



RESEARCH AND EXPERIMENTAL DEVELOPMENT ALL-SECTOR SUMMARY, AUSTRALIA 1981-82 (incorporating results for the Private Non-profit Sector)

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MAIN FEATURES

The estimate of gross expenditure on research and experimental development (GERD) carried out in Australia during 1981-82 was \$1,522m at current prices. This represents a 44% increase in expenditure compared with 1978-79. At constant (average 1979-80) prices GERD is estimated to have increased by 4% over the same period.

Of the \$1,522m current price estimate of 1981-82 GERD, business enterprises accounted for \$341m (22%), general government organisations \$708m (47%), higher education organisations \$452m (30%), and private non-profit organisations \$21m (1%). General government sources funded \$976m (64%), business enterprises sources funded \$179m (12%), and other Australian and overseas sources funded \$48m (3%).

The total manpower effort devoted to R&D carried out in Australia during 1981-82 was 44,535 man-years. This represents an increase of 2% compared with 1978-79. Of the total manpower effort, business enterprises accounted for 7,923 man-years (18%), general government organisations 17,683 man-years (40%), higher education organisations 18,241 man-years (41%) and private non-profit organisations 688 man-years (2%).

EXPLANATORY NOTES

Introduction

This publication presents summary statistics on the level and distribution of expenditure and manpower resources devoted to research and experimental development (R&D) carried out in Australia by enterprises/organisations within the Business Enterprise, General Government, Higher Education and Private Non-profit Sectors during 1981-82 (for the Higher Education Sector the statistics relate to the 1981 calendar year). These statistics are shown in Tables 1 to 10. In addition, detailed R&D statistics in respect of the Private Non-profit Sector are presented in Tables 14 to 19.

2. Statistics of extramural R&D expenditure are shown in Table 11.

3. Summary statistics of payments and receipts for technical know-how (Table 12) and summary statistics of patent applications lodged and patents granted (Table 13) are also shown in this publication.

4. Apart from the data relating to the Private Non-profit Sector, data shown in this publication, together with more detailed results, have been previously published by the ABS on a Sector basis (see paragraph 32 for details of publications).

Data sources

5. Most of the statistics presented in this publication were derived from data collected in the Survey of

Research and Experimental Development in respect of the year ended 30 June 1982 (year ended 31 December 1981 for the Higher Education Sector).

6. The source of all data relating to the Private Non-profit Sector was the 1981-82 Survey of Research and Experimental Development. Information relating to data sources for the other sectors is contained in the individual sector publications (see paragraph 32).

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. To be classified as R&D, an activity should contain an appreciable amount of novelty or innovation, should have investigation as a primary objective, and should have a potential to produce results that recognisably increase mankind's stock of knowledge. The concept of novelty is not associated with the actual creation of something which, although new, is made by artistry or by application of techniques that have already been established for that class of object. R&D activity extends to substantial modifications to existing products or processes. R&D ceases and pre-production begins when work is no longer experimental.

9. *R&D expenditure* includes capital expenditure on the acquisition (less disposals) of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment, and current expenditure on such items as wages, salaries, materials, fuels, rent and leasing, repairs and maintenance, data processing, etc., and a proportion of expenditure on general services and overhead costs attributable to the R&D effort.

10. *Gross expenditure on R&D (GERD)* relates to the total of R&D expenditures incurred by all enterprises/organisations in the various Sectors.

11. The item *man years of effort on R&D* includes the effort of researchers, technicians and other staff directly supporting R&D. *Overhead staff*, i.e. administrative and general service employees such as personnel officers, canteen staff, pay clerks, janitors, cleaners, groundsmen, etc., whose work *indirectly supports R&D, are excluded*.

12. *Researchers* refers to persons actually engaged in the conception and/or creation of new knowledge, products, processes, methods and systems. *Technicians* refers to persons performing technical tasks in support of R&D, normally under the direction and supervision of a researcher. These tasks include assisting with or performing experiments, tests and analyses; preparing materials and equipment for experiments, taking records, making calculations and preparing charts and graphs;

maintaining and operating advanced machinery and equipment; interviewing in social science surveys; and computer programming. *Other supporting staff* refers to skilled and unskilled craftsmen, secretarial and clerical staff working on or directly associated with R&D.

13. *Basic research* is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. *Pure basic research* is research which is carried out without looking for long term economic or social benefits other than advancement of knowledge. It includes all Humanities R&D. *Strategic basic research* is research 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. *Applied research* also refers to original investigation undertaken in order to acquire new knowledge. It is, however directed towards a specific practical aim or objective. Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving some specific and predetermined objectives. *Experimental development* refers to systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new materials, products and devices, to installing new processes and improving substantially those already produced or installed. In the social sciences, experimental development may be defined as the process of translating knowledge gained through research into operational programs including demonstration projects for testing and evaluation.

14. For a more comprehensive interpretation of the definitions of R&D or an explanation of other definitions not covered above contact the ABS or refer to the OECD publication *The Measurement of Scientific and Technical Activities* ('Frascati Manual', 1980), OECD, Paris, 1981.

Sector classification

15. The sector classification used in the compilation of these statistics is adapted from the guidelines specified by the OECD for use in the conduct of R&D studies. Four institutional sectors are recognised: Business Enterprises, General Government, Higher Education and Private Non-profit.

- (a) *Business Enterprise Sector* includes all firms, organisations and institutions (private and public sector) whose primary activity is the production of goods or services for sale to the general public at a price intended approximately to cover at least the cost of production. It includes the private non-profit institutions mainly serving business enterprises.
- (b) *General Government Sector* includes government departments and other authorities engaged in administration, defence and regulation of public order, promotion of economic growth

and welfare and technological development, provision of health, cultural, recreational and other social and community services free of charge or at prices which do not fully cover their costs of production. Also included are other non-profit organisations wholly or mainly financed and controlled by public authorities or which primarily serve government bodies and unincorporated government enterprises producing goods and services for the government itself. Excluded are public sector enterprises mainly engaged in higher education (e.g. universities and colleges of advanced education), trading or financial activities.

- (c) *Higher Education Sector* includes all universities, colleges of advanced education (CAE) and other institutions of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations and clinics operating under the direct control of, or administered by, or associated with, higher education establishments.
- (d) *Private Non-profit Sector* includes private or semi-public organisations which are not established primarily with the aim of making a profit, and private individuals or households. Non-profit organisations which mainly serve or are wholly or mainly financed and controlled by organisations within the other sectors are excluded from this sector.

Coverage

16. The main exclusions from the survey coverage are:

- (a) Business Enterprise Sector-Enterprises mainly engaged in agriculture, forestry, fishing and hunting (i.e. industries in Division A of the ASIC, 1978 edition).
- (b) General Government Sector-Local government organisations.
- (c) Higher Education Sector-Technical and Further Education (TAFE) colleges and other post-secondary institutions apart from Universities and CAEs.

17. The main reasons for excluding these organisations is that, in general, their contribution to R&D is very low.

18. There are no coverage exclusions in respect of the Private Non-profit Sector. More detailed information relating to the coverage of each of the other sectors is contained in the individual sector publications (see paragraph 32).

Socio-economic objective and field of science classifications

19. Statistical information for the General Government, Higher Education and Private Non-profit Sectors is classified by both socio-economic objective and field of science.

20. Respondents in the General Government, Higher Education and Private Non-profit Sectors were asked to classify each of their R&D projects or programs to a particular socio-economic objective and then to report the manpower and expenditure devoted to those projects or programs (except for Universities which were not required to report any expenditure amounts).

21. R&D programs are classified to socio-economic objectives according to the ultimate purpose of the program (which may not necessarily be the immediate objectives of the researcher). For example, an R&D program concerned with the development of a new type of rolling stock as part of a re-organisation of the nation's railways may involve several short term objectives, but as the ultimate objective is improved transportation the R&D program would be classified to transport.

22. Respondents in the General Government and Private Non-profit Sectors also classified their R&D programs to fields of science.

23. The classification to fields of science is done according to the field which is applicable to the topic of concern to the R&D program; this will not necessarily be the field which is associated with the technique(s) actually used in the investigation. For example, in the case of an R&D program concerned with investigating the structure of plant tissues by electron microscopy, the technique being used in the investigations is associated with the physical sciences field, but the program would be classified to biological sciences as this is the major field of concern of the R&D program.

24. The ABS classified Higher Education Sector departmental returns to fields of science according to the fields which were applicable to the topic of concern of each department.

25. For a more detailed description and explanation of socio-economic objective and field of science classifications please contact the ABS.

Australian Standard Industrial Classification (ASIC)

26. Most of the statistical information in respect of the Business Enterprise Sector is classified by industry of enterprise in accordance with the 1978 edition of the Australian Standard Industrial Classification (ASIC). Each enterprise is classified by the ABS to the industry in which it mainly operates even though one or more of its component establishments (factories, shops, etc.) may be classified to other industries. For further comment see the *Australian Standard Industrial Classification, 1978, Volume 1* (1201.0).

Constant price estimates

27. Estimates of total R&D expenditure for 1976-77, 1978-79 and 1981-82 are shown at both current and constant (average 1979-80) prices in Table I. In concept, constant price estimates are measures from which the direct effects of price change have been eliminated. Although expressed in monetary terms, the constant

price measures shown in this publication vary only with changes in the underlying quantities in *inpus* purchased (including labour). In effect, quantities of broadly defined categories of inputs are weighted by their prices in the base year (1979-80). Because the measures relate to input quantities, they do not reflect changes in the efficiency with which labour, capital and other inputs are used.

28. The estimates of the wages, salaries and other labour cost components of these constant price estimates were obtained by multiplying, for each broad category of labour, the quantity (man years) of labour used in each period by the relevant average labour cost in the base period. The non-labour cost components were estimated by deflating each current price value by a composite price index of relevant materials or capital expenditure items. In revaluing R&D expenditure, extensive use has been made of price series used in deriving constant price national accounts estimates.

29. 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

30. Many respondents had to make estimates when completing the survey questionnaire because they did not record data on R&D activity separately. Additionally, the OECD standard definition of R&D used for the survey differs in some respects from what particular respondents may regard as research and development.

31. In addition to the general qualifications outlined above, the statistics in respect of individual sectors are subject to specific qualifications. For example, in the Higher Education Sector, university R&D expenditure data were derived indirectly using R&D manpower data from the survey in conjunction with general expenditure data collected by the Commonwealth Tertiary Education Commission (CTEC) in its annual statistical collection. For more information about the estimation procedures used for universities R&D expenditure data and specific qualifications relating to data for other sectors refer to the individual sector publications (see paragraph 32).

Related publications

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

Research and Experimental Development, Business Enterprises, Australia, 1981-82 (8104.0)

Research and Experimental Development, General Government Organisations, Australia, 1981-82 (8109.0)

Research and Experimental Development, Higher Education Organisations, Australia, 1981 (8111.0)

Research and Experimental Development, Energy Production, Utilisation and Conservation, All Sectors, Australia, 1979-80 (8110.0)

Science and Technology Statement 1982-83 (Department of Science and Technology, Canberra, Australia, 1983).

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

33. Current publications produced 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.a. not available

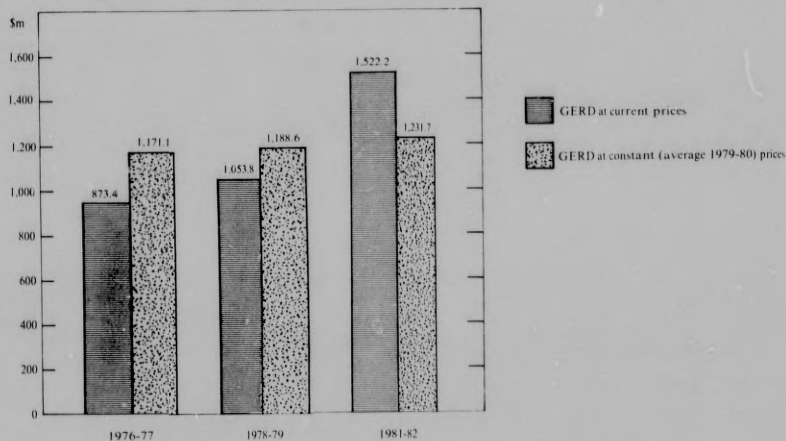
— nil or less than half the final digit shown
n.p. not available for separate publication (but included in totals where applicable)

ASIC Australian Standard Industrial Classification

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

R.J. CAMERON
Australian Statistician

FIGURE 1. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82 GERD AT CURRENT AND CONSTANT (AVERAGE 1979-80) PRICES(a)



(a) See paragraphs 27 to 29 of the Explanatory notes.

FIGURE 2. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82 GERD AS A PERCENTAGE OF GROSS DOMESTIC PRODUCT

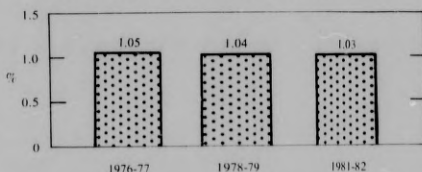
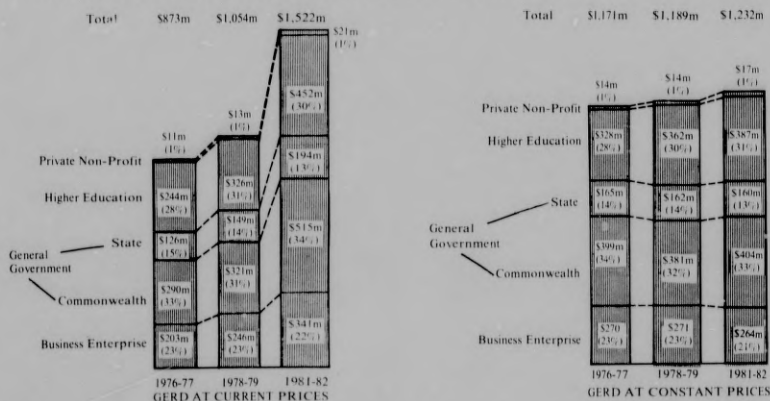


FIGURE 3. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82 GERD BY SECTOR(a) AT CURRENT AND CONSTANT (AVERAGE 1979-80) PRICES(b)



(a) See paragraphs 15 to 18 of the Explanatory notes.

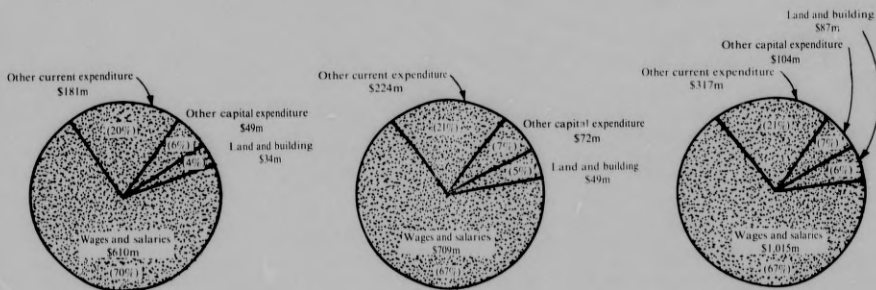
(b) See paragraphs 27 to 29 of the Explanatory notes.

TABLE 1. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82 GERD BY SECTOR(a) AT CURRENT AND CONSTANT (AVERAGE 1979-80) PRICES(b)
(S m)

Sector(a)	1976-77	1978-79	1981-82
AT CURRENT PRICES			
Business enterprise	202.8	245.8	340.5
General government—			
Commonwealth	289.5	321.2	514.8
State	126.3	148.7	193.6
Higher education	244.1	325.5	452.5
Private non-profit	10.7	12.6	20.9
Total	873.4	1,053.8	1,522.2
AT CONSTANT (AVERAGE 1979-80) PRICES(b)			
Business enterprise	270.3	270.5	263.8
General government—			
Commonwealth	398.9	380.8	403.8
State	164.6	161.7	160.0
Higher education	323.5	361.9	387.2
Private non-profit	13.8	13.7	16.9
Total	1,171.1	1,188.6	1,231.7

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraphs 27 to 29 of the Explanatory notes.

FIGURE 4. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82 GERD BY TYPE OF EXPENDITURE



Total Expenditure 1976-77 : \$873m

Total Expenditure 1978-79 : \$1,054m

Total Expenditure 1981-82 : \$1,522m

TABLE 2. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1978-79 AND 1981-82 GERD BY SECTOR(a) BY TYPE OF EXPENDITURE
(S'000)

Sector(a)	1978-79				Total	1981-82				Total
	Land and buildings	Other capital expenditure	Wages and salaries	Other current expenditure		Land and buildings	Other capital expenditure	Wages and salaries	Other current expenditure	
Business enterprise	4,731	21,353	153,246	66,510	245,841	10,208	34,358	207,006	88,934	340,507
General government—										
Commonwealth	31,821	17,638	200,122	71,605	321,187	66,764	25,493	317,220	105,282	514,759
State	3,720	7,937	107,764	29,282	148,703	6,700	13,076	143,331	30,476	193,583
Higher education	8,064	24,177	239,917	53,356	325,514	2,911	29,149	333,662	86,766	452,489
Private non-profit	260	837	8,044	3,424	12,566	348	1,447	13,753	5,361	20,909
Total	48,596	71,942	709,093	224,177	1,053,811	86,931	103,523	1,014,972	316,819	1,522,247

(a) See paragraphs 15 to 18 of the Explanatory notes.

FIGURE 5. RESEARCH AND EXPERIMENTAL DEVELOPMENT (R & D) MANPOWER EFFORT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82
R & D MANPOWER BY SECTOR(a)

Total	43,746	43,643	44,534	
Private Non-Profit	579 (1%)	546 (1%)	688 (2%)	
Higher Education	15,290 (35%)	17,047 (39%)	18,241 (41%)	
General Government	State	6,605 (15%)	6,106 (14%)	6,230 (14%)
	Commonwealth	11,929 (27%)	11,318 (26%)	11,412 (26%)
Business Enterprise	9,343 (21%)	8,626 (20%)	7,923 (18%)	
	1976-77	1978-79	1981-82	

MAN YEARS OF EFFORT ON R & D

(a) See paragraphs 15 to 18 of the Explanatory notes.

FIGURE 6. RESEARCH AND EXPERIMENTAL DEVELOPMENT (R & D) MANPOWER EFFORT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82
R & D MANPOWER AS A PERCENTAGE OF CIVILIAN LABOUR FORCE(CLF)

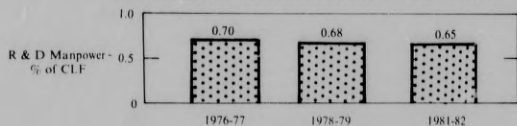


FIGURE 7. RESEARCH AND EXPERIMENTAL DEVELOPMENT (R & D) MANPOWER EFFORT IN AUSTRALIA, 1976-77, 1978-79 AND 1981-82
R & D MANPOWER BY TYPE OF MANPOWER

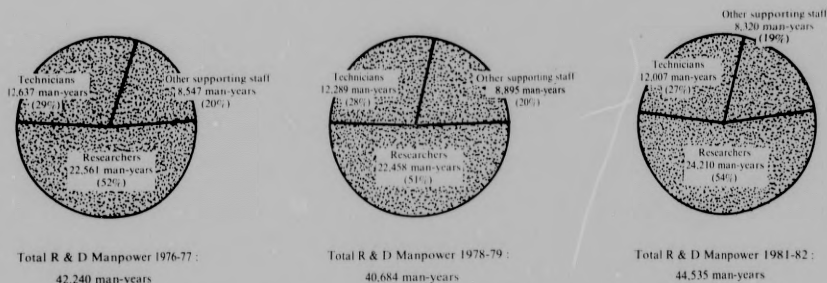


TABLE 3. RESEARCH AND EXPERIMENTAL DEVELOPMENT (R&D) MANPOWER EFFORT IN AUSTRALIA, 1978-79 AND 1981-82
R & D MANPOWER BY SECTOR(a) BY TYPE OF MANPOWER (b)

Sector(a)	1978-79			1981-82				
	Researchers	Technicians	Other supporting staff	Total	Researchers	Technicians	Other supporting staff	Total
Business enterprise	3,649	3,171	1,806	8,626	3,472	2,928	1,523	7,923
General government—								
Commonwealth	4,054	3,315	3,949	11,318	4,374	3,194	3,845	11,412
State	2,401	2,064	1,640	6,106	2,422	2,253	1,596	6,271
Higher education	12,089	3,591	1,367	17,047	13,610	3,438	1,193	18,241
Private non-profit	265	148	133	546	332	194	163	688
Total	22,458	12,289	8,895	43,643	24,210	12,007	8,320	44,535

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraph 12 of the Explanatory notes.

TABLE 4. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1981-82
GERD BY SECTOR(a) BY SOURCE OF FUNDS
 (\$' 000)

Sector(a)	Source of funds						Total
	Commonwealth government	State government	Business enterprise	Higher education	Private non-profit and other Australian	Overseas	
Business enterprise	32,845	502	299,575		1,199	6,386	340,507
General government—							
Commonwealth	501,322	2,282	6,333	18	2,297	2,507	514,759
State	11,451	166,210	6,399	72	9,189	262	193,583
Higher education	423,169	7,023	6,526	—	11,982	3,789	452,489
Private non-profit	6,826	2,636	663	273	7,400	3,111	20,909
Total	975,613	178,653	319,496		32,430	16,055	1,522,247

(a) See paragraphs 15 to 18 of the Explanatory notes.

TABLE 5. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1981-82
GERD BY SECTOR(a) BY TYPE OF ACTIVITY(b)
 (\$' 000)

Sector(a)	Type of activity(b)				Total
	Pure basic research	Strategic basic research	Applied research	Experimental development	
Business enterprise	4,622	14,422	115,012	206,451	340,507
General government—					
Commonwealth	39,586	163,896	226,379	84,898	514,759
State	6,046	10,028	149,126	28,383	193,583
Higher education	231,547	69,442	123,878	27,624	452,489
Private non-profit	7,811	3,239	9,604	255	20,909
Total	289,612	261,027	623,999	347,611	1,522,247

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraph 13 of the Explanatory notes.

TABLE 6. GROSS EXPENDITURE ON RESEARCH AND EXPERIMENTAL DEVELOPMENT (GERD) CARRIED OUT IN AUSTRALIA, 1981-82
GERD BY SECTOR(a) BY STATE
 (\$' 000)

Sector(a)	State									Total
	N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Overseas	
Business enterprise	106,560	160,650	29,647	20,172	14,515	8,479	33	450	—	340,507
General government—										
Commonwealth	140,088	153,503	39,939	61,994	10,906	10,072	5,814	85,161	5,283	514,759
State	56,883	39,986	44,811	14,484	31,411	5,732	—	19	255	193,583
Higher education	135,446	96,561	47,062	41,099	33,079	9,206	—	90,036	—	452,489
Private non-profit	6,514	14,092	6	231	5	—	—	60	—	20,909
Total	445,491	466,792	161,465	137,980	89,916	33,489	5,847	175,726	5,538	1,522,247

(a) See paragraphs 15 to 18 of the Explanatory notes.

TABLE 7. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT IN AUSTRALIA, 1981-82
RESEARCHER EFFORT BY SECTOR(a) BY STATE
 (man-years)

Sector(a)	State									Total
	N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Overseas	
Business enterprise	1,249	1,418	304	252	139	87	n.p.	n.p.	12	3,472
General government—										
Commonwealth	1,055	1,325	240	590	106	52	32	947	25	4,374
State	672	571	520	212	348	95	—	—	2	7,422
Higher education	4,189	3,906	1,505	1,089	1,035	283	—	1,603	—	13,610
Private non-profit	115	207	—	6	1	—	—	3	—	332
Total	7,280	7,427	2,569	2,149	1,629	517	n.p.	n.p.	39	24,210

(a) See paragraphs 15 to 18 of the Explanatory notes.

**TABLE 8. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT IN AUSTRALIA(a), 1981-82
R&D EXPENDITURE AND R&D MANPOWER BY SOCIO-ECONOMIC OBJECTIVE(b) BY SECTOR(c)**

Socio-economic objective(b)	Expenditure (\$'000)					Manpower (man-years)				
	General government				Total	General government				Total
	Common-wealth	State	Higher education	Private non-profit		Common-wealth	State	Higher education	Private non-profit	
National security (defence)	113,215	—	743	—	113,958	3,625	—	19	—	3,644
Economic development—										
Agriculture	104,005	131,864	35,476	36	271,381	1,553	4,125	1,554	3	7,235
Forestry and fisheries	18,584	21,901	4,267	—	44,752	367	751	167	—	1,285
Mining (prospecting)—										
energy sources	11,571	435	1,813	—	13,819	237	7	64	—	308
other	7,548	1,640	1,798	—	10,986	193	44	67	—	304
Mining (extraction)—										
energy sources	4,859	171	1,015	—	6,045	115	9	44	—	168
other	8,044	650	2,398	—	11,092	202	26	104	—	332
Manufacturing	63,657	18,300	12,984	—	78,471	1,427	44	—	—	2,054
Construction	7,002	7	2,669	—	9,678	205	1	107	—	313
Energy	41,107	1,602	21,703	3	64,415	704	27	764	1	1,496
Transport	1,607	4,605	2,582	196	8,990	22	111	98	12	243
Communications	603	—	3,234	—	3,837	26	—	143	—	169
Economic services n.e.c.	20,881	1,700	21,003	512	44,096	699	59	677	18	1,253
Total economic development	289,467	166,405	110,942	747	567,561	5,551	5,204	4,372	34	15,161
Community welfare—										
Urban and regional planning	2,701	110	3,962	—	6,773	76	4	161	—	241
Environment	28,981	7,695	5,741	—	42,417	592	284	256	—	1,132
Health	12,678	10,452	87,322	17,758	128,210	372	454	3,345	562	4,733
Education	853	1,810	18,116	1,739	22,518	31	68	923	63	1,085
Welfare	893	773	5,693	420	7,779	26	38	202	22	288
Community services n.e.c.	2,594	981	11,293	35	14,903	50	34	427	1	512
Total community welfare	48,700	21,821	132,127	19,952	222,600	1,148	883	5,314	649	7,994
Advancement of knowledge—										
Earth, ocean and atmosphere n.e.c.	30,907	3,354	26,276	—	60,537	437	104	1,019	—	1,560
General advancement of knowledge	32,470	2,003	182,402	210	217,085	651	79	7,516	6	8,252
Total advancement of knowledge	63,377	5,357	208,678	210	277,622	1,089	184	8,535	6	9,814
Total	514,759	193,583	452,489	20,909	1,181,740	11,412	6,270	18,241	688	36,611

(a) Excludes business enterprises. (b) See paragraphs 19 to 25 of the Explanatory notes. (c) See paragraphs 15 to 18 of the Explanatory notes.

**TABLE 9. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT IN AUSTRALIA(a), 1981-82
R&D EXPENDITURE AND R&D MANPOWER BY FIELD OF SCIENCE(b) BY SECTOR(c)**

Field of science(b)	Expenditure (\$'000)					Manpower (man-years)				
	General government				Total	General government				Total
	Common-wealth	State	Higher education	Private non-profit		Common-wealth	State	Higher education	Private non-profit	
Natural sciences—										
Physical sciences	38,931	1,016	49,106	183	89,236	875	40	1,672	6	2,593
Chemical sciences	23,949	1,525	29,135	67	54,676	517	45	1,143	2	1,707
Biological sciences	55,798	20,321	73,179	1,668	150,966	982	875	3,089	48	4,794
Earth sciences	66,522	7,233	18,775	3	92,533	1,328	193	648	1	2,170
Engineering and applied sciences	196,857	8,385	51,407	220	256,869	5,365	221	2,145	14	7,745
Agricultural sciences	110,494	141,831	33,746	36	286,107	1,722	4,548	1,428	3	7,701
Medical sciences	5,617	7,625	59,721	15,962	88,925	164	339	2,274	510	3,287
Total natural sciences	498,167	187,935	315,068	18,139	1,019,309	10,953	6,062	12,399	583	29,997
Social sciences and humanities—										
Economics	6,114	576	15,182	413	22,285	195	13	462	15	685
Education	921	1,885	16,193	1,743	20,742	33	69	891	58	1,051
Management	254	138	3,685	5	4,082	7	6	120	—	133
Political science	64	—	7,405	73	7,469	—	—	297	—	299
Sociology	1,056	790	6,686	73	8,605	30	31	257	4	322
Information science	4,946	—	—	40	—	118	4	—	1	—
Other social sciences and humanities	3,238	2,180	—	497	—	74	85	—	28	—
Total social sciences and humanities	16,592	5,648	137,421	2,770	162,431	459	208	5,840	105	6,612
Total	514,759	193,583	452,489	20,909	1,181,740	11,412	6,270	18,241	688	36,611

(a) Excludes business enterprises. (b) See paragraphs 19 to 25 of the Explanatory notes. (c) See paragraphs 15 to 18 of the Explanatory notes.

**TABLE 10. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY BUSINESS ENTERPRISES, AUSTRALIA, 1981-82
R&D EXPENDITURE AND R&D MANPOWER BY INDUSTRY OF ENTERPRISE(a)**

ASIC code	Description	Industry of enterprise(a)		
		Expenditure \$ 000	Manpower man-years	Enterprises number
11-15	Mining (excl. services to mining)	22,585	381	23
	Manufacturing—			
21	Food, beverages and tobacco	13,124	367	69
23-24	Textiles, clothing and footwear	785	24	16
25	Wood, wood products and furniture	1,719	43	19
26	Paper, paper products and printing	5,255	125	12
27	Chemical, petroleum and coal products	53,114	1,231	124
28	Non-metallic mineral products	4,826	109	22
29	Basic metal products	27,359	673	27
31	Fabricated metal products	6,729	161	80
32	Transport equipment	31,933	903	51
334	Photographic, professional and scientific equipment	5,083	160	25
335	Appliances and electrical equipment	37,208	899	156
336	Industrial machinery and equipment	14,654	414	153
33	Total other machinery and equipment	56,945	1,473	334
34	Miscellaneous manufacturing	7,226	180	65
C	Total manufacturing	209,116	5,287	819
	Other industries—			
E	Construction	2,761	51	23
F	Wholesale and retail trade	11,912	290	102
63	Property and business services	18,599	466	203
8461	Research and scientific institutions	21,770	464	28
(b)	Other n.e.c.	53,853	983	47
16, D-L	Total other industries	108,805	2,255	404
	Total all industries(c)	340,507	7,923	1,246

(a) See paragraph 26 of the Explanatory notes. (b) ASIC codes 16, D, G-H, 61-62, J, 8141-8306, 8462-9364. (c) Excludes ASIC Division A.

**TABLE 11. EXTRAMURAL R&D EXPENDITURE, AUSTRALIA, 1981-82
PAYMENTS BY SECTOR BY COUNTRY OF RECIPIENT
(\$ 000)**

Sector(a)	Country of recipient				Total
	Australia	U. K.	U.S.A.	Other countries	
Business enterprise	26,279	1,095	7,933	4,129	39,436
General government—					
Commonwealth	223,132	156	167	23,997	247,451
State	4,236	—	—	30	4,266
Higher education(b)	n.a.	n.a.	n.a.	n.a.	n.a.
Private non-profit	2,718	10	—	24	2,752
Total	256,365	1,261	8,100	28,180	293,965

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) Not collected.

**TABLE 12. PAYMENTS AND RECEIPTS FOR TECHNICAL KNOW-HOW, AUSTRALIA, 1981-82
PAYMENTS AND RECEIPTS BY SECTOR(a) BY TYPE OF TECHNICAL KNOW-HOW
(\$ 000)**

Sector(a)	Payments for technical know-how			Receipts for technical know-how		
	Patent licence fees and royalties	Other technical know-how	Total	Patent licence fees and royalties	Other technical know-how	Total
Business enterprise	69,426	57,158	126,584	9,653	7,740	17,393
General government—						
Commonwealth	36	—	36	353	71	423
State	32	53	84	2	45	47
Higher education(b)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Private non-profit	—	50	50	—	39	39
Total	69,494	57,261	126,754	10,008	7,895	17,902

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) Not collected.

**TABLE 13. PATENT ACTIVITY, AUSTRALIA, JULY 1979 TO JUNE 1982
PATENT APPLICATIONS LODGED AND PATENTS GRANTED BY SECTOR(a)**

Sector(a)	Patent applications lodged in Australia		Patent applications lodged abroad	
	Patent applications lodged in Australia	Patents granted in Australia	Patent applications lodged abroad	Patents granted abroad
Business enterprise	1,149	560	2,933	1,527
General government—				
Commonwealth	204	82	546	254
State	20	15	10	10
Higher education(b)	n.a.	n.a.	n.a.	n.a.
Private non-profit	1	—	1	—
Total	1,374	657	3,490	1,791

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) Not collected.

TABLE 14. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY PRIVATE NON-PROFIT ORGANISATIONS(a), AUSTRALIA, 1981-82
 DETAILS OF R&D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE(b)
 (\$' 000)

Socio-economic objective(b)	Total expenditure	Major field of science(b)		Type of expenditure				Type of activity(c)			
		Natural sciences	Social sciences	Land and buildings	Other capital expenditure	Wages and salaries	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
National security (defence)	—	—	—	—	—	—	—	—	—	—	—
Economic development—											
Agriculture	36	36	—	—	—	—	30	6	—	—	36
Forestry and fisheries	—	—	—	—	—	—	—	—	—	—	—
Mining (prospecting)—											
energy sources	—	—	—	—	—	—	—	—	—	—	—
other	—	—	—	—	—	—	—	—	—	—	—
Mining (extraction)—											
energy sources	—	—	—	—	—	—	—	—	—	—	—
other	—	—	—	—	—	—	—	—	—	—	—
Manufacturing	—	—	—	—	—	—	—	—	—	—	—
Construction	—	—	—	—	—	—	—	—	—	—	—
Energy	3	3	—	—	—	—	3	—	—	—	3
Transport	196	196	—	—	—	—	186	9	—	16	180
Communications	—	—	—	—	—	—	—	—	—	—	—
Economic services n.e.c.	512	—	512	—	3	372	137	—	—	16	512
Total economic development	747	235	512	—	3	591	152	—	—	16	731
Community welfare—											
Urban and regional planning	—	—	—	—	—	—	—	—	—	—	—
Environment	17,758	17,693	65	348	1,387	11,357	4,666	7,684	3,148	6,782	144
Health	1,739	—	1,739	—	1	1,304	434	22	45	1,672	—
Education	420	—	420	—	5	325	91	—	30	384	6
Welfare	35	—	35	—	—	35	—	—	—	35	—
Community services n.e.c.	19,952	17,693	2,259	348	1,392	13,021	5,191	7,706	3,223	8,873	150
Total community welfare	19,952	17,693	2,259	348	1,392	13,021	5,191	7,706	3,223	8,873	150
Advancement of knowledge—											
Earth, ocean and atmosphere n.e.c.	—	—	—	—	—	—	—	—	—	—	—
General advancement of knowledge	210	210	—	—	52	141	17	105	—	—	105
Total advancement of knowledge	210	210	—	—	52	141	17	105	—	—	105
Total	20,909	18,139	2,771	348	1,447	13,753	5,361	7,811	3,239	9,604	255

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraphs 19 to 25 of the Explanatory notes. (c) See paragraph 13 of the Explanatory notes.

TABLE 15. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY PRIVATE NON-PROFIT ORGANISATIONS(a), AUSTRALIA, 1981-82
R&D EXPENDITURE BY FIELD OF SCIENCE(b) BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY(c)
(\$'000)

Field of science(b)	Type of expenditure					Type of activity(c)			
	Total expenditure	Land and buildings	Other capital expenditure	Wages and salaries	Other current expenditure	Pure basic research	Strategic basic research	Applied research	Experimental development
Natural sciences—									
Physical sciences	183	—	40	126	17	71	15	13	84
Chemical sciences	67	—	22	42	3	34	—	—	34
Biological sciences	1,668	—	256	1,082	330	445	781	403	40
Earth sciences	3	—	—	2	—	—	—	3	—
Engineering and applied sciences	220	—	—	211	9	—	16	191	13
Agricultural sciences	36	—	—	30	6	—	—	36	—
Medical sciences	15,962	348	1,097	10,187	4,331	7,239	2,352	6,348	23
<i>Total natural sciences</i>	<i>18,139</i>	<i>348</i>	<i>1,416</i>	<i>11,679</i>	<i>4,696</i>	<i>7,789</i>	<i>3,164</i>	<i>6,993</i>	<i>193</i>
Social sciences and humanities—									
Economics	413	—	2	313	98	—	—	413	—
Education	1,743	—	1	1,290	453	11	25	1,690	17
Management	5	—	1	4	—	—	1	3	1
Political science	—	—	—	—	—	—	—	—	—
Sociology	73	—	3	59	10	—	4	66	2
Information science	40	—	22	15	3	—	—	—	40
Other social sciences and humanities	497	—	3	392	101	11	45	438	3
<i>Total social sciences and humanities</i>	<i>2,770</i>	<i>—</i>	<i>32</i>	<i>2,073</i>	<i>665</i>	<i>22</i>	<i>75</i>	<i>2,611</i>	<i>62</i>
Total	20,909	348	1,447	13,753	5,361	7,811	3,239	9,604	255

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraphs 19 to 25 of the Explanatory notes. (c) See paragraph 13 of the Explanatory notes.

TABLE 16. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY PRIVATE NON-PROFIT ORGANISATIONS(a), AUSTRALIA, 1981-82
R&D MANPOWER BY SOCIO-ECONOMIC OBJECTIVE(b) BY MAJOR FIELD OF SCIENCE(b) AND TYPE OF EMPLOYEE(c)
 (man-years)

Socio-economic objective(b)	Major field of science(b)		Type of employee(c)			
	Total man-years	Natural sciences	Social sciences	Researchers	Technicians	Other supporting staff
National security (defence)	—	—	—	—	—	—
Economic development—						
Agriculture	3	3	—	3	—	—
Forestry and fisheries	—	—	—	—	—	—
Mining (prospecting)—						
energy sources	—	—	—	—	—	—
other	—	—	—	—	—	—
Mining (extraction)—						
energy sources	—	—	—	—	—	—
other	—	—	—	—	—	—
Manufacturing	—	—	—	—	—	—
Construction	—	—	—	—	—	—
Energy	1	1	—	1	—	—
Transport	12	12	—	6	3	3
Communications	—	—	—	—	—	—
Economic services n.e.c.	18	—	18	8	2	8
Total economic development	34	16	18	17	5	11
Community welfare—						
Urban and regional planning	—	—	—	—	—	—
Environment	—	—	—	—	—	—
Health	563	561	1	255	176	132
Education	63	—	63	39	9	16
Welfare	22	—	22	17	1	4
Community services n.e.c.	1	—	1	—	—	—
Total community welfare	649	561	87	312	185	151
Advancement of knowledge—						
Earth, ocean and atmosphere n.e.c.	—	—	—	—	—	—
General advancement of knowledge	6	6	—	3	3	—
Total advancement of knowledge	6	6	—	3	3	—
Total	688	583	105	332	194	163

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraphs 19 to 25 of the Explanatory notes. (c) See paragraph 12 of the Explanatory notes.

TABLE 17. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY PRIVATE NON-PROFIT ORGANISATIONS(a), AUSTRALIA, 1981-82
R&D MANPOWER BY FIELD OF SCIENCE(b) BY TYPE OF EMPLOYEE(c)
 (man-years)

Field of science(b)	Type of employee(c)			Total
	Researchers	Technicians	Other supporting staff	
Natural sciences—				
Physical sciences	3	3	1	6
Chemical sciences	1	1	—	2
Biological sciences	27	16	5	48
Earth sciences	1	—	—	1
Engineering and applied sciences	6	4	3	14
Agricultural sciences	3	—	—	3
Medical sciences	226	158	126	510
Total natural sciences	266	182	135	583
Social sciences and humanities—				
Economics	7	1	6	15
Education	36	8	15	58
Management	—	—	—	—
Political science	—	—	—	—
Sociology	3	—	1	4
Information science	1	—	—	1
Other social sciences and humanities	20	3	5	28
Total social sciences and humanities	66	12	27	105
Total	332	194	163	688

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraphs 19 to 25 of the Explanatory notes. (c) See paragraph 12 of the Explanatory notes.

TABLE 18. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY PRIVATE NON-PROFIT ORGANISATIONS(a), AUSTRALIA, 1981-82
R&D EXPENDITURE AND R&D MANPOWER BY STATE

State or Territory	Total expenditure (\$'000)	Type of employee (man-years) (b)			Total
		Researchers	Technicians	Other supporting staff	
New South Wales	6,514	115	61	34	210
Victoria	14,092	207	128	125	460
Queensland	6	—	—	1	1
South Australia	231	6	4	2	12
Western Australia	5	1	—	—	1
Tasmania	—	—	—	—	—
Northern Territory	—	—	—	—	—
Australian Capital Territory	60	3	1	1	4
Overseas	—	—	—	—	—
Total	20,909	332	194	163	688

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraph 12 of the Explanatory notes.

TABLE 19. RESEARCH AND EXPERIMENTAL DEVELOPMENT CARRIED OUT BY PRIVATE NON-PROFIT ORGANISATIONS(a), AUSTRALIA, 1981-82
R&D EXPENDITURE BY SOCIO-ECONOMIC OBJECTIVE(b) BY STATE
(S' 000)

Socio-economic objective(b)	State									Total
	N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Overseas	
<i>National security (defence)</i>	—	—	—	—	—	—	—	—	—	—
Economic development—										
Agriculture	36	—	—	—	—	—	—	—	—	36
Forestry and fisheries	—	—	—	—	—	—	—	—	—	—
Mining (prospecting)—										
energy sources	—	—	—	—	—	—	—	—	—	—
other	—	—	—	—	—	—	—	—	—	—
Mining (extraction)—										
energy sources	—	—	—	—	—	—	—	—	—	—
other	—	—	—	—	—	—	—	—	—	—
Manufacturing	—	—	—	—	—	—	—	—	—	—
Construction	—	—	—	—	—	—	—	—	—	—
Energy	3	—	—	—	—	—	—	—	—	3
Transport	162	34	—	—	—	—	—	—	—	196
Communications	—	—	—	—	—	—	—	—	—	—
Economic services n.e.c.	404	107	—	—	—	—	—	—	—	512
<i>Total economic development</i>	<i>605</i>	<i>141</i>	—	—	—	—	—	—	—	<i>747</i>
Community welfare—										
Urban and regional planning	—	—	—	—	—	—	—	—	—	—
Environment	—	—	—	—	—	—	—	—	—	—
Health	5,475	12,087	6	190	—	—	—	—	—	17,758
Education	8	1,665	—	—	5	—	60	—	—	1,739
Welfare	181	199	—	41	—	—	—	—	—	420
Community services n.e.c.	35	—	—	—	—	—	—	—	—	35
<i>Total community welfare</i>	<i>5,698</i>	<i>13,951</i>	<i>6</i>	<i>231</i>	<i>5</i>	—	<i>60</i>	—	—	<i>19,952</i>
Advancement of knowledge—										
Earth, ocean and atmosphere n.e.c.	—	—	—	—	—	—	—	—	—	—
General advancement of knowledge	210	—	—	—	—	—	—	—	—	210
<i>Total advancement of knowledge</i>	<i>210</i>	—	—	—	—	—	—	—	—	<i>210</i>
Total	6,514	14,092	6	231	5	—	—	60	—	20,909

(a) See paragraphs 15 to 18 of the Explanatory notes. (b) See paragraphs 19 to 25 of the Explanatory notes.