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- For more information about these and related statistics, contact Bill Pattinson on Canberra 02 6252 5019, or refer to the back cover of this publication.

NOTES

RESEARCH AND DEVELOPMENT (R&D) GUIDELINES

Australian Bureau of Statistics (ABS) surveys of R&D are conducted in accordance with standard guidelines promulgated by the Organisation for Economic Co-operation and Development (OECD).

SYMBOLS AND OTHER USAGES

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

W. McLennan
Australian Statistician

MAIN FEATURES

EXPENDITURE ON R&D

For the first time since the ABS surveys of R&D commenced, estimates for Business Expenditure on R&D (BERD) have fallen compared with the previous year. BERD at current prices was \$4,124m, a 5% decrease on 1995–96. At average 1989–90 prices, BERD was estimated to be \$3,427m, a decrease of 7% on 1995–96.

BERD as a percentage of Australia's Gross Domestic Product (GDP) also decreased from 0.88% in 1995–96 to 0.80% in 1996–97. This change does not appear to have materially affected Australia's relative position in comparison with other countries.

The change in BERD between 1995–96 and 1996–97 resulted from a reduction in total R&D expenditure by businesses which undertook R&D in both years, a larger than usual reduction in expenditure resulting from businesses which undertook R&D in 1995–96 but not in 1996–97 and a smaller than usual increase in expenditure by new R&D performers in 1996–97.

- Nearly 2,800 businesses undertook expenditure in both years; they incurred \$3,998m of R&D in 1995–96 and \$3,900m in 1996–97, a fall of 2.5%. In earlier years, continuing R&D performers in aggregate have generally reported increased expenditure. Not all businesses reduced their expenditure in 1996–97; 36% of continuing R&D performers recorded an increase in expenditure of 10% or more.
- Approximately 850 businesses which recorded \$323m in 1995–96, did not report any R&D in 1996–97. This reduction in R&D is significantly more than that attributable to businesses ceasing R&D activity in previous years.
- Slightly more than 600 businesses which did not report R&D in 1995–96, recorded \$224m in 1996–97. This is less than the contribution of businesses commencing R&D activity in previous years.

The decrease in R&D expenditure is mainly attributable to industries other than Mining and Manufacturing. The Mining industry recorded a 4% increase in expenditure and the Manufacturing industry only recorded a 1% fall. On the other hand, Other industries (in total) recorded a 15% fall. Large decreases in expenditure occurred in the Finance and insurance industry (down 22%) and the Property and business services industry (down 17%).

R&D expenditure in New South Wales, Victoria, Queensland and South Australia fell by 8%, 3%, 7% and 17% respectively, while expenditure in Western Australia increased by 12%, primarily due to the Mining and Metal product manufacturing industries.

HUMAN RESOURCES

Human resources devoted to R&D in 1996–97 at 26,138 person years were 3% lower than in 1995–96.

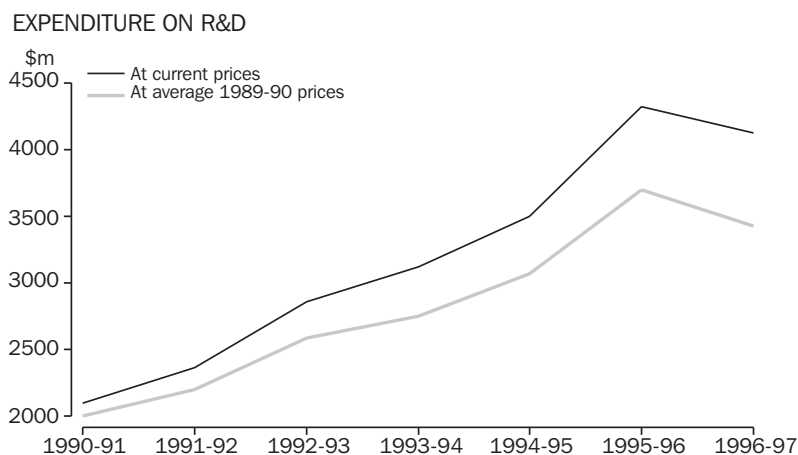
EXPECTED R&D

Businesses reported that they expected BERD to be \$3,798m in 1997–98. This is 8% lower than the actual R&D expenditure incurred in 1996–97. However for 1995–96 and 1996–97, actual expenditure exceeded the expectations by 23% and 8% respectively.

RESOURCES DEVOTED TO R&D

BERD has fallen in 1996–97 by 5% in current prices and 7% in average 1989–90 prices from the record levels of 1995–96. This fall follows average annual rates of growth between 1990–91 and 1995–96 of 16% in current prices and 13% in constant prices.

Human resources devoted to R&D in 1996–97 were estimated to be 26,138 person years, a decrease of 3% on 1995–96. Prior to this decrease, human resources devoted to research had, on average, increased annually from 1990–91 by 5%.



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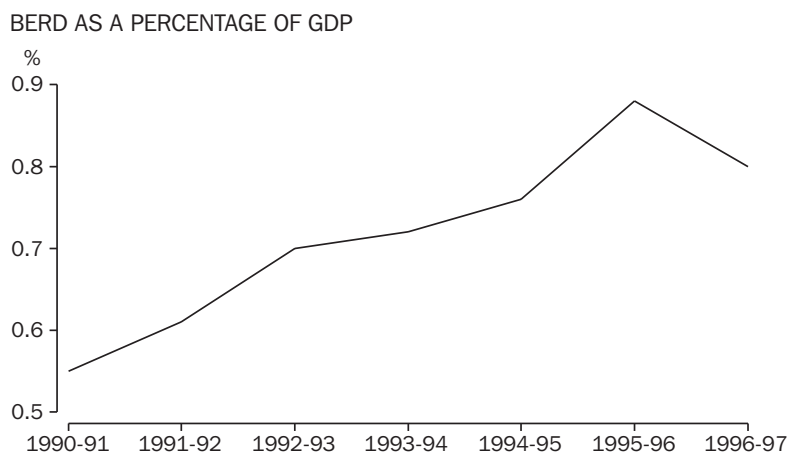
RESOURCES DEVOTED TO R&D(a)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
	\$m	\$m	\$m	\$m	\$m	\$m	\$m
Expenditure							
At current prices	2 099.8	r2 364.5	r2 861.9	r3 119.2	r3 498.7	r4 321.4	4 123.9
At average 1989-90 prices	r2 000.6	r2 200.8	r2 584.7	r2 751.2	r3 070.0	r3 701.1	3 426.5
	person years	person years	person years	person years	person years	person years	person years
Human resources	21 025	21 299	r22 919	r23 742	r25 744	r26 989	26 138

(a) Excludes businesses in ANZSIC Division A.

COMPARISON WITH GDP

Australia's BERD as a percentage of GDP decreased to 0.80% in 1996–97 from a high of 0.88% in 1995–96. This fall follows significant increases between 1990–91 and 1995–96.



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

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BERD/GDP RATIOS OF OECD COUNTRIES

	1994-95	1995-96	1996-97
<i>Country</i>	%	%	%
Sweden	n.a.	2.68	n.a.
Japan	1.87	1.95	n.a.
United States of America	1.78	1.83	1.83
Germany	1.54	1.51	1.50
Finland	1.45	1.50	n.a.
France	1.47	1.42	1.42
United Kingdom	1.38	1.34	n.a.
Netherlands	1.05	1.09	n.a.
Canada	0.96	1.00	1.03
Ireland	0.93	0.99	n.a.
Australia	0.76	0.88	0.80
Czech Republic	0.84	0.75	0.71
Iceland	0.43	0.49	0.47
Spain	0.40	0.41	0.41
Hungary	0.31	0.33	n.a.
Poland	0.34	0.29	n.a.

INDUSTRY COMPARISON

Following a 73% increase in R&D expenditure in 1995–96 compared with 1994–95, the Mining industry increased its expenditure by a further 4% in 1996–97 to \$546m (13% of total R&D expenditure). However, the Mining industry's R&D human resources decreased by 1% on 1995–96 whilst still accounting for 4% of total R&D human resources. The manufacturing industry's R&D expenditure declined by 1% on 1995–96 to \$2,434m (59% of total R&D expenditure). Human resources devoted to R&D by the manufacturing industry increased by 1% on 1995–96 and accounted for 61% of total R&D human resources. Other industries recorded falls in comparison to 1995-96 levels in their contributions to both total R&D expenditure and human resources.

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R&D, BY INDUSTRY OF BUSINESS(a)

ANZSIC Code & Description	Businesses			Expenditure on R & D			Human resources devoted to R & D		
	1994–95r	1995–96r	1996–97	1994–95r	1995–96r	1996–97	1994–95r	1995–96r	1996–97
	no.	no.	no.	\$m	\$m	\$m	person years	person years	person years
B Mining (including services to mining)	102	135	117	303	524	546	1 017	1 107	1 099
Manufacturing									
21 Food, beverages and tobacco	175	195	179	140	289	227	1 108	1 310	1 304
22 Textile, clothing, footwear and leather	62	66	65	28	26	22	215	220	199
23 Wood and paper products	45	37	35	79	184	190	256	259	249
24 Printing, publishing and recorded media	44	53	47	15	21	17	174	199	179
25 Petroleum, coal, chemical and associated product	362	373	348	318	349	321	2 425	2 535	2 442
26 Non-metallic mineral product	77	90	85	45	82	67	427	375	500
27 Metal product	244	254	220	324	337	371	2 020	2 044	1 694
281–282 Motor vehicle and part and other transport equipment	144	151	146	332	405	397	2 025	2 292	2 658
283 Photographic and scientific equipment	113	119	114	114	119	80	973	1 051	791
284–285 Electronic and electrical equipment and appliance	444	454	432	416	494	587	3 871	4 010	4 435
286 Industrial machinery and equipment	293	321	309	93	128	137	1 092	1 248	1 249
29 Other manufacturing	94	97	94	19	21	18	233	218	210
C Total manufacturing	2 097	2 210	2 074	1 924	2 453	2 434	14 819	15 761	15 909
Other industries									
F–G Wholesale and retail trade	262	255	242	193	220	201	1 590	1 622	1 444
K Finance and insurance	36	37	39	101	121	94	979	1 174	1 097
77,782–786 Property and business services	676	761	704	598	617	514	5 007	5 084	4 740
781 Scientific research	77	83	86	118	149	152	933	920	976
(b) Other n.e.c.	137	152	145	262	238	183	1 399	1 321	873
D–Q Total other industries	1 188	1 288	1 216	1 272	1 345	1 144	9 908	10 120	9 130
TOTAL ALL INDUSTRIES	3 387	3 633	3 407	3 499	4 321	4 124	25 744	26 989	26 138

(a) Excludes businesses in ANZSIC Division A.

(b) ANZSIC codes D, E, H–J, M–Q.

TYPE OF EXPENDITURE

In 1996–97, Labour costs accounted for \$1,565m (38%) of the total R&D expenditure, a decrease of \$29m compared with 1995–96. Other current expenditure at \$2,046m (50%) was \$175m lower than 1995–96, while Capital expenditure increased by \$7m on 1995–96 to account for \$513m (12%).

The Mining industry had the lowest labour costs as a proportion of R&D expenditure (16%) and the Finance and insurance industry had the highest (67%). The Metal product mfg industry had the highest capital expenditure (\$91m) of all industries.

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TYPE OF R&D EXPENDITURE(a)

ANZSIC Code & Description	Total \$'000	Capital expenditure \$'000	Labour costs(b) \$'000	Other current expenditure \$'000
B Mining (including services to mining)	545 951	82 559	89 887	373 505
Manufacturing				
21 Food, beverages and tobacco	227 301	23 482	75 828	127 991
22 Textile, clothing, footwear and leather	21 734	2 105	10 485	9 144
23 Wood and paper products	189 965	n.p.	n.p.	91 434
24 Printing, publishing and recorded media	17 201	2 157	9 525	5 519
25 Petroleum, coal, chemical and associated product	320 815	27 834	135 444	157 537
26 Non-metallic mineral product	67 174	5 118	24 749	37 307
27 Metal product	370 995	91 418	109 578	169 999
281–282 Motor vehicle and part and other transport equipment	397 277	30 539	154 422	212 316
283 Photographic and scientific equipment	79 604	6 586	41 567	31 451
284–285 Electronic and electrical equipment and appliance	587 102	34 483	267 645	284 974
286 Industrial machinery and equipment	137 196	12 049	64 692	60 455
29 Other manufacturing	17 977	n.p.	n.p.	6 054
C Total manufacturing	2 434 341	316 105	924 055	1 194 181
Other industries				
F–G Wholesale and retail trade	201 068	18 166	86 889	96 013
K Finance and insurance	93 830	9 845	62 694	21 291
77,782–786 Property and business services	513 516	36 342	280 158	197 016
781 Scientific research	152 037	15 228	62 427	74 382
(c) Other n.e.c.	183 112	34 671	58 668	89 773
D–Q Total other industries	1 143 563	114 252	550 836	478 475
TOTAL ALL INDUSTRIES	4 123 854	512 916	1 564 778	2 046 161

(a) Excludes businesses 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.

(c) ANZSIC codes D, E, H–J, M–Q.

TYPE OF ACTIVITY

Business R&D was predominantly directed towards Experimental development \$2,924m (71%), with \$999m (24%) directed to Applied research and \$201m (5%) to Basic research. The Mining and Manufacturing industries were similar in 1996-97 with their type of activity splits. Experimental development in the Mining industry was \$429m (79%) with \$104m (19%) in Applied research. Manufacturing was \$1,786m (73%) and \$521m (21%) respectively. In comparison, in the Scientific research industry only \$53m (35%) was Experimental development, with \$75m (49%) Applied research and \$25m (16%) Basic research.

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R&D EXPENDITURE BY TYPE OF ACTIVITY(a)(b)

ANZSIC Code & Description		Total	Basic research	Applied research	Experimental development
		\$'000	\$'000	\$'000	\$'000
B	Mining (including services to mining)	545 951	12 890	104 318	428 743
Manufacturing					
21	Food, beverages and tobacco	227 301	11 557	41 140	174 604
22	Textile, clothing, footwear and leather	21 734	n.p.	n.p.	16 532
23	Wood and paper products	189 965	n.p.	n.p.	173 029
24	Printing, publishing and recorded media	17 201	444	5 282	11 475
25	Petroleum, coal, chemical and associated product	320 815	22 674	98 030	200 112
26	Non-metallic mineral product	67 174	5 544	22 977	38 653
27	Metal product	370 995	46 932	103 450	220 613
281-282	Motor vehicle and part and other transport equipment	397 277	2 865	23 589	370 823
283	Photographic and scientific equipment	79 604	8 643	20 727	50 233
284-285	Electronic and electrical equipment and appliance	587 102	12 137	150 945	424 020
286	Industrial machinery and equipment	137 196	8 520	33 536	95 140
29	Other manufacturing	17 977	1 545	5 387	11 045
C	Total manufacturing	2 434 341	127 033	521 028	1 786 280
Other industries					
F-G	Wholesale and retail trade	201 068	9 392	57 572	134 104
K	Finance and insurance	93 830	528	15 800	77 502
77,782-786	Property and business services	513 516	20 079	127 137	366 300
781	Scientific research	152 037	24 707	74 575	52 756
(c)	Other n.e.c.	183 112	6 005	98 923	78 184
D-Q	Total other industries	1 143 563	60 710	374 007	708 846
TOTAL ALL INDUSTRIES		4 123 854	200 633	999 353	2 923 868

(a) Excludes businesses 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 8 of the Explanatory Notes.

(c) ANZSIC codes D, E, H-J, M-Q.

SOURCE OF FUNDS FOR R&D

The business sector provided most of the R&D expenditure funds itself: 88% (\$3,626m) was sourced from Own funds and 5% (\$192m) from Other businesses. The Commonwealth Government provided \$24m (1%) from Competitive grants for Industry R&D and \$78m (2%) from Other Commonwealth Government sources. Overseas funding provided \$134m or 3%.

The Scientific research industry was the only industry that did not provide the bulk of R&D expenditure funding from Own funds (only 32%). A further 32% was provided by Other businesses with Other Australian sources providing 17% and 15% coming from the Commonwealth Government.

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SOURCE OF FUNDS FOR R&D(a)

ANZSIC Code & Description	Total \$'000	Own funds \$'000	Other businesses \$'000	Competitive Grants Scheme \$'000	Other C'wealth Gov't \$'000	State and Local Gov't \$'000	Other Aust(b) \$'000	Overseas \$'000
B Mining (including services to mining)	545 951	510 635	n.p.	313	—	n.p.	383	28 714
Manufacturing								
21 Food, beverages and tobacco	227 301	223 000	1 238	1 685	n.p.	34	n.p.	—
22 Textile, clothing, footwear and leather	21 734	21 720	3	11	—	—	—	—
23 Wood and paper products	189 965	189 844	—	n.p.	—	—	n.p.	—
24 Printing, publishing and recorded media	17 201	15 163	—	n.p.	—	—	n.p.	—
25 Petroleum, coal, chemical and associated product	320 815	291 717	5 164	987	n.p.	n.p.	47	15 294
26 Non-metallic mineral product	67 174	63 108	3 594	472	—	—	—	—
27 Metal product	370 995	365 134	1 164	1 974	n.p.	n.p.	n.p.	n.p.
281–282 Motor vehicle and part and other transport equipment	397 277	353 408	6 885	n.p.	14 877	—	n.p.	n.p.
283 Photographic and scientific equipment	79 604	69 064	2 414	1 687	n.p.	163	n.p.	—
284–285 Electronic and electrical equipment and appliance	587 102	507 494	41 330	3 565	n.p.	n.p.	n.p.	1 343
286 Industrial machinery and equipment	137 196	130 853	4 173	1 349	242	n.p.	392	n.p.
29 Other manufacturing	17 977	17 372	—	n.p.	426	—	n.p.	—
C Total manufacturing	2 434 341	2 247 877	65 965	12 513	55 637	1 939	11 529	38 881
Other industries								
F–G Wholesale and retail trade	201 068	190 533	3 199	2 164	n.p.	—	n.p.	n.p.
K Finance and insurance	93 830	86 058	n.p.	—	n.p.	—	7 745	—
77,782–786 Property and business services	513 516	384 446	45 190	3 949	3 615	1 338	19 713	55 265
781 Scientific research	152 037	47 972	48 448	4 036	18 335	1 381	25 377	6 488
(c) Other n.e.c.	183 112	158 706	n.p.	839	85	n.p.	n.p.	n.p.
D–Q Total other industries	1 143 563	867 715	n.p.	10 988	22 136	n.p.	53 449	66 641
TOTAL ALL INDUSTRIES	4 123 854	3 626 226	191 656	23 814	77 773	4 788	65 361	134 236

(a) Excludes businesses in ANZSIC Division A.

(b) Includes Higher Education and Private Non-profit sectors.

(c) ANZSIC codes D, E, H–J, M–Q.

STATE COMPARISONS

The leading States in terms of R&D expenditure were New South Wales with \$1,452m and Victoria with \$1,419m, accounting for 35% and 34% of total R&D expenditure respectively. Western Australia with \$492m (12%) replaced Queensland with \$434m (11%) as the next highest area of R&D expenditure.

Compared to 1995–96, R&D expenditure decreased in New South Wales by \$127m, in Victoria by \$44m, in South Australia by \$42m and in Queensland by \$34m. In Western Australia, R&D expenditure increased by \$52m.

In the Mining industry, Western Australia accounted for \$204m (37%), New South Wales \$141m (26%) and Queensland \$139m (25%).

Major contributors to R&D in the Manufacturing industry were Victoria \$1,029m (42%) and New South Wales \$771m (32%).

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LOCATION OF R&D EXPENDITURE(a)(b)

ANZSIC Code & Description	Location of expenditure							
	Total \$'000	NSW \$'000	Vic. \$'000	Qld \$'000	SA \$'000	WA \$'000	Other States and Territories \$'000	Over- seas \$'000
B Mining (including services to mining)	545 951	141 031	26 463	138 528	13 591	204 421	19 175	2 742
Manufacturing								
21 Food, beverages and tobacco	227 301	72 636	109 520	21 085	3 688	18 030	1 862	480
22 Textile, clothing, footwear and leather	21 734	5 715	11 236	2 256	385	1 931	n.p.	n.p.
23 Wood and paper products	189 965	28 469	n.p.	6 179	3 141	n.p.	n.p.	16
24 Printing, publishing and recorded media	17 201	6 854	6 801	29	378	1 631	n.p.	n.p.
25 Petroleum, coal, chemical and associated product	320 815	114 955	133 425	21 748	29 075	15 385	2 760	3 467
26 Non-metallic mineral product	67 174	26 645	11 844	11 814	2 351	8 982	n.p.	n.p.
27 Metal product	370 995	124 422	92 013	35 798	5 119	106 315	n.p.	n.p.
281–282 Motor vehicle and part and other transport equipment	397 277	47 766	261 641	19 412	36 307	23 272	2 295	6 584
283 Photographic and scientific equipment	79 604	28 074	25 061	7 703	13 136	2 895	397	2 338
284–285 Electronic and electrical equipment and appliance	587 102	244 194	215 713	52 875	44 278	17 576	10 373	2 093
286 Industrial machinery and equipment	137 196	66 423	31 069	21 719	6 430	8 952	937	1 666
29 Other manufacturing	17 977	4 751	n.p.	3 723	488	n.p.	677	n.p.
C Total manufacturing	2 434 341	770 904	1 029 162	204 341	144 776	211 879	55 190	18 089
Other industries								
F–G Wholesale and retail trade	201 068	89 605	70 903	11 547	11 364	12 299	4 572	778
K Finance and insurance	93 830	53 050	25 031	n.p.	—	n.p.	n.p.	n.p.
77,782–786 Property and business services	513 516	298 708	102 924	38 031	16 567	44 657	10 242	2 387
781 Scientific research	152 037	59 632	54 739	18 789	8 455	6 167	n.p.	n.p.
(c) Other n.e.c.	183 112	38 592	110 129	n.p.	4 488	n.p.	10 153	n.p.
D–Q Total other industries	1 143 563	539 587	363 726	90 984	40 874	75 250	28 877	4 265
TOTAL ALL INDUSTRIES	4 123 854	1 451 522	1 419 351	433 853	199 241	491 550	103 242	25 096

(a) Location of the expenditure. This may not be the location of the organisation's head office.

(b) Excludes businesses in ANZSIC Division A.

(c) ANZSIC codes D, E, H–J, M–Q.

EXPENDITURE BY SIZE OF BUSINESS

The largest businesses, employing 1000 or more, accounted for 36% of total R&D expenditure. This proportion was the same in 1995–96. On average this was more than \$9m per business undertaking R&D. Businesses employing less than 10 people accounted for only 5% of the R&D (up from 4% in 1995–96). This averaged out at approximately \$220,000 for each business undertaking R&D (\$60,000 higher than in 1995–96).

The ABS defines small business as those employing less than 100 in Manufacturing industries and less than 20 in other industries. Small businesses accounted for 23% of Manufacturing R&D and 11% of R&D in other industries.

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EXPENDITURE ON R&D, BY SIZE OF BUSINESS(a)(b)

ANZSIC Code & Description	Total \$'000	Business employment size							
		Less than 10 \$'000	10–19 \$'000	20–49 \$'000	50–99 \$'000	100–199 \$'000	200–499 \$'000	500–999 \$'000	1000 or more \$'000
B Mining (including services to mining)	545 951	20 910	7 522	33 103	3 511	36 718	137 435	147 015	159 737
Manufacturing									
21 Food, beverages and tobacco	227 301	3 611	556	24 857	14 443	7 419	30 455	15 348	130 612
22 Textile, clothing, footwear and leather	21 734	n.p.	531	1 859	3 888	6 740	2 697	3 887	n.p.
23 Wood and paper products	189 965	545	50	979	1 376	185	n.p.	4 842	n.p.
24 Printing, publishing and recorded media	17 201	1 161	1 086	6 640	1 231	n.p.	1 925	n.p.	2 810
25 Petroleum, coal, chemical and associated product	320 815	5 979	8 255	22 835	48 533	22 894	95 745	48 580	67 994
26 Non-metallic mineral product	67 174	899	2 817	1 960	4 024	17 300	11 853	11 919	16 402
27 Metal product	370 995	n.p.	n.p.	50 761	11 295	54 608	18 748	99 399	72 247
281–282 Motor vehicle and part and other transport equipment	397 277	2 770	2 870	5 977	4 031	25 672	39 163	52 959	263 835
283 Photographic and scientific equipment	79 604	7 623	7 526	10 420	4 834	9 291	n.p.	n.p.	n.p.
284–285 Electronic and electrical equipment and appliance	587 102	n.p.	52 308	34 616	32 278	73 678	88 722	n.p.	212 969
286 Industrial machinery and equipment	137 196	12 265	n.p.	24 467	17 285	11 722	15 975	17 084	n.p.
29 Other manufacturing	17 977	4 185	2 880	3 980	2 593	n.p.	2 421	n.p.	—
C Total manufacturing	2 434 341	120 893	94 362	189 351	145 811	231 063	336 147	335 811	980 903
Other industries									
F–G Wholesale and retail trade	201 068	5 459	11 027	24 941	10 114	20 913	39 046	34 224	55 344
K Finance and insurance	93 830	1 872	n.p.	n.p.	2 661	n.p.	8 866	n.p.	66 016
77,782–786 Property and business services	513 516	53 647	44 566	77 624	96 683	90 324	32 601	35 178	82 893
781 Scientific research	152 037	18 884	n.p.	67 219	48 980	—	5 969	n.p.	—
(c) Other n.e.c.	183 112	3 964	6 478	n.p.	1 782	n.p.	9 733	10 158	120 459
D–Q Total other industries	1 143 563	83 826	72 739	173 778	160 220	139 985	96 215	92 088	324 712
TOTAL ALL INDUSTRIES	4 123 854	225 629	174 623	396 232	309 542	407 766	569 797	574 914	1 465 352

(a) Excludes businesses in ANZSIC Division A.

(b) Employment size is based on the number of persons employed by the business.

(c) ANZSIC codes D, E, H–J, M–Q.

SOCIO-ECONOMIC OBJECTIVE

Most business R&D was directed towards Economic Development, \$3,693m or 90%. Of this \$2,054m (56%) was directed towards Manufacturing. Approximately 5% was directed towards Defence, 3% to Society, 2% to Environment and 1% to Advancement of knowledge.

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RESOURCES DEVOTED TO R&D, BY SOCIO-ECONOMIC OBJECTIVE(a)

	Type of expenditure				
	Total	Capital expenditure	Labour costs(b)	Other current expenditure	Human resources
<i>Socio-economic objective</i>	\$'000	\$'000	\$'000	\$'000	person years
Defence	193 432	18 280	69 721	105 431	1 015
Economic development					
Plant-production and primary products	32 786	3 107	15 923	13 757	334
Animal-production and primary products	26 361	3 884	9 877	12 600	207
Mineral resources (excl. energy)	466 904	103 205	83 756	279 943	1 197
Energy resources	211 141	30 745	41 204	139 192	483
Energy supply	85 804	26 347	29 306	30 151	492
Manufacturing	2 053 879	227 615	779 565	1 046 699	13 434
Construction	45 062	4 447	20 586	20 029	384
Transport	92 861	5 903	42 931	44 027	778
Information and communication services	515 243	30 711	278 237	206 295	4 396
Commercial services	156 042	32 390	81 543	42 110	1 425
Economic framework	6 821	286	5 040	1 495	64
<i>Total economic development</i>	3 692 905	468 641	1 387 966	1 836 297	23 192
Society					
Health	102 704	7 202	45 690	49 812	757
Education and training	2 421	231	1 533	657	46
Social development and community services	12 777	1 456	7 063	4 258	144
<i>Total society</i>	117 902	8 888	54 286	54 728	947
Environment					
Environmental knowledge	25 795	4 542	8 145	13 108	156
Environmental aspects of economic development	30 727	6 289	11 761	12 676	239
Environmental management and other aspects	15 415	1 448	6 001	7 966	108
<i>Total environment</i>	71 936	12 279	25 907	33 750	503
Advancement of knowledge	47 680	4 827	26 899	15 955	481
Total	4 123 854	512 916	1 564 778	2 046 161	26 138

(a) Excludes businesses 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.

FIELD OF RESEARCH

Almost all the R&D expenditure took place in the Natural sciences, technologies and engineering. Of this, 17% was in Manufacturing and process technologies and engineering, 11% in Mechanical and industrial engineering, 11% in Mining and mineral processing and 10% in Computer software.

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RESOURCES DEVOTED TO R&D, BY FIELD OF RESEARCH(a)

Field of research	Type of expenditure				Human resources person years
	Total \$'000	Capital expenditure \$'000	Labour costs(b) \$'000	Other current expenditure \$'000	
Natural sciences, technologies and engineering					
Mathematical sciences	11 891	1 810	4 426	5 655	78
Physical sciences	43 493	5 180	16 512	21 800	308
Chemical sciences	177 915	37 657	61 459	78 800	1 091
Earth sciences	91 520	14 040	27 158	50 322	348
Information systems and technologies	224 018	14 343	125 930	83 745	2 130
Computer software	422 321	28 256	249 457	144 608	4 129
Communications technologies	348 857	21 300	145 772	181 786	2 241
Other information, computers and communication technologies	187 984	14 539	83 673	89 772	1 289
Manufacturing and process technologies and engineering	714 932	145 941	201 586	367 406	3 390
Industrial biotechnology and food sciences	134 439	10 293	53 053	71 094	882
Material sciences and technologies	213 095	46 477	64 434	102 183	1 129
Other applied sciences and technologies	107 671	9 323	43 069	55 279	733
Mechanical and industrial engineering	437 476	43 251	174 672	219 552	3 154
Mining and mineral processing	435 040	60 037	73 428	301 576	962
Other general engineering	249 211	35 334	110 351	103 525	2 014
Biological sciences	58 419	2 965	24 479	30 975	427
Agricultural sciences	80 589	10 097	31 612	38 880	590
Medical and health sciences	177 529	11 813	68 616	97 100	1 161
Total natural sciences, technologies and engineering	4 116 401	512 656	1 559 686	2 044 059	26 056
Social sciences and humanities					
Social sciences	6 594	244	4 430	1 920	68
Humanities	860	16	663	181	14
Total social sciences and humanities	7 454	260	5 093	2 101	82
Total	4 123 854	512 916	1 564 778	2 046 161	26 138

(a) Excludes businesses 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 R&D business expenditures reported in the 1994-95, 1995-96 and 1996-97 surveys.

In each of these surveys, businesses were also asked to report the level of expenditure they expected to incur in the following 12 months. These estimates are respectively shown as 1995-96, 1996-97 and 1997-98 'expected' data in the table.

These estimates should be used with caution because:

- only some businesses have long-term R&D projects and can provide a fairly accurate forecast; and
- many businesses perform R&D on a 'needs be' basis or have projects nearing completion. For these businesses any forecast expenditure is a best guess.

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EXPECTED AND ACTUAL EXPENDITURE ON R&D(a)

ANZSIC Code & Description	1994-95r		1995-96r		1996-97	1997-98
	Actual	Expected	Actual	Expected	Actual	Expected
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
B Mining (including services to mining)	302 775	351 264	523 640	430 795	545 951	402 564
Manufacturing						
21 Food, beverages and tobacco	140 131	144 615	288 944	202 659	227 301	196 219
22 Textile, clothing, footwear and leather	28 425	35 647	25 669	20 315	21 734	20 086
23 Wood and paper products	79 252	67 184	183 781	70 975	189 965	96 359
24 Printing, publishing and recorded media	15 062	13 575	20 665	19 826	17 201	13 352
25 Petroleum, coal, chemical and associated product	317 524	311 847	348 548	326 740	320 815	340 135
26 Non-metallic mineral product	45 260	45 466	81 762	53 064	67 174	61 145
27 Metal product	324 129	302 440	337 079	316 546	370 995	423 279
281-282 Motor vehicle and part and other transport equipment	331 524	306 388	404 956	387 411	397 277	326 333
283 Photographic and scientific equipment	114 444	109 171	119 000	98 809	79 604	82 573
284-285 Electronic and electrical equipment and appliance	415 940	437 686	493 858	539 846	587 102	569 849
286 Industrial machinery and equipment	93 254	101 492	128 006	119 801	137 196	120 535
29 Other manufacturing	19 188	20 109	20 504	21 136	17 977	17 847
C Total manufacturing	1 924 132	1 895 620	2 452 772	2 177 129	2 434 341	2 267 712
Other industries						
F-G Wholesale and retail trade	192 909	195 201	220 315	206 104	201 068	207 013
K Finance and insurance	100 880	103 500	120 562	116 797	93 830	67 891
77,782-786 Property and business services	597 933	551 622	617 070	517 983	513 516	511 883
781 Scientific research	118 384	131 888	148 752	160 562	152 037	170 018
(b) Other n.e.c.	261 665	291 297	238 254	204 481	183 112	171 240
D-Q Total other industries	1 271 770	1 273 507	1 344 953	1 205 927	1 143 563	1 128 045
Total	3 498 677	3 520 391	4 321 365	3 813 850	4 123 854	3 798 321

(a) Excludes businesses in ANZSIC Division A.

(b) ANZSIC codes D, E, H-J, M-Q.

HUMAN RESOURCES BY SIZE OF BUSINESS

Businesses employing 1,000 or more contributed 29% of human resource effort. However only 1% of their total employment was devoted to R&D. Businesses with less than 10 employees devoted 45% of their total employment to research, although this only contributed 7% of the total resources undertaking R&D.

Using the ABS definitions (see page 12) small businesses contributed 28% of human resources to R&D in Manufacturing and 19% in Other industries.

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HUMAN RESOURCES DEVOTED TO R&D, BY SIZE OF BUSINESS(a)(b)

ANZSIC Code & Description	Total person years	BUSINESS EMPLOYMENT SIZE							
		Less than 10 person years	10-19 person years	20-49 person years	50-99 person years	100-199 person years	200-499 person years	500-999 person years	1000 or more person years
B Mining (including services to mining)	1 099	73	56	41	19	65	339	198	309
Manufacturing									
21 Food, beverages and tobacco	1 304	31	8	150	134	96	198	134	553
22 Textile, clothing, footwear and leather	199	9	n.p.	17	44	51	35	23	n.p.
23 Wood and paper products	249	4	4	4	12	3	11	37	174
24 Printing, publishing and recorded media	179	26	11	82	19	11	n.p.	n.p.	13
25 Petroleum, coal, chemical and associated product	2 442	78	98	226	312	204	678	356	490
26 Non-metallic mineral product	500	11	31	21	41	141	43	91	121
27 Metal product	1 694	51	35	189	113	234	122	619	331
281-282 Motor vehicle and part and other transport equipment	2 658	37	37	88	53	84	254	407	1 698
283 Photographic and scientific equipment	791	84	72	120	49	91	n.p.	n.p.	n.p.
284-285 Electronic and electrical equipment and appliance	4 435	305	351	404	354	559	670	347	1 444
286 Industrial machinery and equipment	1 249	98	110	215	206	113	162	n.p.	n.p.
29 Other manufacturing	210	48	n.p.	57	40	5	24	n.p.	—
C Total manufacturing	15 909	780	789	1 573	1 376	1 592	2 398	2 212	5 191
Other industries-									
F-G Wholesale and retail trade	1 444	95	143	203	88	172	296	193	254
K Finance and insurance	1 097	13	n.p.	7	29	n.p.	46	32	937
77,782-786 Property and business services	4 740	711	512	913	655	777	302	349	522
781 Scientific research	976	141	84	416	296	—	n.p.	n.p.	—
(c) Other n.e.c.	873	74	n.p.	51	12	n.p.	n.p.	n.p.	452
D-Q Total other industries	9 130	1 033	798	1 591	1 080	1 101	710	652	2 165
TOTAL ALL INDUSTRIES	26 138	1 886	1 642	3 205	2 474	2 757	3 447	3 062	7 664

(a) Excludes businesses in ANZSIC Division A.

(b) Employment size is based on the numbers of persons employed by the business, whereas human resources data are person years of R&D effort.

(c) ANZSIC codes D, E, H-J, M-Q.

TYPE OF HUMAN RESOURCES

Researchers comprised 58% of the human resources devoted to R&D, followed by Technicians with 28% and Other supporting staff with 14%. In Mining, Researchers accounted for 59% and Technicians 22%. Researchers made up 55% in Manufacturing with 30% by Technicians. Within the Manufacturing industries, the proportion by Researchers ranged from a high of 70% in Printing, publishing and recorded media to a low of 39% in Motor vehicle and part and other transport equipment. Other industries had a high proportion of Researchers with 61%. Within Other industries, Property and business services had 64% Researchers, Wholesale and Retail trade 62% and Scientific research 61%.

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HUMAN RESOURCES DEVOTED TO R&D, BY TYPE OF EMPLOYEE(a)

		<i>Total</i>	<i>Researchers</i>	<i>Technicians</i>	<i>Other supporting staff</i>
<i>ANZSIC Code & Description</i>		<i>person years</i>	<i>person years</i>	<i>person years</i>	<i>person years</i>
B	Mining (including services to mining)	1 099	652	246	201
Manufacturing					
21	Food, beverages and tobacco	1 304	681	342	282
22	Textile, clothing, footwear and leather	199	89	69	41
23	Wood and paper products	249	110	102	38
24	Printing, publishing and recorded media	179	126	31	21
25	Petroleum, coal, chemical and associated product	2 442	1 397	711	335
26	Non-metallic mineral product	500	233	180	86
27	Metal product	1 694	904	484	306
281-282	Motor vehicle and part and other transport equipment	2 658	1 041	1 112	505
283	Photographic and scientific equipment	791	472	247	72
284-285	Electronic and electrical equipment and appliance	4 435	3 011	1 008	417
286	Industrial machinery and equipment	1 249	623	355	271
29	Other manufacturing	210	110	59	41
C	<i>Total manufacturing</i>	<i>15 909</i>	<i>8 796</i>	<i>4 700</i>	<i>2 414</i>
Other industries-					
F-G	Wholesale and retail trade	1 444	899	358	187
K	Finance and insurance	1 097	558	385	154
77,782-786	Property and business services	4 740	3 016	1 242	482
781	Scientific research	976	600	260	116
(b)	Other n.e.c.	873	533	246	95
D-Q	<i>Total other industries</i>	<i>9 130</i>	<i>5 606</i>	<i>2 490</i>	<i>1 033</i>
TOTAL ALL INDUSTRIES		26 138	15 054	7 436	3 648

(a) Excludes businesses in ANZSIC Division A.

(b) ANZSIC codes D, E, H-J, M-Q.

EXTRAMURAL R&D EXPENDITURE

Extramural R&D expenditure (payments to other organisations to undertake R&D projects) increased by \$169m (32%) compared with 1994–95. A large rise in Other industries of \$213m (75%) and a smaller rise in mining of \$32m (63%) was offset by a fall in Manufacturing industries of \$77m (39%).

Extramural payments were 17% of BERD, an increase from 15% in 1994–95.

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EXTRAMURAL R&D EXPENDITURE(a)(b)

ANZSIC Code & Description	Total		Location of recipient			
	Businesses	Payments	Australia		Overseas	
			Businesses	Payments	Businesses	Payments
	no.	\$'000	no.	\$'000	no.	\$'000
B Mining (including services to mining)	59	83 712	58	66 248	7	17 464
Manufacturing						
21 Food, beverages and tobacco	44	18 417	43	12 425	5	5 992
22 Textile, clothing, footwear and leather	7	1 603	4	1 557	3	46
23 Wood and paper products	6	1 526	5	n.p.	2	n.p.
24 Printing, publishing and recorded media	5	225	5	225	—	—
25 Petroleum, coal, chemical and associated product	55	34 802	48	32 719	13	2 083
26 Non-metallic mineral product	11	1 522	11	n.p.	3	n.p.
27 Metal product	29	15 045	29	14 274	5	771
281–282 Motor vehicle and part and other transport equipment	18	3 939	18	n.p.	1	n.p.
283 Photographic and scientific equipment	18	8 728	15	n.p.	7	n.p.
284–285 Electronic and electrical equipment and appliance	39	32 937	36	21 366	5	11 571
286 Industrial machinery and equipment	23	2 489	21	n.p.	3	n.p.
29 Other manufacturing	10	364	10	364	—	—
C Total manufacturing	265	121 596	245	91 840	47	29 756
Other industries-						
F–G Wholesale and retail trade	52	43 289	52	n.p.	6	n.p.
K Finance and insurance	15	n.p.	15	n.p.	—	—
77,782–786 Property and business services	94	n.p.	92	n.p.	9	n.p.
781 Scientific research	42	38 900	41	36 290	6	2 610
(c) Other n.e.c.	52	161 052	52	158 381	7	2 671
D–Q Total other industries	255	497 719	252	484 661	28	13 058
TOTAL ALL INDUSTRIES	579	703 027	555	642 749	82	60 278

(a) Expenditure on R&D which is funded by a business but carried out by others.

(b) Excludes businesses 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 (TKH) were estimated to be \$465m while receipts were estimated to be \$271m. These payments and receipts were equivalent to 11% and 7% of BERD, compared with 18% and 9% respectively in 1994–95.

Motor vehicle and part and other transport equipment mfg was the leading industry making payments for TKH at \$123m followed by Petroleum, coal, chemical and associated product mfg at \$98m.

Property and business services was the leading industry earning receipts for TKH at \$95m followed by Electronic and electrical equipment and appliance mfg at \$64m.

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PAYMENTS AND RECEIPTS FOR TECHNICAL KNOW-HOW(a)

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
	\$m	\$m	\$m	\$m	\$m	\$m
B Mining (including services to mining)	12.5	n.p.	n.p.	n.p.	n.p.	n.p.
Manufacturing						
21 Food, beverages and tobacco	83.5	n.p.	n.p.	n.p.	—	n.p.
22 Textile, clothing, footwear and leather	6.0	n.p.	n.p.	n.p.	—	n.p.
23 Wood and paper products	n.p.	n.p.	n.p.	n.p.	n.p.	—
24 Printing, publishing and recorded media	n.p.	—	n.p.	n.p.	—	n.p.
25 Petroleum, coal, chemical and associated product	97.8	73.8	24.0	29.0	27.9	1.1
26 Non-metallic mineral product	6.4	2.4	4.0	0.8	n.p.	n.p.
27 Metal product	14.8	2.9	11.9	3.8	0.6	3.2
281–282 Motor vehicle and part and other transport equipment	122.7	78.4	44.2	20.3	n.p.	n.p.
283 Photographic and scientific equipment	31.2	29.0	2.2	n.p.	n.p.	5.7
284–285 Electronic and electrical equipment and appliance	25.1	9.2	15.9	64.3	1.4	62.9
286 Industrial machinery and equipment	3.4	2.3	1.1	2.5	0.2	2.3
29 Other manufacturing	0.7	—	0.7	1.8	—	1.8
C Total manufacturing	399.0	210.2	188.7	135.6	35.0	100.6
Other industries-						
F–G Wholesale and retail trade	35.9	28.8	7.0	9.4	n.p.	n.p.
K Finance and insurance	n.p.	—	n.p.	n.p.	n.p.	n.p.
77,782–786 Property and business services	10.6	2.2	8.4	95.1	30.8	64.3
781 Scientific research	n.p.	n.p.	0.4	14.4	n.p.	n.p.
(b) Other n.e.c.	6.1	3.5	2.6	3.5	n.p.	n.p.
D–Q Total other industries	53.5	n.p.	n.p.	n.p.	n.p.	n.p.
TOTAL ALL INDUSTRIES	464.9	245.4	219.5	271.4	78.0	193.4

(a) Excludes businesses in ANZSIC Division A.

(b) ANZSIC codes D, E, H–J, M–Q.

PATENT ACTIVITY

Businesses with R&D activity during 1996–97 lodged 867 patent applications within Australia and 3,017 applications, designating 16,509 countries, abroad during the period 1 July 1995 to 30 June 1997. During this period 753 patents were granted in Australia and 1,500 granted abroad.

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PATENT ACTIVITY(a) JULY 1995–JUNE 1997

ANZSIC Code Description	Australia				Overseas		
	Standard patents lodged	Petty patents lodged	Standard patents granted	Petty patents granted	Patents lodged(b)		Patents granted
	no.	no.	no.	no.	Applications	Countries designated	no.
B Mining (including services to mining)	20	1	28	1	75	494	84
Manufacturing							
21 Food, beverages and tobacco	16	n.p.	20	n.p.	34	422	29
22 Textile, clothing, footwear and leather	n.p.	—	n.p.	n.p.	21	156	35
23 Wood and paper products	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	8
24 Printing, publishing and recorded media	—	—	—	—	n.p.	n.p.	—
25 Petroleum, coal, chemical and associated product	90	4	86	3	474	1 876	246
26 Non-metallic mineral product	16	5	13	5	25	103	8
27 Metal product	108	9	108	12	139	839	98
281–282 Motor vehicle and part and other transport equipment	46	8	16	2	92	157	37
283 Photographic and scientific equipment	21	n.p.	26	1	203	512	49
284–285 Electronic and electrical equipment and appliance	118	10	101	8	583	2 138	141
286 Industrial machinery and equipment	98	4	58	3	275	1 179	78
29 Other manufacturing	17	5	15	3	70	222	22
C Total manufacturing	555	51	455	41	1 936	7 637	751
Other industries-							
F–G Wholesale and retail trade	56	4	53	—	157	2 575	116
K Finance and insurance	n.p.	n.p.	2	n.p.	17	90	8
77,782–786 Property and business services	75	21	76	4	424	2827	393
781 Scientific research	49	6	57	n.p.	230	2075	122
(c) Other n.e.c.	n.p.	n.p.	25	5	178	809	27
D–Q Total other industries	204	36	213	15	1006	8377	666
TOTAL ALL INDUSTRIES	779	88	696	57	3017	16509	1500

(a) Excludes businesses in ANZSIC Division A.

(b) See Paragraph 9 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 the Business sector during 1996–97.

2 For details of R&D statistics available for the General government, Private non-profit and Higher education sectors see paragraph 25.

DATA SOURCES

3 The 1996–97 data presented in this publication have been compiled from data collected from businesses in the Survey of Research and Experimental Development in respect of the year ended June 1997. 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 90% response was obtained. The ABS believes that the non-respondents were non-R&D performers.

4 The GDP(I) figures used to derive BERD/GDP ratios are current at the time of manuscript finalisation (*Australian National Accounts: National Income, Expenditure and Product, March Quarter 1998* (Cat. no. 5206.0)), and, at current prices, are as follows: \$380,761m (1990–91); \$389,469m (1991–92); \$407,952m (1992–93); \$432,436m (1993–94); \$460,292m (1994–95); \$491,934m (1995–96) and \$517,401m (1996–97). 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, 1997–2*, OECD, Paris, 1998.

STATISTICAL UNIT

5 For 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.

DEFINITIONS

6 R&D 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'.

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

DEFINITIONS *continued*

8 Type of R&D activity comprises basic research, applied research, and experimental development. Data in this classification are subjectively allocated by respondents, 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.

9 The question relating to lodgement of patent applications overseas specifically asks for both the number of applications and 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 this as one patent application with four countries designated.

SCOPE

10 The scope of this survey is all businesses within the Business sector of Australia which have undertaken R&D.

11 The Business sector includes all businesses 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 costs of production, and the private non-profit institutions mainly serving them.

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

COVERAGE

13 The 1996–97 R&D survey comprised a complete enumeration of businesses identified by the ABS as likely to have carried out R&D activity.

14 The Business sector for the R&D survey excludes businesses mainly engaged in agriculture, forestry and fishing (i.e. industries in Division A of the *Australian and New Zealand Standard Industrial Classification (ANZSIC), 1993* (Cat. no. 1292.0)), partly because of collection difficulties and partly because such businesses 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).

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

- businesses which, in previous R&D surveys, reported R&D activity;
- businesses applying for the 125% Tax Concession and Competitive Grants for Industry R&D; or
- businesses identified from reports in newspapers, industrial journals, research compendia etc. as likely to have R&D activity.

16 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

17 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).

18 Each management unit 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 unit is classified to the predominant industry of the group rather than to ANZSIC 7810 Scientific research, in accordance with standards laid down in the Frascati Manual.

SOCIO-ECONOMIC OBJECTIVE AND FIELD OF RESEARCH CLASSIFICATIONS

19 Statistics of business R&D classified by Socio-economic objective (SEO) and Field of research (FOR) 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 (SEO) and the fields in which its research was undertaken (FOR). For more information on these classifications see the *Australian Standard Research Classification (ASRC), 1993* (Cat. no. 1297.0).

CONSTANT PRICE ESTIMATES

20 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.

21 In revaluing R&D expenditure, extensive use has been made of price series used in deriving constant price national accounts estimates. The constant price estimate for the labour costs component was obtained by deflating by a wage rate index. Constant price estimates for the non-labour costs components were derived by deflating each by a composite price index of relevant materials or capital expenditure items.

22 For a more comprehensive description of constant price concepts and estimation procedures see *Australian National Accounts: Concepts, Sources and Methods* (Cat. no. 5216.0).

RELIABILITY OF STATISTICS

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

- many respondents made estimates because their accounts did not separately record data on R&D activity; and
- the OECD standard definition of R&D used in this survey differs in some respects from what data providers may regard as R&D activity. This is because the definitions used within the Competitive Grants for Industry R&D scheme (for the allocation of grants), and the 125% Tax Concession scheme (for tax deductibility for specific R&D activities) are slightly different from the international standard.

UNPUBLISHED STATISTICS

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

RELATED PUBLICATIONS

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

Main Science and Technology Indicators 1997–2, OECD, Paris, 1998

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

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

Research and Experimental Development, Higher Education Organisations, Australia, 1996 (Cat no. 8111.0)

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

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

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

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. Pure basic research is carried out without looking for long-term benefits other than the advancement of knowledge. Strategic basic research is directed into specified broad areas in the expectation of useful discoveries. It provides the broad base of knowledge necessary for the solution of recognised practical problems.
BERD—Business expenditure on R&D	The sum of intramural R&D expenditures incurred by all businesses 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 funded by an organisation but carried out by other businesses, organisations, institutions or individuals.
Field of research	Field in which the R&D activity was performed. The FOR classification is primarily structured around disciplines or activities. It describes what research is being performed.
FOR	Field of research
GDP	Gross Domestic Product
Human resources devoted to R&D	The effort of researchers, technicians and other staff directly involved with R&D activity. Overhead staff (e.g. administrative and general service employees such as personnel officers, janitors, etc.) whose work indirectly supports R&D, are excluded.
Intramural R&D	R&D carried out by an organisation on its own behalf or on the behalf of other businesses, 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.
OECD	Organisation for Economic Co-operation and Development.

Other current expenditure	Expenditure on materials, fuels, rent and hiring, repairs and maintenance, data processing etc. and the proportion of expenditure on general services and overheads which is attributable to R&D activity.
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 new knowledge, with or without a specific practical application or new or improved products, processes, materials, devices or services. R&D activity extends to modifications to existing products/processes. R&D activity ceases and pre-production begins when work is no longer experimental.
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 executive and directors concerned primarily with budgets and human resources rather than project content.
SEO	Socio-economic objective.
Socio-economic objective	The area of expected national benefit rather than the immediate objectives of the researcher. The SEO classification defines the main areas of Australian economic and social activity to which the results of research programs are applied. It describes the purpose of the research; i.e. why the research is being performed.
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 a business. Payments are those made directly to the holders of TKH which is new to a business. They exclude non-monetary transfers, and costs incurred by a business 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.

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