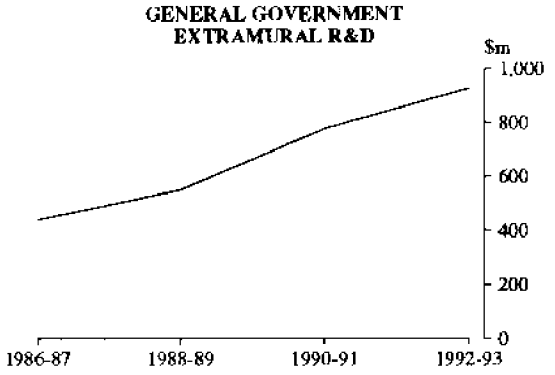
Extramural payments are equivalent to 53 per cent of General government expenditure on R&D, up from 47 per cent in 1990-91.

General government extramural R&D expenditure within Australia remains very high at 95 per cent of total extramural R&D expenditure. This has been at a similar level since 1986-87.

Private non-profit

Extramural R&D expenditure is estimated to be $52m, an increase of 36 per cent over 1990-91. Extramural payments are equivalent to 63 per cent of Private non-profit expenditure on R&D, up from 54 per cent in 1990-91 but down from 68 per cent in 1988-89.

Most Private non-profit extramural expenditure is within Australia (86%).



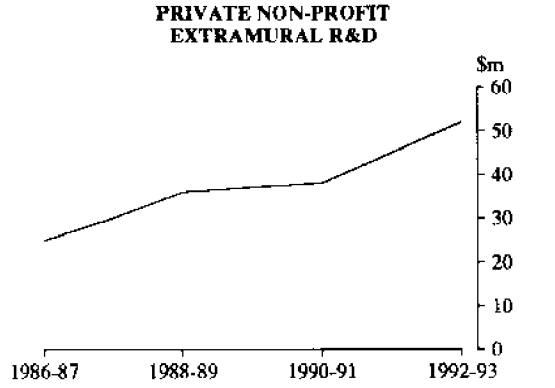


TABLE 19. EXTRAMURAL R & D EXPENDITURE(a) BY GENERAL GOVERNMENT AND PRIVATE-NON PROFIT ORGANISATIONS, AUSTRALIA BY COUNTRY OF RECIPIENT
($'000)

Type of organisation	*Total payments*	*Country of recipient*									
		Australia	*Africa*	*Asia*	*Canada*	*Europe*	*New Zealand*	*Oceania*	*U.K.*	*U.S.A.*	*Other Countries*
General government											
Commonwealth	874,444	830,257	340	16,675	10	1,434	1,006	3,758	438	463	20,063
State	51,237	50,982	—	27	—	150	1	—	40	37	—
Total — 1992-93	**925,681**	**881,239**	**340**	**16,702**	**10**	**1,584**	**1,007**	**3,758**	**478**	**500**	**20,063**
Total — 1990-91	776,165	735,295	701	20,353	24	706	112	4,735	420	377	13,443
Private non-profit											
Total — 1992-93	**51,865**	**44,586**	**442**	**3,620**	**78**	**697**	**36**	**—**	**191**	**1,777**	**438**
Total — 1990-91	38,210	37,666	2	58	—	6	32	—	71	377	—

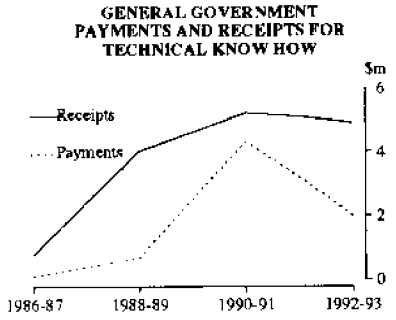
(a) Expenditure on R & D which is funded by an organisation but carried out by other organisations.

Payments and receipts for technical know-how

General government

Payments for technical know-how are estimated to be $2.0m, of which 95 per cent were payments within Australia.

Receipts for technical know-how are estimated to be $4.9m, of which 92 per cent were receipts from Australian organisations.



Private non-profit

Payments for technical know-how are estimated to be $0.1m, of which 93 per cent were payments within Australia.

Receipts for technical know-how are estimated to be $0.9m, all of which were receipts from Australian organisations.

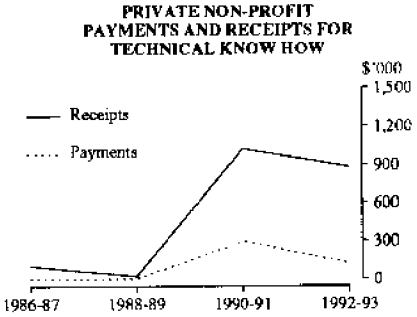


TABLE 20. PAYMENTS FOR TECHNICAL KNOW-HOW BY GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA
TYPE OF TECHNICAL KNOW-HOW AND COUNTRY OF RECIPIENT
($'000)

		Type of technical know-how		*Country of recipient*											
Type of organisation	*Total payments*	*Patent licence fees and royalties*	*Other technical know-how*	*Australia*	*Canada*	*Germany*	*France*	*Japan*	*Netherlands*	*New Zealand*	*Sweden*	*Switzerland*	*U.K.*	*U.S.A.*	*Other Countries*
General government															
Commonwealth	153	63	90	90	63	—	—	—	—	—	—	—	—	—	—
State	1,885	128	1,757	1,844	—	—	—	1	8	—	—	—	—	6	26
Total — 1992-93	**2,038**	**191**	**1,847**	**1,934**	**63**	—	—	**1**	**8**	—	—	—	—	**6**	**26**
Total — 1990-91	4,335	329	4,006	3,982	5	3	75	—	58	—	3	3	5	190	11
Private non-profit															
Total — 1992-93	**122**	**—**	**122**	**114**	—	—	—	—	—	4	—	—	—	—	**4**
Total — 1990-91	297	5	292	297	—	—	—	—	—	—	—	—	—	—	—

TABLE 21. RECEIPTS FOR TECHNICAL KNOW-HOW BY GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS, AUSTRALIA
TYPE OF TECHNICAL KNOW-HOW AND COUNTRY OF PAYING ORGANISATION
($'000)

		Type of technical know-how		*Country of paying organisation*											
Type of organisation	*Total receipts*	*Patent licence fees and royalties*	*Other technical know-how*	*Australia*	*Canada*	*Germany*	*France*	*Japan*	*Netherlands*	*New Zealand*	*Sweden*	*Switzerland*	*U.K.*	*U.S.A.*	*Other Countries*
General government															
Commonwealth	3,536	648	2,888	3,267	1	—	90	—	—	1	—	—	—	171	6
State	1,350	164	1,186	1,242	—	—	—	1	—	—	—	—	10	4	93
Total — 1992-93	**4,886**	**812**	**4,074**	**4,509**	**1**	**—**	**90**	**1**	**—**	**1**	**—**	**—**	**10**	**175**	**99**
Total — 1990-91	5,232	581	4,651	5,062	—	—	—	—	—	—	—	—	—	98	72
Private non-profit															
Total — 1992-93	**881**	**—**	**881**	**881**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**
Total — 1990-91	1,022	121	901	1,022	—	—	—	—	—	—	—	—	—	—	—

Patent activity

Please note that, as the questions on patents were revised for the 1992-93 R&D survey, the results may not be comparable with those of earlier years. For further details see paragraph 10 of the Explanatory Notes.

General government

Government organisations with R&D activity during 1992-93 lodged 149 patent applications within Australia, and 3,575 abroad during the period 1 July 1991 to 30 June 1993. During this period 146 patents were granted in Australia, and 268 granted abroad.

Private non-profit

Patent activity by the Private non-profit sector has greatly increased with 23 patents being lodged in Australia and 354 overseas during the period 1 July 1991 to 30 June 1993. During this period 9 patents were granted in Australia and 27 overseas.

TABLE 22. PATENT ACTIVITY BY GENERAL GOVERNMENT AND PRIVATE NON-PROFIT ORGANISATIONS WITH RESEARCH AND EXPERIMENTAL DEVELOPMENT ACTIVITY

	Australia		*Overseas*	
Type of organisation	*Patents lodged*	*Patents granted*	*Patents lodged(a)*	*Patents granted*
General government				
Commonwealth	140	135	3,168	250
State	9	11	407	18
Total — July 1991 to June 1993	**149**	**146**	**3,575**	**268**
Total — July 1989 to June 1991	155	112	1,406	116
Private non-profit				
Total — July 1991 to June 1993	**23**	**9**	**354**	**27**
Total — July 1989 to June 1991	13	11	7	17

(a) See paragraph 10 of the Explanatory Notes.

EXPLANATORY NOTES

Introduction

This publication presents estimates of expenditure and human resources devoted to R&D carried out by General Government and Private Non-profit organisations during 1992-93.

2. Statistics are included for extramural R&D activity, payments and receipts for technical know-how and patent activity.

3. Comparable R&D statistics are produced for the Business Enterprise and Higher Education sectors (See paragraph 23).

Data sources

4. The 1992-93 statistics presented in this publication have been compiled from data collected from General Government and Private non-profit organisations in the ABS Survey of Research and Experimental Development in respect of the year ended 30 June 1993. This survey was based on a complete enumeration of General Government and Private non-profit organisations identified by the Australian Bureau of Statistics (ABS) as likely R&D performers. The survey was conducted by mail questionnaire.

5. Statistics for earlier years were derived from similar surveys. A number of revisions have been made to previous statistics.

6. The GDP(E) figures used to derive General Government expenditure on R&D / GDP ratios quoted in the Summary of Findings are current at time of manuscript finalisation (National Income, Expenditure and Product, March Quarter 1994, Catalogue No 5206.0) and, at current prices are as follows: $216,214m (1984-85); $241,536m (1985-86); $264,732m (1986-87); $298,076m (1987-88); $335,384m (1988-89); $377,116m (1990-91); $404,745m (1992-93). The available General Government expenditure on R&D / GDP ratios for other OECD countries are current at time of manuscript finalisation and are sourced from "Main Science and Technology Indicators, 1994-1", OECD, Paris 1994.

Definitions

7. *Research and Experimental Development* is defined in accordance with the Organisation for Economic Co-operation and Development (OECD) standard as comprising 'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications'.

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

9. Type of R&D activity comprises pure basic research, strategic basic research, applied research and experimental development. Data in this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. 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 in mind the subjectivity of respondents in classifying these codes.

10. The questions on patents have been revised for the 1992-93 survey. In particular, the question relating to lodgement of patent applications overseas now specifically asks for the number of countries in which protection was originally sought. For example, if four countries were designated in an application (a PCT application or a European Patent application) then the General Government or Private Non-profit organisation was asked to record the number of patent applications as four. In previous surveys, it is possible that the patent application would have been recorded as only one lodgement. For this reason the number of patent applications lodged overseas shown in Table 22 of this publication is considerably higher than those shown in earlier publications.

Scope

11. The General Government sector includes all Commonwealth, State and Local Government departments and authorities.

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

Coverage

13. Local government organisations are excluded from this survey because it is considered that their contribution to total R&D activity would be minimal. Public sector organisations mainly engaged in higher education (e.g. universities) are included in the Higher Education sector whilst those mainly engaged in trading or financial activities are included in the Business Enterprise sector.

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

Socio-economic objective and Field of research classifications

15. The statistics in this publication are classified by Socio-economic objective (SEO) and Field of research (FOR).The classifications used in this publication are an extension and refinement of the interim classifications used in the 1990-91 publication and resulted in changes in series for some categories. For more information on these classifications see the Australian Standard Research Classification, 1993 (1297.0).

16. Respondents are asked to classify each of their R&D programs or projects to a SEO and a FOR . Two reporting possibilities exist. The first possibility allows for reporting of an obviously predominant SEO and FOR. The

second allows reporting at program level of several SEOs and FORs, where there was no obvious single predominant classification for either or both SEO and FOR. In these instances ABS distributes the reported data to R&D projects, with relevant SEOs and FORs according to classifications and estimated percentage splits provided by respondents. Most of the data has been reported on the second basis.

17. For a more detailed explanation of SEO and FOR classifications please contact the ABS.

Constant price estimates

18. 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.

19. 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 (1989-90). 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.

20. 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

21. The statistics in this publication must be interpreted with caution for the following reasons:

(a) Many respondents had to make estimates because their accounts do not separately record data on R&D activity, receipts and payments for technical know-how or patent activity.

(b) The OECD standard definition of R&D differs in some respects from what respondents may regard as R&D activity.

Unpublished statistics

22. Limited additional detailed R&D statistics will be available at a charge from the ABS when compiled.

Related publications

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

Research and Experimental Development, Business Enterprises, Australia, 1992-93 (8104.0)

Research and Experimental Development, Higher Education Organisations, Australia, 1992 (8111.0) (to be released later this year)

Research and Experimental Development, All Sector Summary, Australia, 1992-93 (8112.0) (to be released later this year)

Measures of Science and Innovation 4, Australian Science and Innovation Resources Brief 1994, Department of Industry, Science and Technology, Canberra, Australia, 1994

Main Science and Technology Indicators 1994-1, OECD, Paris, 1994

The Measurement of Scientific and Technical activities ("Frascati Manual" 1993) OECD, Paris, 1994

24. 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

— nil or rounded to zero
r revised since previous issue

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

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.

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

Extramural R&D statistics refer to R&D activity *funded* by an organisation but *carried out by other* enterprises, organisations, institutions or individuals.

Field of Research refers to the field in which the R & D activity was *performed* rather than the fields used in the research program. The FOR classification is primarily structured around disciplines or activities. It describes 'what' research is being performed.

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.

Labour costs include wages and salaries, payroll tax, payments to contract staff on the payroll, fringe benefit tax and workers compensation payments, sick pay, and employer contributions to superannuation and pension schemes.

Other current expenditure is expenditure on materials, fuel, rent and hiring, repairs and maintenance, data processing, payments for the use of specialised testing facilities and commission and sub-contract work.

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

R&D activity is systematic investigation or experimentation involving innovation or technical risk, the outcome of which is *new knowledge*, with or without practical application or *new or improved* products, processes, materials, devices or services. R&D activity extends to modifications to existing products/processes. R&D activity ceases and pre-production begins when work is no longer experimental.

Researchers 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. They exclude executives and directors concerned primarily with budgets and human resources rather than project content.

Socio-economic objective (SEO) refers to the area of expected national benefit rather than to 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 'why' the research is being performed.

Technical know-how (TKH) is the specialised technical knowledge required to successfully produce a product or implement a process, etc. (e.g. patent licences; technical data and information; scientific, technical or engineering assistance) that increases technical knowledge and understanding in an enterprise. Payments are those made directly to the holders of TKH which is new to a business enterprise. They exclude non-monetary transfers, and costs incurred by an enterprise in obtaining TKH, such as overseas travel costs.

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.

Australian Bureau of Statistics

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The ABS publishes a wide range of statistics and other information on Australia's economic and social conditions. Details of what is available in various publications and other products can be found in the *ABS Catalogue of Publications and Products* available at all ABS Offices (see below for contact details).

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