



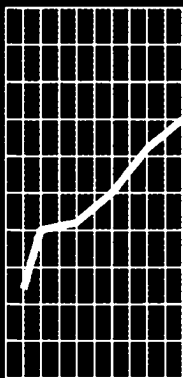
1994-95

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Research and Experimental Development

Business Enterprises

Australia



NOTES

SYMBOLS AND OTHER USAGES

n.a.	not available
n.e.c.	not elsewhere classified
n.p.	not available for separate publication (but included where applicable)
—	nil or rounded to zero
r	revised since previous issue
mfg	manufacturing

INQUIRIES

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

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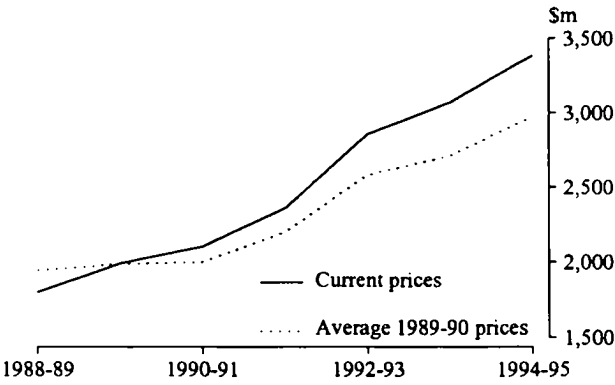
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SUMMARY OF FINDINGS

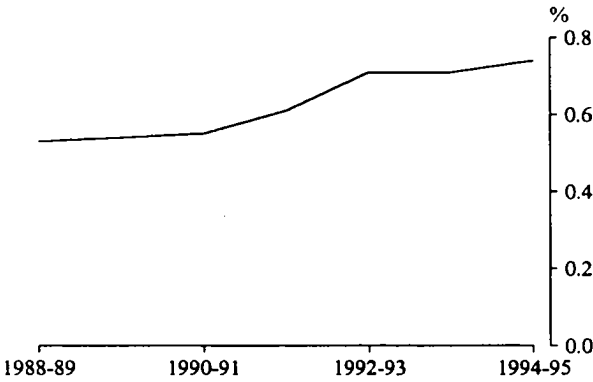
BUSINESS EXPENDITURE
ON R&D (BERD)

BERD has increased every year since 1988–89 in both current and average 1989–90 terms. Both series increased by 10% in 1994–95.



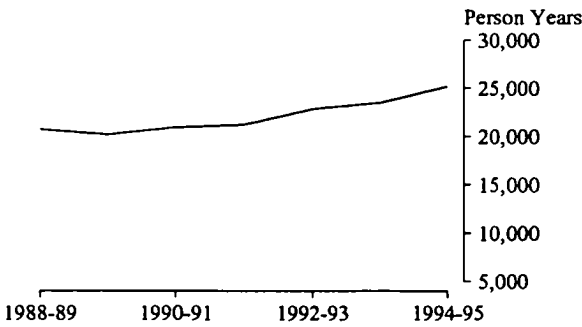
BERD AS A PERCENTAGE
OF GDP

After plateauing between 1988–89 and 1990–91, BERD as a percentage of GDP increased by 27% in the next two years, levelled off in 1993–94, then increased by 4% in 1994–95.



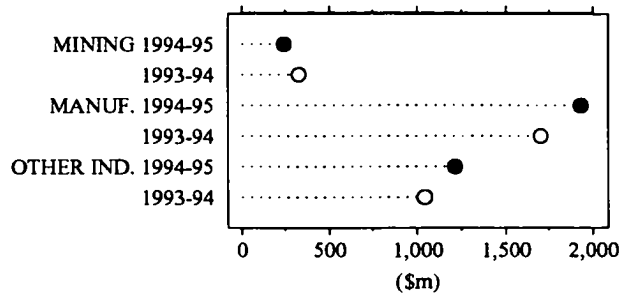
HUMAN RESOURCES
DEVOTED TO R&D

After steadily increasing since 1989–90, human resources devoted to R&D increased by 7% between 1993–94 and 1994–95.



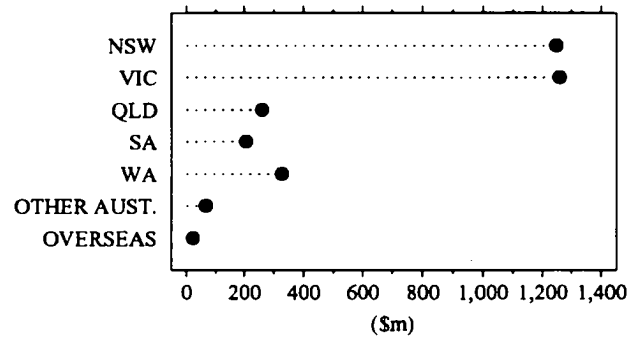
EXPENDITURE BY INDUSTRY

From 1993-94 to 1994-95 Manufacturing increased from \$1,700m to \$1,929m while Mining fell from \$327m to \$242m.



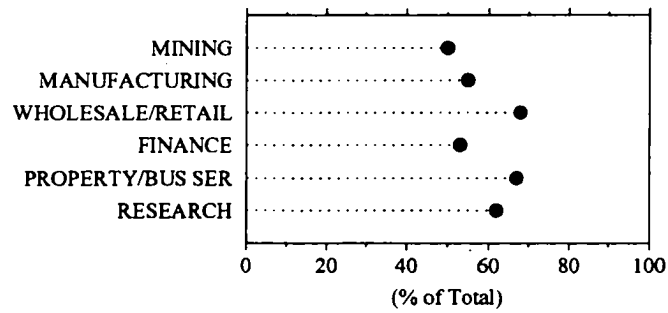
LOCATION OF EXPENDITURE

Victoria and New South Wales were the States with the greatest R&D expenditure in 1994-95 of \$1,258m and \$1,247m respectively.



RESEARCHER EFFORT BY INDUSTRY

The proportion of researchers to total human resources devoted to R&D in 1994-95 ranged from 68% in Wholesale and retail trade to 50% in Mining.



INTERNATIONAL COMPARISON BERD represented 0.74% of Gross Domestic Product (GDP). This percentage increased by 4% over 1993–94.

The BERD/GDP ratio remained relatively low when compared with other OECD countries as shown in the table below.

	1993–94	1994–95
Australia	0.72	0.74
Canada	0.90	0.91
Czech Republic	0.99	0.84
Denmark	1.05	n.a.
Finland	1.29	1.46
France	1.51	1.47
Germany	1.62	1.54
Greece	0.16	n.a.
Iceland	0.42	0.43
Ireland	0.84	n.a.
Italy	0.71	0.67
Japan	1.94	1.91
Netherlands	0.99	n.a.
New Zealand	0.31	n.a.
Norway	1.04	n.a.
Spain	0.44	0.47
Sweden	2.32	n.a.
Turkey	0.10	n.a.
United Kingdom	1.44	1.43
United States	1.89	1.80

R&D EXPENDITURE

Business expenditure on R&D (BERD) carried out in Australia in 1994-95 was estimated to be \$3,383m at *current* prices. This represented an increase of 10% compared with 1993-94. Expenditure by private sector businesses increased by 8%, while expenditure by public sector businesses increased by 42%.

At *average* 1989-90 prices, R&D expenditure was estimated to be \$2,972m, a similar increase of 10% compared with 1993-94. Expenditure by private sector businesses increased by 7%, while expenditure by public sector businesses increased by 44%.

1

EXPENDITURE ON R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA (\$m)

	1988-89	1989-90	1990-91r	1991-92r	1992-93r	1993-94r	1994-95
AT CURRENT PRICES							
Private Sector	1,649.1	1,802.6	1,896.1	2,143.9	2,609.8	2,835.7	3,051.3
Public Sector	149.2	187.0	203.6	216.4	244.8	233.3	331.8
TOTAL BUSINESS ENTERPRISES	1,798.3	1,989.6	2,099.8	2,360.2	2,854.5	3,069.0	3,383.1
AT AVERAGE 1989-90 PRICES							
Private Sector	1,785.2	1,802.6	1,811.7	2,002.0	2,361.7	2,503.5	2,673.5
Public Sector	159.7	187.0	190.8	198.0	220.5	207.8	298.6
TOTAL BUSINESS ENTERPRISES	1,944.9	1,989.6	2,002.5	2,200.0	2,582.2	2,711.3	2,972.1

(a) Excludes enterprises in ANZSIC Division 'A'

HUMAN RESOURCES DEVOTED TO R&D

Human resources devoted to R&D carried out in Australia in 1994-95 was estimated to be 25,240 person years. This represented a 7% increase over 1993-94. Human resources devoted to research steadily increased since 1989-90.

Private sector businesses increased their person years of effort devoted to R&D by 8% over 1993-94, while public sector businesses increased by only 1%.

2

HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA (person years)

	1988-89	1989-90	1990-91r	1991-92r	1992-93r	1993-94r	1994-95
Private Sector	19,206	18,572	19,158	19,184	20,665	21,402	23,116
Public Sector	1,597	1,729	1,867	2,088	2,219	2,105	2,123
TOTAL BUSINESS ENTERPRISES	20,803	20,301	21,025	21,272	22,883	23,507	25,240

(a) Excludes enterprises in ANZSIC Division 'A'

INDUSTRY PERSPECTIVE

Manufacturing industries accounted for 57% (\$1,929m) of total R&D expenditure and 59% (14,914 person years) of human resources devoted to R&D. The major contributors to total manufacturing were: Electronic and electrical equipment and appliance mfg (23% of expenditure, 28% of human resources); Motor vehicle and part and other transport equipment mfg (18% of expenditure, 14% of human resources); Petroleum, coal, chemical and associated product mfg (16% of expenditure, 16% of human resources); and Metal product mfg (16% of expenditure, 13% of human resources).

The largest other industries were Property and business services (16% of total expenditure, 18% of total human resources); Mining (7% of total expenditure, 3% of total human resources); and Wholesale and retail trade (6% of total expenditure, 7% of total human resources).

Expenditure on R&D increased over 1993-94 in all industries other than Mining, Wood and paper product mfg, Wholesale and retail trade and Finance and insurance, down by 26%, 26%, 11% and 8% respectively. The largest increases occurred in Property and business services (\$103m, 23%), Electronic and electrical equipment and appliance mfg (\$80m, 21%) and Motor vehicle and part and other transport equipment mfg (\$68m, 25%).

3

R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY INDUSTRY OF ENTERPRISE

Industry of enterprise ANZSIC Code Description	Enterprises (number)			Expenditure on R & D (\$m)			Person years of effort on R & D		
	1992-93r	1993-94r	1994-95	1992-93r	1993-94r	1994-95	1992-93r	1993-94r	1994-95
B Mining (Including services to mining)	91	85	92	176.3	326.5	241.6	850	838	825
Manufacturing —									
21 Food, beverage and tobacco	125	130	178	136.1	140.2	141.6	1,141	1,156	1,131
22 Textile, clothing, footwear and leather	50	50	60	16.3	17.0	26.9	148	170	197
23 Wood and paper product	29	31	43	44.4	103.0	76.5	249	224	253
24 Printing, publishing and recorded media	34	34	44	14.3	10.8	15.1	140	121	174
25 Petroleum, coal, chemical and associated product	317	306	356	290.8	272.2	309.8	2,123	2,175	2,400
26 Non-metallic mineral product	48	50	77	31.3	31.3	45.3	299	274	427
27 Metal product	178	176	235	336.5	294.2	309.5	1,773	1,763	1,970
281-282 Motor vehicle and part and other transport equipment	112	125	145	307.7	269.8	338.1	1,694	1,918	2,014
283 Photographic and scientific equipment	96	108	113	96.5	102.6	123.0	931	989	1,102
284-285 Electronic and electrical equipment and appliance	458	444	448	344.1	371.5	451.0	3,483	3,783	4,108
286 Industrial machinery and equipment	241	249	288	65.2	72.2	73.5	786	835	907
29 Other manufacturing	58	62	93	10.9	14.6	18.3	147	161	233
C Total manufacturing	1,746	1,765	2,080	1,694.1	1,699.5	1,928.6	12,912	13,568	14,914
Other industries —									
F-G Wholesale and retail trade	260	263	263	224.1	221.0	196.4	1,716	1,745	1,662
K Finance and insurance	27	28	34	119.7	113.0	103.4	1,463	1,175	923
77,782-786 Property and business services	527	574	651	363.0	442.6	545.9	3,644	4,044	4,668
781 Scientific research	66	70	74	84.0	87.1	114.1	812	805	961
(b) Other n.e.c.	118	108	127	193.3	179.4	253.0	1,487	1,333	1,287
D-Q Total other industries	998	1,043	1,149	984.1	1,043.0	1,212.8	9,122	9,101	9,500
TOTAL ALL INDUSTRIES	2,835	2,893	3,321	2,854.5	3,069.0	3,383.1	22,883	23,507	25,240
Private Sector Contribution	2,792	2,858	3,273	2,609.8	2,835.7	3,051.3	20,665	21,402	23,116
Public Sector Contribution	43	35	48	244.8	233.3	331.8	2,219	2,105	2,123

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H-J,M-Q.

TYPE OF EXPENDITURE

Other current expenditure was the main component of R&D expenditure (46%), up 2% on 1993-94. Labour costs (42%) have remained at the same proportion as for 1993-94. The Finance and insurance industry has the highest labour costs as a proportion of total R&D expenditure (58%) and Wood and paper product mfg the lowest (20%).

TYPE OF ACTIVITY

Business R&D expenditure was mainly directed towards Experimental development (69%), with 25% towards Applied research and 6% towards Basic research.

For the Manufacturing sector, 73% of research was Experimental development and 20% was Applied research. For the Mining sector, 64% was Experimental development while 31% was Applied research. In the Scientific research industry only 29% was Experimental development, with 56% Applied research and 14% Basic research.

4

R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY TYPE OF EXPENDITURE AND TYPE OF ACTIVITY, 1994-95 (\$'000)

Industry of enterprise ANZSIC Code Description		Type of expenditure				Type of activity(b)		
		Total	Capital expenditure	Labour costs(c)	Other current expenditure	Basic research	Applied research	Experimental development
B	Mining (including services to mining)	241,650	46,392	50,461	144,797	11,590	75,116	154,944
	Manufacturing —							
21	Food, beverage and tobacco	141,603	16,327	65,536	59,740	10,339	31,982	99,282
22	Textile, clothing, footwear and leather	26,905	4,575	8,867	13,463	2,275	7,654	16,975
23	Wood and paper product	76,524	9,022	14,969	52,533	6,847	18,687	50,990
24	Printing, publishing and recorded media	15,062	2,285	8,671	4,106	438	5,864	8,761
25	Petroleum, coal, chemical and associated product	309,835	39,010	127,528	143,297	28,175	75,738	205,922
26	Non-metallic mineral product	45,260	7,598	18,224	19,438	6,017	13,909	25,334
27	Metal product	309,543	26,090	105,883	177,570	47,338	58,358	203,846
281-282	Motor vehicle and part and other transport equipment	338,145	16,646	123,549	197,950	3,052	22,240	312,853
283	Photographic and scientific equipment	123,003	9,298	59,123	54,582	3,654	26,114	93,235
284-285	Electronic and electrical equipment and appliance	450,957	40,593	221,967	188,398	14,525	105,456	330,976
286	Industrial machinery and equipment	73,456	4,746	38,679	30,032	5,065	20,638	47,752
29	Other manufacturing	18,337	1,379	9,646	7,312	1,366	5,228	11,743
C	Total manufacturing	1,928,629	177,569	802,639	948,421	129,092	391,869	1,407,669
	Other industries —							
F-G	Wholesale and retail trade	196,376	17,489	97,249	81,638	11,436	65,609	119,332
K	Finance and insurance	103,409	12,258	60,041	31,110	2,897	15,347	85,165
77,782-786	Property and business services	545,919	90,306	271,100	184,513	21,063	129,336	395,520
781	Scientific research	114,102	10,220	49,239	54,643	16,180	64,303	33,619
(d)	Other n.e.c.	253,041	59,973	79,333	113,735	23,426	107,433	122,182
D-Q	Total other industries	1,212,846	190,245	556,961	465,640	75,001	382,028	755,817
	TOTAL ALL INDUSTRIES	3,383,125	414,207	1,410,062	1,558,857	215,682	849,013	2,318,430
	Private Sector Contribution	3,051,279	357,924	1,274,108	1,419,247	180,556	726,730	2,143,993
	Public Sector Contribution	331,846	56,282	135,954	139,610	35,126	122,283	174,437

(a) Excludes enterprises in ANZSIC Division 'A' (b) 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 11 of the Explanatory Notes. (c) Includes wages and salaries, overtime allowances, penalty rates, leave loadings, bonuses, commission payments, all paid leave, employer contributions to superannuation and pension schemes, payroll tax, fringe benefits tax, payments to contract staff on the payroll, severance, termination and redundancy payments and workers compensation insurance (d) ANZSIC codes D,E,H-J,M-Q.

SOURCE OF FUNDS FOR R&D Most of the funding for R&D expenditure came from the business sector itself: 86% from Own funds and 6% from Other business enterprises, totalling \$3,136m. The Commonwealth Government provided \$90m in funding, \$25m from the Grants for Industry R&D (GIRD) Scheme and \$65m from Other Commonwealth Government sources. Overseas funding contributed \$110m or 3%.

Industries where a significant proportion of funding was other than from Own funds included: Scientific research (34% from Other business enterprises, 15% from the Commonwealth Government and 15% from Other Australian); Wholesale and retail trade (16% from Overseas); and Property and business services (15% from Other business enterprises).

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SOURCE OF FUNDS FOR R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1994-95 (\$'000)

Industry of enterprise ANZSIC Code Description		Source of funds							
		Total	Own funds	Other business enterprises	GIRD Scheme(b)	Other C'wealth Gov't	State and Local Gov't	Other Aust(c)	Overseas
B	Mining (including services to mining)	241,650	238,756	2,572	n.p.	—	—	n.p.	—
	Manufacturing —								
21	Food, beverage and tobacco	141,603	137,138	2,537	809	n.p.	200	n.p.	—
22	Textile, clothing, footwear and leather	26,905	25,765	951	n.p.	n.p.	—	—	—
23	Wood and paper product	76,524	76,448	—	n.p.	—	—	n.p.	—
24	Printing, publishing and recorded media	15,062	13,366	n.p.	n.p.	—	35	400	—
25	Petroleum, coal, chemical and associated product	309,835	287,220	3,363	407	n.p.	n.p.	n.p.	n.p.
26	Non-metallic mineral product	45,260	44,184	621	348	n.p.	—	n.p.	—
27	Metal product	309,543	307,480	756	623	647	27	10	—
281-282	Motor vehicle and part and other transport equipment	338,145	310,195	n.p.	283	n.p.	10	n.p.	n.p.
283	Photographic and scientific equipment	123,003	101,447	n.p.	1,350	n.p.	n.p.	2,123	n.p.
284-285	Electronic and electrical equipment and appliance	450,957	377,133	46,560	3,346	n.p.	n.p.	1,166	1,378
286	Industrial machinery and equipment	73,456	69,374	3,035	540	355	n.p.	n.p.	—
29	Other manufacturing	18,337	16,376	1,377	n.p.	n.p.	n.p.	—	—
C	Total manufacturing	1,928,629	1,766,125	72,643	8,763	41,627	971	n.p.	n.p.
	Other industries —								
F-G	Wholesale and retail trade	196,376	152,619	3,147	6,067	2,370	n.p.	n.p.	31,636
K	Finance and insurance	103,409	95,947	685	n.p.	—	—	n.p.	—
77,782-786	Property and business services	545,919	405,957	83,768	5,939	2,598	1,259	3,655	42,743
781	Scientific research	114,102	34,724	38,460	3,488	13,951	2,911	17,397	3,172
(d)	Other n.e.c.	253,041	222,808	17,384	n.p.	4,031	n.p.	272	n.p.
D-Q	Total other industries	1,212,846	912,055	143,443	n.p.	22,950	11,608	n.p.	n.p.
	TOTAL ALL INDUSTRIES	3,383,125	2,916,935	218,658	25,421	64,577	12,579	35,019	109,936
	Private Sector Contribution	3,051,279	2,613,557	200,537	n.p.	n.p.	n.p.	34,622	109,936
	Public Sector Contribution	331,846	303,378	18,121	n.p.	n.p.	n.p.	397	—

(a) Excludes enterprises in ANZSIC Division 'A' (b) Grants for Industry R & D Scheme. (c) Includes Higher Education and Private Non-profit sectors. (d) ANZSIC codes D,E,H-J,M-Q.

STATE COMPARISONS

The leading States in terms of R&D expenditure were Victoria at \$1,258m and New South Wales at \$1,247m, each accounting for 37% of total expenditure. New South Wales' proportion of total R&D increased by 1% compared with 1993-94 while Victoria's remained the same. South Australia increased its share of total R&D from 5% in 1993-94 to 6% in 1994-95.

The main industries undertaking R&D in Victoria were Motor vehicle and part and other transport equipment mfg, Electronic and electrical equipment and appliance mfg and Property and business services. In New South Wales they were Property and business services, Electronic and electrical equipment and appliance mfg and Metal product manufacturing. The largest R&D expenditure by the Mining industry occurred in Western Australia (\$114m or 47% of total R&D expenditure by the industry).

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LOCATION OF R&D EXPENDITURE(a) BY BUSINESS ENTERPRISES(b), AUSTRALIA, 1994-95 (\$'000)

Industry of enterprise ANZSIC Code Description		Location of expenditure							
		Total	NSW	Vic.	Qld	SA	WA	Other Australian states and territories	Overseas
B	Mining (including services to mining)	241,650	18,952	38,728	57,976	3,512	114,034	6,980	1,468
	Manufacturing —								
21	Food, beverage and tobacco	141,603	64,904	46,945	17,792	4,389	4,564	2,157	852
22	Textile, clothing, footwear and leather	26,905	8,275	10,208	1,940	4,971	1,140	301	70
23	Wood and paper product	76,524	18,926	22,347	4,487	14,284	1,818	n.p.	n.p.
24	Printing, publishing and recorded media	15,062	6,560	6,835	283	n.p.	804	n.p.	n.p.
25	Petroleum, coal, chemical and associated product	309,835	101,700	123,631	25,158	33,389	13,862	10,026	2,069
26	Non-metallic mineral product	45,260	23,045	7,686	8,990	n.p.	3,815	n.p.	—
27	Metal product	309,543	111,469	98,064	22,269	6,169	n.p.	n.p.	n.p.
281-282	Motor vehicle and part and other transport equipment	338,145	22,378	265,779	6,895	n.p.	3,062	1,327	n.p.
283	Photographic and scientific equipment	123,003	58,752	26,329	6,122	29,346	n.p.	500	n.p.
284-285	Electronic and electrical equipment and appliance	450,957	201,462	153,360	14,805	30,913	36,058	n.p.	n.p.
286	Industrial machinery and equipment	73,456	27,315	18,937	14,573	5,923	5,038	887	783
29	Other manufacturing	18,337	6,592	6,069	3,410	510	1,446	n.p.	n.p.
C	Total manufacturing	1,928,629	651,378	786,190	126,723	165,529	143,846	36,835	18,130
	Other industries —								
F-G	Wholesale and retail trade	196,376	106,548	53,864	14,971	5,485	10,315	3,999	1,195
K	Finance and insurance	103,409	67,323	n.p.	536	n.p.	n.p.	152	n.p.
77,782-786	Property and business services	545,919	310,857	128,061	34,832	13,880	45,523	10,982	1,784
781	Scientific research	114,102	43,133	40,153	16,172	10,006	2,462	2,022	155
(c)	Other n.e.c.	253,041	49,090	n.p.	6,804	n.p.	n.p.	4,844	n.p.
D-Q	Total other industries	1,212,846	576,951	433,524	73,315	35,369	67,965	21,999	3,723
	TOTAL ALL INDUSTRIES	3,383,125	1,247,282	1,258,441	258,014	204,410	325,844	65,813	23,321
	Private Sector Contribution	3,051,279	1,150,214	1,042,611	254,154	199,647	318,156	63,433	23,064
	Public Sector Contribution	331,846	97,068	215,830	3,860	4,763	7,688	2,380	257

(a) Location of the expenditure. This may not be the location of the organisations head office. (b) Excludes enterprises in ANZSIC Division 'A' (c) ANZSIC Codes D,E,H,J,M-Q.

DIRECTIONS OF R&D EFFORT

Computer software accounted for \$668m of R&D effort. Although this was an increase of \$21m over 1992-93, computer software's share of total R&D expenditure fell from 26% in 1990-91 and 23% in 1992-93 to 20% in 1994-95. The next largest product areas were: Electronic equipment (\$349m, 10% of the total); Motor vehicles and parts (\$280m, 8%); Mining products (\$205m, 6%); Basic iron and steel (\$197m, 6%); and Pharmaceutical and veterinary products (\$185m, 5%).

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PRODUCT FIELD(a) OF R&D EXPENDITURE BY BUSINESS ENTERPRISES(b), AUSTRALIA

Product field	Enterprises(c) (number)			R&D expenditure (\$'000)		
	1990-91r	1992-93r	1994-95	1990-91r	1992-93r	1994-95
Agriculture, forestry, fishing and hunting	89	123	147	32,279	54,643	59,084
Mining	99	165	208	133,107	149,829	205,341
Manufacturing —						
Food, beverages and tobacco	146	159	211	78,388	116,158	121,480
Textiles, clothing and footwear	46	59	68	8,095	12,154	21,485
Wood, wood products and furniture	48	42	74	5,622	11,397	26,407
Paper, paper products, printing and publishing	61	50	61	35,133	40,933	64,813
Petroleum refining	10	17	41	4,922	30,208	11,169
Pharmaceutical and veterinary products	105	108	111	109,286	132,969	184,967
Rubber and plastic products	135	111	109	34,004	71,176	49,383
Other industrial chemical products	299	183	197	127,550	118,274	140,265
Non-metallic mineral products	87	46	58	27,268	34,525	29,087
Basic iron and steel	44	37	42	64,760	144,936	196,860
Basic non-ferrous metals	54	49	38	41,718	95,642	101,420
Fabricated metal products	241	241	278	62,492	104,793	102,311
Industrial machinery and equipment	392	341	400	103,625	96,549	117,043
Computer hardware	187	203	195	42,359	61,082	59,950
Electronic equipment	293	277	309	206,701	248,341	348,950
Other electrical appliances, machinery and equipment	165	169	172	53,287	70,823	73,997
Photographic, professional and scientific equipment	145	118	101	57,315	47,393	75,877
Motor vehicles and parts	109	121	128	154,995	168,228	280,295
Ships and boats	19	27	45	n.p.	116,824	n.p.
Railway rolling stock and locomotives	12	21	34	n.p.	11,948	n.p.
Aircraft	20	26	30	14,764	56,881	11,863
Other transport equipment	34	51	69	4,815	13,544	15,386
Other manufacturing	90	218	320	23,128	70,074	100,013
Total manufacturing	2,065	2,039	2,351	1,283,249	1,874,853	2,214,480
Other industries —						
Computer software	587	763	795	539,880	647,027	667,908
Construction	—	70	102	—	13,774	20,628
Other n.e.c.	282	206	306	111,257	114,405	215,684
Total other industries	826	988	1,136	651,137	775,206	904,220
TOTAL ALL INDUSTRIES	2,710	2,835	3,321	2,099,772	2,854,530	3,383,125
Private Sector Contribution	2,658	2,792	3,273	1,896,143	2,609,759	3,051,279
Public Sector Contribution	52	43	48	203,629	244,771	331,846

(a) The industry of product (or process) field towards which the R & D activity was directed. For further explanation see paragraph 22 of the Explanatory Notes. (b) Excludes enterprises in ANZSIC Division 'A' (c) Where the R & D performed by an enterprise was directed towards more than one product, that enterprise is counted in each of the product fields to which its products are coded. Therefore, the enterprise counts shown in this table cannot be summed to aggregates for combinations of product fields.

BUSINESS SIZE COMPARISON – EXPENDITURE

The largest enterprises, employing 1,000 or more, accounted for 37% of total R&D expenditure. On average this was more than \$8m per business undertaking R&D. Businesses employing less than 10 people accounted for only 4% of the R&D. This averages out at about \$157,000 for each business undertaking R&D.

The ABS defines small business as those employing less than 100 in Manufacturing industries and less than 20 in other industries. Out of those businesses undertaking R&D, small manufacturers accounted for 21% of Manufacturing R&D, an average of \$286,000 per business. Small businesses undertaking R&D in other industries accounted for 10% or \$220,000 per business.

Manufacturing industries where small businesses accounted for large percentages of R&D were Industrial machinery and equipment mfg (63%) and Printing, publishing and recorded media (57%). For other industries, small businesses accounted for the largest percentage of R&D in Scientific research (17%) and Property and business services (15%).

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R&D EXPENDITURE BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY SIZE OF BUSINESS(b), 1994–95 (\$'000)

Industry of enterprise ANZSIC Code Description		Enterprise employment size (persons)								
		Total	Less than 10	10 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 to 999	1000 or more
B	Mining (including services to mining)	241,650	11,826	4,701	n.p.	3,172	n.p.	66,306	34,456	113,061
	Manufacturing —									
21	Food, beverage and tobacco	141,603	2,907	1,596	7,005	11,951	9,531	19,132	22,024	67,457
22	Textile, clothing, footwear and leather	26,905	n.p.	n.p.	1,817	4,826	4,849	3,553	10,353	n.p.
23	Wood and paper product	76,524	1,153	n.p.	n.p.	1,103	1,369	n.p.	17,608	53,464
24	Printing, publishing and recorded media	15,062	1,296	1,151	5,370	763	675	587	n.p.	n.p.
25	Petroleum, coal, chemical and associated product	309,835	8,790	8,807	20,300	36,866	20,592	74,490	66,167	73,824
26	Non-metallic mineral product	45,260	806	2,279	3,044	3,143	2,168	5,486	12,552	15,782
27	Metal product	309,543	2,813	4,705	9,177	51,120	11,624	11,108	83,092	135,904
281-282	Motor vehicle and part and other transport equipment	338,145	3,087	2,209	2,934	2,334	6,319	21,325	35,734	264,203
283	Photographic and scientific equipment	123,003	4,753	6,460	n.p.	3,863	8,421	n.p.	35,502	27,970
284-285	Electronic and electrical equipment and appliance	450,957	22,010	25,732	41,838	27,663	36,067	59,383	81,723	156,540
286	Industrial machinery and equipment	73,456	8,324	8,088	14,605	15,158	7,798	16,764	n.p.	n.p.
29	Other manufacturing	18,337	n.p.	1,901	3,766	2,549	2,202	2,210	2,837	n.p.
C	Total manufacturing	1,928,629	58,590	63,355	120,263	161,338	111,615	241,409	369,143	802,917
	Other industries —									
F-G	Wholesale and retail trade	196,376	8,645	13,407	17,225	30,562	21,810	36,976	15,740	52,011
K	Finance and insurance	103,409	541	n.p.	n.p.	1,278	n.p.	1,896	n.p.	89,165
77,782-786	Property and business services	545,919	42,614	38,988	76,878	141,985	69,125	45,217	47,755	83,357
781	Scientific research	114,102	11,588	8,100	46,739	38,778	n.p.	n.p.	—	—
(c)	Other n.e.c.	253,041	7,235	n.p.	7,158	5,309	n.p.	n.p.	n.p.	124,366
D-Q	Total other industries	1,212,846	70,622	63,943	n.p.	217,912	n.p.	95,136	79,106	348,899
	TOTAL ALL INDUSTRIES	3,383,125	141,038	131,999	276,001	382,421	301,233	402,851	482,705	1,264,877
	Private Sector Contribution	3,051,279	141,038	131,999	276,001	n.p.	n.p.	399,540	446,469	1,070,374
	Public Sector Contribution	331,846	—	—	—	n.p.	n.p.	3,311	36,236	194,503

(a) Excludes enterprises in ANZSIC Division 'A' (b) Employment size is based on the number of persons employed by the enterprise. (c) ANZSIC Codes D,E,H-J,M,Q.

PURPOSE OF RESEARCH

Businesses were asked to classify their R&D expenditure according to the Socio-economic objective classification (SEO). This required the businesses undertaking R&D to categorise expenditure according to the purpose of their research projects.

Most business R&D was directed towards Economic development, \$3,039m or 90%. Of this, \$1,836m (60%) was towards Manufacturing, \$517m (17%) towards Information and communication services and \$202m (7%) towards Mineral resources (excluding energy).

Approximately 4% of business R&D was directed towards Defence and 2% each towards Society, Environment and Advancement of knowledge.

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RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY SOCIO-ECONOMIC OBJECTIVE, 1994-95

	Expenditure (\$ '000)				
	Type of expenditure				
Socio-economic objective	Total	Capital expenditure	Labour costs(b)	Other current expenditure	Human Resources (person years)
Defence	139,969	5,224	44,717	90,029	674
<i>Economic development</i>					
Plant — production and primary products	28,656	1,453	13,029	14,174	275
Animal — production and primary products	35,451	2,575	12,038	20,838	219
Mineral resources (excl. energy)	202,147	39,175	43,115	119,857	819
Energy resources	126,788	22,863	31,851	72,074	506
Energy supply	117,470	39,836	26,818	50,816	466
Manufacturing	1,836,290	219,251	744,352	872,687	13,848
Construction	33,995	5,626	16,907	11,463	352
Transport	61,401	2,075	35,443	23,883	586
Information and communication services	517,215	37,888	304,767	174,561	4,931
Commercial services	69,663	9,136	38,130	22,398	660
Economic framework	9,851	2,173	4,730	2,948	76
Total Economic development	3,038,928	382,052	1,271,179	1,385,697	22,740
<i>Society</i>					
Health	52,583	4,881	23,412	24,289	471
Education and training	5,246	342	3,742	1,162	83
Social development and community services	12,906	944	6,610	5,352	152
Total Society	70,734	6,167	33,764	30,803	706
<i>Environment</i>					
Environmental knowledge	31,458	6,863	11,613	12,981	254
Environmental aspects of economic development	27,561	3,591	10,089	13,882	198
Environmental management and other aspects	20,938	4,270	7,775	8,893	150
Total environment	79,957	14,724	29,477	35,756	603
Advancement of knowledge	53,537	6,039	30,925	16,572	517
TOTAL	3,383,125	414,207	1,410,062	1,558,857	25,240

(a) Excludes enterprises in ANZSIC Division 'A' (b) Includes wages and salaries, overtime allowances, penalty rates, leave loadings, bonuses, commission payments, all paid leave, employer contributions to superannuation and pension schemes, payroll tax, fringe benefits tax, payments to contract staff on the payroll, severance, termination and redundancy payments and workers compensation insurance

EXPECTED R&D EXPENDITURE

The 'actual' data in the table below are the business expenditures reported in the 1992-93, 1993-94 and 1994-95 surveys.

In each of these surveys, businesses were asked to report the level of expenditure they expected to incur in the following twelve months. These estimates are respectively the 1993-94, 1994-95 and 1995-96 'expected' data in the table below.

These estimates should be used with caution because:

- Only some businesses have long-term R&D projects and can provide a fairly accurate forecast.
- Many businesses perform R&D on a 'needs be' basis or have projects nearing completion. In such cases funding for future projects is uncertain and any forecast expenditure is only a best guess.

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R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, EXPECTED AND ACTUAL EXPENDITURE (\$'000)

		1992-93		1993-94		1994-95		1995-96	
<i>Industry of enterprise</i>									
<i>ANZSIC</i>									
<i>Code</i>	<i>Description</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>
B	Mining (including services to mining)	176,347	191,733	326,509	167,043	241,650	209,021		
	Manufacturing —								
21	Food, beverage and tobacco	136,137	132,811	140,246	131,275	141,603	143,880		
22	Textile, clothing, footwear and leather	16,271	13,419	17,037	16,564	26,905	34,477		
23	Wood and paper product	44,447	33,804	103,020	49,960	76,524	61,274		
24	Printing, publishing and recorded media	14,281	11,895	10,787	10,056	15,062	13,575		
25	Petroleum, coal, chemical and associated product	290,832	279,625	272,199	282,563	309,835	303,025		
26	Non-metallic mineral product	31,296	28,157	31,299	29,674	45,260	45,346		
27	Metal product	336,488	264,902	294,216	286,425	309,543	290,666		
281-282	Motor vehicle and part and other transport equipment	307,673	295,455	269,815	282,608	338,145	307,176		
283	Photographic and scientific equipment	96,478	109,717	102,599	107,714	123,003	117,366		
284-285	Electronic and electrical equipment and appliance	344,101	353,254	371,483	412,659	450,957	468,143		
286	Industrial machinery and equipment	65,206	68,582	72,187	69,386	73,456	77,388		
29	Other manufacturing	10,858	12,027	14,618	17,529	18,337	19,209		
C	Total manufacturing	1,694,067	1,603,648	1,699,505	1,696,414	1,928,629	1,881,524		
	Other industries —								
F-G	Wholesale and retail trade	224,053	326,166	220,983	232,024	196,376	205,844		
K	Finance and insurance	119,738	115,306	112,998	109,438	103,409	109,300		
77,782-786	Property and business services	362,996	394,867	442,559	472,242	545,919	494,343		
781	Scientific research	84,050	96,796	87,060	93,478	114,102	130,385		
(b)	Other n.e.c.	193,279	163,633	179,386	174,710	253,041	277,394		
D-Q	Total other industries	984,116	1,096,767	1,042,986	1,081,892	1,212,846	1,217,266		
	TOTAL ALL INDUSTRIES	2,854,530	2,892,148	3,069,000	2,945,348	3,383,125	3,307,811		
	Private Sector Contribution	2,609,759	2,603,329	2,835,698	2,714,762	3,051,279	2,947,767		
	Public Sector Contribution	244,771	288,819	233,302	230,586	331,846	360,044		

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H-J,M-Q.

BUSINESS SIZE COMPARISON – EMPLOYMENT

For those businesses undertaking R&D, those employing 1,000 or more contributed 31% of the human resource effort. However only 1% of their total employment was devoted to R&D. On the other hand, businesses in the smallest size category (less than 10 employees) devoted 41% of their total employment to research, but this contributed only 6% of the total human resources undertaking R&D.

Using the ABS definitions of small business undertaking R&D in Manufacturing (see page 10), small businesses contributed 28% of the human resource effort (representing 11% of their total employment). The 72% contributed by large manufacturers represented 3% of their total employment. In other industries, small businesses contributed 16% of total human resources (35% of their total employment) while the 84% of human resources contributed by large businesses amounted to 2% of their total employment.

11 HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY SIZE OF BUSINESS(b), 1994-95 (person years)

Industry of enterprise ANZSIC Code Description		Enterprise employment size (persons)								
		Total	Less than 10	10 to 19	20 to 49	50 to 99	100 to 199	200 to 499	500 to 999	1000 or more
B	Mining (including services to mining)	825	84	38	16	9	8	221	99	350
	Manufacturing —									
21	Food, beverage and tobacco	1,131	22	11	40	96	112	150	187	513
22	Textile, clothing, footwear and leather	197	n.p.	n.p.	20	28	45	35	51	n.p.
23	Wood and paper product	253	6	n.p.	n.p.	11	13	n.p.	60	152
24	Printing, publishing and recorded media	174	17	15	68	5	6	8	n.p.	n.p.
25	Petroleum, coal, chemical and associated product	2,400	95	89	229	291	209	582	473	431
26	Non-metallic mineral product	427	9	21	41	43	27	37	152	97
27	Metal product	1,970	34	48	117	186	110	135	637	702
281-282	Motor vehicle and part and other transport equipment	2,014	37	40	54	24	103	222	328	1,205
283	Photographic and scientific equipment	1,102	n.p.	89	101	41	86	n.p.	210	277
284-285	Electronic and electrical equipment and appliance	4,108	260	327	484	285	352	548	587	1,265
286	Industrial machinery and equipment	907	94	118	196	175	92	197	n.p.	n.p.
29	Other manufacturing	233	20	30	n.p.	43	26	24	25	n.p.
C	Total manufacturing	14,914	667	798	1,416	1,227	1,182	2,168	2,732	4,724
	Other industries —									
F-G	Wholesale and retail trade	1,662	102	140	182	263	185	282	97	411
K	Finance and insurance	923	5	n.p.	15	9	n.p.	n.p.	n.p.	811
77,782-786	Property and business services	4,668	541	485	795	642	600	506	459	640
781	Scientific research	961	90	76	306	363	n.p.	n.p.	—	—
(c)	Other n.e.c.	1,287	52	n.p.	51	79	96	23	n.p.	896
D-Q	Total other industries	9,500	789	746	1,349	1,355	902	931	670	2,758
	TOTAL ALL INDUSTRIES	25,240	1,541	1,582	2,781	2,591	2,092	3,320	3,501	7,832
	Private Sector Contribution	23,116	1,541	1,582	2,781	n.p.	2,009	3,298	n.p.	6,151
	Public Sector Contribution	2,123	—	—	—	n.p.	83	22	n.p.	1,681

(a) Excludes enterprises in ANZSIC Division 'A' (b) Employment size is based on the number of persons employed by the enterprise, whereas human resources data are person years of R & D effort (c) ANZSIC Codes D,E,H,J,M-Q.

TYPE OF R&D STAFF

There was a 7% increase in total human resources devoted to R&D in 1994-95 compared with 1993-94.

The proportion of Researchers to total R&D staff ranged from 68% in Wholesale and retail trade to 38% in Non-metallic mineral product mfg. In total Manufacturing, 55% of the R&D staff were Researchers and 29% were Technicians. This compared with Mining (50% Researchers, 27% Technicians) and Other industries (63% Researchers, 25% Technicians).

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HUMAN RESOURCES DEVOTED TO R&D BY BUSINESS ENTERPRISES(a), AUSTRALIA, BY TYPE OF EMPLOYEE, 1994-95 (person years)

Industry of enterprise ANZSIC Code Description		Type of employee			
		Total	Researchers	Technicians	Other supporting staff
B	Mining (including services to mining)	825	413	225	187
	Manufacturing —				
21	Food, beverage and tobacco	1,131	642	322	166
22	Textile, clothing, footwear and leather	197	98	62	37
23	Wood and paper product	253	111	106	36
24	Printing, publishing and recorded media	174	90	58	26
25	Petroleum, coal, chemical and associated product	2,400	1,249	795	356
26	Non-metallic mineral product	427	161	138	128
27	Metal product	1,970	1,071	533	367
281-282	Motor vehicle and part and other transport equipment	2,014	892	626	497
283	Photographic and scientific equipment	1,102	704	269	129
284-285	Electronic and electrical equipment and appliance	4,108	2,665	1,021	421
286	Industrial machinery and equipment	907	412	262	233
29	Other manufacturing	233	107	78	48
C	Total manufacturing	14,914	8,202	4,269	2,444
	Other industries —				
F-G	Wholesale and retail trade	1,662	1,136	315	211
K	Finance and insurance	923	486	308	129
77,782-786	Property and business services	4,668	3,122	1,077	469
781	Scientific research	961	594	262	104
(b)	Other n.e.c.	1,287	686	369	232
D-Q	Total other industries	9,500	6,024	2,332	1,145
	TOTAL ALL INDUSTRIES	25,240	14,638	6,825	3,776
	Private Sector Contribution	23,116	13,451	6,179	3,486
	Public Sector Contribution	2,123	1,187	646	290

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H-J,M-Q.

EXTRAMURAL R&D

Extramural R&D expenditure (payments to other organisations to undertake R&D projects) was estimated to be \$534m, an increase of 77% over 1992-93.

Large extramural payments were made by Petroleum, coal, chemical and associated product mfg (\$79m) and the Mining industry (\$51m).

Extramural payments were equivalent to 16% of BERD, up from 11% in 1992-93.

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EXTRAMURAL R&D EXPENDITURE(a) BY BUSINESS ENTERPRISES(b), AUSTRALIA, 1994-95

Industry of enterprise making payment ANZSIC Code Description		Location of recipient					
		Total		Australia		Overseas	
		Enterprises (number)	Payments (\$'000)	Enterprises (number)	Payments (\$'000)	Enterprises (number)	Payments (\$'000)
B	Mining (including services to mining)	47	51,228	46	37,388	6	13,840
	Manufacturing —						
21	Food, beverage and tobacco	54	22,749	52	n.p.	6	n.p.
22	Textile, clothing, footwear and leather	7	n.p.	5	n.p.	3	n.p.
23	Wood and paper product	8	n.p.	8	n.p.	5	109
24	Printing, publishing and recorded media	4	646	4	646	—	—
25	Petroleum, coal, chemical and associated product	71	78,577	65	n.p.	15	n.p.
26	Non-metallic mineral product	17	1,906	16	n.p.	3	n.p.
27	Metal product	35	18,227	33	16,760	5	1,467
281-282	Motor vehicle and part and other transport equipment	20	n.p.	17	10,573	5	n.p.
283	Photographic and scientific equipment	16	5,431	14	2,632	5	2,799
284-285	Electronic and electrical equipment and appliance	45	37,620	38	21,281	10	16,339
286	Industrial machinery and equipment	28	4,062	27	4,026	1	36
29	Other manufacturing	13	2,324	13	2,024	1	300
C	Total manufacturing	318	234,684	292	129,280	59	105,405
	Other industries —						
F-G	Wholesale and retail trade	45	22,140	45	n.p.	4	n.p.
K	Finance and insurance	12	28,599	12	28,529	1	70
77,782-786	Property and business services	57	25,657	54	n.p.	9	n.p.
781	Scientific research	25	33,028	20	n.p.	7	n.p.
(c)	Other n.e.c.	43	138,810	42	n.p.	6	n.p.
D-Q	Total other industries	182	248,234	173	215,358	27	32,876
	TOTAL ALL INDUSTRIES	547	534,146	511	382,026	92	152,120
	Private Sector Contribution	518	466,146	482	314,243	88	151,903
	Public Sector Contribution	29	68,000	29	67,783	4	217

(a) Expenditure on R & D which is funded by an enterprise but carried out by others. (b) Excludes enterprises in ANZSIC Division 'A'. (c) ANZSIC codes D,E,H-J,M-Q.

PAYMENTS AND RECEIPTS FOR TECHNICAL KNOW-HOW

Payments for technical know-how were estimated to be \$635m while receipts were estimated to be \$397m. These payments and receipts were equivalent to 19% and 12% of BERD, compared with 17% and 10%, respectively, in 1992-93.

Petroleum, coal, chemical and associated product mfg was the leading industry making payments for technical know-how at \$134m followed by Wholesale and retail trade at \$103m and Motor vehicle and part and other transport equipment mfg at \$100m.

Property and business services was the leading industry earning receipts for technical know-how at \$100m followed by Petroleum, coal, chemical and associated product mfg at \$54m and Electronic and electrical equipment and appliance mfg at \$49m.

14 PAYMENTS AND RECEIPTS FOR TECHNICAL KNOW-HOW BY BUSINESS ENTERPRISES(a), AUSTRALIA, 1994-95 (\$m)

Industry of enterprise ANZSIC Code Description	Payments for technical know-how			Receipts for technical know-how		
	Total	Patent licence fees and royalties	Other technical know-how	Total	Patent licence fees and royalties	Other technical know-how
B Mining (including services to mining)	0.7	n.p.	n.p.	n.p.	—	n.p.
Manufacturing —						
21 Food, beverage and tobacco	73.0	n.p.	n.p.	0.8	n.p.	n.p.
22 Textile, clothing, footwear and leather	n.p.	n.p.	n.p.	0.4	n.p.	n.p.
23 Wood and paper product	n.p.	n.p.	n.p.	—	—	—
24 Printing, publishing and recorded media	n.p.	—	n.p.	—	—	—
25 Petroleum, coal, chemical and associated product	133.6	91.8	41.8	53.7	48.2	5.5
26 Non-metallic mineral product	10.7	n.p.	n.p.	n.p.	n.p.	n.p.
27 Metal product	9.3	4.5	4.8	16.5	0.4	16.1
281-282 Motor vehicle and part and other transport equipment	100.3	68.1	32.2	11.8	0.9	10.9
283 Photographic and scientific equipment	n.p.	n.p.	0.5	n.p.	n.p.	0.5
284-285 Electronic and electrical equipment and appliance	35.1	12.2	22.9	48.9	11.7	37.3
286 Industrial machinery and equipment	8.5	3.3	5.2	8.7	7.0	1.6
29 Other manufacturing	0.3	n.p.	n.p.	6.4	n.p.	n.p.
C Total manufacturing	410.8	240.4	170.5	176.9	87.8	89.0
Other industries —						
F-G Wholesale and retail trade	103.2	87.2	16.0	14.9	n.p.	n.p.
K Finance and insurance	48.2	—	48.2	—	—	—
77,782-786 Property and business services	35.6	4.7	30.9	99.8	44.0	55.8
781 Scientific research	n.p.	n.p.	n.p.	45.1	11.0	34.1
(b) Other n.e.c.	n.p.	0.7	n.p.	n.p.	n.p.	n.p.
D-Q Total other industries	223.9	n.p.	n.p.	n.p.	64.4	n.p.
TOTAL ALL INDUSTRIES	635.4	333.5	301.9	396.8	152.2	244.6
Private Sector Contribution	606.2	n.p.	n.p.	388.2	n.p.	n.p.
Public Sector Contribution	29.2	n.p.	n.p.	8.6	n.p.	n.p.

(a) Excludes enterprises in ANZSIC Division 'A' (b) ANZSIC codes D,E,H,I,J,M,Q.

PATENT ACTIVITY

Businesses with R&D activity during 1994-95 lodged 1,171 patent applications within Australia and 11,285 abroad during the period 1 July 1993 to 30 June 1995. During this period 856 patents were granted in Australia and 1,484 granted abroad.

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PATENT ACTIVITY BY BUSINESS ENTERPRISES(a) UNDERTAKING R&D

		July 1993 - June 1995					
		Australia				Overseas	
Industry of enterprise		Standard	Petty	Standard	Petty	Patents	Patents
ANZSIC		patents	patents	patents	patents	lodged	granted
Code	Description	lodged	lodged	granted	granted	(b)	
B	Mining (including services to mining)	32	—	24	—	532	76
	Manufacturing —						
21	Food, beverage and tobacco	19	n.p.	24	n.p.	154	29
22	Textile, clothing, footwear and leather	14	3	14	3	n.p.	9
23	Wood and paper product	11	—	15	—	214	55
24	Printing, publishing and recorded media	n.p.	—	n.p.	—	n.p.	n.p.
25	Petroleum, coal, chemical and associated product	98	13	67	8	1,263	159
26	Non-metallic mineral product	n.p.	—	54	—	478	n.p.
27	Metal product	127	22	118	n.p.	1,144	164
281-282	Motor vehicle and part and other transport equipment	21	—	29	n.p.	341	48
283	Photographic and scientific equipment	88	n.p.	35	7	574	115
284-285	Electronic and electrical equipment and appliance	199	12	111	7	994	149
286	Industrial machinery and equipment	53	9	43	4	837	54
29	Other manufacturing	10	21	n.p.	2	211	22
C	Total manufacturing	703	154	547	77	6,501	903
	Other industries —						
F-G	Wholesale and retail trade	98	4	69	2	680	64
K	Finance and insurance	1	—	1	—	n.p.	9
77,782-786	Property and business services	64	9	60	7	1,583	258
781	Scientific research	56	n.p.	30	n.p.	1,520	109
(c)	Other n.e.c.	44	n.p.	29	n.p.	n.p.	65
D-Q	Total other industries	263	19	189	19	4,252	505
	TOTAL ALL INDUSTRIES	998	173	760	96	11,285	1,484
	Private Sector Contribution	946	173	734	96	10,783	1,465
	Public Sector Contribution	52	—	26	—	502	19

(a) Excludes enterprises in ANZSIC Division 'A'. (b) See paragraph 12 of the Explanatory Notes. (c) ANZSIC Codes D,E,H-J,M-Q.

EXPLANATORY NOTES

INTRODUCTION

- 1 This publication presents statistics on expenditure and human resources devoted to R&D carried out in Australia by enterprises within the Business Enterprise sector during 1994–95.
- 2 Statistics also included are extramural R&D activity, payments and receipts for technical know-how and patent activity.
- 3 Comparable R&D statistics are produced for the General Government, Private Non-Profit and Higher Education sectors (see paragraph 28).

DATA SOURCES

- 4 The 1994–95 data presented in this publication have been compiled from data collected from business enterprises in the Survey of Research and Experimental Development in respect of the year ended June 1995. This survey was based on a complete enumeration of businesses identified by the Australian Bureau of Statistics (ABS) as likely R&D performers. The survey was conducted by mailed questionnaires and a 93% response was obtained. The ABS believes that the non-respondents were non-R&D performers.
- 5 The 1988–89 and 1990–91 to 1993–94 statistics in this publication were derived from similar surveys. The 1989–90 statistics were derived from a stratified random sample of businesses identified as likely R&D performers.
- 6 The GDP(I) figures used to derive BERD/GDP ratios quoted in the Summary of Findings are current at the time of manuscript finalisation (*National Income, Expenditure and Product, March Quarter 1996*, (5206.0)), and, at current prices, are as follows: \$339,068m (1988–89); \$370,070m (1989–90); \$378,681m (1990–91); \$386,505m (1991–92); \$404,275m (1992–93); \$428,910m (1993–94); and \$455,675m (1994–95). The available BERD/GDP ratios for other OECD countries are current at the time of manuscript finalisation and are sourced from *Main Science and Technology Indicators, 1996–1*, OECD, Paris, 1996.

STATISTICAL UNIT

- 7 For large businesses the unit from which information is collected and published is the *management unit*. The management unit is the highest-level accounting unit within a business, having regard for industry homogeneity, for which accounts are maintained; in nearly all cases it coincides with the legal entity owning the business (i.e. company, partnership, trust, sole operator, etc.). In the case of large diversified businesses, however, there may be more than one management unit, each coinciding with a 'division' or 'line of business'. A division or line of business is recognised where separate and comprehensive accounts are compiled for it.
- 8 For small businesses the statistical unit is the *enterprise*. An enterprise is defined broadly as the unit comprising all the operations in Australia of a single operating legal entity (e.g. company, partnership or sole proprietor).

DEFINITIONS

9 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'.

10 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.

11 Type of R&D activity comprises basic research, applied research and experimental development. Data in this classification are subjectively allocated by respondents at the time of reporting, using OECD/ABS definitions. ABS makes every effort to ensure correct and consistent interpretation and reporting of this data and applies consistent processing methodologies. Analysts using this classification should bear the original subjectivity in mind.

12 The question relating to lodgement of patent applications overseas specifically asks for the number of countries in which protection was initially sought. For example, if four countries were designated in an application (a PCT application or a European Patent application) then the business was asked to record the number of patent applications lodged as four. Prior to 1992-93 it is possible that the patent application would have been recorded as only one lodgement.

SCOPE

13 The scope of this survey is all enterprises within the Business Enterprise sector of Australia which have undertaken R&D.

14 The Business Enterprise sector includes all enterprises whose primary activity is the production of goods or services for sale to the general public at a price intended to cover at least the cost of production, and the private non-profit institutions mainly serving them.

15 The vast majority of enterprises in this sector are private businesses. The remainder are public business enterprises mainly engaged in trading or financial activities.

COVERAGE

16 The 1994-95 R&D survey comprised a complete enumeration of business enterprises identified by the ABS as likely to have carried out R&D activity.

17 The Business Enterprise sector for the R&D survey excludes enterprises mainly engaged in agriculture, forestry and fishing (i.e. industries in Division A of the *Australian and New Zealand Standard Industrial Classification (ANZSIC), 1993 (1292.0)*), partly because of collection difficulties and partly because such enterprises are believed to have very low R&D activity (agricultural R&D activity is generally carried out by specialised research institutes not included in ANZSIC Division A).

18 Within the scope of the survey, enterprises were included in the collection if they satisfied any of the following criteria:

- Enterprises which, in previous R&D surveys, reported R&D activity, payments or receipts for technical know-how, or patent activity.
- Units applying for the 150% Tax Concession Scheme and the Grants for Industry R&D Scheme.
- Enterprises identified from reports in newspapers, industrial journals, research compendia etc. as likely to have R&D activity.

19 The ABS continues to investigate enhancement of the above criteria, or the introduction of additional criteria, with the aim of further improving the coverage of the R&D survey.

INDUSTRY CLASSIFICATION

20 The statistics in this publication are classified to industry in accordance with the 1993 edition of the Australian and New Zealand Standard Industrial Classification (ANZSIC).

21 Each management unit or 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. In cases where an enterprise group sets up a dedicated research unit, that is classified to the predominant industry of the group rather than research, in accordance with standards laid down in the *Frascati Manual*.

PRODUCT FIELD

22 Business Enterprise sector R&D expenditure presented in table 7 are classified by product (or process) field. This involved asking each business to apportion its total R&D expenditure towards the products/processes to which it was directed. For example, an enterprise classified as being in mining may have performed R&D activity into a more efficient ore crusher. This R&D expenditure would be classified to the Industrial machinery and equipment product field.

SOCIO-ECONOMIC OBJECTIVE CLASSIFICATION

23 Statistics of business enterprise R&D classified by Socio-economic objective (SEO) have been collected and presented in this publication. Each business undertaking R&D was asked to categorise its R&D expenditure according to the purpose of its research projects. For more information on this classification see the *Australian Standard Research Classification, 1993* (1297.0).

CONSTANT PRICE ESTIMATES

24 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.

25 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.

26 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

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

- 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.
- The OECD standard definition of R&D used in this survey differs in some respects from what respondents may regard as R&D activity. This is because the definitions used within the Grants for Industry R&D scheme (for the allocation of grants), and the 150% Tax Concession scheme (for tax deductability for specific R&D activities) are slightly different from the international standard.

UNPUBLISHED STATISTICS

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

RELATED PUBLICATIONS

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

Research and Experimental Development, General Government and Private Non-Profit Organisations, Australia, 1994–95 (8109.0) (to be released shortly)

Research and Experimental Development, Higher Education Organisations, Australia, 1994 (8111.0) (to be released later this year)

Research and Experimental Development, All Sector Summary, Australia, 1994–95 (8112.0) (to be released later this year)

Research and Experimental Development, Business Enterprises (Inter Year Survey), Australia, 1993–94 (8114.0)

Australian Business Innovation — A Strategic Analysis, Measures of Science and Innovation 5, Department of Industry, Technology and Commerce, Canberra, Australia, 1996

Main Science and Technology Indicators 1996–1, OECD, Paris, 1996

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

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

GLOSSARY

Applied research	Original work undertaken in order to acquire new knowledge with a specific application in view. It is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving some specific and predetermined objectives.
Basic research	Experimental and theoretical work undertaken primarily to acquire new knowledge without a specific application in view. It consists of pure basic research and strategic basic research. <i>Pure</i> basic research is carried out without looking for long-term benefits other than the advancement of knowledge. <i>Strategic</i> 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.
BERD – Business expenditure on R&D	The sum of intramural R&D expenditures incurred by all organisations in the survey.
Capital expenditure	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	Systematic work, using existing knowledge gained from research or practical experience for the purpose of creating new or improved products/processes.
Extramural R&D	R&D activity <i>funded</i> by an organisation but <i>carried out by other</i> enterprises, organisations, institutions or individuals.
GIRD	Grants for Industry R&D Scheme.
Human resources devoted to R&D	The effort of researchers, technicians and other staff <i>directly</i> involved with R&D activity. <i>Overhead staff</i> (e.g. administrative and general service employees such as personnel officers, janitors, etc.) whose work <i>indirectly</i> supports R&D, are <i>excluded</i> .
Intramural R&D	R&D carried out by an organisation on its own behalf or on behalf of other organisations, institutions or individuals.
Labour costs	Wages and salaries, overtime allowances, penalty rates, leave loadings, bonuses, commission payments, all paid leave, employer contributions to superannuation and pension schemes, payroll tax, fringe benefits tax, payments to contract staff on the payroll, severance, termination and redundancy payments and workers compensation insurance.
Other current expenditure	Expenditure on materials, fuels, rent and leasing, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
Other supporting staff	Skilled and unskilled craftpersons, secretarial and clerical staff directly associated with R&D activity.

R&D activity	In the business context is systematic investigation or experimentation involving innovation or technical risk, the outcome of which is <i>new knowledge</i> , with or without a specific practical application or <i>new or improved</i> 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	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)	The area of expected national benefit rather than the immediate objectives of the researcher. The SEO classification defines the main areas of Australian economic and social activity to which the results of research programs are applied. It describes the purpose of the research; i.e. 'why' the research is being performed.
Technical know-how (TKH)	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	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.