

Research and Development in New Zealand

2002

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Preface

Recent exposure given to the government's Growth and Innovation Framework has reinforced the need for detailed statistics on research and development activity. Research and development is an important factor in promoting economic growth, and in developing a more dynamic New Zealand economy capable of competing successfully on the international stage. This report presents a statistical picture of the state of research and development activity in New Zealand.

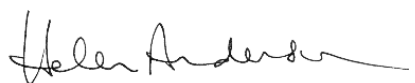
The information in this report was collected in the Research and Development Survey (R&D 2002) conducted in August 2002. R&D 2002 was jointly sponsored by the Ministry of Research, Science & Technology and Statistics New Zealand.

R&D 2002 collected information on government, business and university spending on research and development. Initial results from the survey were released in May 2003. This report contains more detailed information from the survey.

Statistics New Zealand is grateful for the cooperation of the enterprises that participated in R&D 2002.



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Contents

Preface	iii
Acknowledgement	v
List of Tables	viii
List of Figures	x
Guide to interpreting data	xiii
Part 1 All sectors	1
Part 2 Business sector	9
Part 3 Government sector	25
Part 4 Higher education sector	35
Appendix A: Technical documentation	43
Research and Development Survey questionnaire	59
Bibliography	71

List of Tables

Part 1 All sectors

1.01	Gross expenditure on R&D (GERD)	1
1.02	GERD as proportion of GDP	1
1.03	Gross expenditure on R&D (GERD), by expenditure type, 2002 reference year	3
1.04	Gross expenditure on R&D (GERD), by research type, 2002 reference year	4
1.05	Gross expenditure on R&D (GERD), by sector, by reference year	5
1.06	R&D funding, by source of funds, 2002 reference year	6
1.07	R&D funding, by source allocation, 2002 reference year	7
1.08	Personnel involved in R&D, by full-time equivalent employee, 2002 reference year	8
1.09	OECD R&D expenditure, 2001 reference year (OECD)	8

Part 2 Business sector

2.01	Business expenditure on R&D (BERD), by reference year	9
2.02	BERD as proportion of GDP, by reference year	10
2.03	Business R&D funding, by source of funds, year ended 30 June	12
2.04	Business expenditure on R&D (BERD), by sector, by reference year	13
2.05	Business expenditure on R&D (BERD), proportion by sector, by reference year	14
2.06	Business expenditure on R&D (BERD), by industry, 2002 reference year	14
2.07	Business expenditure on R&D (BERD), proportion by size of business, by reference year	15
2.08a	Business expenditure on R&D (BERD), by firm size in sector, 2000 reference year	16
2.08b	Business expenditure on R&D (BERD), by firm size in sector, 2002 reference year	16
2.09	R&D expenditure by manufacturing industries, by technology intensity, by reference year	19
2.10	Business expenditure on R&D (BERD), by research type, 2002 reference year	20
2.11	Business expenditure on R&D (BERD), by industry and research type, 2002 reference year	20

List of Tables (continued)

2.12	Business expenditure on R&D (BERD), by expenditure type, 2002 reference year	21
2.13	Personnel involved in business R&D, by sector and occupation, 2002 reference year	22
2.14	Personnel involved in business R&D, headcount by industry, as at 30 June 2002	23
2.15	Personnel involved in business R&D, by occupation, by reference year	23
2.16	Personnel involved in business R&D, by industry and occupation, 2002 reference year	24
2.17	Personnel involved in business R&D, by qualification and sex, 2002 reference year	24
Part 3 Government sector		
3.01	Government expenditure on R&D (GOVERD), by reference year	25
3.02	GOVERD as proportion of GDP, compared with OECD balance year 2001	27
3.03	GOVERD as proportion of GDP, by reference year	28
3.04	Government expenditure on R&D (GOVERD), by expenditure type, by reference year	29
3.05	Government expenditure on R&D (GOVERD), by research type, 2002 reference year	30
3.06	Source of funding for government R&D, by reference year	31
3.07	Personnel involved in government R&D, by occupation, by reference year	32
3.08	Personnel involved in government R&D, by headcount, by reference year	32
3.09	Personnel involved in government R&D, by qualification and sex, by reference year	33
Part 4 Higher education sector		
4.01	HERD as proportion of GDP, comparison with OECD and selected countries	36
4.02	Higher education expenditure on R&D (HERD), by expenditure type, year ended 31 December	37
4.03	Higher education expenditure on R&D (HERD), by socio-economic objective, year ended 31 December 2002	38
4.04	Higher education expenditure on R&D (HERD), by research type, year ended 31 December 2002	39

List of Tables *(continued)*

4.05	Source of funds for higher education R&D, by source of funds, year ended 31 December	40
4.06	Personnel involved in higher education R&D, year ended 31 December 2002	41
4.07	Higher education expenditure on R&D (HERD)	42
4.08	HERD as proportion of total R&D spending	42
4.09	R&D staff and research post-graduate students, year ended 31 December 2002	42

List of Figures

Part 1 All sectors

1.01	Gross expenditure on R&D (GERD)	1
1.02	Sector contribution to GDP, 2002 reference year	2
1.03	Gross expenditure on R&D (GERD), by sector, 2002 reference year	5
1.04	R&D in New Zealand, by funding and research sectors, 2002 reference year	6

Part 2 Business sector

2.01	Business expenditure on R&D (BERD)	9
2.02	BERD as proportion of GDP, compared with OECD average	10
2.03	BERD as proportion of total R&D spending	11
2.04	Source of business R&D funding, 2002 reference year	11
2.05	Business expenditure on R&D (BERD), proportion by sector	13
2.06a	Business expenditure on R&D (BERD), by firm size in primary sector	17
2.06b	Business expenditure on R&D (BERD), by firm size in manufacturing sector	17
2.06c	Business expenditure on R&D (BERD), by firm size in services sector	17
2.07a	Business expenditure on R&D (BERD), by technology class, 2000 reference year	18
2.07b	Business expenditure on R&D (BERD), by technology class, 2002 reference year	18
2.08	Business expenditure on R&D (BERD), by research type, 2002 reference year	19
2.09	Business expenditure on R&D (BERD), by expenditure type	21

List of Figures *(continued)*

Part 3	Government sector	
3.01	Government expenditure on R&D (GOVERD), by reference year	25
3.02	Government expenditure on R&D (GOVERD), as proportion of total R&D spending, by reference year	26
3.03	GOVERD as proportion of GDP, compared with OECD	27
3.04	Government expenditure on R&D (GOVERD), by expenditure type, 2002 reference year	29
3.05	Government expenditure on R&D (GOVERD), by research type, 2002 reference year	30
3.06	Source of funding for government R&D, 2002 reference year ...	31
Part 4	Higher education sector	
4.01	Higher education expenditure on R&D (HERD)	35
4.02	HERD as proportion of total R&D spending	36

Guide to interpreting data

Following is a summary of issues to consider when analysing Research and Development Survey (R&D 2002) results. A full technical description of the survey is contained in Appendix A: Technical documentation.

Definition of R&D

The definition of R&D used in the survey is consistent with Organisation for Economic Co-operation and Development (OECD) recommendations contained in the *Frascati Manual* (see www.oecd.org). R&D performed by enterprises is generally investigative work of actual or potential use in development of new or enhanced materials, products, devices, processes or services. R&D directed towards duplicating work already developed by others is included only if the knowledge or technology required for development is not available to the enterprise.

Data collection

R&D 2002 was a postal survey consisting of two questionnaires. The first questionnaire collected information from private sector enterprises, government departments and government-owned trading entities. The second questionnaire collected information from universities. The university questionnaire was designed to allow universities to use financial information generally produced for annual reporting purposes. This means a number of data items for university R&D were produced using modelled information. The New Zealand Vice-Chancellors' Committee and the Ministry of Research, Science & Technology assisted Statistics New Zealand in questionnaire development and determination of modelling specifications.

Nature of the survey

Given the nature of the data collected, there are limitations on the level of accuracy that can be expected from R&D 2002. Many respondents do not keep separate accounts of their R&D expenditure, or they may include R&D with other scientific and technological services, such as consulting. Records may not be kept in the form required by the survey and an estimation may be required. Detailed descriptions of what should and should not be included as R&D were provided in the questionnaires and phone-in help was available to respondents.

Published sector and industry breakdowns

Published results have been created using classifications and frameworks recommended by the *Frascati Manual* to allow for international comparability with other OECD member country surveys. Full details of sector and industry breakdowns are provided in Appendix A: Technical documentation.

Differences in population selection criteria

R&D expenditure figures in the 2002 reference year are not directly comparable with those collected in 2000 and previous years because of changes in the methods employed to identify enterprises undertaking R&D activity. In order to achieve more comprehensive coverage of R&D activity in the 2002 survey, additional sources of information to those used in the 2000 survey were used to derive the R&D 2002 survey population. R&D 2002 expenditure figures resulting from the sources used in the 2000 population selection, and those added as a result of the additional sources used in 2002, have been clearly identified in this report.

Interpretation of expenditure on R&D and sources of funding

Respondents were asked to provide information on spending on R&D-related activities separately from the sources of funding used to undertake this R&D. Consequently, there is the potential for an imbalance between the figures provided for these two variables. Such an imbalance may occur for a number of reasons, such as funding being provided for R&D activities which were not in fact carried out in the reference period; and funding provided including an element of overhead not reported as expenditure on the R&D in question.

Part 1

All sectors

Gross expenditure on R&D (GERD)

Total research and development (R&D) expenditure in New Zealand was estimated at \$1,416.2 million in the 2002 reference year, as shown in figure 1.01. This was an increase of 20 percent on the 2000 reference year, when employing the same population selection criteria used in 2000.

Figure 1.01

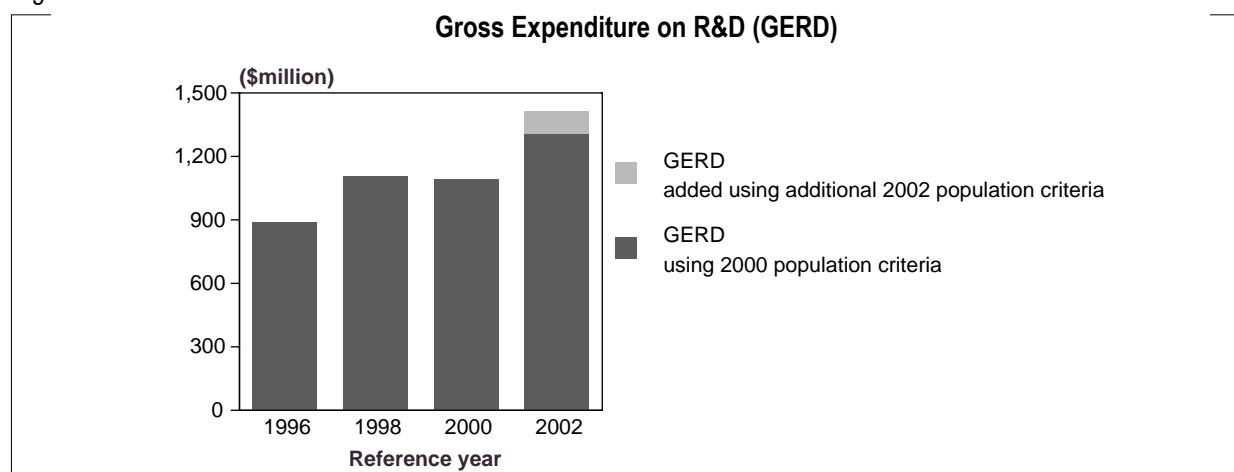


Table 1.01 shows total R&D expenditure from the 1996 to the 2002 reference years.

Table 1.01

Gross Expenditure on R&D (GERD)						
	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
	\$(million)					
Gross expenditure on R&D (GERD)	889.1	1,108.3	1,091.2	1,308.3	107.9	1,416.2

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 population selection criteria.
 (3) Total expenditure in 2002.

Table 1.02 shows that R&D as a percentage of gross domestic product (GDP) was 1.06 percent in the 2002 reference year (using the 2000 population selection criteria), compared with 1.00 percent in the 2000 reference year.

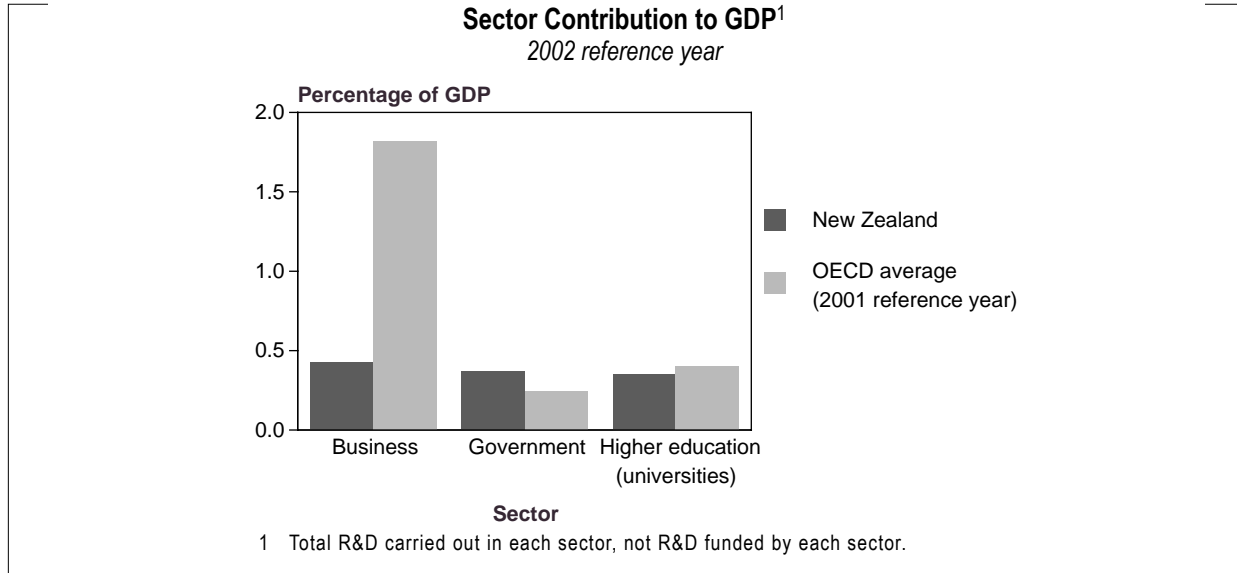
Table 1.02

GERD as Proportion of GDP ⁽¹⁾						
	1996	1998	2000	2002 ⁽²⁾	2002 ⁽³⁾	2002 ⁽⁴⁾
	Percent					
Percentage of gross domestic product	0.95	1.10	1.00	1.06	0.09	1.15

(1) Statistics New Zealand GDP current price expenditure measure, year ended 30 June.
 (2) Firms selected according to the 2000 population selection criteria.
 (3) Firms selected according to the 2002 population selection criteria.
 (4) Total expenditure in 2002.

Figure 1.02 shows the contribution to GDP made by the various sectors, compared with the Organisation for Economic Co-operation and Development (OECD) average.

Figure 1.02



GERD by type of expenditure

As table 1.03 shows, wages and salaries accounted for 48.3 percent of GERD in the 2002 reference year. Other current expenditure (including consumables and overheads incurred by direct and indirect R&D support activities) accounted for 40.7 percent of GERD, while capital expenditure on R&D contributed the remaining 11 percent.

Table 1.03

Gross Expenditure on R&D (GERD)

By expenditure type
2002 reference year

	\$(million)	Percentage of GERD
Wages and salaries ⁽¹⁾	683.8	48.3
Other current expenditure ⁽²⁾	576.7	40.7
Capital expenditure ⁽³⁾	155.8	11.0
Total	1,416.2	100.0

(1) Wages and salaries in the business and government sectors include wages and salaries for R&D personnel. They also include other employment related costs (eg overtime, holiday pay, sick pay, redundancy and severance payments). They exclude wages and salaries of personnel indirectly supporting R&D. Wages and salaries in the higher education sector are modelled estimates based on total university wages, salaries and other employment related costs.

(2) Other current expenditure in the business and government sectors includes all consumables and overheads incurred by direct and indirect R&D support activities (eg materials, power, rent, repairs etc.). It includes the wages and salaries of personnel indirectly supporting R&D (only the part of wages and salaries that is attributable to the indirect support of R&D). For example, central finance or personnel services. Other current expenditure in the higher education sector is a modelled estimate based on all consumables and overheads incurred by direct and indirect university support activities. Depreciation is excluded in all three sectors.

(3) Capital expenditure on R&D in the business and government sectors includes purchases of land and buildings; and purchases of plant, equipment, machinery, vehicles, capitalised software and other assets. Capital expenditure in the higher education sector is a modelled estimate based on total university expenditure on land and buildings; and purchases of plant, equipment, machinery, vehicles, capitalised software and other assets.

Note: Due to rounding, some figures may not add to stated total.

GERD by type of research¹

R&D 2002 calculated gross expenditure on three categories of research – pure basic research; strategic research; and applied research and experimental development combined.

As table 1.04 shows, more than half (54.2 percent) of GERD in the 2002 reference year was spent on applied research and experimental development. More than a quarter (25.5 percent) was spent on strategic research, while pure basic research accounted for the remaining 20.2 percent.

Table 1.04

Gross Expenditure on R&D (GERD)

By research type
2002 reference year

	\$million	Percentage
Pure basic research	286.5	20.2
Strategic research	361.5	25.5
Applied research and experimental development	768.2	54.2
Total	1,416.2	100.0

Note: Due to rounding, some figures may not add to stated total.

¹ See Appendix A: Technical documentation for definitions of the different types of research.

GERD by sector

R&D 2002 measured R&D expenditure in the business, government and higher education (universities) sectors. Some countries calculate R&D expenditure by private non-profit organisations separately, but in the New Zealand survey they are included in the business sector.

The business sector undertook 37 percent of expenditure on R&D in New Zealand in the 2002 reference year. The government sector undertook 32 percent and the higher education sector 31 percent.

Figure 1.03 shows that the distribution of R&D activity across the three sectors in New Zealand is quite different from the OECD average. In the 2001 reference year in the OECD, an average of 69 percent of R&D was carried out by the business sector, 17 percent by the higher education sector and 13 percent by the government sector (OECD, 2003).

Figure 1.03

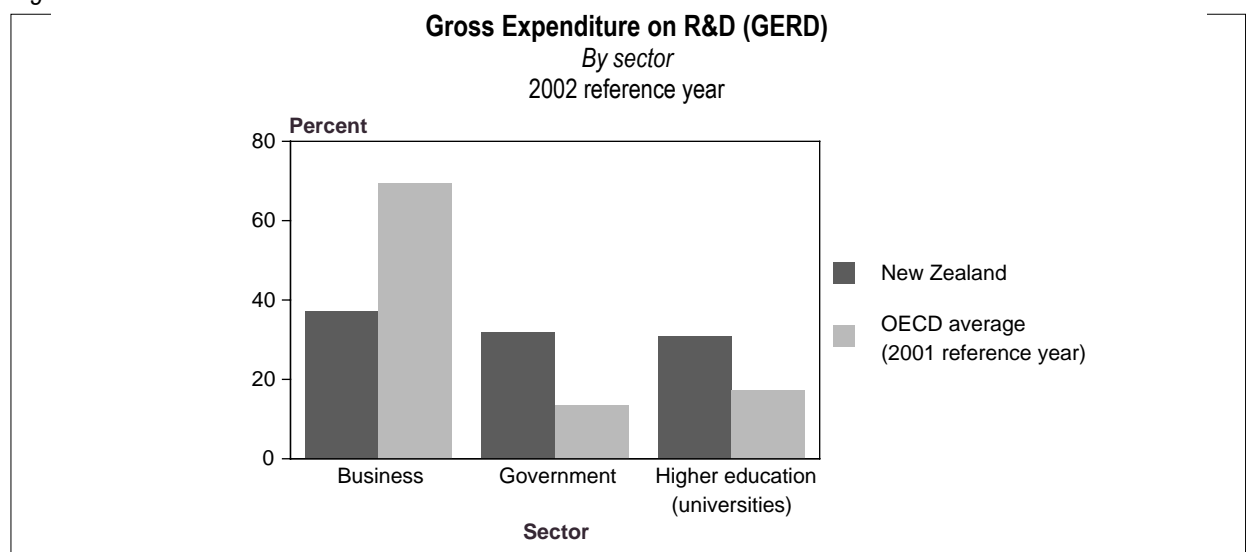


Table 1.05 shows GERD by sector from the 1994 reference year.

Table 1.05

Gross Expenditure on R&D (GERD)
By sector
By reference year

	1994	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
	\$(million)						
Business	247.9	240.3	312.5	324.1	422.9	101.1	524.0
Government	343.4	375.7	391.3	393.0	449.6	6.8	456.4
Universities	233.5	273.4	403.6	374.1	435.8		435.8
Total	824.8	889.3	1,107.4	1,091.3	1,308.3	107.9	1,416.2

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 population selection criteria.
 (3) Total expenditure in 2002.

Note: Due to rounding, some figures may not add to stated total.

Source of funding

The source of funding for R&D does not necessarily equal expenditure on R&D. Such an imbalance may occur for a number of reasons, such as funding being provided for R&D activities not carried out in the reference period. As table 1.06 shows, the total source of funds provided for R&D in the 2002 reference year was \$1,438.8 million. Total R&D expenditure in the reference year was \$1,416.2 million.

Table 1.06

R&D Funding <i>By source of funds</i> 2002 reference year		
	\$million	Percentage
NZ business ⁽¹⁾	535.4	37.2
NZ government ⁽²⁾	667.0	46.4
NZ universities	115.1	8.0
Overseas	94.7	6.6
Other funding sources	26.6	1.8
Total	1,438.8	100.0

(1) Includes state-owned enterprises.
(2) Includes New Zealand local government agencies.

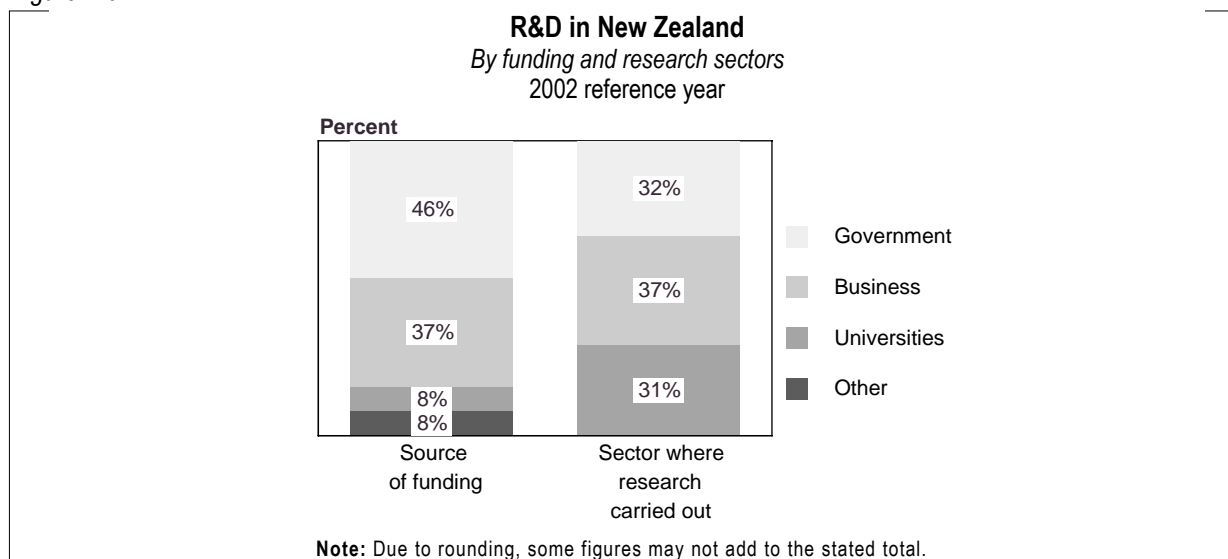
Figure 1.04 summarises funding of research in New Zealand in 2002 and the sectors where R&D was carried out. The government funded 46 percent (\$667 million) of research in New Zealand in 2002 and carried out just under a third (32 percent). The university sector funded only 8 percent (\$115 million) of R&D, but carried out 31 percent.

Between them, the government and the business sector provided 84 percent of funds for R&D in New Zealand in the 2002 reference year. The rest of the funding came from the university sector (\$115 million) and other sources (\$121 million).

The proportion of R&D funding provided by the government in New Zealand (46 percent) is higher than the OECD average (29 percent¹), while the proportion of funding provided by the business sector (37 percent) in New Zealand is lower than the OECD average (64 percent¹) (OECD, 2003).

When New Zealand's research is looked at in relation to GDP however, total research funded by the New Zealand government as a percentage of GDP is 0.54 percent, which is less than the OECD average at 0.67 percent or Australia at 0.71 percent. This is due to the fact that although the New Zealand government's share of the total is more than the OECD average share, total R&D for New Zealand is less than half OECD total R&D as a percentage of GDP.

Figure 1.04



1 In the 2001 reference year.

Collaboration among sectors

Collaboration among sectors is seen as an important requirement of the innovation system for a number of reasons. It can result in lower costs and lower innovation risks, as well as the sharing of scientific or technical knowledge. Firms can seek access to the fundamental knowledge necessary for their research; universities can seek links to commercialise their research and obtain funding; and the government can look to alliances that ensure that the economy benefits from public research.

Table 1.07 shows that 20 percent of funding provided for R&D in the government sector was supplied by New Zealand businesses, while 9 percent of funding for R&D in the business sector was supplied by the government. Five percent of funding provided for R&D in the university sector came from New Zealand businesses.

Table 1.07

R&D Funding				
<i>By source allocation</i>				
2002 reference year				
Source of funds	Government	Business	Universities	Total
\$(million)				
NZ government ⁽¹⁾	355.7	47.1	264.2	667.0
NZ business ⁽²⁾	96.7	415.5	23.2	535.4
NZ universities	1.8	0.1	113.2	115.1
Overseas	18.6	61.8	14.3	94.7
Other funding sources	1.2	4.5	20.9	26.6
Total source of funds	474.0	529.0	435.8	1,438.8
Total R&D expenditure	456.4	524.0	435.8	1,416.2
Difference	17.6	5.0	0.0	22.6
Percent				
NZ government ⁽¹⁾	75	9	61	46
NZ business ⁽²⁾	20	79	5	37
NZ universities	0	0	26	8
Overseas	4	12	3	7
Other funding sources	0	1	5	2
Total source of funds	100	100	100	100
<p>(1) Includes New Zealand local government agencies.</p> <p>(2) Includes state-owned enterprises.</p> <p>Note: Due to rounding, some figures may not add to stated total.</p>				

R&D personnel

R&D personnel information was collected in R&D 2002 by both a headcount and on the full-time equivalent employee (FTE)² basis. R&D personnel information was also collected by occupation. Categories collected included researchers,³ technicians and support staff.

As table 1.08 shows, total FTE R&D staff in New Zealand for the 2002 reference year was estimated to be 17,768. Seventy-four percent were researchers, with the rest technicians (16 percent) and support staff (10 percent).

Statistics New Zealand does not advise comparison of total R&D personnel data in 2002 with results produced in previous surveys. There have been significant changes in the methodology used to calculate R&D FTEs in the university sector (which accounted for 66 percent of total researchers), which impacts on the ability to make these comparisons. Note that comparisons have been made in the business and government sections of the report.

Table 1.08

Personnel Involved in R&D⁽¹⁾ By full-time equivalent employee 2002 reference year

	Number
Researchers ⁽²⁾	13,133
Technicians	2,784
Support staff	1,851
Total	17,768

(1) See Appendix A: Technical documentation for definitions of the different types of research.

(2) Post-graduate research students counted in the universities component of the survey have been included in the researchers category.

Supplementary table

Table 1.09

OECD R&D Expenditure⁽¹⁾ 2001 reference year (OECD)

	Million current PPP \$	Percentage of GERD
Business Enterprise Expenditure on R&D (BERD)	449,301.1	69.3
Government Intramural Expenditure on R&D (GOVERD)	66,851.1	13.4
Higher Education Expenditure on R&D (HERD)	111,817.9	17.3
Gross Domestic Expenditure on R&D (GERD) ⁽²⁾	645,409.6	100.0

(1) OECD, *Main Science and Technology Indicators*, May 2003.

(2) The secretariat made a number of estimates to fill gaps and update series in order to obtain a full data set for OECD countries. This has resulted in the sum of BERD, GOVERD and HERD not equalling the value recorded for GERD.

2 The headcount of R&D personnel includes a count of all personnel involved in research activities. The full-time equivalent employee (FTE) measure takes into account each person's total working time on research activities. For example, a full-time employee spending half their time on research activities during the year would contribute 0.5 towards the FTE measure.

3 Post-graduate research students counted in the universities component of the survey have been included in the researchers category in this section.

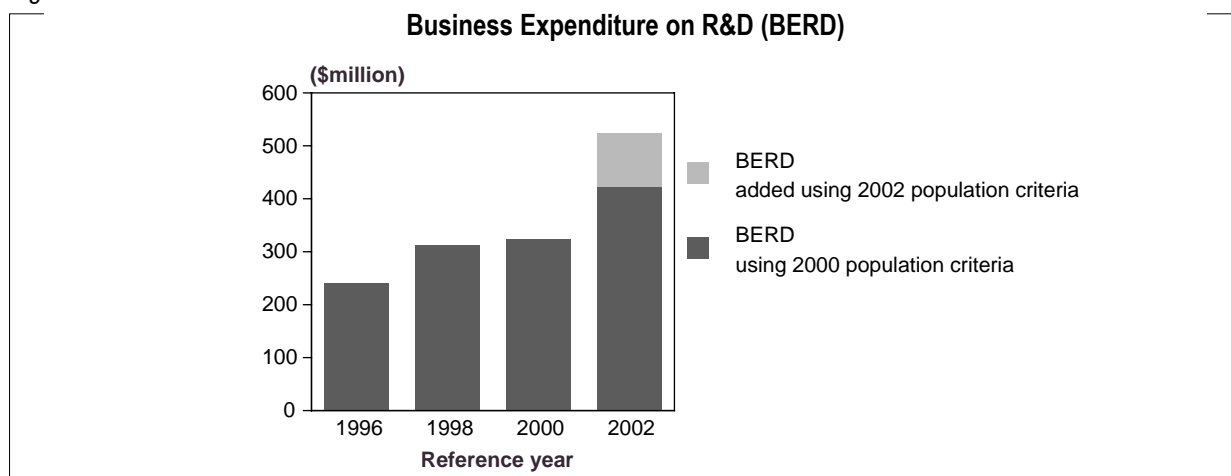
Part 2

Business sector

Total business expenditure on R&D (BERD)

Total business expenditure on R&D (BERD) in 2002 was estimated at \$524.0 million, as shown in figure 2.01. Of this amount, \$422.9 million was spent by enterprises selected using the 2000 population selection criteria. The remaining \$101.1 million was spent by enterprises in the 2002 additional population.

Figure 2.01



Adjusted for methodology changes, BERD increased 30.5 percent between the 2000 and 2002 reference years, from \$324.1 million to \$422.9 million, as show in table 2.01.

Table 2.01

	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
				\$(million)		
Expenditure	240.1	312.5	324.1	422.9	101.1	524.0

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 additional population selection criteria.
 (3) Total expenditure in 2002.

Ratio of BERD to gross domestic product (GDP)

As shown in table 2.02, the large increase in the dollar value of BERD was reflected in an equally significant increase in BERD as a percentage of GDP, from 0.30 percent in 2000 to 0.42 percent in 2002. Of this increase, 0.04 percentage points were attributable to increased R&D activity by enterprises included in the survey through the 2000 population selection criteria. The rest of the increase (0.08 percentage points) came from the additional coverage in the 2002 survey.

Table 2.02

BERD as Proportion of GDP ⁽¹⁾						
By reference year						
	1996	1998	2000	2002 ⁽²⁾	2002 ⁽³⁾	2002 ⁽⁴⁾
	Percent					
Percentage of GDP	0.26	0.31	0.30	0.34	0.08	0.42

(1) Expenditure on GDP at current prices for year ended June of each reference period (using data available after the March 2003 quarter GDP release).
 (2) Firms selected according to the 2000 population selection criteria.
 (3) Firms selected according to the 2002 additional population selection criteria.
 (4) Total expenditure in 2002.

Figure 2.02 shows that New Zealand continues to have lower BERD as a proportion of GDP than the Organisation for Economic Co-operation and Development (OECD) average.

Figure 2.02

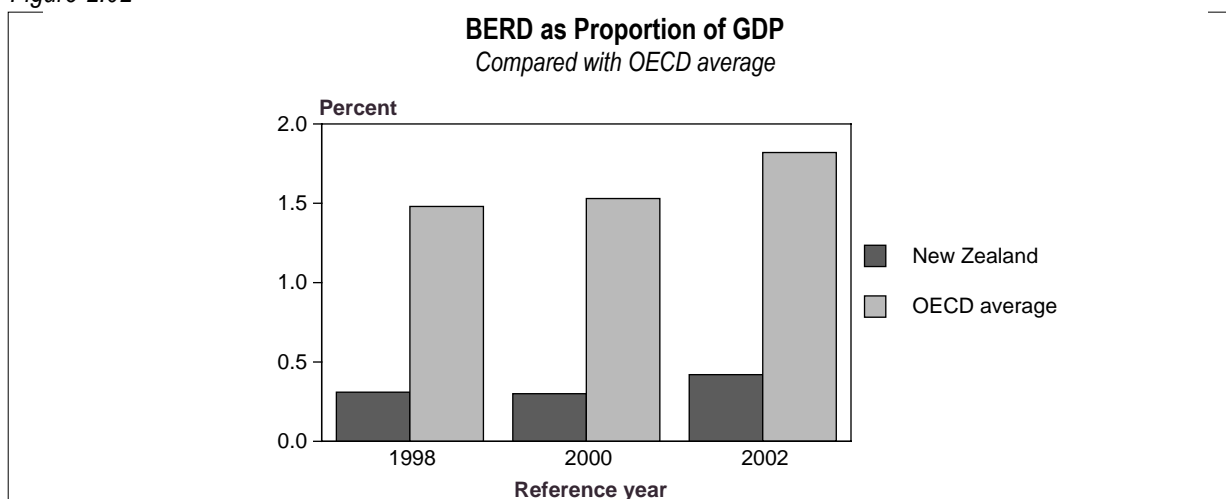
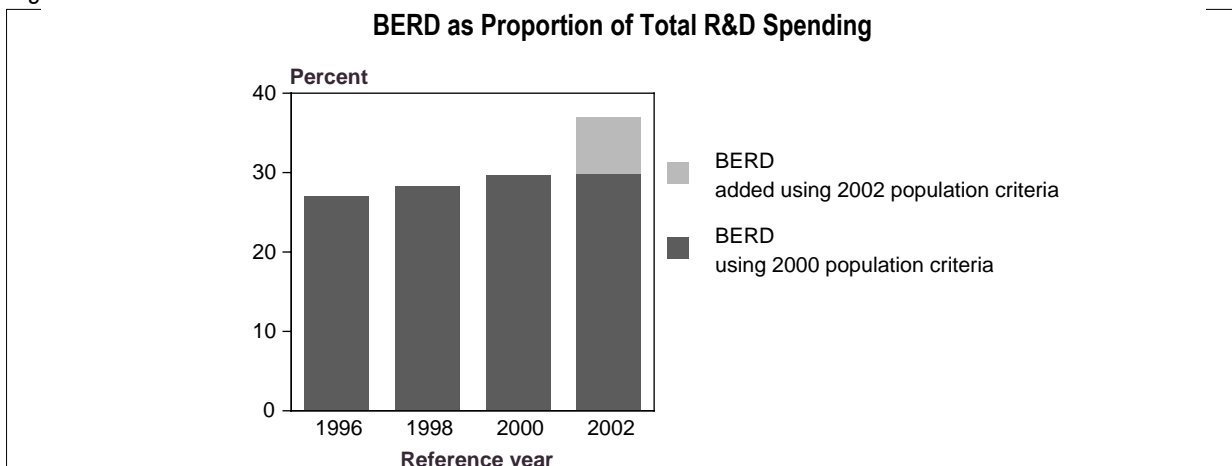


Figure 2.03 shows that using the 2000 population criteria, BERD in the 2002 reference year was 29.9 percent of total R&D spending. This compared with 29.7 percent in 2000. The proportion increased by 7.1 percentage points to 37 percent using the 2002 population criteria.

Figure 2.03



Source of funds

As figure 2.04 shows, the New Zealand business sector continued to fund most of business R&D (79 percent) from its own resources. This proportion compares with 84 percent in 2000, 79 percent in 1998 and 86 percent in 1996. There was a significant increase in funds sourced from abroad (12 percent in 2002, compared with 5 percent in 2000). The government provided 9 percent of funds in 2002, while higher education and non-profit organisations combined provided 0.8 percent.

Figure 2.04

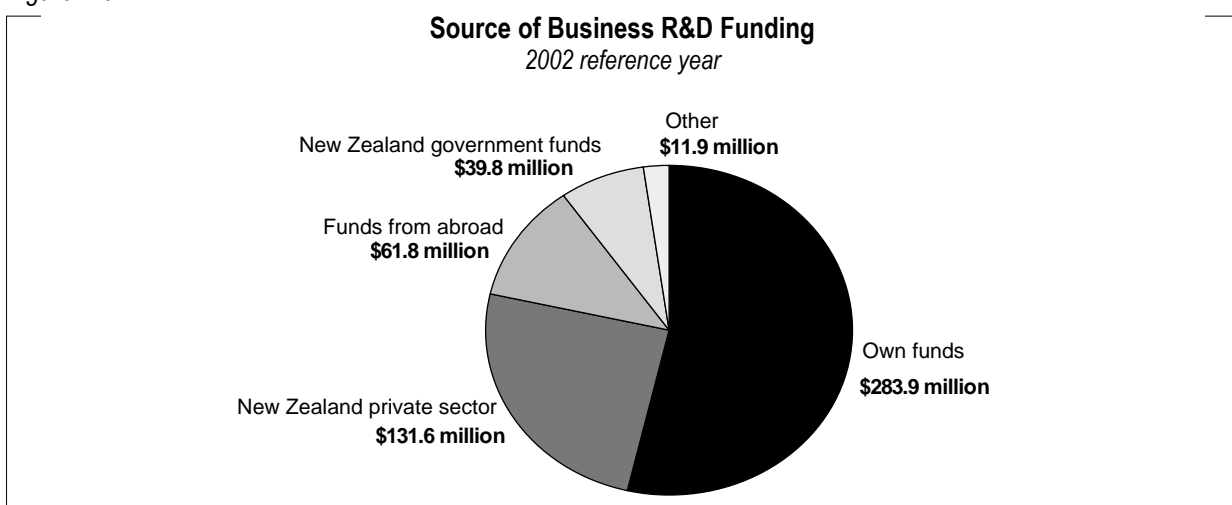


Table 2.03 compares business R&D funding sources from 1996 to 2002.

Table 2.03

Business R&D Funding						
<i>By source of funds</i>						
Year ended 30 June						
	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
	\$(million)					
Private sector	55.3	79.0	77.5	106.9	24.7	131.6
Government funding agencies	14.4	23.7	27.1	33.7	6.1	39.8
Government departments	2.1	3.1	4.0	7.0	0.0	7.0
Local government	0.2	..C	..C	0.3	0.0	0.3
Tertiary education	0.3	..C	..C	0.1	0.0	0.1
Overseas	14.0	35.6	17.4	57.0	4.8	61.8
Own funds	155.5	172.6	198.8	218.0	65.9	283.9
Other	2.1	0.6	3.7	3.9	0.6	4.5
Total	244.0	317.2	329.0	426.9	102.1	529.0
	Percent of total business R&D funds					
Private sector	22.7	24.8	23.5	20.2	4.7	24.9
Government funding agencies	5.9	7.4	8.3	6.4	1.2	7.5
Government departments	0.9	1.0	1.2	1.3	0.0	1.3
Local government	0.1	..C	..C	0.1	0.0	0.1
Tertiary education	0.1	..C	..C	0.0	...	0.0
Overseas	5.7	11.2	5.3	10.8	0.9	11.7
Own funds	63.7	54.4	60.4	41.2	12.5	53.7
Other	0.9	0.2	1.1	0.7	0.1	0.9
Total	100.0	100.0	100.0	80.7	19.3	100.0

(1) Firms selected according to the 2000 population selection criteria.
(2) Firms selected according to the 2002 additional population selection criteria.
(3) Total expenditure in 2002.

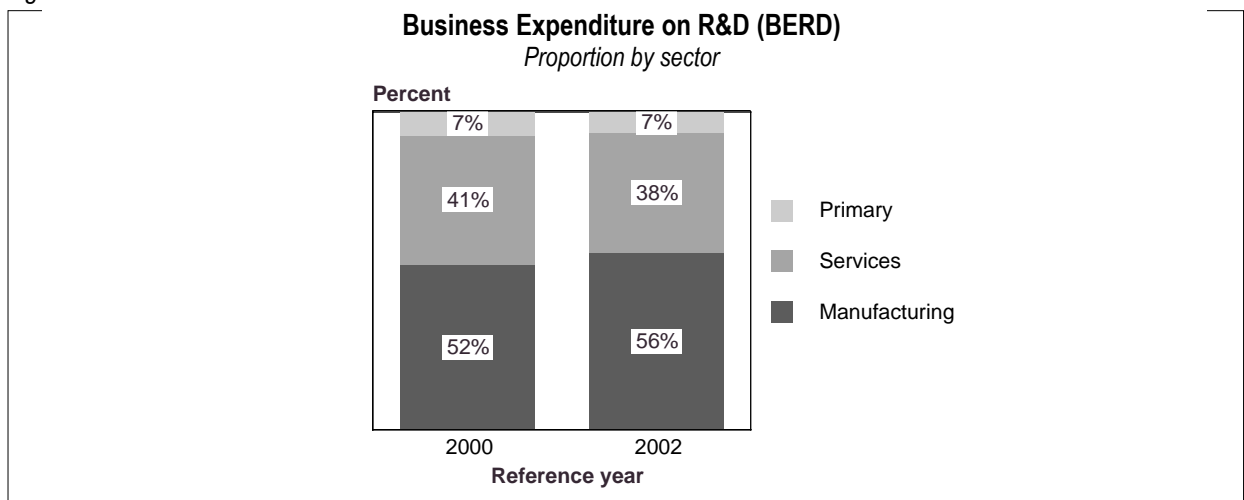
Note: Due to rounding, some figures may not add to stated total.

Symbols:
C confidential
.. figures not available
... not applicable

BERD by industry

Fifty-six percent of BERD was spent by the manufacturing sector in 2002, as figure 2.05 shows. R&D expenditure by the manufacturing sector was concentrated in three areas: machinery and equipment manufacturing (37 percent), petroleum, coal, chemical and associated product manufacturing (27 percent), and food, beverage and tobacco manufacturing (23 percent). The distribution of BERD across broad industrial sectors remained relatively unchanged between 2000 and 2002.

Figure 2.05



Total manufacturing R&D in 2002 using the 2000 population selection criteria was \$245.6 million, an increase of 46 percent on 2000, as shown in table 2.04.

R&D expenditure in the service sector was \$198.8 million in 2002, or 38 percent of all BERD. Computer and related activities was the biggest spender within the service sector, accounting for 31 percent of the sector's spending on R&D.

Table 2.04

Business Expenditure on R&D (BERD)
By sector
By reference year

	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
	\$(million)			
Primary	23.6	20.1	14.1	34.2
Food, beverage and tobacco manufacturing	27.1	61.8	6.0	67.8
Petroleum, coal, chemical and associated product manufacturing	29.2	56.2	23.1	79.3
Fabricated metal products except machinery and equipment	6.0	3.7	2.1	5.8
Radio, television and communication equipment and apparatus	37.0	39.8	0.7	40.5
Other manufacturing	69.2	84.1	13.5	97.6
Manufacturing	168.5	245.6	45.4	291.0
Wholesale, retail trade and motor vehicle repair	33.7	24.1	7.0	31.1
Computer and related activities	25.5	42.2	20.2	62.4
Other services (including other business activities)	72.8	90.9	14.4	105.3
Services	132.0	157.2	41.6	198.8
Total	324.1	422.9	101.1	524.0

(1) Firms selected according to the 2000 population selection criteria.

(2) Firms selected according to the 2002 additional population selection criteria.

(3) Total expenditure in 2002.

Note: Due to rounding, some figures may not add to stated total.

Table 2.05

Business Expenditure on R&D (BERD)				
<i>Proportions by sector</i>				
By reference year				
	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
Percent				
Primary	7.3	3.8	2.7	6.5
Manufacturing	52.0	46.9	8.7	55.6
Services	40.7	30.0	7.9	37.9
Total	100.0	80.7	19.3	100.0

(1) Firms selected according to the 2000 population selection criteria.
(2) Firms selected according to the 2002 additional population selection criteria.
(3) Total expenditure in 2002.

Table 2.06 shows the proportion of BERD spent by various industries in the 2002 reference year.

Table 2.06

Business Expenditure on R&D (BERD)⁽¹⁾			
<i>By industry</i>			
2002 reference year			
	2002		
	No. of Firms	\$(million)	Percent
Primary	109	34.2	6.5
Food, beverages and tobacco	114	67.8	12.9
Textiles, fur and leather, wood, paper, printing, publishing	136	24.2	4.6
Petroleum, coal, chemical and associated product manufacturing	133	79.3	15.1
Non-metallic mineral products	26	4.1	0.8
Basic metals	15	2.4	0.5
Fabricated metal products except machinery and equipment	52	5.8	1.1
Machinery and equipment nec	108	30.6	5.8
Office accounting and computing machinery	6	..C	..C
Electrical machinery and apparatus nec	32	12.2	2.3
Radio, television and communication equipment and apparatus	38	40.6	7.7
Medical, precision and optical instruments, watches and clocks	14	..C	..C
Motor vehicles, trailers and semi-trailers	17	2.2	0.4
Other transport equipment	23	1.3	0.2
Furniture and manufacturing nec	42	2.0	0.4
Manufacturing	756	291.1	55.6
Electricity, gas and water	12	..C	..C
Construction	46	2.1	0.4
Wholesale, retail trade, motor vehicle repair	278	31.2	5.9
Hotels and restaurants	22	-	-
Transport, storage and communications	43	9.5	1.8
Financial intermediation (including insurance)	76	..C	..C
Renting of office machinery and equipment	7	0.3	0.0
Computer and related activities	196	62.4	11.9
Research and development	30	3.9	0.8
Other business activities	262	59.5	11.3
Community, social and personal service activities	100	21.5	4.1
Other services	32	0.2	0.0
Services	1,103	198.7	37.9
Total	1,968	524.0	100.0

(1) The industries listed in this table are defined according to ISIC Rev3. Appendix A: Technical documentation contains a concordance between this and the ANZSIC industrial classification system.

Note: Due to rounding, some figures may not add to stated total.

Symbols:
C confidential
nec not elsewhere classified
- nil or zero
.. figures not available

BERD by size of business

As table 2.07 shows, businesses employing fewer than 50 full-time equivalent employees (FTEs) spent 37 percent of BERD in 2002. Firms employing between 100 and 500 FTEs spent 40 percent of the total. The largest firms (those employing 1,000 FTEs or more) accounted for 6 percent of total BERD, down slightly on the 8 percent recorded in 2000. Firms with fewer than 500 FTEs accounted for 86 percent of BERD in 2002.

Table 2.07

Business Expenditure on R&D (BERD)						
<i>Proportion by size of business</i>						
By reference year						
FTEs	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
Percent						
Fewer than 50	31.5	24.4	25.5	26.2	10.5	36.7
50-99	10.8	11.2	16.8	7.6	0.9	8.5
100-499	38.1	37.3	39.7	33.3	7.0	40.3
500-999	9.3	16.3	10.5	8.0	0.6	8.6
1,000 and over	10.3	10.8	7.6	5.6	0.4	6.0
Total	100.0	100.0	100.0	80.7⁽⁴⁾	19.3⁽⁴⁾	100.0

(1) Firms selected according to the 2000 population selection criteria.

(2) Firms selected according to the 2002 additional population selection criteria.

(3) Total expenditure in 2002.

(4) The percentages in this column are calculated using the total value of expenditure for 2002.

Tables 2.08a and 2.08b compare the amount spent on BERD by firms having less than 50 FTEs with the amount spent by firms having 50 or more FTEs in the 2000 and 2002 reference years.

Table 2.08a

Business Expenditure on R&D (BERD)				
<i>By firm size in sector</i>				
2000 reference year				
	2000			
	49 or fewer FTEs		50 or more FTEs	
	(\$million)	Firms	(\$million)	Firms
Primary	3.4	41	20.2	12
Food, beverage and tobacco manufacturing	2.3	23	24.8	43
Petroleum, coal, chemical and associated product manufacturing	5.9	59	23.4	27
Fabricated metal products except machinery and equipment	1.6	27	4.4	14
Radio, television and communication equipment and apparatus	4.7	19	32.3	7
Other manufacturing	10.2	139	57.9	76
Manufacturing	24.7	267	142.8	167
Wholesale, retail trade and motor vehicle repair	11.6	126	22.1	20
Computer and related activities	15.1	74	10.4	9
Other services (including other business activities)	27.4	291	45.4	83
Services	54.1	491	77.9	112
Total	82.7	799	241.4	291

Table 2.08b

Business Expenditure on R&D (BERD)				
<i>By firm size in sector</i>				
2002 reference year				
	2002			
	49 or fewer FTEs		50 or more FTEs	
	(\$million)	Firms	(\$million)	Firms
Primary	13.0	84	21.2	25
Food, beverage and tobacco manufacturing	2.6	56	65.2	58
Petroleum, coal, chemical and associated product manufacturing	17.4	92	61.9	41
Fabricated metal products except machinery and equipment	3.2	36	2.6	16
Radio, television and communication equipment and apparatus	3.9	30	36.6	8
Other manufacturing	23.4	286	74.2	133
Manufacturing	50.5	500	240.5	256
Wholesale, retail trade and motor vehicle repair	13.1	226	18.0	52
Computer and related activities	31.6	169	30.8	27
Other services (including other business activities)	83.8	512	21.5	117
Services	128.5	907	70.3	196
Total	192.0	1,491	332.0	474

Note: Due to rounding, some figures may not add to stated total.

Businesses employing fewer than 50 FTEs in 2002 accounted for 37 percent of BERD. These firms were concentrated in the services sector. The remainder, ie employing 50 or more FTEs, accounted for 63 percent of BERD and were mainly in the manufacturing sector. Figures 2.06a, 2.06b and 2.06c show by sector BERD spent by firms in each size category.

Figure 2.06a

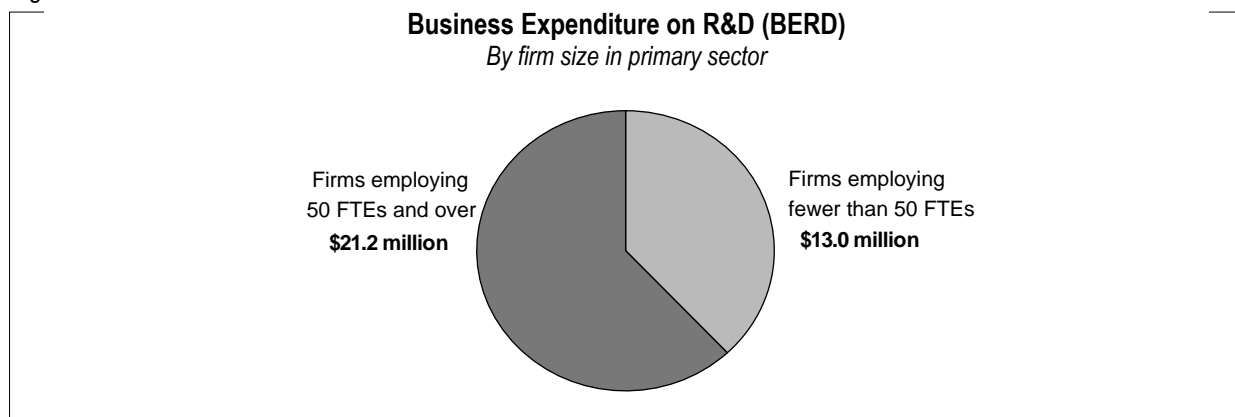


Figure 2.06b

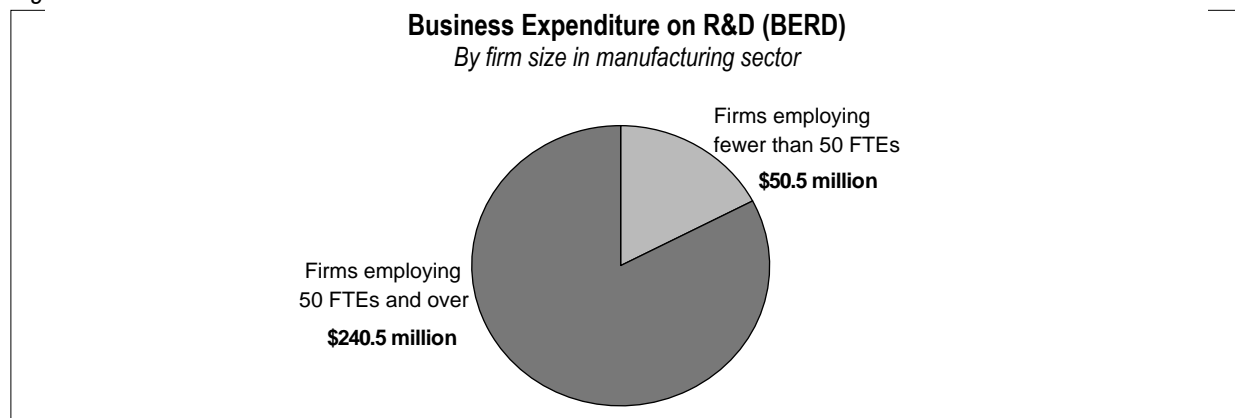
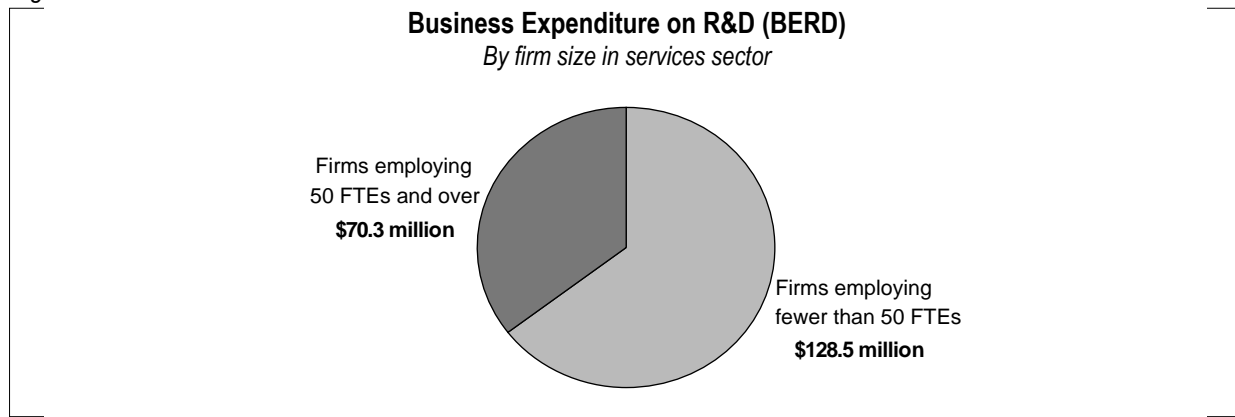


Figure 2.06c



BERD by technology

Distribution of BERD across the technology classes in 2002 remained relatively unchanged from 2000, as figures 2.07a and 2.07b and table 2.09 show.

Figure 2.07a

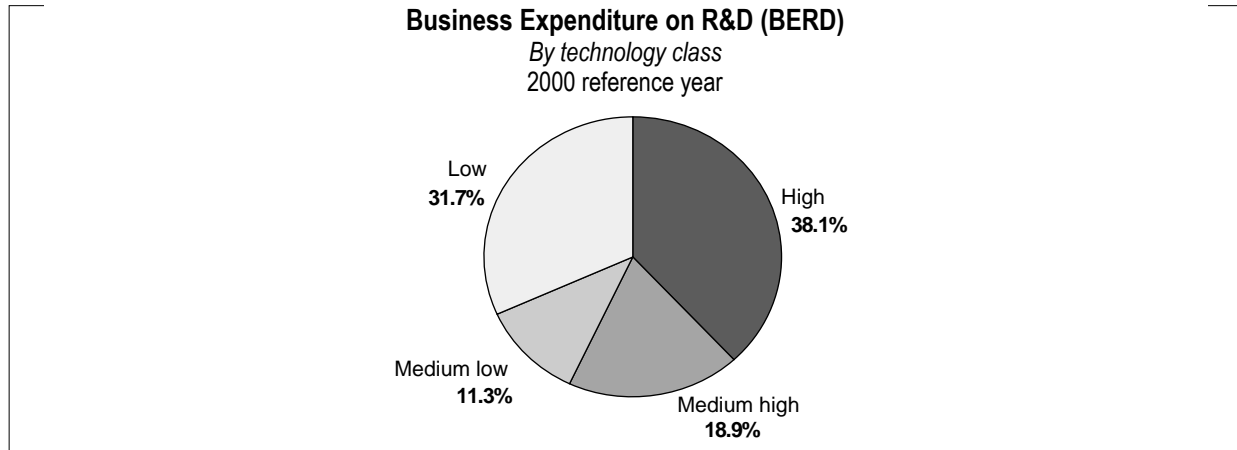


Figure 2.07b

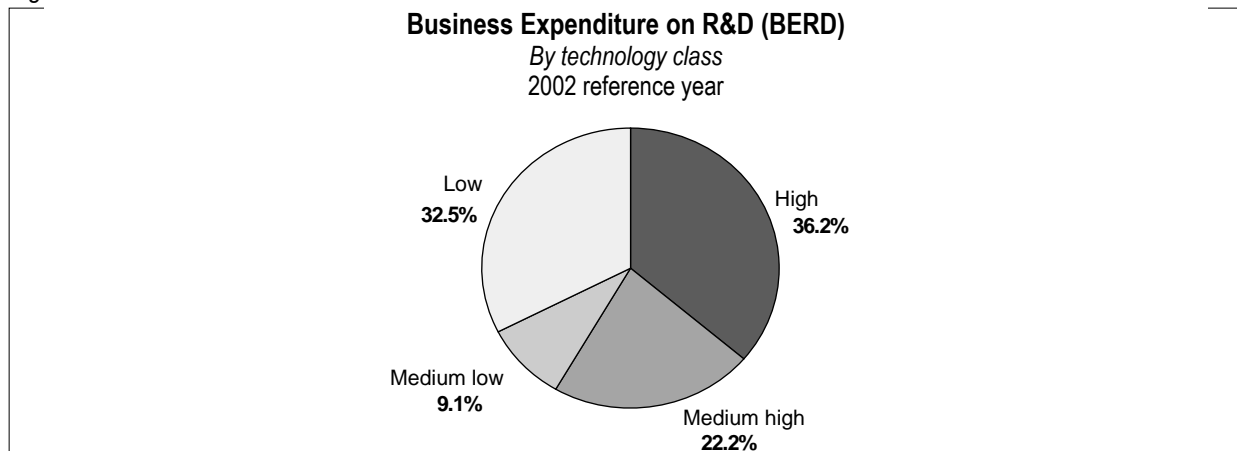


Table 2.09

R&D Expenditure by Manufacturing Industries				
<i>By technology intensity</i>				
<i>By reference year</i>				
	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
	\$(million)			
High	64.2	100.8	4.6	105.5
Medium-high	31.9	38.8	25.9	64.7
Medium-low	19.0	19.8	6.6	26.5
Low	53.4	86.1	8.4	94.5
Total	168.5	245.6	45.6	291.2
	Percent			
High	38.1	34.6	1.6	36.2
Medium-high	18.9	13.3	8.9	22.2
Medium-low	11.3	6.8	2.3	9.1
Low	31.7	29.6	2.9	32.5
Total	100.0	84.3⁽⁴⁾	15.7⁽⁴⁾	100.0

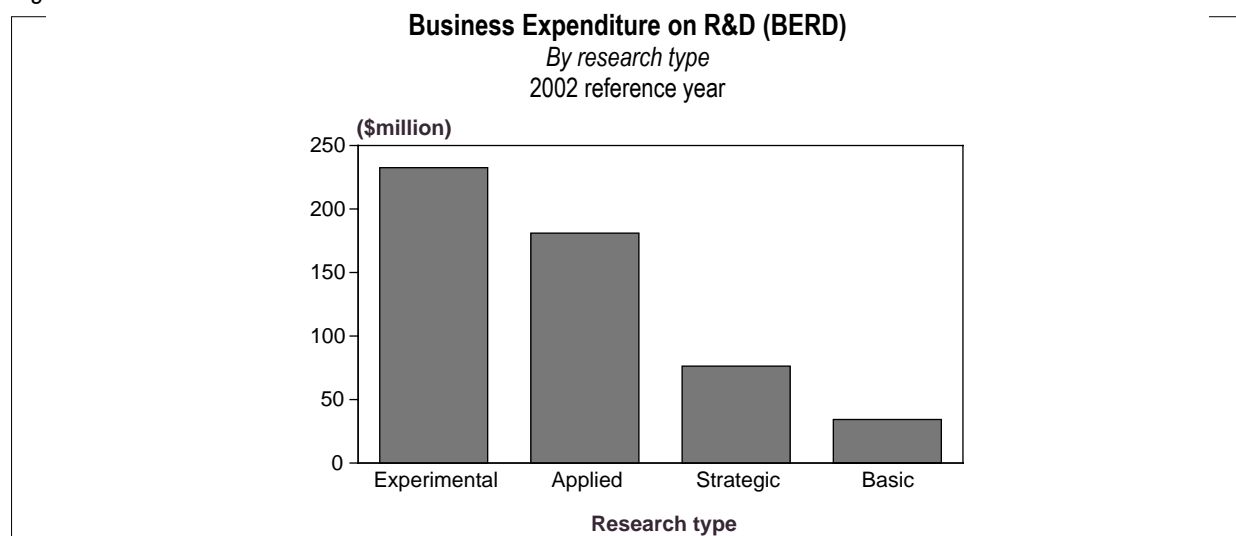
(1) Firms selected according to the 2000 population selection criteria.
(2) Firms selected according to the 2002 additional population selection criteria.
(3) Total expenditure in 2002.
(4) The percentages in this column are calculated using the total expenditure for 2002.

Note: Due to rounding, some figures may not add to stated total.

BERD by type of research⁽¹⁾

R&D 2002 included for the first time a question on the type of research carried out by enterprises. As illustrated in figure 2.08, this showed that BERD was heavily focussed on applied and experimental research, which together accounted for 79 percent of total business spending on R&D.

Figure 2.08



(1) See Appendix A: Technical documentation for definitions of the four types of research.

Table 2.10 breaks down BERD by research type, while table 2.11 shows amounts spent by various industries on each type of research.

Table 2.10

Business Expenditure on R&D (BERD)

By research type
2002 reference year

	\$(million)	Percent
Basic	34.3	6.5
Strategic	76.3	14.6
Applied	181.0	34.5
Experimental	232.5	44.4
Total R&D expenditure	524.0	100.0

Note: Due to rounding, some figures may not add to stated total.

Table 2.11

Business Expenditure on R&D (BERD)

By industry and research type
2002 reference year

	Basic	Strategic	Applied	Experimental	Total
	\$(million)				
Primary	..C	..C	10.9	5.8	34.2
Manufacturing					
Basic metals	-	..C	..C	0.9	2.4
Petroleum, coal, chemical and associated product manufacturing	..C	..C	23.5	41.5	79.3
Textiles, fur and leather, wood, paper, printing, publishing	..C	..C	..C	9.6	24.2
Other manufacturing	1.9	3.9	20.9	50.1	76.9
Fabricated metal products except machinery and equipment	0.3	0.9	1.6	3.1	5.8
Food beverages and tobacco	..C	..C	17.6	33.4	67.8
Machinery and equipment nec	2.0	4.7	9.2	14.6	30.6
Non-metallic mineral products	..C	..C	1.7	1.6	4.1
Services					
Other business activities	5.3	8.1	27.8	18.3	59.5
Community, social and personal service activities	2.8	1.4	12.6	4.6	21.5
Research and development	0.6	1.2	1.7	0.5	3.9
Other services (including other business activities)	12.6	4.6	32.0	33.2	82.8
Wholesale, retail trade, motor vehicle repairs	0.6	2.9	12.4	15.2	31.2
Total	34.3	76.3	181.0	232.5	524.0
	Percent				
Primary	..C	..C	6.0	2.5	6.5
Manufacturing					
Basic metals	..C	..C	..C	0.4	0.5
Petroleum, coal, chemical and associated product manufacturing	..C	..C	13.0	17.8	15.1
Textiles, fur and leather, wood, paper, printing, publishing	..C	..C	..C	4.1	4.6
Other manufacturing	5.6	5.1	11.6	21.5	14.7
Fabricated metal products except machinery and equipment	0.8	1.2	0.9	1.3	1.1
Food beverages and tobacco	..C	..C	9.7	14.4	12.9
Machinery and equipment nec	5.9	6.2	5.1	6.3	5.8
Non-metallic mineral products	..C	..C	1.0	0.7	0.8
Services					
Other business activities	15.6	10.6	15.3	7.9	11.3
Community, social and personal service activities	8.1	1.8	7.0	2.0	4.1
Research and development	1.8	1.5	0.9	0.2	0.8
Other services (including other business activities)	36.8	6.0	17.7	14.3	15.8
Wholesale, retail trade, motor vehicle repairs	1.7	3.8	6.9	6.5	5.9
Total	100.0	100.0	100.0	100.0	100.0

Note: Due to rounding, some figures may not add to stated total.

Symbols:

- C confidential
- nec not elsewhere classified
- nil or zero
- .. figures not available

BERD by type of expenditure

As figure 2.09 and table 2.12 show, expenditure categories as proportions of total expenditure have remained fairly constant since at least 1996. Other current expenditure made up 41 percent of total expenditure in 2002, compared with 40 percent in 2000. Labour costs, which include redundancy and severance payments, as well as salaries and wages, dropped from 52 percent of total expenditure in 2000 to 47 percent in 2002. This was matched by a rise in capital expenditure. The capital split between land and buildings and plant, machinery and equipment has been stable since 1996.

Figure 2.09

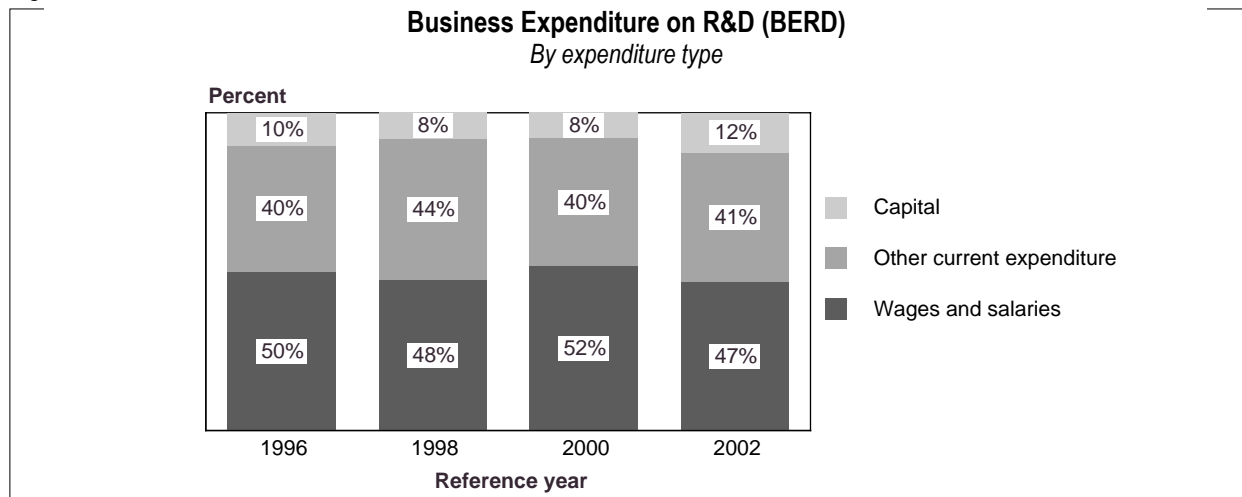


Table 2.12

Business Expenditure on R&D (BERD)
By expenditure type
2002 reference year

	1996	1998	2000	2002
	Percent			
Wages and salaries ⁽¹⁾	50.0	47.5	51.8	46.8
Other current expenditure ⁽²⁾	39.7	44.3	40.2	40.8
Capital expenditure (land and buildings)	1.9	0.8	0.5	1.4
Capital expenditure (other) ⁽³⁾	8.4	7.4	7.5	11.0
Total	100.0	100.0	100.0	100.0

(1) Includes redundancy and severance payments
 (2) Includes all consumables and overheads incurred by direct and indirect support activities. For example, materials, power, rent, rates, repairs, interest, books, travel. Depreciation is excluded.
 (3) Includes purchases of plant, equipment, machinery, vehicles, capitalised software and other assets.

R&D personnel

The 2002 reference year saw more human resources devoted to R&D by the business sector, continuing the trend of recent years. As table 2.13 shows, 4,152 FTEs were employed in 2002, an increase of 864 (26 percent) on 2000. Much of this increase came from businesses added to the survey population by the expanded 2002 population selection criteria. Even without this additional source, however, the number of FTEs would still have increased by 6 percent.

Table 2.13

Personnel Involved in Business R&D

By sector and occupation
2002 reference year

	Full-time equivalent employees (FTEs)			
	Research	Support	Technical	Total
Primary	139	61	96	296
Manufacturing	1,432	287	695	2,414
Services	919	192	331	1,442
Total	2,490	540	1,122	4,152
	Percent			
Primary	5.6	11.3	8.6	7.1
Manufacturing	57.5	53.1	61.9	58.1
Services	36.9	35.6	29.5	34.7
Total	100.0	100.0	100.0	100.0

Note: Due to rounding, some figures may not add to stated total.

Further details of personnel involved in R&D in the business sector are given in tables 2.14, 2.15, 2.16 and 2.17.

Table 2.14

Personnel Involved in Business R&D				
<i>Headcount by industry</i>				
As at 30 June 2002				
	Occupation			
	Research	Technical	Support	Total
Primary	165	117	80	362
Manufacturing				
Food, beverages and tobacco	372	164	106	642
Textiles, fur and leather, wood, paper, printing, publishing	121	..C	..C	327
Petroleum, coal, chemical and associated product manufacturing	215	210	67	493
Non-metallic mineral products	25	12	6	43
Basic metals	16	..C	..C	31
Fabricated metal products except machinery and equipment	59	40	14	114
Machinery and equipment nec	254	127	54	434
Office accounting and computing machinery	..C	..C	..C	..C
Electrical machinery and apparatus nec	86	..C	..C	141
Radio, television and communication equipment	334	96	43	474
Medical, precision and optical instruments, watches and clocks	..C	..C	..C	..C
Motor vehicles, trailers and semi-trailers	13	..C	..C	37
Other transport equipment	9	..C	..C	30
Furniture and manufacturing nec	31	45	13	89
Services				
Electricity, gas and water	..C	..C	..C	..C
Construction	21	18	15	54
Wholesale, retail trade, motor vehicle repair	207	85	54	346
Hotels and restaurants	-	-	-	-
Transport, storage and communications	67	16	10	93
Financial intermediation (including insurance)	..C	..C	..C	..C
Renting of office machinery and equipment	..C	..C	..C	..C
Computer and related activities	397	136	81	613
Research and development	46	11	15	72
Other business activities	399	130	126	654
Community, social and personal service activities	78	67	30	175
Other services	9	..C	..C	13
Total	3,185	1,526	838	5,549

Note: Due to rounding, some figures may not add to stated total.

Symbols:
 C confidential
 nec not elsewhere classified
 - nil or zero
 .. figures not available

Table 2.15

Personnel Involved in Business R&D						
<i>By occupation</i>						
By reference year						
	Full-time equivalent employees (FTEs)					
	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
Researchers	1,580	1,692	2,141	2,080	410	2,490
Technicians	823	829	820	967	155	1,122
Support staff	425	415	327	453	87	540
Total	2,828	2,936	3,288	3,500	652	4,152

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 additional population selection criteria.
 (3) Total expenditure in 2002.

Table 2.16

Personnel Involved in Business R&D*By industry and occupation*
2002 reference year

	Full-time equivalent employees (FTEs)		
	Research	Support	Technical
Primary	139	61	96
Food beverages and tobacco	308	..C	..C
Textiles, fur and leather, wood, paper, printing, publishing	85	..C	..C
Petroleum, coal, chemical and associated product manufact	151	38	165
Non-metallic mineral products	18	..C	..C
Basic metals	8	..C	..C
Fabricated metal products except machinery and equipment	37	4	22
Machinery and equipment nec	200	25	87
Other manufacturing	625	61	166
Manufacturing	1,432	287	695
Construction, electricity, gas and water, and other services	406	68	125
Wholesale, retail trade, motor vehicle repair	145	32	62
Research and development	35	..C	..C
Other business activities	277	62	84
Community, social and personal service activities, etc	56	..C	..C
Services	919	192	331
Total	2,490	540	1,122

Symbols:

C confidential
nec not elsewhere classified
.. figures not available

Table 2.17

Personnel Involved in Business R&D*By qualification and sex*
2002 reference year

	Full-time equivalent employees (FTEs)		
	Male	Female	Total
Phd	401	92	493
Batchelor	1,515	554	2,069
Technical	493	77	570
Trade	303	29	332
Other post tertiary	93	70	163
Secondary	141	145	286
Other post secondary	126	113	239
Total	3,072	1,079	4,152

Note: Due to rounding, some figures may not add to stated total.

Part 3

Government sector**Total government research and development (R&D) funding**

Government funding of all New Zealand R&D, including general university funds, amounted to \$667 million in the 2002 reference year, equivalent to 0.54 percent of gross domestic product (GDP). Government funds continue to be a major source of R&D financing, accounting for 46 percent of total R&D funding in New Zealand in the 2002 year.

R&D carried out in the government sector

As shown in table 3.01, expenditure on R&D carried out by the government sector (GOVERD) in New Zealand in the 2002 reference year totalled \$456.4 million, up 16 percent on the \$393.0 million spent in 2000. Crown research institutes continued to be the largest spenders on R&D in the government sector, accounting for 88 percent of government R&D activity in the 2002 reference year.¹ This compared with 93 percent in the 2000 year.

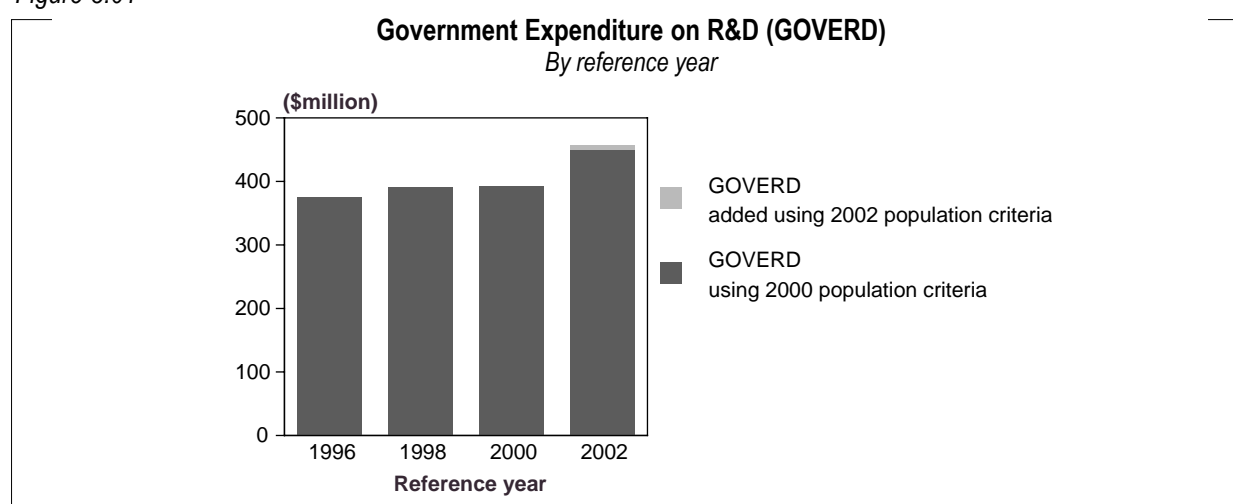
Table 3.01

Government Expenditure on R&D (GOVERD)						
<i>By reference year</i>						
	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
\$(million)						
Expenditure on R&D	375.6	391.3	393.0	449.6	6.8	456.4

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 additional population selection criteria.
 (3) Total expenditure in 2002.

Enterprises added to the survey by the expanded 2002 population selection criteria had a small impact, accounting for only 1.5 percent of GOVERD in 2002, as shown in figure 3.01.

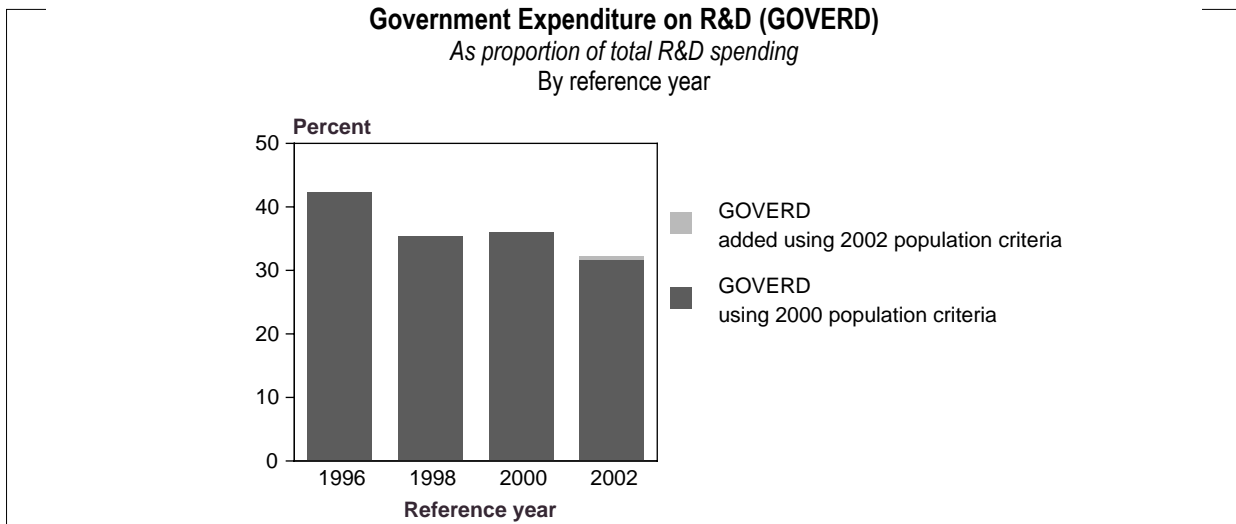
Figure 3.01



¹ The Foundation for Research, Science & Technology (www.frst.govt.nz) is a useful resource for further information on crown research institute R&D activity and funding.

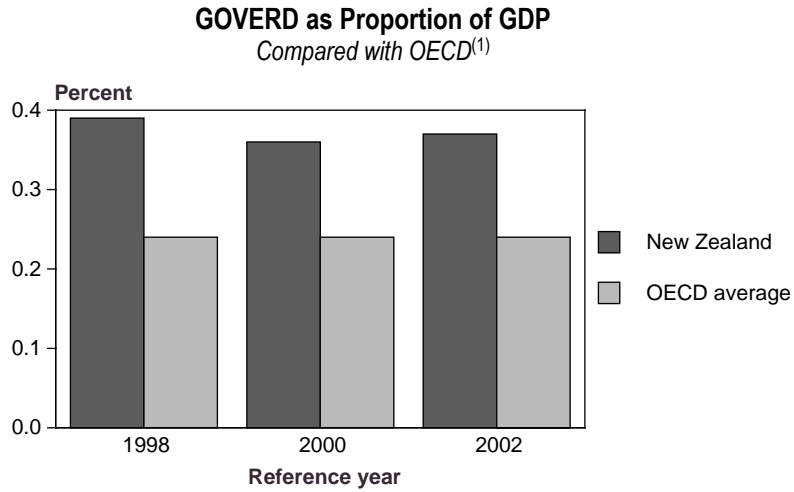
GOVERD as a proportion of total R&D expenditure has declined in recent years, as shown in figure 3.02. In the 1996 reference year, GOVERD totalled 42 percent of all R&D expenditure, but by the 2002 reference year the proportion had dropped to 32 percent. The extension in the population selection criteria for the 2002 survey further reduced the ratio of GOVERD to total R&D expenditure because 94 percent of the \$107.9 million R&D expenditure attributed to the additional population was accounted for within the business sector.

Figure 3.02



As shown in figure 3.03, GOVERD represented 0.37 percent of GDP in the 2002 reference year, higher than the Organisation for Economic Co-operation and Development (OECD) average of 0.24 percent, and at the higher end of OECD reference countries, as shown in table 3.02.

Figure 3.03



(1) Source: OECD, (2003)

Note: GOVERD refers to R&D carried out in the government sector, not R&D funded by the government.

Table 3.02

GOVERD as Proportion of GDP
Compared with OECD balance year 2001⁽¹⁾

Country	Percent
New Zealand	0.37
Australia	0.35 ⁽²⁾
Finland	0.35
Denmark	0.29 ⁽²⁾
Norway	0.24
OECD average	0.24
Sweden	0.12
Ireland	0.11

(1) Source: OECD, (2003)

(2) OECD balance year 2000.

Table 3.03 shows the trend in GOVERD as a proportion of GDP from 1996 to 2002.

Table 3.03

GOVERD as Proportion of GDP⁽¹⁾
By reference year

	1996	1998	2000	2002 ⁽²⁾	2002 ⁽³⁾	2002 ⁽⁴⁾
Percentage of GDP	0.40	0.39	0.36	0.36	0.00	0.37

(1) Expenditure on GDP at current prices for year ended June of each reference period (using data available after the March 2003 quarter GDP release).

(2) Firms selected according to the 2000 population selection criteria.

(3) Firms selected according to the 2002 additional population selection criteria.

(4) Total expenditure in 2002.

GOVERD by type of expenditure

Labour costs accounted for \$194.6 million (43 percent) of GOVERD in the 2002 reference year, as shown in figure 3.04. Other current expenditure, which includes all consumables and overheads incurred by direct and indirect R&D support activities, accounted for \$227.4 million (50 percent). Capital expenditure on land and buildings amounted to \$9.13 million (2 percent), while capital expenditure on other capital items accounted for \$25.19 million (5 percent).

Figure 3.04

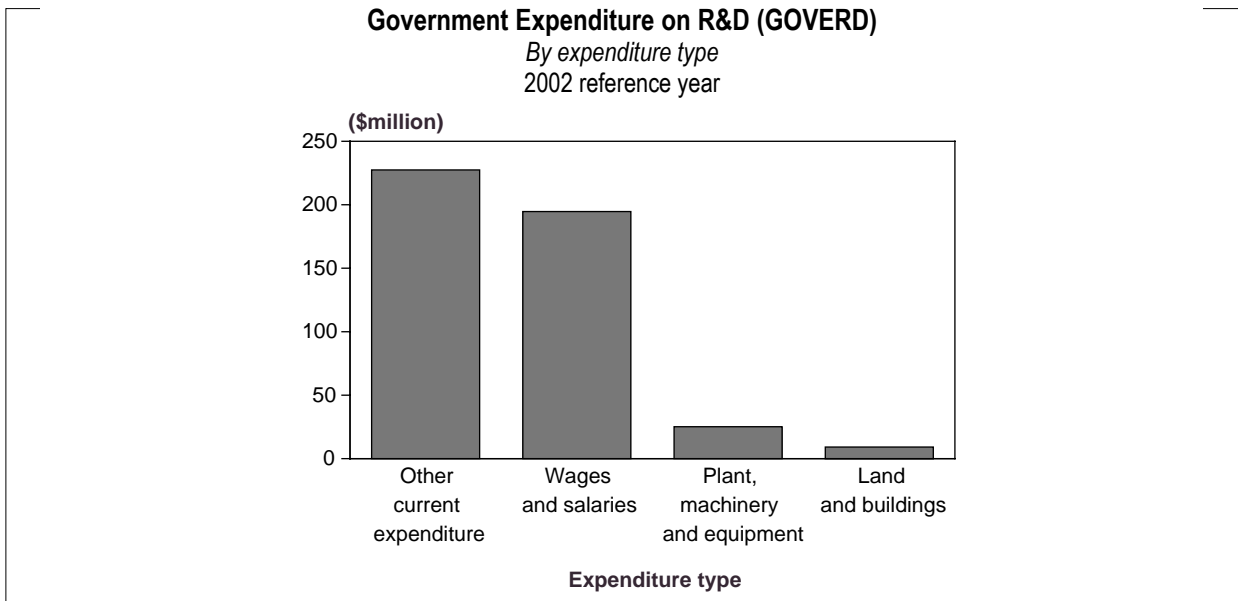


Table 3.04 shows that wages and salaries have steadily declined since 1996 as a proportion of total GOVERD, while other current expenditure has generally increased.

Table 3.04

Government Expenditure on R&D (GOVERD)
By expenditure type
By reference year

	1996	1998	2000	2002
	Percent			
Wages and salaries ⁽¹⁾	47.7	45.9	44.5	42.6
Other current expenditure ⁽²⁾	39.9	45.1	44.7	49.8
Capital expenditure (land and buildings)	3.2	3.1	3.1	2.0
Capital expenditure (other) ⁽³⁾	9.3	5.9	7.7	5.5
TOTAL	100.0	100.0	100.0	100.0

(1) Includes redundancy and severance payments.
 (2) Includes all consumables and overheads incurred by direct and indirect support activities. For example, materials, power, rent, rates, repairs, interest, books and travel. Depreciation is excluded.
 (3) Includes purchases of plant, equipment, machinery, vehicles, capitalised software and other assets.

GOVERD by type of research²

R&D 2002 counted GOVERD across four types of research. As table 3.05 and figure 3.05 show, applied research took \$165.4 million (36 percent) of GOVERD, strategic research \$135.5 million (30 percent), pure basic research \$105.7 million (23 percent) and experimental research \$49.8 million (11 percent).

Table 3.05

Government Expenditure on R&D (GOVERD)

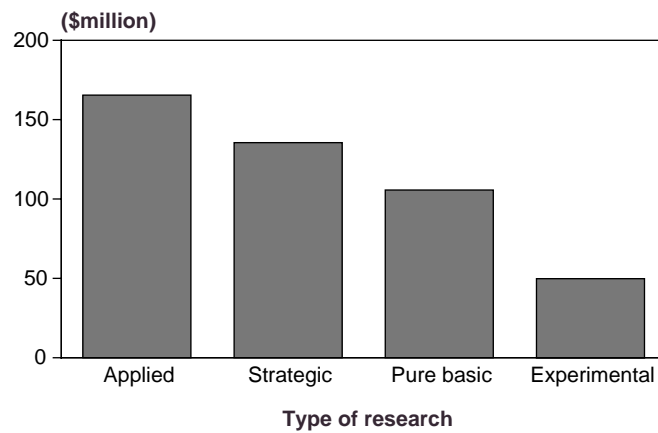
By research type
2002 reference year

	\$(million)	Percentage
Pure basic	105.7	23.1
Strategic	135.5	29.7
Applied	165.4	36.2
Experimental	49.8	10.9
Total R&D expenditure	456.4	100.0

Figure 3.05

Government Expenditure on R&D (GOVERD)

By research type
2002 reference year



² See Appendix A: Technical documentation for definitions of the four types of research.

Source of funds for government R&D

As figure 3.06 illustrates, the New Zealand government sector provided 75 percent (\$355.7 million) of the funds for R&D in the government sector in the 2002 reference year, compared with 77 percent in 2000. Fifty-six percent of funds (\$266 million) came from government funding agencies, including the Foundation for Research, Science & Technology. The contribution of the business sector to funding for government R&D remained relatively unchanged at 20 percent (\$96.7 million). Note that the OECD average of government R&D expenditure financed by industry was 4.1 percent in the 2000 OECD reference year. Firms added to the survey by the expanded 2002 population selection criteria made a negligible contribution to the amount of funds provided for government R&D.

Figure 3.06

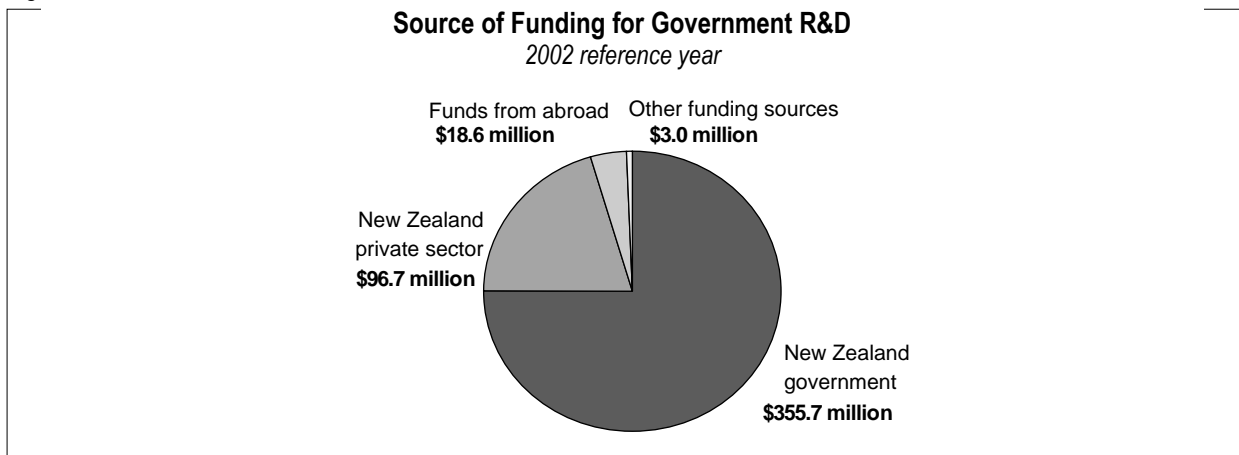


Table 3.06 shows trends in the source of funding for government R&D since 1996.

Table 3.06

Source of Funding for Government R&D						
	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
	\$(million)					
Private sector	65.6	74.5	80.2	96.7	-	96.7
Government funding agencies	218.8	248.0	253.7	266.0	-	266.0
Other government departments	48.4	42.4	36.2	44.3	-	44.3
Local government	4.3	4.5	3.1	6.7	6.1	12.8
Tertiary education	0.7	1.2	1.2	1.8	-	1.8
Overseas	7.1	10.1	11.4	18.6	-	18.6
Own funds	22.8	29.3	15.8	31.9	0.7	32.6
Other sources	1.9	1.0	0.9	1.2	-	1.2
Total	369.7	411.0	402.6	467.2	6.8	474.0
	Percent					
Private sector	17.7	18.1	19.9	20.4	0.0	20.4
Government funding agencies	59.2	60.3	63.0	56.1	0.0	56.1
Other government departments	13.1	10.3	9.0	9.4	0.0	9.4
Local government	1.2	1.1	0.8	1.4	1.3	2.7
Tertiary education	0.2	0.3	0.3	0.4	0.0	0.4
Overseas	1.9	2.4	2.8	3.9	0.0	3.9
Own funds	6.2	7.1	3.9	6.7	0.1	6.9
Other sources	0.5	0.2	0.2	0.2	0.0	0.2
Total	100.0	100.0	100.0	98.6⁽⁴⁾	1.4⁽⁴⁾	100.0

(1) Firms selected according to the 2000 population selection criteria.

(2) Firms selected according to the 2002 additional population selection criteria.

(3) Total expenditure in 2002.

(4) Percentages are calculated using the total value of the source of funds for 2002.

R&D personnel

There were 3,849 full-time equivalent employees (FTEs) involved in R&D in the government sector in 2002, as table 3.07 shows. Researchers accounted for 52 percent of R&D staff, followed by technicians (30 percent) and support staff (18 percent). Total R&D staff in the government sector in the 2002 reference year (using the 2000 population selection criteria) increased 10 percent on the 2000 reference year. This was a reversal of the decline apparent in previous years. Government sector R&D staff made up 22 percent of the national total, compared with 26 percent in 2000.

Table 3.07

Personnel Involved in Government R&D						
<i>By occupation</i>						
<i>By reference year</i>						
	1996	1998	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
Full-time equivalent employees (FTEs)						
Researchers	1,498	1,765	1,631	1,958	30	1,988
Technicians	1,518	1,211	1,118	1,157	9	1,166
Support staff	968	840	696	687	8	695
Total	3,984	3,816	3,445	3,802	47	3,849

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 additional population selection criteria.
 (3) Total 2002.

The increase in R&D personnel numbers was also apparent in headcount numbers, as shown in table 3.08. Again, there was a significant increase in 2002, with staff employed increasing 15 percent on the 2000 figure (using the 2000 population selection criteria).

Table 3.08

Personnel Involved in Government R&D				
<i>By headcount</i>				
<i>By reference year</i>				
	2000	2002 ⁽¹⁾	2002 ⁽²⁾	2002 ⁽³⁾
Number of staff				
Researchers	1,741	2,154	38	2,192
Technicians	1,176	1,284	10	1,294
Support staff	744	773	9	782
Total	3,661	4,211	57	4,268

(1) Firms selected according to the 2000 population selection criteria.
 (2) Firms selected according to the 2002 additional population selection criteria.
 (3) Total 2002.

Table 3.09 shows that FTEs with a minimum of a bachelor's degree made up the majority of employees in R&D, comprising 67 percent of all FTEs in the 2002 reference year. This was an increase of 63 percent on the 2000 reference year. The ratio of male FTEs to female FTEs remained fairly constant between the two reference years.

Table 3.09

Personnel Involved in Government R&D

By qualification and sex

By reference year

Qualification	Male	Female	Total
Full-time equivalent employees (FTEs)			
PhD	904	232	1,136
Bachelor ⁽¹⁾	832	623	1,455
Technical ⁽²⁾	216	109	325
Trade ⁽³⁾	18	13	31
Other post-secondary ⁽⁴⁾	142	82	224
Secondary ⁽⁵⁾	196	178	373
Other or no qualifications	130	175	305
Total	2,437	1,412	3,849

(1) Bachelor degrees or equivalent and post-graduate qualifications other than a PhD.

(2) Technical qualifications, eg NZ Certificate of Engineering.

(3) Trade qualifications, eg NZ Trade Certificate or Advanced Trade.

(4) Other post-secondary qualifications, eg Diploma of Business Administration, National Certificate of Business Studies.

(5) Secondary qualifications, eg bursary, Sixth Form Certificate, School Certificate.

*Part 4***Higher education sector****Introduction**

The Ministry of Research, Science & Technology (MoRST) commissioned Statistics New Zealand to undertake the universities component of R&D 2002. Previously, university R&D data had been collected by MoRST.

R&D 2002 introduced fundamental changes to previous university R&D surveys. The questionnaire was redesigned to impose a lower level of burden on the universities, without impeding the accuracy of results. Previous surveys collected data at the university department level. However, most data items collected in the 2002 survey allowed the universities to use financial information generally produced for annual reporting purposes. As a consequence, a number of data items from the universities component of R&D 2002 have been produced using modelled information.

The New Zealand Vice-Chancellors' Committee (NZVCC) and MoRST assisted Statistics New Zealand in questionnaire development and in determination of modelling specifications.

Due to the methodological changes in the 2002 survey, users are advised to be cautious when comparing 2002 results with earlier surveys.

Higher education expenditure on R&D (HERD)

Expenditure by New Zealand universities on R&D was estimated at \$435.8 million in the 2002 reference year, an increase of 16 percent on the \$374.1 million spent in 2000, as shown in figure 4.01. The 2000 figure was down on the \$403.6 million spent in 1998, but ahead of 1996 expenditure of \$273.4 million.

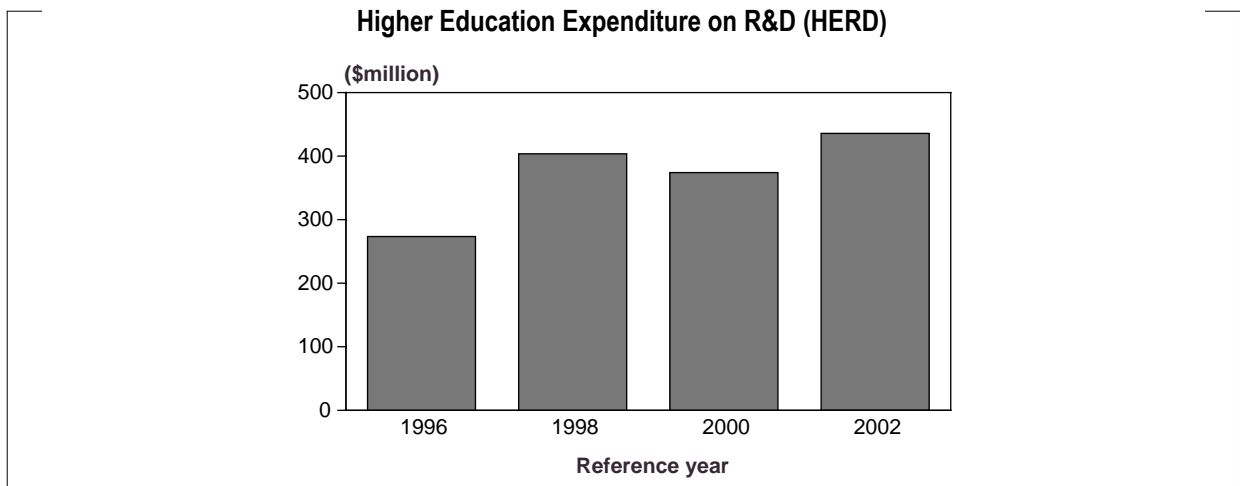
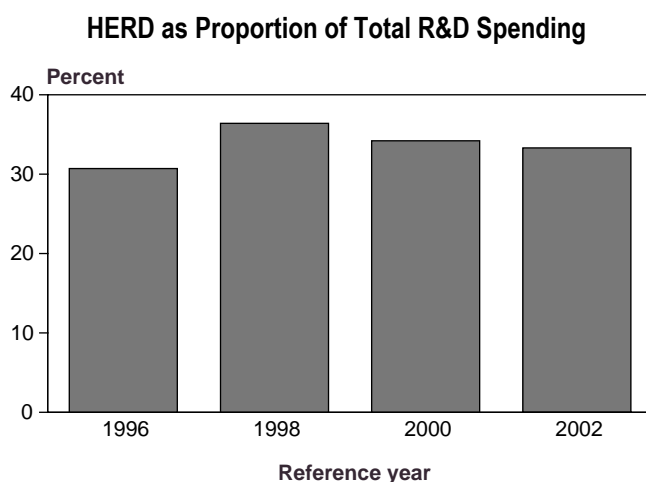
Figure 4.01

Figure 4.02 shows that HERD made up 33 percent of total R&D expenditure¹ in the 2002 reference year, compared with 34 percent in 2000, 36 percent in 1998 and 31 percent in 1996.

Figure 4.02



The proportion of HERD to gross domestic product (GDP) was 0.35 percent in the 2002 reference year, compared with 0.33 percent in 2000 and 0.40 percent in 1998. Table 4.01 compares the New Zealand proportions with the Organisation for Economic Co-operation and Development (OECD) average and the proportions of selected countries.

Table 4.01

HERD as Proportion of GDP
Comparison with OECD and selected countries

	1997	1998	1999	2000	2001	
	Percent ⁽¹⁾					
Australia	..	0.43	..	0.41	..	
Denmark	0.43	0.41	0.43	0.45	..	
Sweden	0.76	..	0.78	..	0.83	
Norway	0.44	..	0.47	..	0.42	
Finland	0.54	0.57	0.64	0.61	0.61	
Ireland	0.27	0.26	0.28	0.23	..	
Total OECD average	0.37	0.37	0.38	0.38	0.40	
	Percent ⁽²⁾					
		1998	1999	2000	2001	2002
New Zealand ⁽³⁾		0.40	..	0.33	..	0.35

(1) OECD balance years

(2) New Zealand R&D Survey balance years

(3) Expenditure on GDP at current prices for year ended December for each reference period (using data available after the March 2003 quarter GDP release).

Symbols:

.. figures not available

¹ Calculated as a percentage of R&D 2002 expenditure using the 2000 population selection criteria. This allows for more accurate comparison with results from previous surveys. A full description of the population selection criteria can be found in Appendix A: Technical documentation.

HERD by type of expenditure

Wages and salaries accounted for 56 percent of HERD in the 2002 reference year, followed by other current expenditure (31 percent) and capital expenditure (13 percent). Other current expenditure includes all consumables and overheads incurred by R&D support activities (other than wages and salaries). Depreciation is excluded. Capital expenditure includes purchases of land and buildings, and purchases of plant, equipment, machinery, vehicles, capitalised software and other assets. Table 4.02 compares 2002 spending and proportions with 2000 year figures.

Table 4.02

Higher Education Expenditure on R&D (HERD)

By expenditure type
Year ended 31 December

	2000		2002	
	\$(million)	Percent	\$(million)	Percent
Wages and salaries	164.5	44.0	243.9	56.0
Other current expenditure	179.3	47.9	135.4	31.1
Capital expenditure	30.4	8.1	56.5	13.0
Total	374.1	100.0	435.8	100.0

Note: Due to rounding, some figures may not add to stated total.

HERD by socio-economic objectives

A breakdown of HERD by socio-economic objectives indicates the purpose of R&D expenditure in the university sector and provides an insight into the goals and strategic directions of R&D activities.

The general advancement of knowledge (\$143 million), health (\$93 million) and social development and services (\$58 million) objectives accounted for more than two-thirds of total R&D expenditure in the university sector. General advancement of knowledge includes R&D activities which cannot be attributed to any of the specific objectives shown in table 4.03. Expenditure on these specific objectives ranged from \$31 million on information, communication and technology software to \$0.9 million on fibre and skin.

Table 4.03

Higher Education Expenditure on R&D (HERD)		
<i>By socio-economic objective</i>		
Year ended 31 December 2002		
	\$(million)	Percentage
Animal production	4.6	1.0
Dairy production	1.2	0.3
Horticulture, arable production	3.4	0.8
Forestry	1.8	0.4
Fishing	2.3	0.5
Meat and fish processing	1.5	0.3
Dairy processing	4.0	0.9
Fruit, crop and beverage processing	3.1	0.7
Fibre and skin	0.9	0.2
Wood and paper products	2.7	0.6
Materials, construction, electronics and engineering	17.5	4.0
Energy	4.6	1.1
Commercial and trade services	20.4	4.7
Urban and rural planning	6.3	1.5
Transport	2.8	0.6
Information, communication and technology software	31.0	7.1
Care of the environment	19.8	4.5
Health	93.3	21.4
Social development and services	57.7	13.2
Earth and atmosphere	12.3	2.8
General advancement of knowledge	143.1	32.8
Defence	1.5	0.3
Total	435.8	100.0

Note: Due to rounding, some figures may not add to stated total.

HERD by type of research²

Three types of research are categorised in the universities component of R&D 2002: pure basic research; strategic research; and applied research and experimental development combined.

Compared with the business and government sectors, the type of research conducted within the university sector is more directed towards pure basic and strategic research, as table 4.04 shows. More than two-thirds (68 percent) of HERD was spent in the pure basic and strategic areas, compared with 53 percent of GOVERD and 21 percent of BERD.

Table 4.04

Higher Education Expenditure on R&D (HERD)

By research type
Year ended 31 December 2002

	\$(million)	Percentage
Pure basic research	146.6	33.6
Strategic research	149.7	34.4
Applied knowledge and experimental development	139.5	32.0
Total	435.8	100.0

² See Appendix A: Technical documentation for definitions of the four types of research.

Source of funds

R&D in universities is funded from various sources. These include internal sources such as general funds received from the government, student fees and other discretionary income. There are also various external funding sources, including research contracts from the government, New Zealand businesses and overseas sources.

As table 4.05 shows, the major funding sources for university R&D in the 2002 reference year were New Zealand research contracts from the government (\$162.7 million), New Zealand general university funds from the government (\$101.5 million) and other internal funding sources, including student fees (\$113.2 million). The remaining funding sources (New Zealand businesses, overseas sources and other sources) accounted for 13.4 percent of total funding for R&D in the university sector.

Table 4.05

Source of Funds for Higher Education R&D

By source of funds
Year ended 31 December

	2000		2002	
	\$(million)	Percent	\$(million)	Percent
General university funds (government)	105.2	28.1	101.5	23.3
Internal funds (including student fees)	98.9	26.4	113.2	26.0
Research contracts (government)	114.7	30.7	162.7	37.3
Business	21.7	5.8	23.2	5.3
Overseas	18.3	4.9	14.3	3.3
Other	15.4	4.1	20.9	4.8
Total	374.1	100.0	435.8	100.0

Note: Due to rounding, some figures may not add to stated total.

R&D personnel

R&D personnel information was collected in the university component of R&D 2002 by headcount and by full-time equivalent employee (FTE).³

R&D staff in the university sector are categorised as researchers, technicians and support staff.

- Researchers consist of academic staff who supervise or conduct teaching and/or research and whose salaries are related to academic salaries. Research fellows/officers with academic duties are included.
- Technicians are staff who undertake technical or professional tasks in support of teaching and/or research, and whose salaries are related to technical salaries. Research assistants with technical duties are included.
- Support staff are administrative and general service employees whose work supports teaching and/or research (eg typists, administration officers).

As table 4.06 shows, for the year ended 31 December 2002, there were estimated to be 2,516 FTE researchers, making up 69 percent of total R&D staff in the university sector. There were estimated to be 496 FTE technicians and 615 FTE support staff.

The university component of R&D 2002 also collected a headcount and FTE measure for research post-graduate students. Research post-graduate students had to be undertaking at least one thesis to be considered for inclusion. There were estimated to be 6,139 FTE research post-graduate students in New Zealand universities in the year ended 31 December 2002.

Table 4.06

Personnel Involved in Higher Education R&D	
<i>Year ended 31 December 2002</i>	
R&D personnel	FTEs
Researchers	2,516
Technicians	496
Support staff	615
Total	3,627
Research post-graduate students	6,139
Total FTE	9,766

Male and female personnel (including R&D staff and research post-graduate students) in the university sector were evenly distributed, with 4,923 FTE males involved in R&D activities and 4,843 FTE females.

³ The headcount of R&D personnel includes a count of all personnel involved in research activities at 31 December 2002. The full-time equivalent employee (FTE) measure takes into account each person's total working time on research activities. For example, a full-time employee spending half their time on research activities during the year, would contribute 0.5 towards the FTE measure. A full description of headcount and FTE is contained in Appendix A: Technical documentation.

Supplementary tables

Table 4.07

Higher Education Expenditure on R&D (HERD)⁽¹⁾

	1996	1998	2000	2002
	\$(million)			
HERD	273.4	403.6	374.1	435.8

(1) Due to methodological changes in the 2002 survey, users are advised to make comparisons between 2002 and previous results with caution.

Table 4.08

HERD as Proportion of Total R&D Spending⁽¹⁾

	1996	1998	2000	2002 ⁽²⁾
	Percent			
HERD as percentage of total R&D expenditure	30.7	36.4	34.2	33.3

(1) Due to methodological changes in the 2002 survey, users are advised to make comparison between 2002 and previous results with caution.

(2) Calculated as a percentage of R&D 2002 expenditure using the 2000 population selection criteria. This allows for a more accurate comparison with results from previous surveys. A full description of the population selection criteria can be found in Appendix A: Technical documentation.

Table 4.09

R&D Staff and Research Post-graduate Students

Year ended 31 December 2002

	Male	Female	Total
Headcount			
R&D staff			
Researchers	4,308	2,836	7,144
Technicians	820	560	1,380
Support staff	431	1,887	2,318
Research post-graduate students	4,767	4,757	9,524
Total headcount	10,326	10,040	20,366
Full-time equivalent employees(FTEs)			
R&D staff			
Researchers	1,502	1,014	2,516
Technicians	299	196	496
Support staff	121	494	615
Research post-graduate students	3,001	3,138	6,139
Total FTEs	4,923	4,843	9,766

Note: Due to rounding, some figures do not add to stated total.

Appendix A

Technical documentation

Introduction

This section provides a technical description of the data used to compile the *Research and Development in New Zealand 2002* report. The section focuses on data quality and the processes used for data collection and analysis.

Background

The Research and Development Survey (R&D 2002) was designed to collect R&D data as defined by the *Frascati Manual* (OECD, 1993):

“Research and experimental development (R&D) comprise 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.” (p29)

Research differs from studies, in that studies involve collecting, processing and analysing data, but are usually not characterised by novelty and innovation.

The purpose of R&D 2002 was to collect data to produce summarised statistics of research and development activities for the use of the government, business and others in the community. The statistics will be used in the development of science policy in areas such as the setting of research priorities, government research funding levels, science education and innovation encouragement schemes.

R&D 2002 was sponsored by the Ministry of Research, Science & Technology (MoRST). An R&D survey is carried out biennially by Statistics New Zealand. Results from previous surveys have been released by MoRST.

Data collection

R&D 2002 was a postal survey consisting of two questionnaires. The first questionnaire (referred to in this section as the General R&D Survey) collected information from private sector enterprises, government departments and government-owned trading entities. The second questionnaire (referred to in this section as the R&D Universities Survey) collected information from universities.

The General R&D Survey was posted out in late August 2002. Information collected included the number of personnel within an enterprise working on R&D, current and capital expenditure on R&D, expenditure by type of R&D, and the source of funds for R&D carried out by the enterprise. The accounting period requested was for the year ended 30 June 2002, or the last accounting year ended within the 12 months up to 30 June 2002.

The R&D Universities Survey was posted out in March 2003. Data was collected for the year ended 31 December 2002. Information collected included university discretionary income and internal and external research funding, academic staff salaries, university operating expenditure by faculty, and R&D personnel data. The questionnaire was designed to allow universities to use financial information generally produced for annual reporting purposes. This means a number of data items from the R&D Universities Survey have been produced using modelled information. The New Zealand Vice-Chancellors' Committee (NZVCC) and MoRST assisted Statistics New Zealand in questionnaire development and in determination of modelling specifications.

Statistics New Zealand issued a first release of R&D 2002 data on 7 May 2003.

Target population

The target population for R&D 2000 was all enterprises in New Zealand performing R&D in the 2001/02 financial year. The following conditions had to be met:

- The enterprise had to be live on Statistics New Zealand's Business Frame as at the population selection date in August 2002 for the General R&D Survey, and March 2003 for the R&D Universities Survey.
- The enterprise had to have a GST turnover greater than \$30,000.

The following sources were used to derive the 2002 survey population:

- Lists of potential R&D performers supplied by MoRST and the Foundation for Research, Science & Technology. This included enterprises funded under the Public Good Science and Technology Fund, the Technology New Zealand Fund, and the Grants for Private Sector Research and Development Fund.
- A core group of government entities included in every iteration of the R&D survey. Further work was carried out in R&D 2002 to increase coverage in the government sector. For instance, local authorities were included.
- R&D 2000 private sector performers. Enterprises that carried out between \$50,000 and \$150,000 worth of R&D in 2000 were included if they were in the manufacturing industry (ANZSIC Division C). Enterprises that carried out more than \$150,000 of R&D in 2000 were included regardless.
- Annual Frame Update Survey (AFUS) 2002. The AFUS 2002 questionnaire included a question on R&D. Respondents were asked to indicate if they carried out R&D in the previous year and whether they spent more than \$5,000 on it. R&D was defined as “any activity characterised by originality: it should have investigation as a primary objective, the outcome of which is new knowledge, or improved materials, products, processes or services. R&D activity does not include market research, efficiency studies or style changes in existing products.” All enterprises that answered yes to this question were included in the population if they had more than two full-time equivalent employees (FTEs), if they were in ANZSIC Division C (Manufacturing), F (Wholesale Trade), L (Property and Business Services), M (Government Administration and Defence), or if they had R&D expenditure in the 2000 survey.
- Sources investigated by Statistics New Zealand. These included:
 - Industry association membership lists (for example, Biotenz New Zealand, New Zealand Biotechnology Association, Royal Society of New Zealand, and New Zealand Institute of Agricultural Science.)
 - Potential R&D performers sourced through the media.
 - The Business Practices Survey (BPS). The BPS was carried out in June 2001 and collected information on a wide variety of business practices in New Zealand businesses. As part of this survey, information was collected on the R&D activity of New Zealand businesses. This included whether the business carried out R&D in the development of new products/processes, and the level of intensity this was performed at (not at all, occasionally, regularly, continuously). All enterprises that performed R&D at a regular or continuous level of intensity were included in the R&D 2002 population. It has to be noted that no definitions of R&D were provided in the BPS questionnaire, and it was a sample of private sector businesses with only six or more FTEs.
 - Potential R&D performers sourced through tax data from the Inland Revenue Department. IR10 forms include an R&D field. The form states: “Enter the total amount claimed for research and development expenditure. Include farm development, drug development, machinery research and other scientific research and development.” Although this definition is quite different than that provided in R&D 2002, enterprises were considered for selection if they had greater than \$50,000 R&D expenditure in their 2001 IR10 and more than two FTEs.

Additions to the 2002 target population

R&D expenditure figures in the 2000 and 2002 reference years are not directly comparable as a result of changes in the methods employed to identify enterprises undertaking R&D activity.

Additional sources of information to those used in the 2000 survey were used to derive the 2002 survey population. R&D 2002 expenditure figures resulting from the sources used in the 2000 population selection, and those added as a result of the additional sources used in 2002, have been clearly identified in the various sections of this report.

Measurement errors

R&D 2002 results are subject to measurement errors, which need to be considered when analysing them.

Measurement errors include mistakes by respondents when completing the questionnaire, variation in respondent interpretation of questions asked, and errors made during processing data. In addition, the survey applies imputation methodologies to cope with non-respondents. Statistics New Zealand adopts procedures to minimise these types of errors, but they may still occur and are not quantifiable.

Given the nature of the data collected, there are limitations on the level of accuracy that can be expected from R&D 2002. Many respondents do not keep separate account of their R&D expenditure, or they may include R&D with other scientific and technological services, such as consulting. Records may not be kept in the form required for the survey and estimation may be required. Detailed descriptions of what should and should not be included as R&D were provided in the questionnaire, and phone-in help was available to respondents.

R&D surveys are described as 'full-coverage' surveys and are consequently not subject to sample errors. There are, however, known levels of undercoverage in the surveys. The AFUS questionnaire does not cover the whole economy. For instance, it excludes single geographic enterprises in the agriculture industry and economically insignificant units (those with less than \$30,000 annual GST turnover).

Response rates

The target overall response rate for the General R&D Survey was 85 percent. The survey achieved an actual response rate of 86.1 percent. The target population for the General R&D Survey included 2,126 enterprises. Of these, 1,831 responded to the survey.

The target overall response rate for the R&D Universities Survey was 100 percent. This component of the survey achieved a response rate of 100 percent.

Full details of response rates by sector and published industry are provided in Tables A and B at the end of this section.

Imputation methodology

The following gives an outline of the imputation methodology used in the General R&D Survey. No unit non-response was required in the R&D Universities Survey as a 100 percent response rate was achieved.

Unit non-response

Unit (or complete) non-response occurs when units in the population do not return the questionnaire. A weight adjustment method is used to rate up responding firms to compensate for non-responding firms within the same unit non-response estimation cell. Responding firms are multiplied by the inverse of the response rate for the estimation cell.

For responding firms in estimation cell i :

1. Identify responding firms that are outliers in estimation cell i . These firms are 'unlinked' and not used in estimation for non-response.
2. Assign a 'non-response adjustment factor' or weight ($NONRESFACT_i$) to responding firms within estimation cell i .

For responding firms that are not 'unlinked' in estimation cell i , the non-response adjustment factor is:

$$NONRESFACT_i = \frac{\text{Total number of firms minus number of "unlinked" firms}}{\text{Number of responded firms minus number of "unlinked" firms}}$$

For responding firms that are 'unlinked' in estimation cell i , the non-response adjustment factor is:

$$NONRESFACT_i = 1 \text{ (ie the 'unlinked' firms represent themselves).}$$

For non-responding firms in estimation cell i :

$$NONRESFACT_i = 0$$

Estimates of the total are produced by summing the weighted values of the responding firms.

(($NONRESFACT_{ij} * y_j$) is the weighted value of firm j in estimation cell i for variable of interest y).

Item non-response

Item (or partial) non-response is when units return the questionnaire, but fail to provide breakdowns for selected aggregates.

Item non-response was applied to those breakdowns where a total could be sourced from another question. The item non-response method then uses the mean proportion of all responding linked units within the item non-response estimation cell, and applies these proportions to the sourced total.

Published sector and industry breakdowns

The published sector and industry breakdowns provided in this report have been created using recommendations from the Organisation for Economic Co-operation and Development (OECD) *Frascati Manual*. This manual recommends that State-owned enterprises (Business Type 1990 classification) be classified to the business sector.

In addition, the *Frascati Manual* recommends that the industrial classification code for significant research organisations be changed to the industry they predominantly serve. The industry breakdowns have been applied using the *Australian and New Zealand Standard Industrial Classification – NZ Version 1996 (ANZSIC)*.

The *Frascati Manual* recommendations have been adopted in production of this report in order to maintain comparability with previous reports produced by MoRST, as well as to allow greater international comparability.

Government sector (excluding universities)

All enterprises with the following New Zealand Institutional Sector 1996 codes:

New Zealand Institutional Sector 1996 code	New Zealand Institutional Sector 1996 description
1311 ¹	Central Government Enterprises
1321 ¹	Local Government Enterprises
2111	Central Bank
2212	Central Government Registered Banks
2213	Local Government Registered Banks
2222	Central Government Other Broad Money (M3) Depository Organisations
2223	Local Government Other Broad Money (M3) Depository Organisations
2292	Central Government Other Depository Organisations nec
2293	Local Government Other Depository Organisations nec
2312	Central Government Other Financial Organisations except Insurance and Pension Funds
2313	Local Government Other Financial Organisations except Insurance and Pension Funds
2412	Central Government Insurance and Pension Funds
2413	Local Government Insurance and Pension Funds
3 pt	General Government (excluding universities)

¹ Central and Local Government Trading Enterprises are included in the business sector

Business sector

All enterprises with the following New Zealand Institutional Sector 1996 codes:

New Zealand Institutional Sector 1996 code	New Zealand Institutional Sector 1996 description
1311 ¹	Central Government Enterprises
1321 ¹	Local Government Enterprises
1111	Private Corporate Producer Enterprises
1121	Private Non-corporate Producer Enterprises
1211	Producer Boards
2211	Private Registered Banks
2221	Private Other Broad Money (M3) Depository Organisations
2291	Private Other Depository Organisations
2311	Private Other Financial Organisations except Insurance and Pension Funds
2411	Private Insurance and Pension Funds
4	Private Non-Profit Organisations Serving Households

¹ Central and Local Government Trading Enterprises are included in the business sector

Universities

Includes the eight New Zealand universities which are members of the NZVCC. These are classified to New Zealand Institutional Sector 1996 code of 3111 (Cent Govt excl Funded Social Security), with an *Australian and New Zealand Standard Industrial Classification – NZ Version* 1996 code of N843100 (Higher Education).

OECD technology classification

OECD Technology Classification	ANZSIC Code	ANZSIC Descriptor
High Technology Industries	C254300	Medicinal and Pharmaceutical Product Manufacturing
High Technology Industries	C282400	Aircraft Manufacturing
High Technology Industries	C283100	Photographic and Optical Good Manufacturing
High Technology Industries	C283200	Medical and Surgical Equipment Manufacturing
High Technology Industries	C283900	Professional and Scientific Equipment Manufacturing nec
High Technology Industries	C284100	Computer and Business Machine Manufacturing
High Technology Industries	C284200	Telecommunication, Broadcasting and Transceiving Equipment Manufacturing
High Technology Industries	C284900	Electronic Equipment Manufacturing nec
Medium High Technology Industries	C221200	Synthetic Fibre Textile Manufacturing
Medium High Technology Industries	C253100	Fertiliser Manufacturing
Medium High Technology Industries	C253200	Industrial Gas Manufacturing
Medium High Technology Industries	C253300	Synthetic Resin Manufacturing
Medium High Technology Industries	C253400	Organic Industrial Chemical Manufacturing nec
Medium High Technology Industries	C253500	Inorganic Industrial Chemical Manufacturing nec
Medium High Technology Industries	C254100	Explosive Manufacturing
Medium High Technology Industries	C254200	Paint Manufacturing

OECD Technology Classification	ANZSIC Code	ANZSIC Descriptor
Medium High Technology Industries	C254400	Pesticide Manufacturing
Medium High Technology Industries	C254500	Soap and Other Detergent Manufacturing
Medium High Technology Industries	C254600	Cosmetic and Toiletry Preparation Manufacturing
Medium High Technology Industries	C254700	Ink Manufacturing
Medium High Technology Industries	C254900	Chemical Product Manufacturing nec
Medium High Technology Industries	C281100	Motor Vehicle Manufacturing
Medium High Technology Industries	C281200	Motor Vehicle Body Manufacturing
Medium High Technology Industries	C281300	Automotive Electrical and Instrument Manufacturing
Medium High Technology Industries	C281900	Automotive Component Manufacturing nec
Medium High Technology Industries	C282300	Railway Equipment Manufacturing
Medium High Technology Industries	C282900	Transport Equipment Manufacturing nec
Medium High Technology Industries	C285100	Household Appliance Manufacturing
Medium High Technology Industries	C285200	Electric Cable and Wire Manufacturing
Medium High Technology Industries	C285300	Battery Manufacturing
Medium High Technology Industries	C285400	Electric Light and Sign Manufacturing
Medium High Technology Industries	C285900	Electrical Equipment Manufacturing nec
Medium High Technology Industries	C286100	Agricultural Machinery Manufacturing
Medium High Technology Industries	C286200	Mining and Construction Machinery Manufacturing
Medium High Technology Industries	C286300	Food Processing Machinery Manufacturing
Medium High Technology Industries	C286400	Machine Tool and Part Manufacturing
Medium High Technology Industries	C286500	Lifting and Material Handling Equipment Manufacturing
Medium High Technology Industries	C286600	Pump and Compressor Manufacturing
Medium High Technology Industries	C286700	Commercial Space Heating and Cooling Equipment Manufacturing
Medium Low Technology Industries	C251000	Petroleum Refining
Medium Low Technology Industries	C252000	Petroleum and Coal Product Manufacturing nec
Medium Low Technology Industries	C255100	Rubber Tyre Manufacturing
Medium Low Technology Industries	C255900	Rubber Product Manufacturing nec
Medium Low Technology Industries	C256100	Plastic Blow Moulded Product Manufacturing
Medium Low Technology Industries	C256200	Plastic Extruded Product Manufacturing
Medium Low Technology Industries	C256300	Plastic Bag and Film Manufacturing
Medium Low Technology Industries	C256400	Plastic Product Rigid Fibre Reinforced Manufacturing
Medium Low Technology Industries	C256500	Plastic Foam Product Manufacturing
Medium Low Technology Industries	C256600	Plastic Injection Moulded Product Manufacturing
Medium Low Technology Industries	C262100	Clay Brick Manufacturing
Medium Low Technology Industries	C262200	Ceramic Product Manufacturing
Medium Low Technology Industries	C262300	Ceramic Tile and Pipe Manufacturing
Medium Low Technology Industries	C262900	Ceramic Product Manufacturing nec
Medium Low Technology Industries	C263100	Cement and Lime Manufacturing
Medium Low Technology Industries	C263200	Plaster Product Manufacturing
Medium Low Technology Industries	C263300	Concrete Slurry Manufacturing

OECD Technology Classification	ANZSIC Code	ANZSIC Descriptor
Medium Low Technology Industries	C263400	Concrete Pipe and Box Culvert Manufacturing
Medium Low Technology Industries	C263500	Concrete Product Manufacturing nec
Medium Low Technology Industries	C264000	Non-Metallic Mineral Product Manufacturing nec
Medium Low Technology Industries	C271100	Basic Iron and Steel Manufacturing
Medium Low Technology Industries	C271200	Iron and Steel Casting and Forging
Medium Low Technology Industries	C271300	Steel Pipe and Tube Manufacturing
Medium Low Technology Industries	C272100	Alumina Production
Medium Low Technology Industries	C272200	Aluminium Smelting
Medium Low Technology Industries	C272300	Copper, Silver, Lead and Zinc Smelting, Refining
Medium Low Technology Industries	C272900	Basic Non-Ferrous Metal Manufacturing nec
Medium Low Technology Industries	C273100	Aluminium Rolling, Drawing, Extruding
Medium Low Technology Industries	C273200	Non-Ferrous Metal Rolling, Drawing, Extruding nec
Medium Low Technology Industries	C273300	Non-Ferrous Metal Casting
Medium Low Technology Industries	C274100	Structural Steel Fabricating
Medium Low Technology Industries	C274200	Architectural Aluminium Product Manufacturing
Medium Low Technology Industries	C274900	Structural Metal Product Manufacturing nec
Medium Low Technology Industries	C275100	Metal Container Manufacturing
Medium Low Technology Industries	C275900	Sheet Metal Product Manufacturing nec
Medium Low Technology Industries	C276100	Hand Tool and General Hardware Manufacturing
Medium Low Technology Industries	C276200	Spring and Wire Product Manufacturing
Medium Low Technology Industries	C276300	Nut, Bolt, Screw and Rivet Manufacturing
Medium Low Technology Industries	C276400	Metal Coating and Finishing
Medium Low Technology Industries	C276500	Non-Ferrous Pipe Fitting Manufacturing
Medium Low Technology Industries	C276900	Fabricated Metal Product Manufacturing nec
Medium Low Technology Industries	C282100	Shipbuilding
Medium Low Technology Industries	C282200	Boatbuilding
Medium Low Technology Industries	C286900	Industrial Machinery and Equipment Manufacturing nec
Medium Low Technology Industries	C291100	Prefabricated Metal Building Manufacturing
Low Technology Industries	C211100	Meat Processing
Low Technology Industries	C211200	Poultry Processing
Low Technology Industries	C211300	Bacon, Ham and Smallgood Manufacturing
Low Technology Industries	C212100	Milk and Cream Processing
Low Technology Industries	C212200	Ice Cream Manufacturing
Low Technology Industries	C212900	Dairy Product Manufacturing nec
Low Technology Industries	C213000	Fruit and Vegetable Processing
Low Technology Industries	C214000	Oil and Fat Manufacturing
Low Technology Industries	C215100	Flour Mill Product Manufacturing
Low Technology Industries	C215200	Cereal Food and Baking Mix Manufacturing
Low Technology Industries	C216100	Bread Manufacturing
Low Technology Industries	C216200	Cake and Pastry Manufacturing
Low Technology Industries	C216300	Biscuit Manufacturing

OECD Technology Classification	ANZSIC Code	ANZSIC Descriptor
Low Technology Industries	C217100	Sugar Manufacturing
Low Technology Industries	C217200	Confectionery Manufacturing
Low Technology Industries	C217300	Seafood Processing
Low Technology Industries	C217400	Prepared Animal and Bird Feed Manufacturing
Low Technology Industries	C217900	Food Manufacturing nec
Low Technology Industries	C218100	Soft Drink, Cordial and Syrup Manufacturing
Low Technology Industries	C218200	Beer and Malt Manufacturing
Low Technology Industries	C218300	Wine Manufacturing
Low Technology Industries	C218400	Spirit Manufacturing
Low Technology Industries	C219000	Tobacco Product Manufacturing
Low Technology Industries	C221100	Wool Scouring
Low Technology Industries	C221400	Wool Textile Manufacturing
Low Technology Industries	C221500	Textile Finishing
Low Technology Industries	C222100	Made-Up Textile Product Manufacturing
Low Technology Industries	C222200	Textile Floor Covering Manufacturing
Low Technology Industries	C222300	Rope, Cordage and Twine Manufacturing
Low Technology Industries	C222900	Textile Product Manufacturing nec
Low Technology Industries	C223100	Hosiery Manufacturing
Low Technology Industries	C223200	Cardigan and Pullover Manufacturing
Low Technology Industries	C223900	Knitting Mill Product Manufacturing nec
Low Technology Industries	C224000	Clothing Manufacturing
Low Technology Industries	C225000	Footwear Manufacturing
Low Technology Industries	C226110	Leather Tanning and Fur Dressing excluding Fellmongery
Low Technology Industries	C226120	Fellmongery
Low Technology Industries	C226200	Leather and Leather Substitute Product Manufacturing
Low Technology Industries	C231100	Log Sawmilling
Low Technology Industries	C231200	Wood Chipping
Low Technology Industries	C231300	Timber Resawing and Dressing
Low Technology Industries	C232100	Plywood and Veneer Manufacturing
Low Technology Industries	C232200	Fabricated Wood Manufacturing
Low Technology Industries	C232300	Wooden Structural Component Manufacturing
Low Technology Industries	C232900	Wood Product Manufacturing nec
Low Technology Industries	C233100	Pulp, Paper and Paperboard Manufacturing
Low Technology Industries	C233200	Solid Paperboard Container Manufacturing
Low Technology Industries	C233300	Corrugated Paperboard Container Manufacturing
Low Technology Industries	C233400	Paper Bag and Sack Manufacturing
Low Technology Industries	C233900	Paper Product Manufacturing nec
Low Technology Industries	C241200	Printing
Low Technology Industries	C241300	Services to Printing
Low Technology Industries	C242100	Newspaper Printing or Publishing
Low Technology Industries	C242200	Other Periodical Publishing

OECD Technology Classification	ANZSIC Code	ANZSIC Descriptor
Low Technology Industries	C242300	Book and other Publishing
Low Technology Industries	C243000	Recorded Media Manufacturing and Publishing
Low Technology Industries	C261000	Glass and Glass Product Manufacturing
Low Technology Industries	C291900	Prefabricated Building Manufacturing nec
Low Technology Industries	C292100	Wooden Furniture and Upholstered Seat Manufacturing
Low Technology Industries	C292200	Sheet Metal Furniture Manufacturing
Low Technology Industries	C292300	Mattress Manufacturing (except Rubber)
Low Technology Industries	C292900	Furniture Manufacturing nec
Low Technology Industries	C294100	Jewellery and Silverware Manufacturing
Low Technology Industries	C294200	Toy and Sporting Good Manufacturing
Low Technology Industries	C294900	Manufacturing nec

Business sector published industries

The published industries within the business sector have been determined based on OECD recommendations with respect to publication of R&D statistics (contained in the *Frascati Manual*). These industry aggregations are based on ISIC Rev3, and an indication of the ANZSIC categories included in each industry appears in the table below:

Published Industry	ANZSIC Codes	ANZSIC Descriptions
Primary sector		
Agriculture and Mining	A	Agriculture, Forestry and Fishing
	B (excl B151)	Mining (excl Exploration)
	Q9525	Gardening Services
Manufacturing sector		
Food Beverages and Tobacco	C21	Food Beverage and Tobacco Manufacturing
Textiles, Fur and Leather, Wood, Paper, Printing, Publishing	C22	Textile, Clothing, Footwear and Leather Manufacturing
	C23	Wood and Paper Product Manufacturing
	C24	Printing, Publishing and Recorded Media
Coke, Petroleum, Nuclear Fuel, Chemicals & Prod., Rubber & Plastic	C25	Petroleum, Coal, Chemical and Associated Product Manufacturing
Non-metallic Mineral Products	C26	Non-Metallic Mineral Product Manufacturing
Basic Metals	C271	Iron and Steel Manufacturing
	C272	Basic Non-Ferrous Metal Manufacturing
	C2731	Aluminium Rolling, Drawing, Extruding
	C2733	Non-Ferrous Metal Casting
Fabricated Metal Products Except Machinery and Equipment	C274	Structural Metal Product Manufacturing
	C275	Sheet Metal Product Manufacturing
	C276	Fabricated Metal Product Manufacturing
	C2732	Non-Ferrous Rolling, Drawing, Extruding nec.
	C2911	Prefabricated Metal Building Manufacturing
Machinery and Equipment nec	C286	Industrial Machinery and Equipment Manufacturing
	C2851	Household Appliance Manufacturing
Office Accounting and Computing Machinery	C2841	Computer and Business Machine Manufacturing
Electrical Machinery and Apparatus nec	C285 (excl C2851)	Electrical Equipment and Appliance Manufacturing (excl Household Appliance Manufacturing)
Radio, Television and Communication Equipment and Apparatus	C284 (excl C2841)	Electronic Equipment Manufacturing (excl Computer and Business Machine Manufacturing)
Medical, Precision and Optical Instruments, Watches and Clocks (Instruments)	C283	Photographic and Scientific Equipment Manufacturing
Motor Vehicles, Trailers and Semi-trailers	C281	Motor Vehicle and Part Manufacturing
Other Transport Equipment	C282	Other Transport Equipment Manufacturing

Published Industry	ANZSIC Codes	ANZSIC Descriptions
Furniture and Manufacturing nec	C29 (excl C2911)	Other Manufacturing (excl Prefabricated Metal Building Manufacturing)
Services sector		
Electricity, Gas and Water	D36 D37 (excl D3702)	Electricity and Gas Supply Water Supply
Construction	E	Construction
Wholesale, Retail Trade, Motor Vehicle Repair	F	Wholesale Trade
	G51 (excl G5125)	Food Retailing (excl Takeaway Food Retailing)
	G52	Personal and Household Good Retailing
	G53	Motor Vehicle Retailing and Services
Hotels and Restaurants	H	Accommodation, Cafes and Restaurants
	G5125	Takeaway Food Retailing
Transport, Storage and Communications	I	Transport and Storage
	J	Communication Services
Financ. Intermediation (inc. insur)	K	Finance and Insurance
	L773	Non-Financial Asset Investors
Renting of Office Machinery and Equipment	L7743	Plant Hiring or Leasing
Computer and Related Activities	L783	Computer Services
Research and Development	L781	Scientific Research
Other Business Activities	B151	Exploration
	L782	Technical Services
	L784	Legal and Accounting Services
	L785	Marketing and Business Management Services
	L786	Other Business Services
	Q9522	Photographic Film Processing
	Q9523	Photographic Studios
Community, Social and Personal Service Activities, etc	D3702	Sewerage and Drainage Services
	M	Government Administration and Defence
	N	Education
	O	Health and Community Services
	P	Cultural and Recreational Services
	Q9521	Laundries and Drycleaners
	Q9524	Funeral Directors, Crematoria and Cemeteries
	Q9529	Personal Services nec.

Published Industry	ANZSIC Codes	ANZSIC Descriptions
Other Services	L771	Property Operators and Developers
	L772	Real Estate Agents
	L7741	Motor Vehicle Hiring
	L7742	Other Transport Equipment Leasing
	Q951	Personal Household Goods Hiring

Universities

Total universities.

Types of R&D

This section details the type of research definitions that were used in the All sectors, Business, Government and Higher education sections of the report.

Business and Government sectors

The Business and Government sector questionnaire asked for R&D expenditure to be categorised into the following R&D types (basic research, strategic research, applied research, experimental development), with the following definitions provided:

1. Underpinning research

a. Basic research

- Experimental or theoretical work undertaken primarily to acquire new knowledge without a specific application.
- Work carried out without looking for long term economic or social benefits other than the advancement of knowledge.
- Humanities R&D would normally involve this type of research.

b. Strategic research

- Research directed into specific broad areas in expectation of useful discoveries or applications.
- Research providing the broad base of knowledge necessary for the solution of recognised practical problems.

2. Applied research

- To acquire new knowledge with a specific application in view.
- To determine the possible uses for the findings of basic research.
- To determine new methods or ways of achieving some specific predetermined objectives.

3. Experimental development

- Systematic work using existing knowledge gained from research and/or practical experience for the purpose of creating new or improved materials, products, processes or services.

Note the title 'underpinning research' used in the questionnaire stands for basic or fundamental research, with its two sub-categories pure basic (referred to as basic research in the questionnaire), and strategic research. In the Business and Government sections of the report, data collected in the basic research category above is labelled pure-basic research.

The wording of these definitions is the result of cognitive testing the definitions provided in the *Frascati Manual*, OECD, 2002 (Chapter 4); and the *Glossary of Terms for Scientific and Technological Activities in New Zealand*; Ministry of Research, Science & Technology, July 1991. The extracts section below details the relevant references from these publications that were used to compile these definitions.

Universities sector

Types of R&D expenditure were not directly captured in the universities component of the R&D Survey. They were derived by applying type of research weightings provided to Statistics New Zealand by the NZVCC.

Weightings for three types of research were provided: pure-basic research, oriented-basic research, and applied research and experimental development combined. These types of research were based on the *Frascati* 2002 definitions (detailed below in the extracts section). In the universities section of the report oriented basic research has been labelled strategic research.

All sectors

Three types of research have been provided in the All sectors section of the report: pure basic research, strategic research, and applied research and experimental development combined. These were compiled from the Government, Business and Universities sector types of research breakdowns detailed above.

Extracts

Paragraphs 240 - 250 of the *Frascati Manual*, OECD, 2002 provides definitions for types of research:

Basic research

240. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

241. Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws. The reference to no "particular application in view" in the definition of basic research is crucial, as the performer may not know about the actual applications when doing the research or responding to survey questionnaires. The results of basic research are not generally sold but are usually published in scientific journals or circulated to interested colleagues. Occasionally, basic research may be "classified" for security reasons.

242. In basic research, scientists have some freedom to set their own goals. Such research is usually performed in the higher education sector but also to some extent in the government sector. Basic research can be oriented or directed towards some broad fields of general interest, with the explicit goal of a broad range of applications in the future. One example is the public research programmes on nanotechnology which several countries have decided on. Firms in the private sector may also undertake basic research, with a view to preparing for the next generation of technology. Research on fuel cell technology is a case in point. Such research is basic according to the above definition as it does not have a particular use in view. It is defined in the *Frascati Manual* as "oriented basic research".

243. Oriented basic research may be distinguished from pure basic research as follows:

- Pure basic research is carried out for the advancement of knowledge, without seeking long-term economic or social benefits or making any effort to apply the results to practical problems or to transfer the results to sectors responsible for their application.
- Oriented basic research is carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to recognised or expected, current or future problems or possibilities.

244. The separate identification of oriented basic research may provide some assistance towards identifying "strategic research", a broad notion often referred to in policy making.

Applied research

245. Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

246. Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems. In the business enterprise sector, the distinction between basic and applied research is often marked by the creation of a new project to explore promising results of a basic research programme.

247. The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. Applied research gives operational form to ideas. The knowledge or information derived from it is often patented but may be kept secret.

248. It is recognised that an element of applied research can be described as strategic research, but the lack of an agreed approach in member countries to its separate identification prevents making a recommendation.

Experimental development

249. Experimental development is systematic work, drawing on knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

250. In the social sciences, experimental development may be defined as the process of translating knowledge gained through research into operational programmes, including demonstration projects undertaken for testing and evaluation purposes. The category has little or no meaning for the humanities.

Strategic research

Page 26 of the *Glossary of Terms For Scientific and Technological Activities in New Zealand*; Ministry of Research, Science and Technology; July 1991, provides a definition for strategic research:

Research activities conducted to support long-term “national needs” and directed into specific broad areas in expectation of useful discoveries, or providing the broad knowledge base necessary for solution of recognised practical problems.

Definitions

ANZSIC: *Australian and New Zealand Standard Industrial Classification System – NZ Version 1996.*

ISIC: *International Standard Industrial Classification of All Economic Activities (Revision 3).*

Business Frame: A register of all businesses operating in New Zealand.

Enterprise: A legal business entity operating in New Zealand.

Research and development (R&D): The definition of R&D used in this survey is consistent with the OECD recommendations contained in the *Frascati Manual*. R&D performed by enterprises is generally investigative work which is of actual or potential use in the development of new or enhanced materials, products, devices, processes or services. R&D directed towards duplicating work already developed by others is included only if the knowledge or technology required for the development is not available to the enterprise.

Table A: Response Rate by Sector

Description	No. in Survey	No. Received	Response Rate
Government	164	157	96%
Business	2,319	1,969	85%
Universities	8	8	100%

Table B: Response Rate by Industry (Business sector)

Description	No. in Survey	No. Received	Response Rate
Agriculture and Mining	133	111	83%
Food Beverages and Tobacco	138	113	82%
Textiles, Fur and Leather, Wood, Paper, Printing, Publishing	154	136	88%
Coke, Petroleum, Nuclear Fuel, Chemicals & Prod., Rubber & Plastic	157	133	85%
Non-metallic Mineral Products	30	26	86%
Basic Metals	18	15	84%
Fabricated Metal Products Except Machinery and Equipment	65	52	80%
Machinery and Equipment nec	132	108	82%
Office Accounting and Computing Machinery	7	6	80%
Electrical Machinery and Apparatus nec	39	32	82%
Radio, Television and Communication Equipment and Apparatus	47	38	81%
Medical, Precision and Optical Instruments, Watches and Clocks (Instruments)	17	14	81%
Motor Vehicles, Trailers and Semi-trailers	21	17	82%
Other Transport Equipment	28	23	82%
Furniture and Manufacturing nec	48	42	87%
Electricity, Gas and Water	12	11	94%
Construction	53	46	88%
Wholesale, Retail Trade, Motor Vehicle Repair	314	278	89%

Description	No. in Survey	No. Received	Response Rate
Hotels and Restaurants	24	22	91%
Transport, Storage and Communications	49	43	89%
Financ. Intermediation (inc. insur)	86	76	88%
Renting of Office Machinery and Equipment	8	7	89%
Computer and Related Activities	255	196	77%
Research and Development	38	31	82%
Other Business Activities	298	262	88%
Community, Social and Personal Service Activities, etc	110	97	89%
Other Services	38	34	89%

Survey of Research and Development (R&D)

YEAR ENDED 30 JUNE 2002
OR your last accounting year that ended within the 12 months up to 30 June 2002

*Please correct
any errors in
this panel.*

PLEASE READ CAREFULLY

Please return this questionnaire in the envelope provided, within **30 days of receiving it**. A return is required even if the enterprise undertakes no research and development activities. See question 1.

Information to be supplied - This questionnaire must be completed for all the activities of the enterprise named in the above address panel. **Do not include** the activities of subsidiary or associate companies.

Compulsory requirement - The taking of this survey has been approved by the Minister of Statistics and the return of this questionnaire duly filled in and signed is a compulsory requirement under the Statistics Act 1975.

Confidentiality of information supplied - This is a joint survey by Statistics New Zealand and the Ministry of Research, Science and Technology. The Ministry of Research, Science and Technology may also want to contact you for further information. You have the right to object, in writing, to the Government Statistician to the sharing of information with the Ministry of Research, Science and Technology. Only people authorised by the Statistics Act 1975 are allowed to see your individual information, and they must use it only for statistical purposes. Your information will be combined with similar information to prepare summary statistics.

Purpose - The purpose of this survey is to collect data which will be used to produce summarised statistics of research and development activities for release to Government, business and other users in the community. The statistics will be used in the development of science policy in areas such as the setting of research priorities, Government research funding levels, science education and innovation encouragement schemes.



Brian Pink
Government Statistician

NOTE:

- 1) Please give whole dollar amounts only.
- 2) Where actual figures are not available, please give careful estimates.
- 3) Please give all figures **exclusive** of GST.
- 4) Please keep a record of the time it takes you to complete this questionnaire. You are asked to record this in question 10, page 11.

Help and Advice (Please quote the reference number in the above label)

<p>Mail</p> <p>Survey Help Desk Statistics New Zealand Freepost 10007 Private Bag 92003 AUCKLAND</p>	<p>Phone</p> <p>Survey Help Desk 0800 809 464</p>	<p>Fax</p> <p>Auckland 0-9-357 2195</p> <p>Email</p> <p>surveys@stats.govt.nz</p>
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What is Research and Development? (R&D)

What is business R&D?

The R&D performed by businesses is generally investigative work which is of actual or potential use in the development of new or enhanced materials, products, devices, processes or services. R&D directed towards duplicating work already developed by others should only be included if the knowledge or technology required for development is not available to this business.

R&D covers

- Any activity characterised by ORIGINALITY; it should have INVESTIGATION as a primary objective, the outcome of which is the prospect (or expectation) of gaining **new knowledge**, with or without a specific practical application or **new or improved materials**, products, devices, processes or services.
- **Basic** and **applied research** and experimental development in the natural and applied sciences and social sciences and humanities.

R&D includes

- Design, construction and operation of prototypes where the main objective is technical testing or to make further improvements.
- Construction and operation of pilot plants not operated or intended to be operated as commercial units.
- Research into and original development (or substantial modification) of computer software such as new programming languages and new operating systems.
- "Feedback R&D" directed at solving problems occurring beyond the R&D phase, for example technical problems arising during initial production runs.
- Research work in the biological, physical and social sciences, and the humanities.
- Social science research includes economic, cultural, educational and sociological research.

The following are only included if used primarily for the support of, or as part of, R&D projects

- Scientific and technical information services.
- Policy related studies, management studies, efficiency studies.
- Routine quality control and testing.
- Pre-production activities such as demonstration of commercial viability, tooling up and trial production runs.
- Prospecting, exploring or drilling for minerals, petroleum or natural gas.
- Cosmetic modifications or style changes to existing products.
- General purpose or routine data collection.
- Routine computer programming, systems maintenance or software development and application.
- Operations research and mathematical or statistical analysis.
- Commercial, legal and administrative aspects of patenting, copyrighting or licensing activities.
- Activities associated with standards compliance.
- Specialised routine medical care, for example routine pathology services.

Where does R&D end?

R&D ends when the work is no longer experimental and pre-production begins.

If the primary objective is to make further technical improvements then the work comes within the definition of R&D.

However, if the material, product, etc. is substantially developed and the primary objective is to develop markets, (ie market research) to do pre-production planning or to get production or control systems working smoothly, then the work is no longer R&D.

Note: for the borderline between **research** and **studies**, see box on page 3.

If you require any further information or clarification on R&D or Technical Know-how for specific cases, please contact: **Mathew Page**
phone 0-3-371 4554 or 0800 809 464 and ask for ext. 8554
email mathew_page@stats.govt.nz

What is Technical Know-how?

Technical Know-how is the existing specialised technical knowledge in an enterprise that is required to produce a product or implement a process or processes which are not readily available to other enterprises - eg patents; licences; trademarks; restricted technical data and information; scientific, technical, or engineering assistance that increases technical knowledge and understanding in the enterprise buying the know-how. Please ignore transactions where no charges are made, eg official technical aid.

Payments for purchases of technical know how

Don't count:

- other costs incurred by this business to obtain know-how, for example overseas travel, subscriptions to periodicals, copyright material.
- the cost of computer software and scientific, technical or engineering services that are not aimed primarily at increasing the technical knowledge of this business.
- training costs.

Receipts for sales of technical know-how

Don't count:

- receipts for contracts or commission work carried out by this business on behalf of others.
- receipts for sales of merchandise (including 'high-tech' merchandise); copyright material.
- receipts for sales of training services.

Borderline between research and studies

Research activities are usually performed in scientific units. Their aim is to produce innovative results which can be generalised or be generally utilised. The activities are often connected to other research and financed from research funds; the results have a considerable novelty value and they are usually widely published.

Studies involve collecting, processing and analysing data for decision making and planning. The studies are often made by enterprises as an integral part of their planning activities. The results are mainly descriptive, they are not widely published and they cannot easily be generalised or utilised for any other purpose. Income and expenditure on studies should not be included in this questionnaire.

1 Do you need to complete the whole questionnaire?

Answer the following three questions to find out if you have to complete the rest of the questionnaire. See page 2 for a more detailed definition of Research and Development (R&D).

a Did this enterprise **carry out any** R&D in 2001/2002? Yes No

If "Yes", please answer questions 2, 3, 4, 5, 6, 9, 10, and 11 and return the questionnaire in the freepost envelope provided.

b Did this enterprise **fund**, or pay any levies which may have been used to fund, any R&D **at other organisations** in 2001/2002? Yes No

If "Yes", please answer questions 3, 7, 9, 10, and 11 and return the questionnaire in the freepost envelope provided.

c Did this enterprise buy or sell Technical Know-how abroad in 2001/2002? See page 3 for a detailed definition of Technical Know-how. Yes No

If "Yes", please answer questions 3, 8, 9, 10, and 11 and return the questionnaire in the freepost envelope supplied.

If you answer "No" to all of the questions, please complete questions 10 and 11 on page 11 and return the questionnaire in the freepost envelope provided.

2(i) R&D Personnel By Occupation

Please show how many personnel were working on R&D **as at 30 June 2002**, and show the number of full-time equivalents working on R&D **during the year ended 30 June 2002**.

Note: Full-time equivalents may be given to a decimal point.

Full-time equivalents are measured in terms of full-time equivalent years: Example.

- A full-time person spending **40%** of his/her working time on R&D during **half** of the survey year would contribute **0.4** persons x **0.5** = **0.2 full-time equivalent** years to the R&D effort.
- A part-time person working 50% of a normal week on R&D for the full survey year would contribute 0.5 persons x 1.0 = 0.5 full-time equivalent years to the R&D effort.

Exclude: Staff outside the R&D performing unit providing **indirect** support:

- central finance or personnel services
- centralised support services eg computer departments, security, cleaning, canteen

	Personnel	Head-count as at 30 June 2002		Full-time equivalents during the year ended 30 June 2002	
		Male	Female	Male	Female
a	Researchers Staff engaged in the conception and/or creation of new knowledge/products, personnel involved in the planning or management of scientific and technical aspects of R&D projects, and software developers.	8108	8112	8100	8104
b	Technicians Staff engaged in technical tasks in support of R&D, normally under the direction and supervision of a researcher.	8109	8113	8101	8105
c	Other supporting staff Staff providing specific information acquisition and treatment (drafting, typing, reproducing R&D reports, in-house libraries etc.) or specific administrative support (bookkeeping, personnel etc.).	8110	8114	8102	8106
d	Total	8111	8115	8103	8107

2(ii) R&D Personnel By Qualification

Please show the qualification levels of full-time equivalents working on R&D tasks **during the year ended 30 June 2002**.

The total number of full-time equivalents should agree with question 2(i) on page 4.

Note: Full-time equivalents may be given to a decimal point.
See question 2(i) for a detailed explanation of Full-time equivalents.

	Qualification	Full-time equivalents during the year ended 30 June 2002	
		Male	Female
a	PhD	8150	8160
b	Bachelor degrees or equivalent and post graduate qualifications other than those above	8151	8161
c	Technical qualifications eg NZ Certificate of Engineering	8152	8162
d	Trade qualification eg NZ Trade Certificate or Advanced Trade	8153	8163
e	Other post-secondary qualification eg Diploma of Business Administration, National Certificate of Business Studies	8155	8165
f	Secondary qualifications eg Bursary, Sixth Form Certificate, School Certificate	8156	8166
g	Other or no qualifications	8158	8168
h	Total to agree with the total for question 2(i)	8159	8169

3 Accounting period and accounting information

Accounting period to be either – year ended 30 June 2002, or
– your last accounting year ended within the 12 months up to 30 June 2002.

a Please state the accounting period covered by this questionnaire.

From: To:

If other than 12 months please give reason:

b Do your accounts identify R&D expenditure?

Yes No

If "No" please supply careful estimates to expenditure questions.

If "Yes" please complete the expenditure questions from your accounts.

4 Current and capital expenditure on R&D carried out by this enterprise during the accounting period

Only answer this question if you answered "Yes" to question 1a.

What was the total expenditure on R&D carried out by this enterprise during the accounting period?

Exclude:

- R&D funded by this enterprise, but carried out by others. See question 7.
- Amount spent abroad on the purchase of Technical Know-how. See question 8a.

Note: If the figures are not given in your accounts, please estimate.

Include a proportion of all overheads in c. If necessary, estimate from your total overheads in proportion to the full-time equivalents engaged in R&D.

a	<p>• Wages and salaries only for full-time equivalent personnel given in question 2</p> <p>Include</p> <ul style="list-style-type: none"> • Other employment related costs eg overtime, holiday pay, sick pay, ACC, employer superannuation contributions and fringe benefits. <p>Exclude</p> <ul style="list-style-type: none"> • Redundancy and severance payments • Wages and salaries of personnel indirectly supporting R&D 	8200	\$ <input type="text"/>
b	• Redundancy and Severance Payments	8201	\$ <input type="text"/>
c	<p>• Other current R&D expenditure</p> <p>Include</p> <ul style="list-style-type: none"> • All consumables and overheads incurred by direct and indirect support activities eg materials, power, rent, rates, repairs, interest, books, travel. • Wages and salaries of personnel indirectly supporting R&D. Include only that part of their wages and salaries that is attributable to the indirect support of R&D eg wages and salaries of staff outside the R&D performing unit providing indirect support: <ul style="list-style-type: none"> – central finance or personnel services – centralised support services eg computer departments, libraries, security, cleaning, canteen. <p>Exclude</p> <ul style="list-style-type: none"> • Depreciation. • Wages and salaries etc. included in a, above. 	8202	\$ <input type="text"/>
d	<p>Capital expenditure on (i) land and buildings</p> <p>(ii) plant, equipment, machinery, vehicles, capitalised software and other assets used in carrying out R&D during the accounting period.</p> <p>N.B. If the assets purchased are also used for production, please include only the portion used for R&D.</p>	8203	\$ <input type="text"/>
		8204	\$ <input type="text"/>
e	<p>Total expenditure to agree with the total for question 5 & 6.</p>	8210	\$ <input style="border: 2px solid black;" type="text"/>

5 Expenditure by type of R&D undertaken during the accounting period

Only answer this question if you answered "Yes" to question 1a.

How much of the total expenditure given in question 4 was spent on each type of R&D activity during the accounting period?

Please give either as dollar amounts or as a percentage of the total expenditure given in question 4.

a	Underpinning research						
	i Basic research						
	Include						
	<ul style="list-style-type: none"> • Experimental or theoretical work undertaken primarily to acquire new knowledge without a specific application. • Work carried out without looking for long term economic or social benefits other than the advancement of knowledge. • Humanities R&D would normally involve this type of research. 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">%</td> </tr> <tr> <td style="text-align: center;">8250</td> <td></td> </tr> </table>	\$	%	8250		
\$	%						
8250							
	ii Strategic research						
	Include						
	<ul style="list-style-type: none"> • Research directed into specific broad areas in expectation of useful discoveries or applications. • Research providing the broad base of knowledge necessary for the solution of recognised practical problems. 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">%</td> </tr> <tr> <td style="text-align: center;">8251</td> <td></td> </tr> </table>	\$	%	8251		
\$	%						
8251							
b	Applied research						
	Include original work undertaken						
	<ul style="list-style-type: none"> • To acquire new knowledge with a specific application in view. • To determine the possible uses for the findings of basic research. • To determine new methods or ways of achieving some specific and predetermined objectives. 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">%</td> </tr> <tr> <td style="text-align: center;">8252</td> <td></td> </tr> </table>	\$	%	8252		
\$	%						
8252							
c	Experimental development						
	Include						
	<ul style="list-style-type: none"> • Systematic work using existing knowledge gained from research and/or practical experience for the purpose of creating new or improved materials, products, processes or services. 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">%</td> </tr> <tr> <td style="text-align: center;">8254</td> <td></td> </tr> </table>	\$	%	8254		
\$	%						
8254							
d	Total expenditure to agree with the total for question 4 & 6.						
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">\$</td> <td style="width: 20%; text-align: center;">%</td> </tr> <tr> <td style="text-align: center;">8260</td> <td></td> </tr> </table>	\$	%	8260		
\$	%						
8260							

6 Source of funds for R&D carried out by this enterprise during the accounting period

Only answer this question if you answered "Yes" to question 1a.

If you carried out the R&D yourself what were the sources of your funds? Please give either as dollar amounts or as a percentage of total R&D funds.

Note: Funds received as levies or subscription fees from member associations or associated industry enterprises should be treated as payments for research from other enterprises, and not included in g.

Source		Amount			
a	NZ private sector Include: <ul style="list-style-type: none"> • private and publicly listed enterprises • state owned enterprises • producer boards • research associations 	8301	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
b	NZ government funding agencies Include: <ul style="list-style-type: none"> • Foundation for Research Science and Technology (FRST) <ul style="list-style-type: none"> Public Good Science Fund (PGSF) Non-Specific Output Funding (NSOF) Technology New Zealand (TechNZ) Technology for Business Growth (TBG) Graduate Research in Industry Fellowship (GRIF) New Zealand Science and Technology Post-Doctoral Fellowship • Royal Society of New Zealand (RSNZ) <ul style="list-style-type: none"> The Marsden Fund • Health Research Council 	8302	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
c	Other New Zealand government departments, ministries, crown entities or crown-owned companies eg Ministry for the Environment, Forest Research Institute, Transit NZ, Agricultural and Marketing Research and Development Trust (AGMARDT) Exclude: <ul style="list-style-type: none"> • State owned enterprises (include in 6a above) • Treasury vote (include in 6g below) 	8303	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
d	New Zealand local government sector eg district councils, city councils and regional councils	8304	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
e	New Zealand tertiary education sector eg universities, polytechnics	8305	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
f	Funds from abroad	8306	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
g	Own funds eg Treasury vote, equity, reserves, borrowings, retained earnings	8307	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
h	Other funding sources eg Lottery Board, Cancer Society, Heart Foundation, charities (please specify)	8308	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				
i	Total R&D funds if this does not agree with the total for question 4 and 5 please give reasons eg profit Reasons:	8320	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">\$</td> <td style="width: 50%; text-align: center;">%</td> </tr> </table>	\$	%
\$	%				

7 R&D funded during the accounting period by this enterprise but carried out by others

Only answer this question if you answered “Yes” to question 1b.

If you paid for R&D but you did not do the work yourself, where did you spend the money?

Note: If you paid a levy or fee to another organisation that contained an **unknown component** of R&D funding, please record these funds only in **7(j)** on the next page.

Performer of Research		Amount of R&D funded \$
a	NZ private sector Include: private and publicly listed enterprises, state owned enterprises, producer boards and research associations	8800
b	NZ central government sector eg Departments, Ministries, crown entities, etc. Exclude Crown Research Institutes (include in c below)	8806
c	Crown Research Institutes eg NZFRI, NIWA, IRL, Landcare, Crop & Food Research, AG Research, Hort Research, IGNS, ESR	8807
d	NZ local government sector eg regional councils.	8802
e	NZ tertiary education sector eg universities, polytechnics.	8803
f	Overseas organisations	8804
g	Other (please specify).	8805
h	Total Do not include this amount in question 4 or 5.	8810

Note: *If your organisation is a subsidiary of a multinational, include only money spent by this subsidiary.

7(i) Performer of research

Only answer this question if you answered any part of question 7a to h.

If you paid another organisation(s) to undertake R&D on your behalf, please list the organisation(s) below.

Organisation(s) receiving payment to undertake R&D

8820

7(j) Levies or fees paid with an unknown R&D component

If you paid a levy or fee to another organisation that contained an unknown component of R&D funding, please record these funds.

Do not include this amount in any part of question 7a to h.

Organisation receiving the levy/fee	Location (Country)	Total amount of levy/fee paid during the accounting period \$
8830	8831	8832
8833	8834	8835

Bibliography

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OECD (1993). *Frascati Manual*, Organisation for Economic Co-operation and Development, Paris.

OECD (2003). *Main Science and Technology Indicators*, Organisation for Economic Co-operation and Development, Paris.