



NATIONAL SURVEY OF RESEARCH AND
EXPERIMENTAL DEVELOPMENT (R&D)
(2004/05 FISCAL YEAR)

Centre for Science, Technology and Innovation Indicators,
Human Sciences Research Council

for

Department of Science and Technology

DRAFT

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Executive Summary

1. The Centre for Science, Technology and Innovation Indicators (CeSTII) is now located within the Knowledge Systems group of the HSRC.
2. CeSTII has become a national resource to perform surveys on the system of innovation according to international best practice and to form the hub of a network of excellence involving local, regional and international peers.
3. This Report presents the results of the third survey that CeSTII has conducted, namely the 2004/05 Survey of Inputs into Research and Experimental Development (R&D), referred to as the 2004/05 R&D Survey.
4. The 2004/05 R&D Survey constitutes the second in the intended annual series of R&D Surveys and thus follows that of 2003/04.
5. As previously, the 2004/05 questionnaire followed the OECD Frascati Manual guidelines. It included standard items as well as inquiring more deeply into staff demographics, R&D collaboration and higher education funding.
6. The universe of R&D performers was divided into five sectors:
 - i. **The Business Enterprise Sector:** The business sector of large, medium and small enterprises, including state-owned companies.
 - ii. **The Government Sector:** All government departments with an R&D component, government research institutions and museums.
 - iii. **The Higher Education Sector:** All public Higher Education institutions and some private higher education institutions with an R&D component 35 Higher Education institutions (18 Universities, 8 Technikons, 3 Universities of Science and Technology, 1 Institute of Technology and 5 private higher education institutions.
 - iv. **The Not-for-Profit Sector:** Non-governmental and other organisations formally registered as not-for-profit institutions.
 - v. **The Science Council Sector:** the 8 science research councils plus the Africa Institute, all established through Acts of Parliament
7. The indicators and data tables provided in this Report are the main subset of the S&T indicators and data tables specified for R&D surveys by the OECD.
8. In Table E1 we present the breakdown of the national total of R12, 0 billion of intramural R&D Expenditure by sector.

Table E1: Total In-house R&D expenditure* per sector, 2004/05 and 2003/04

Sector	2004/05		2003/4	
	R 000s	%	R 000s	*%
Business enterprise (BERD)	6,766,361	56.3	5,591,325	55.5
Government	515,331	4.3	465,367	4.6
Higher education	2,533,971	21.1	2,071,351	20.5
Not-for-profit	198,268	1.7	209,023	2.1
Science Councils	1,996,050	16.6	1,745,493	17.3
Grand Total	12,009,981	100.0	10,082,559	100.0

*Rounding error sums to 99,9%

9. The Business Sector at 56,3% was the largest performer; Government combined with the Science Councils accounts for 20,9%; Higher Education comprises 21,1%.

10. Table E2 depicts the main information on human resources by sector.

Table E2: Headcount of R&D personnel by sector, 2004/05

Sector	Researchers	Technicians Directly Supporting R&D	Other Personnel Directly Supporting R&D	Grand Total	%
Business enterprise	6575	3724	4038	14337	25.4
Government	692	494	1125	2311	4.1
Higher education*	27603	2801	2722	33126	58.7
Not-for-profit	285	40	184	509	0.9
Science Councils	1846	1582	2742	6170	10.9
Grand Total	37001	8641	10811	56453	100.0

*Including Doctoral and Post-Doctoral Students

11. Deployment of Researchers varies considerably by sector. For example, the higher education sector has many more researchers (including doctoral students) compared to the Business Sector in terms of head counts. However in terms of Full-Time Equivalents (FTEs) business researchers appear to spend about 80% of their time on R&D while higher education researchers spend about 37% of their time on R&D, with the rest of their time devoted to teaching and administrative duties. 17915 FTE Researchers and a grand total of 29695 FTE R&D personnel support the country's R&D effort. The latter translates into 2.6 R&D personnel per 1000 total employment.

12. A close working relationship was maintained with Statistics Canada who provided valuable guidance in the finalization of the R&D Survey.

13. The Science and Industry Directorate of the OECD also gave valuable advice toward submission of the 2003/04 R&D Survey results for inclusion in the *OECD Main S&T Indicators* and the accompanying *OECD science, Technology and Industry Scoreboard*.
14. Statistics South Africa declared the 2001/02 Survey of Inputs to Research and Development as a component of Official Statistics on 13 June 2005.
15. All data extractions that CeSTII performs for users are governed by the Access Protocol, and are generally provided free of charge unless they require fairly substantial analytical work.
16. The knowledge and expertise developed through the surveys have been codified in the CeSTII Survey Operations Manual.
17. The recurring advice from various participants in this sector continues to be that the feedback process following each survey will affect the success of future surveys. There exists a real interest in the findings of any analysis of the data, especially where these indicate the competitive standing of organizations.
18. The Higher Education sector and the Business sector questionnaires are provided in a separate Annex as Appendices 1 and 2 respectively. Also included is the User Guide (Appendix 3).
19. The public web site www.hsrc.ac.za/RnDSurvey hosts this Report and documents for the previous surveys in both .pdf and .xls format.

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As previously we acknowledge the cooperation of the respondents, especially those who attended to the questionnaire under pressure and even outside work hours.

Finally our appreciation to our own administration staff, especially Valda West and Shiraj Gamielien.

The R&D Survey is now being conducted annually. The steady increase in the number of requests for data extractions attests to its value to the policy community. CeSTII continues to learn and is now able to further contribute to measuring the national system of innovation.

Prof. Michael Kahn, Executive Director, CeSTII, Knowledge Systems

Glossary of Abbreviations

AISA	Africa Institute of South Africa
ARC	Agricultural Research Council
BERD	Business Expenditure on R&D
BUS	Business
CGS	Council for Geosciences
CSIR	Council for Scientific and Industrial Research
DST	Department of Science and Technology
DTI	Department of Trade and Industry
ICT	Information and Communication Technology
FTE	Full Time Equivalent
GERD	Gross Expenditure on Research and Development
GDP	Gross Domestic Product
GOV	Government
GOVERD	Government Expenditure on Research and Development
HEI	Higher Education Institution
HERD	Higher Education Expenditure on R&D
HSRC	Human Sciences Research Council
Mintek	Council for Mineral Technology
MRC	Medical Research Council
NGO	Non-Governmental Organisation
NIF	National Innovation Fund
NPO	Not-for-Profit Organisation
NRF	National Research Foundation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
SABS	South African Bureau of Standards
SAIAB	South African Institute for Aquatic Biodiversity
SCI	Science Councils
SIC	Standard Industrial Classification
SMRS	Survey Management and Results System
THRIP	Technology for Human Resources and Industry Programme
UOM	Unit of Measure

Chapter 1: Introduction to the Survey

1.1 Background

The HSRC Centre for Science, Technology and Innovation Indicators (CeSTII) conducts the Surveys on Inputs to Research and Experimental Development (R&D Survey) for the Department of Science and Technology (DST). Since 13 June 2005 the Survey has been a component of Official Statistics as defined under the Statistics Act no. 6 of 1999.

In order to ensure the sustainable production of the R&D Survey and other surveys of the national system of innovation the Department of Science and Technology supports CeSTII through a ring-fenced grant within the Medium Term Expenditure Framework of government.

CeSTII is housed in the Knowledge Systems group of the Human Sciences Research Council (HSRC) in Cape Town and receives additional financial support from HSRC.

The R&D Surveys are carried out according to the guidelines of the OECD Frascati Manual of 2003. Key indicators and data tables arising from the R&D Survey are now included in the authoritative OECD publication *OECD Main S&T Indicators* that appears bi-annually.

Following the Frascati Manual, the Survey covered the following sectors, as listed below.

Business (BUS)

The business sector comprises large, medium and small enterprises, including state-owned companies constituted as juristic persons irrespective of their shareholding structure. To identify respondents purposive sampling was undertaken using earlier registries, business rankings such as the Technology Top100 and JSE 100 and other databases including the National Innovation Fund, Support Programme for Industrial Innovation (SPII), and the Technology and Human Resources for Industry Programme (THRIP).

Government (GOV)

Government departments and associated research institutions and museums performing R&D at national, provincial and local levels. The survey of government entails a census approach.

Higher Education (HE)

Higher Education Institutions (Universities, Technikons, Universities of Science and Technology, Institutes of Education) and Private Higher Education Institutions. The public higher education institutions are surveyed through a census survey of all institutions while the private institutions are surveyed purposively.

Not-for-Profit Organisations (NPO)

Non-governmental and other organisations formally registered as not-for-profit institutions are surveyed through purposive sampling.

Science Councils (SCI)

The eight statutory science research councils plus the Africa Institute of South Africa (AISA), all established through Acts of Parliament, conducted as a census survey.

The survey data were captured through a questionnaire that was largely common across the five sectors. The work of the Survey relies on development and updates of appropriate sector sampling methodologies and sector specific questionnaires, development of capacity and diversity in the survey team, and modification of the database to which the data are captured, namely the Survey Management and Results System (SMRS). The strategy of capacity development in CeSTII included investment in people and systems and ongoing training in survey execution.

These sectors were surveyed over the period August 2005 to March 2006 to gather data on their R&D inputs for the financial year ending 28 February 2005 or nearest. For Higher Education this was the academic (calendar) year 2004.

For Government departments this was the government financial year that ended 31 March 2005, while for Business it was the nearest financial year to that coinciding with the tax year ending 28 February 2005.

Questionnaires were administered by post, face-to-face, electronically and telephonically. Returns were similarly gathered and augmented with telephonic follow-ups for completion and verification of information recorded in the questionnaires. The bulk of data was received by late January 2006, with final returns accepted up to the end of March 2006. Where necessary organisations were assisted in compiling and furnishing their returns.

Compared with the surveys of 2001/02 and 2003/04 the acquisition of data was somewhat smoother though the problem of continuity of responding persons remains a problem. Information system weaknesses and the merger process in the higher education sector continued to be a destabilising factor though we are confident that the higher education data are more robust than before.

The Survey Management and Results System developed at the CSIR Meraka Institute serves as the final repository for the electronic data, survey by survey. In addition a hard copy record of all respondent data is maintained.

1.2 Interpretation

The third survey adhered to the Frascati Manual definition of R&D:

Research and Experimental Development (R&D) is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications.

The boundaries of this definition are constantly shifting, particularly as industrialized societies move further into becoming 'knowledge economies' in which the service sector becomes the dominant component of GDP. Accordingly the business sector coverage was further extended into

the services sector. In addition special effort was made to capture the work conducted by the major pharmaceutical houses, contract research organizations and retailers.

As previously, the lists of Research Fields and Socio-Economic Objectives are compatible with the systems used by OECD countries. They are based on the Australian approach where considerable work has been undertaken on classification systems by the Australian Bureau of Statistics. The Standard Industrial Classification (SIC) codes are those provided by Statistics SA.

Regarding the demographic data, the 2004/5 Race and Qualification data (from complete questionnaires) was scaled-up in order to estimate the overall split of the full head count as only 40.5% of the Business Sector respondents provided full details on the race and qualification of their R&D personnel. A similar exercise was performed for the Not-for-profit sector with its 60.2% returns of personnel data. The upwards scaling was performed by calculating the ratio of aggregate total head counts (including estimated data) to the total aggregate head counts for full questionnaires. The upward scaling only took place once the complete key data on expenditure had if necessary been imputed. The race and qualification data were scaled up in proportion to the total head counts and corrected to ensure that the estimates simultaneously matched the split with respect to gender and researcher type. Estimated confidence intervals for the proportions in each category were calculated from the sample size represented in each race and qualification category. The resulting estimates were found to be consistent with the corresponding figures for the 2001/2 R&D Survey when race and qualification data were last requested of respondents.

1.3 The Report and Dissemination

Each of the Sector reports contains:

- An introduction to the sector
- Key results
- Brief comments on how the survey methodology was implemented
- Basic descriptive data compiled from data in the questionnaire returns.

Where data from secondary sources were used this is indicated in the text.

The five Sector reports are presented as Chapters 2 through Chapter 6. This is followed by concluding remarks in Chapter 7.

This Report is published for wider dissemination at www.hsrc.ac.za/RnDSurvey and is freely downloadable. All the data tables in this Report are available on the web site in Microsoft Excel format.

The data thus presented may be used by third parties provided the original source is acknowledged and the third party accepts responsibility for any onward transmission or interpretation.

1.4 The Data Tables and Indicators

The data tables and indicators provided in this document are the main subset of the S&T data tables and indicators specified for R&D surveys by the OECD. Some of the OECD indicators have been excluded, as they are not derived from the R&D survey itself, such as those relating to government budget appropriations or outlays for R&D (GBAORD).

The data tables and indicators provided cover the core R&D data tables and indicators as required by the OECD for country submissions for publication in the *OECD Main Science and Technology Indicators*.

Economic and other indicators (Table IA) for year 2004/05 are those compiled by the OECD based on official South African government economic data series. Table 1B sets out the key R&D figures and indicators for the country

Table IA: Economic indicators 2004/05

Indicator	Value
GDP - Current Prices (Millions of Rands)	1 386 658
GDP – 2000 Constant Prices (Millions of Rands)	1 056 771
Purchasing Power Parity (Rands per US\$)	2.69
Value Added in Industry (millions of Rands)	979 677
Implicit GDP Price Index (Base year 2000 = 1.00)	1.312
National Population (thousands)	47 208
Total employment (thousands)	11 518
Industrial employment (thousands)	8 066

Table 1B: Key R&D Figures and Indicators 2004/05

Gross domestic expenditure on R&D (GERD) Rand millions	12 010
GERD as a percentage of GDP	0.87
Total R&D personnel (FTE) ^a	29 696
Total researchers (FTE) ^b	17 915
Total researchers per 1000 total employment (FTE)	1.6
Total R&D personnel per 1000 total employment (FTE)	2.6
Civil GERD as a percentage of GDP	0.80
Total researchers (headcount)	37 001
Women researchers as a percentage of total researchers	38.3

^a FTE = Full Time Equivalent

^b Following OECD practice doctoral students are included as researchers

Please note: Due to final database validation processes, some data presented in this report may differ slightly from those presented in the booklet High-Level Key Results for 2004/05 that was released on 22 June 2006.

The five sector reports now follow. They may be read in any order, as they stand independent of one another.

For convenience we also provide summary tables (1.1 to 1.8) of the data parameters common across the five sectors.

Table 1.1: R&D Expenditure by Sector

	Business enterprise	Government	Higher education	Not-for-profit	Science Councils	GERD
Expenditure (R 000s)	6,766,361	515,331	2,533,971	198,268	1,996,050	12,009,981
%	56.3	4.3	21.1	1.7	16.6	100.0

Table 1.2: R&D Expenditure by Accounting category

Type Of Expenditure	Business enterprise		Government		Higher education		Not-for-profit		Science Councils		Total	
	Amount		Amount		Amount		Amount		Amount		Amount	
	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%
Capital Expenditure on R&D	642,863	9.5	99,059	19.2	193,536	7.6	13,069	6.6	127,465	6.4	1,075,992	9.0
<i>Land: Buildings and Other Structures</i>	97,982	1.4	57,403	11.1	16,693	0.7	4,593	2.3	29,299	1.5	205,970	1.7
<i>Vehicles, Plant, Machinery, Equipment</i>	544,881	8.1	41,656	8.1	176,843	7.0	8,476	4.3	98,166	4.9	870,022	7.2
Current Expenditure	6,123,498	90.5	416,272	80.8	2,340,435	92.4	185,199	93.4	1,868,585	93.6	10,933,989	91.0
<i>Labour Costs</i>	3,341,011	49.4	236,489	45.9	1,097,488	43.3	77,502	39.1	968,610	48.5	5,721,100	47.6
<i>Total cost of R&D postgraduate students</i>	0	0.0	0	0.0	308,454	12.2	0	0.0	0	0.0	308,454	2.6
<i>Other Current Expenditure</i>	2,782,487	41.1	179,783	34.9	934,493	36.9	107,697	54.3	899,975	45.1	4,904,435	40.8
Total	6,766,361	100.0	515,331	100.0	2,533,971	100.0	198,268	100.0	1,996,050	100.0	12,009,981	100.0

Table 1.3: R&D Expenditure by Sources of Funds*

Source of Funds	Business enterprise		Government		Higher education		Not-for-profit		Science Councils		Total	
	Amount		Amount		Amount		Amount		Amount		Amount	
	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%
Own Funds	4,295,002	63.5	308,487	59.9	1,107,695	43.71	50,617	25.5	190,521	9.5	5,952,322	49.6
Government	481,519	7.1	129,685	25.2	170,616	6.73	37,892	19.1	1,096,818	54.9	1,916,530	16.0
Other Local Business	371,362	5.5	2,666	0.5	364,041	14.37	18,411	9.3	293,030	14.7	1,049,510	8.7
Higher Education	N/A	N/A	274	0.1	N/A	N/A	586	0.3	1,438	0.1	2,298	0.0
Other South African Sources	410,168	6.1	16,454	3.2	156,640	6.18	19,481	9.8	159,956	8.0	762,699	6.4
Foreign	1,208,310	17.9	57,765	11.2	303,002	11.96	71,281	36.0	254,287	12.7	1,894,645	15.8
Agency Funding (e.g. NRF, MRC, ARC etc.)	N/A	N/A	N/A	N/A	402,925	15.90	N/A	N/A	N/A	N/A	402,925	3.4
Science Councils	N/A	N/A	N/A	N/A	29,052	1.15	N/A	N/A	N/A	N/A	29,052	0.2
Total	6,766,361	100.0	515,331	100.0	2,533,971	100.00	198,268	100.0	1,996,050	100.0	12,009,981	100.0

* N/A entered where specific source of funds was not asked of the relevant sector

Table 1.4: Provincial Split of R&D

	Business enterprise		Government		Higher education		Not-for-profit		Science Councils		Total	
Province	Amount		Amount		Amount		Amount		Amount		Amount	
	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%
Eastern Cape	136,027	2.0	77,762	15.1	184,868	7.3	8,151	4.1	75,170	3.8	481,979	4.0
Free State	520,740	7.7	24,962	4.8	139,497	5.5	4,301	2.2	33,725	1.7	723,225	6.0
Gauteng	4,121,777	60.9	151,197	29.3	885,288	34.9	82,581	41.7	1,312,041	65.7	6,552,884	54.6
KwaZulu-Natal	615,437	9.1	31,213	6.1	373,595	14.7	37,729	19.0	171,424	8.6	1,229,397	10.2
Limpopo	49,948	0.7	9,568	1.9	63,508	2.5	4,201	2.1	23,887	1.2	151,112	1.3
Mpumalanga	178,452	2.6	29,240	5.7	47,379	1.9	9,029	4.6	35,580	1.8	299,681	2.5
North-West	184,691	2.7	13,401	2.6	123,817	4.9	4,810	2.4	43,581	2.2	370,301	3.1
Northern Cape	11,665	0.2	46,075	8.9	21,152	0.8	1,298	0.7	20,051	1.0	100,241	0.8
Western Cape	947,623	14.0	131,912	25.6	694,867	27.4	46,169	23.3	280,591	14.1	2,101,162	17.5
Total	6,766,361	100.0	515,331	100.0	2,533,971	100.0	198,268	100.0	1,996,050	100.0	12,009,981	100.0

Table 1.5: R&D Expenditure by Research Field (RF)

	Business enterprise		Government		Higher education		Not-for-profit		Science Councils		Total	
Main Research Field	Amount		Amount		Amount		Amount		Amount		Amount	
	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%
Division 1: Natural Sciences, Technology and Engineering	6,536,764	96.6	450,456	87.4	1,646,731	65.0	53,198	26.8	1,829,632	91.7	10,516,781	87.6
Mathematical Sciences	92,844	1.4	17,562	3.4	81,251	3.2	0	0.0	13,629	0.7	205,285	1.7
Physical Sciences	211,921	3.1	8,256	1.6	100,761	4.0	0	0.0	58,292	2.9	379,230	3.2
Chemical Sciences	469,211	6.9	8,709	1.7	101,808	4.0	0	0.0	28,710	1.4	608,438	5.1
Earth Sciences	34,269	0.5	32,795	6.4	101,262	4.0	1,386	0.7	96,474	4.8	266,185	2.2
Information, Computer and Communication	1,279,325	18.9	14,180	2.8	98,240	3.9	924	0.5	141,363	7.1	1,534,031	12.8
Applied Sciences and Technologies	856,021	12.7	4,581	0.9	43,653	1.7	5,250	2.6	63,696	3.2	973,201	8.1
Engineering Sciences	2,101,662	31.1	9,663	1.9	307,141	12.1	0	0.0	450,079	22.5	2,868,546	23.9
Biological Sciences	127,322	1.9	53,988	10.5	192,658	7.6	766	0.4	208,812	10.5	583,545	4.9
Agricultural Sciences	187,344	2.8	174,756	33.9	97,248	3.8	12,705	6.4	393,682	19.7	865,736	7.2
Medical and Health Sciences	997,182	14.7	84,629	16.4	440,249	17.4	20,096	10.1	237,103	11.9	1,779,259	14.8
Environmental Sciences	73,775	1.1	19,790	3.8	40,388	1.6	6,067	3.1	61,022	3.1	201,042	1.7
Material Sciences	96,525	1.4	0	0.0	29,918	1.2	0	0.0	65,398	3.3	191,841	1.6
Marine Sciences	9,366	0.1	21,547	4.2	12,154	0.5	6,005	3.0	11,372	0.6	60,444	0.5
Division 2: Social Sciences and Humanities	229,597	3.4	64,875	12.6	887,240	35.0	145,070	73.2	166,418	8.3	1,493,200	12.4
Social Sciences	229,522	3.4	59,831	11.6	577,653	22.8	143,351	72.3	148,758	7.5	1,159,115	9.7
Humanities	75	0.0	5,044	1.0	309,587	12.2	1,719	0.9	17,660	0.9	334,085	2.8
Total	6,766,361	100.0	515,331	100.0	2,533,971	100.0	198,268	100.0	1,996,050	100.0	12,009,981	100.0

Table 1.6: R&D Expenditure by socio-economic objective (SEO)

	Business enterprise		Government		Higher education		Not-for-profit		Science Councils		Total	
	Amount		Amount		Amount		Amount		Amount		Amount	
Socio-Economic Objective	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%	R 000s	%
Division 1: Defence	718,491	10.6	237	0.0	2,069	0.1	1,441	0.7	160,864	8.1	883,101	7.4
Defence	718,491	10.6	237	0.0	2,069	0.1	1,441	0.7	160,864	8.1	883,101	7.4
Division 2: Economic Development	4,895,638	72.4	245,493	47.6	735,329	29.0	56,356	28.4	1,057,410	53.0	6,990,226	58.2
Economic Development Unclassified	0	0.0	0	0.0	102,936	4.1	0	0.0	0	0.0	102,936	0.9
Plant Production And Plant Primary Products	209,583	3.1	57,072	11.1	60,922	2.4	942	0.5	198,256	9.9	526,775	4.4
Animal Production and Animal Primary Products	38,024	0.6	57,955	11.2	72,192	2.8	13,647	6.9	118,171	5.9	299,990	2.5
Mineral Resources (Excluding Energy)	711,661	10.5	0	0.0	15,898	0.6	0	0.0	251,953	12.6	979,512	8.2
Energy Resources	301,603	4.5	0	0.0	16,709	0.7	490	0.2	16,916	0.8	335,717	2.8
Energy Supply	292,545	4.3	0	0.0	31,871	1.3	1,164	0.6	542	0.0	326,122	2.7
Manufacturing	1,115,221	16.5	0	0.0	102,001	4.0	0	0.0	138,792	7.0	1,356,014	11.3
Construction	365,271	5.4	620	0.1	26,956	1.1	0	0.0	61,761	3.1	454,608	3.8
Transport	363,545	5.4	3,140	0.6	14,347	0.6	0	0.0	41,935	2.1	422,968	3.5
Information and Communication Services	588,233	8.7	6,068	1.2	50,745	2.0	0	0.0	22,090	1.1	667,136	5.6
Commercial Services	718,856	10.6	815	0.2	41,588	1.6	2,994	1.5	2,086	0.1	766,339	6.4
Economic Framework	11,280	0.2	35,748	6.9	93,107	3.7	33,695	17.0	50,045	2.5	223,875	1.9
Natural Resources	179,816	2.7	84,076	16.3	106,057	4.2	3,425	1.7	154,861	7.8	528,236	4.4
Division 3: Society	911,606	13.5	189,241	36.7	722,819	28.5	125,674	63.4	324,973	16.3	2,274,312	18.9
Society Unclassified	0	0.0	0	0.0	102,936	4.1	0	0.0	0	0.0	102,936	0.9
Health	873,468	12.9	76,373	14.8	328,251	13.0	23,471	11.8	203,178	10.2	1,504,741	12.5
Education and Training	20,087	0.3	94,694	18.4	132,616	5.2	66,400	33.5	68,755	3.4	382,553	3.2
Social Development and Community Services	18,050	0.3	18,174	3.5	159,016	6.3	35,803	18.1	53,040	2.7	284,082	2.4
Division 4: Environment	145,034	2.1	48,560	9.4	226,063	8.9	10,632	5.4	144,737	7.3	575,026	4.8
Environment Unclassified	0	0.0	0	0.0	34,312	1.4	0	0.0	0	0.0	34,312	0.3
Environmental Knowledge	32,776	0.5	37,663	7.3	94,667	3.7	4,641	2.3	87,752	4.4	257,500	2.1
Environmental Aspects of Development	70,069	1.0	5,252	1.0	40,122	1.6	5,704	2.9	20,436	1.0	141,583	1.2
Environmental and Other Aspects	42,188	0.6	5,645	1.1	56,963	2.2	286	0.1	36,549	1.8	141,631	1.2
Division 5: Advancement of Knowledge	95,593	1.4	31,800	6.2	847,691	33.5	4,165	2.1	308,067	15.4	1,287,316	10.7
Advancement of Knowledge Unclassified	0	0.0	0	0.0	102,936	4.1	0	0.0	0	0.0	102,936	0.9
Natural Sciences, Technologies and Engineering	92,497	1.4	22,797	4.4	427,087	16.9	0	0.0	246,359	12.3	788,740	6.6
Social Sciences and Humanities	3,096	0.0	9,002	1.7	317,668	12.5	4,165	2.1	61,708	3.1	395,640	3.3
Total	6,766,361	100.0	515,331	100.0	2,533,971	100.0	198,268	100.0	1,996,050	100.0	12,009,981	100.0

Table 1.7: R&D personnel headcount by sector*

	Business enterprise	Government	Higher education*	Not-for-profit	Science Councils	Total	%
Occupation							
Researchers	6575	692	27603	285	1846	37001	65.5
Technicians	3724	494	2801	40	1582	8641	15.3
Other Personnel	4038	1125	2722	184	2742	10811	19.2
Total	14337	2311	33126	509	6170	56453	100.0
%	25.4	4.1	58.7	0.9	10.9	100.0	

*Including Doctoral and Post-Doctoral Students

Table 1.8: R&D personnel full-time equivalent (FTE)*

	Business enterprise	Government	Higher education*	Not-for-profit	Science Councils	Total	%
Occupation							
Researchers	5300.66	491.05	10339.79	234.18	1548.83	17915	60.3
Technicians	2856.53	376.25	568.1	30.69	1344.13	5175.7	17.4
Other Personnel	3138.8	800.02	473.04	97.81	2096.6	6606.3	22.2
Total	11295.99	1667.32	11380.93	362.68	4989.56	29696	100.0
%	38.0	5.6	38.3	1.2	16.8	100.0	

*Including Doctoral and Post-Doctoral Students

Chapter 2: The Business Sector

2.1 Introduction

The 2004/5 R&D Survey benefited considerably from the accumulation of knowledge and experience of previous surveys. It achieved greater coverage of R&D performing companies and saw improvements in the knowledge and information systems used to manage this expansion.

Applied statistical analysis using past and current data assisted survey management by profiling industry sectors. This provided improved understanding of sectoral differences and also enabled imputations of data for incomplete responses. Sectoral analysis also enabled a more sophisticated commutation method – this being the use of previously submitted data to supplement current data where justified and necessary. We are very grateful to Stephen Davis of the University of Cape Town for his insight and application to this task. As expected, this resulted in improved on data quality. Issues around data consistency and variability were highlighted and these used to focus fieldwork methods and attention on new detail and accuracy.

Improved application of techniques for locating R&D performing entities in the economy contributed to a greater sample of likely R&D performing companies and expanded the existing register. Essentially, greater quantities of lists of likely R&D performing companies were methodically interrogated. Referrals were also obtained from interactions with experts and with the field as in the past. The register expanded from 1101 (2003/4) to 2262 companies. 1546 companies were surveyed and 511 UOMs were found to be performing R&D and measured. Once R&D performing subsidiaries were allowed for the coverage expands to 561 business entities.

The relational database for fieldwork management was further improved and offered enhanced systems capability and user friendliness.

Similarly, the R&D Protocols Manual that was developed following the previous survey proved most valuable in developing new staff capability. The R&D Protocols Manual also helped bridge the gap when two longstanding members of the Business Sector Survey Team left CeSTII.

The size, dynamic nature and diverse character of the business sector continue to contribute to the ongoing challenge to secure greater coverage while ensuring no double counting or significant under-counting. Complexities in company structures and names (including trade names and brands) contribute to this challenge as we strive to keep the register up to date while our known list of R&D performers expands.

Historically the business sector is known to contribute the major part of R&D activity in the South African economy. The current survey measured this contribution at 56.3%, up from the 55.5% recorded in 2003/4 and the 53.7% recorded in 2001/2.

Table B1: In-house R&D expenditure by sector

Sector	2004/5		2003/4		2001/2	
	R 000s	%	R 000s	%	R 000s	%
Business enterprise (BERD)	6,766,361	56.3	5,591,325	55.5	4,023,576	53.7
Government	515,331	4.3	465,367	4.6	203,110	2.7
Higher education	2,533,971	21.1	2,071,351	20.5	1,896,156	25.3
Not-for-profit	198,268	1.7	209,023	2.1	70,778	0.9
Science Councils	1,996,050	16.6	1,745,493	17.3	1,294,454	17.3
Grand Total	12,009,981	100.0	10,082,559	100	7,488,074	100

2.2 Key Results

Table B2: Main Characteristics of the Business sector

	2004/5	2003/4	2001/2
BERD	R 6,766bn	R 5,591bn	R 4, 023bn
BERD as a percentage of GDP	0.49%	0.45%	0.41%
Percentage of BERD financed by industry	69.0%	80.5%	81.4%
Percentage of BERD financed by government	7.1%	6.2%	8.9%
Percentage of BERD financed by other national sources	6.1%	3.8%	5.2%
Percentage of BERD financed from abroad	17.9%	9.6%	4.5%
Total Business sector R&D personnel (FTE)	11296.0	9131.7	6210.3
Total Business sector Researchers (FTE)	5300.7	4152.9	2952.0

BERD as a percentage of GDP has continued to grow. There has also been strong growth in foreign funded BERD since 2001. The percentage of BERD financed by domestic industry has

fallen, while all other categories have grown. Thus, business is performing more R&D relative to GDP, but a growing portion of the funding for this R&D is coming from outside of local industry.

The business sector R&D community, while performing 56.3% of GERD, employs 30.4% of R&D personnel.

Table B 3: Headcount of R&D personnel by sector

Sector	Researchers		Technicians Directly Supporting R&D		Other Personnel Directly Supporting R&D		Grand Total		%	
	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04
Business enterprise	6575	5058	3724	3430	4038	3120	14337	11608	30.4	28.6
Government	692	929	494	322	1125	1032	2311	2283	4.9	5.6
Higher education*	18270	14055	2801	2594	2722	2728.5	23793	19378	50.5	47.7
Not-for-profit	285	305	40	235	184	275	509	815	1.1	2.0
Science Councils	1846	2414	1582	1612	2742	2496	6170	6522	13.1	16.1
Grand Total	27668	22761	8641	8193	10811	9651.5	47120	40606	100.0	100.0
Higher Education Doctoral and Post-Doctoral Students	9333						9333			
Total Including Doctoral and Post-Doctoral Students	37001						56453			

*Excluding Post-graduate students

The growth in R&D Personnel across all categories in the Business Sector is a combination of improved coverage, increased response rate and organic growth.

2.3 Survey Methodology

2.3.1. Measuring Instrument (Questionnaire) Design & Pilot:

The 2004/5 was an expanded version of the 2003/4 business sector questionnaire, seeking data on the race and qualification of all R&D personnel as well as inquiring into the existence of collaborative R&D between firms and other performers, both at home and abroad.

As in 2003/4, no separate user guide was issued, the survey relying on an ‘embedded’ user guide that took the form of text boxes dispersed throughout the body of the questionnaire.

The questionnaire was piloted at 15 companies that were deliberately varied in their size, industry and BERD. Minor improvements were made following the pilot and prior to fieldwork.

2.3.2. Sample

The Business Sector survey sample took the previous survey register as a base. This data was then verified and updated as required.

The sample is made up of two essential parts:

- Surveys Register (containing previous results)
- Referrals (obtained through systematic intelligence gathering)

Essentially, large known R&D Performers are surveyed and are also interviewed to obtain information on where other large concentrations of private sector R&D may occur in the economy. This method is supplemented by advice from experts and is further bolstered by scanning relevant media.

This strategy levers existing knowledge and applies fieldwork resources to this info. It purposefully seeks all the major contributing R&D amounts while also seeking to measure any known R&D activity, and as such is likely to uncover useful and pertinent lower bounds for the total business on R&D.

Sampling beyond the initial base of the previous register is described below:

- Innovation Fund
- Johannesburg Stock Exchange (JSE)
- SPII (Support Programme for Industrial Innovation)
- Technology Top 100 Companies (Business Day)
- THRIP, and
-
- Business Intelligence Gathering

2.3.3 Fieldwork Methods

The preferred respondent for the business sector is the Chief Financial Officer or equivalent. The CFO is the person usually empowered to release company financial information and that has access through the other corporate components to human resources data.

Table B 4. Business Sector Fieldwork 2004/5

	Register	Sample	No R&D	Questionnaire Returns (non-nil)				No Return
				Regular	Telephonic	Commute	Impute	
Initial Sample (previous register)	991	900	394	153	61	119	53	120
Additional Referrals	1271	646	393	21	26	0	78	128
TOTAL	2262	1546	787	174	87	119	131	248

The initial survey register consisted of 991 companies. Of these, 900 companies were found to be active and independent of other units of measure, and were surveyed.

A further 1271 referrals were added to the register. Available resources and survey priorities enabled constructive survey engagement with 646 of these. Thus the total register amounted to 2262 and survey sample frame was set at 1546 companies.

Table B 5. Business Sector Fieldwork Sample

	2004/5		2003/4	
	Count	Percentage	Count	Percentage
Sample	1546	100.0%	1101	100.0%
Response	1298	84.0%	793	72.0%
No R&D	787	50.9%	377	34.2%
R&D Done	511	33.1%	366	33.2%
No Return	248	16.0%	308	28.0%

In all, 1298 responses were obtained from individual companies constituting an 84.0% response rate. This figure was divided between 787 companies (50.9%) who advised of no R&D and 511 companies (33.1%) for who completed returns were obtained. 248 companies (16.0%) did not respond to the survey. 552 completed questionnaires contained 511 questionnaires with data on R&D performed, while 41 'nil-return' questionnaires were submitted. In total, 637 Questionnaires were dispatched compared with 487 in the previous survey.

Most companies were cooperative and helpful, although some remain elusive. Many non-respondents do not feel the survey provides value to them and some complain of fatigue due to the number of government surveys they are expected to complete.

Table B 6. Business Sector Fieldwork Sample

Regular	Telephonic	Commute	Impute	TOTAL
174	87	119	131	511
34.1%	17.0%	23.3%	25.6%	100.0%

Regular completed questionnaires made up the bulk 174 (or 34.1%) of the non-nil returns. Commuted (119 or 23.3%) and imputed (131 or 25.6%) of questionnaires also featured strongly. Both commuted and imputed data are obtained using a combination of simple modeling and known information relating to a specific company.

In all, data from 511 non-nil questionnaires was entered into the survey results database. Where obvious anomalies existed prior to data entry to the results system, data was cleaned, often through an iterative process with the field. An automated checking and cleaning process followed whereby programmed discrepancy checks were run on the data. Fieldworkers were then required to assist in cleaning data as applicable.

2.3.4 Rationale and Methodology for data imputation in the Business Sector

For a number of firms/entities in the 2004/5, respondents only supplied minimal data on their R&D activity for the current survey period. Moreover, in a number of cases, where data were not obtainable from the firm directly, information was inferred from alternative sources. In such

cases, a method of statistical imputation was applied to portray an accurate, unbiased record of R&D data for this survey.

Where data for a particular firm was available from a previous survey, this previous data was used as a primary source of estimating the current activities, based on agreed increases/decreases in expenditure, and proportionately calculated changes in personnel numbers. In some cases, the expenditure change was obtained from the firm, and in others, a survey management decision was taken to apply sector-specific GDP increases to previous years' R&D expenditure. For cases where little more than the gross expenditure on R&D could be obtained, the key data on personnel numbers, types of R&D, and nature of research were imputed using a sector profile. The sector profile was based on the average structure of a firm in a similar sector in the 2003/4 survey. The 2003/4 survey was the most suitable proxy for the current structure as it was the largest and most recent of the surveys to date, and therefore serves as an appropriate benchmark for calculating sector-specific profiles (parameterisation) of firms in the business sector. These profiles were then used for the imputation of company data.

Where sufficient data were available for an entity from the previous survey, and where that entity's BERD figure is reasonably in line with the current survey, then a simple commutation/transcription of figures was the preferred method of imputation.

Estimated (sector-specific) parameters were calculated in order to obtain:

- Proportional split between the four categories of expenditure.
- Proportional split of labour costs between researchers, technicians and other personnel (percentages with confidence intervals).
- Estimates of the average labour cost per personnel category.
- A table of proportions which estimate the split between FTE's according to personnel category and gender.
- A ratio of head counts to FTE's for each of personnel and gender category.
- Proportional split across the three types of research.

From the splits, it was possible to estimate FTE's and the split between male and female. FTE's were scaled up according to a set of estimated ratios of Head Count to FTE.

2.3.5 Effects of increased survey coverage

There was a panel of 320 entities common to both the 2003/4 and 2004/5 surveys. A nominal growth of 3.09% was measured in these entities, accounting for an overall increase of R170,369,000 in BERD between years. Having 511 firms in the 2004/5 survey resulted in a net addition of 146 firms from the previous year's count (191 new entities less 45 exits). Of the total nominal growth of R1,175,836,000 in BERD, just over R1 billion can be accounted for by the net addition of 146 firms to the survey. Assuming that no more than a nominal growth of 3.09% would have applied to the 45 firms who were no longer in the survey, the extra entities captured in the 2004/5 survey represent a growth of some 18% in BERD represented by a growth of 40% in firm numbers. Clearly there is a situation of diminishing returns in BERD when seeking out more firms to include in the survey.

Of the 21% nominal growth measured in BERD, 18% is attributable to net new entrants and the remaining 3% to growth in the panel of common entities. In future years, the overall expenditure change will depend on the performance of the panel of common firms

The current survey was also characterised by a reduction in the quantum of R&D contributed by key performers. To illustrate this reduction, the top 15 firms in 2003/4 contributed R224,356,000 less to the R&D total in the current survey when compared with the previous year. The remaining medium to small-size firms performed much better in the current year, mitigating this shortfall through a contributing of an extra R394,725,000 (14% growth). In general, the current survey was characterised by a reduction in the contribution of large R&D performers and a significant growth in the contribution of the small-to-medium firms. The top-performing firms will continue to have a significant impact on the overall BERD measured in future surveys, however a growth in the "midriff" of the cohort of contributors has proved to be an important factor to monitor in future surveys.

An analysis of the GDP-adjusted increases in BERD showed that increasing the number of smaller firms in the survey resulted in an insignificant contribution to overall BERD (as shown by the 3 most recent surveys, including the current one. An increase in the size of the survey would only be effective in measuring annual BERD if and only if additional large or medium-sized entities are discovered. Assuming that the existing “radar” of the survey covers all large and medium R&D performers, there is likely to be little merit in seeking out large numbers of low-performance R&D players (assuming of course the sole purpose of the survey was to measure pure expenditure and not personnel numbers, etc.)

2.4 Detailed Results

Table B 7: BERD by accounting category 2004/5 and 2003/4

Type of Expenditure	2004/5			2003/4		
	R 000's		%	R 000's		%
Capital Expenditure on R&D	642,863		9.5	775,849		13.9
<i>Land: Buildings and Other Structures</i>		97,982	1.4		638,957	11.4
<i>Vehicles, Plant, Machinery, Equipment</i>		544,881	8.1		136,892	2.4
Current Expenditure	6,123,498		90.5	4,815,476	0	86.1
<i>Labour Costs</i>		3,341,011	49.4		2,488,458	44.5
<i>Other Current Expenditure</i>		2,782,487	41.1		2,327,018	41.6
Total	6,766,361	6,766,361	100	5,591,325	5,591,325	100.0

Table B7 shows that labour costs (49.4 %) and other current expenditure (41.1 %) continue to account for a substantial part of BERD.

Table B 8: BERD by type of research 2004/5 and 2003/4

Type of Research	2004/5		2003/4	
	R 000's	%	R 000's	%
Basic Research	642,302	9.5	759,345	13.6
Applied Research	2,223,955	32.9	1,883,082	33.7
Experimental	3,900,103	57.6	2,948,898	52.7
Total	6,766,361	100	5,591,325	100.0

The Business Sector shows a continued focus on experimental development. This category has increased to 57.6% from 52.7% in 2003/4. Applied Research continues to accounts for about one third of all Business R&D at 33.7 % in 2003/4 and 32.9% in 2004/5.

Basic Research has decreased to 9.5% in 2004/5 having contributed 13.6% in 2003/4. This drop could signal a real change, however it may also be a result of combining two different categories of Basic Research (Pure Basic & Strategic Basic) in 2004/5 (whereas they were separate categories in the 2003/4 survey). The greater coverage of the pharmaceutical sector and financial services sectors has almost certainly pulled the emphasis away from basic research.

Table B 9. BERD by sources of funds 2004/05 and 2003/4

Source of Funds	2004/5			2003/4		
	R 000's		%	R 000's		%
Own Funds	4,295,002		63.5	3,964,107		70.9
		4,295,002	63.5		3,964,107	70.9
Government	481,519		7.1	345,504		6.2
Grants		187396	2.8		*345,504	6.2
Contracts		294123	4.3			
Other Local Business	371,362		5.5	535,549		9.6
		371,362	5.5		535,549	9.6
Other South African Sources	410,168		6.1	206,396		3.7
		410,168	6.1		206,396	3.7
Foreign	1,208,310		17.9	534,636		9.6
		1,208,310	17.9		534,636	9.6
Total	6,766,361	6766361	100.0	5,591,325		100.0

*Not split by Grant & Contract categories in 2003/4.

Business sector R&D funding from own internal sources has dropped to 63.5% from 70.9% in 2003/4. Furthermore, less R&D is being performed for other local businesses - at 5.5%, this is down from 9.6% in 2003/4.

Government funding of BERD has increased from 6.2% in 2003/4 to 7.1% for the current period. Similarly foreign investment in South African Business R&D has increased significantly from 9.6% in 2003/4 to 17.9% in 2004/5. This rise is strongly driven by the identification of considerable foreign input into health sciences research.

Table B 10: BERD by Research Fields 2003/4 and 2001/02

Main Research Field	2004/05		2003/04	
	Amount R 000s	%	Amount R 000s	%
Division 1: Natural Sciences, Technology and Engineering	6,536,764	96.6	5,456,725	97.6
Mathematical Sciences	92,844	1.4	43,823	0.8
Physical Sciences	211,921	3.1	208,386	3.7
Chemical Sciences	469,211	6.9	410,939	7.3
Earth Sciences	34,269	0.5	36,788	0.7
Information, Computer and Communication	1,279,325	18.9	944,070	16.9
Applied Sciences and Technologies	856,021	12.7	857,404	15.3
Engineering Sciences	2,101,662	31.1	1,980,965	35.4
Biological Sciences	127,322	1.9	52,867	0.9
Agricultural Sciences	187,344	2.8	200,856	3.6
Medical and Health Sciences	997,182	14.7	571,171	10.2
Environmental Sciences	73,775	1.1	56,473	1.0
Material Sciences	96,525	1.4	86,627	1.5
Marine Sciences	9,366	0.1	6,355	0.1
Division 2: Social Sciences and Humanities	229,597	3.4	134,600	2.4
Social Sciences	229,522	3.4	134,600	2.4
Humanities	75	0.0	0	0.0
Total	6,766,361	100	5,591,325	100.0

This survey saw a continuation of the strong emphasis placed on the natural sciences, technology & engineering. These research fields attracted 96.6% of BERD.

The current survey showed a renewed interest in the Humanities and Social Sciences as the spend on the research fields covered by this category experienced an increase from 2.4% in 2003/4 to 3.4% in 2004/5.

Engineering Sciences (31.1%) absorbed more expenditure than any other research field. There was a drop in Engineering Sciences from 35.4% in 2003/4 to 31.1% in 2004/5. Medical & Health Science have increased from 10.2% (2003/4) to 14.7% (2004/5)

Table B 11: BERD by Socio-Economic Objective (SEO) 2004/5 & 2003/4

Socio-Economic Objective	2004/2005		2003/2004	
	R 000s	%	R'000	%
Division 1: Defense	718,491	10.6	849,574	15.2
Defense	718,491	10.6	849,574	15.2
Division 2: Economic Development	4,895,638	72.4	3,935,136	70.4
Economic Development Unclassified	0	0.0	0	0
Plant Production And Plant Primary Products	209,583	3.1	153,202	2.7
Animal Production and Animal Primary Products	38,024	0.6	21,967	0.4
Mineral Resources (Excluding Energy)	711,661	10.5	469,983	8.4
Energy Resources	301,603	4.5	277,337	5
Energy Supply	292,545	4.3	279,093	5
Manufacturing	1,115,221	16.5	1,023,487	18.3
Construction	365,271	5.4	385,179	6.9
Transport	363,545	5.4	351,443	6.3
Information and Communication Services	588,233	8.7	355,231	6.4
Commercial Services	718,856	10.6	486,682	8.7
Economic Framework	11,280	0.2	14,803	0.3
Natural Resources	179,816	2.7	116,730	2.1
Division 3: Society	911,606	13.5	502,865	9
Society Unclassified	0	0.0	0	0
Health	873,468	12.9	475,478	8.5
Education and Training	20,087	0.3	16,672	0.3
Social Development and Community Services	18,050	0.3	10,715	0.2
Division 4: Environment	145,034	2.1	151,043	2.7
Environment Unclassified	0	0.0	0	0
Environmental Knowledge	32,776	0.5	43,489	0.8
Environmental Aspects of Development	70,069	1.0	56,246	1.0
Environmental and Other Aspects	42,188	0.6	51,307	0.9
Division 5: Advancement of Knowledge	95,593	1.4	152,708	2.7
Advancement of Knowledge Unclassified	0	0.0	0	0
Natural Sciences, Technologies and Engineering	92,497	1.4	147,486	2.6
Social Sciences and Humanities	3,096	0.0	5,222	0.1
Total	6,766,361	100.0	5,591,325	100

In 2004/5, the four largest SEO categories absorbed half (50.6%) of BERD, these categories being Manufacturing (16.5%), Health Services (12.9%), Commercial Services (10.6%) and Defense (10.6%). Manufacturing, while being the top performer, was also somewhat down at 16.5% (from 18.3% in 2003/4). Similarly, Defense sector spending was lower at 10.6%, this being 4.6% down from the 2003/4 figure of 15.2%. Commercial services grew to 10.6% (8.7% in 2003/4). Health experienced a sharp rise to 12.9%, (8.5% in 2003/4), resulting in SEO Division 3 (Society) growing to 13.5% against the 2003/4 figure of 9%.

Table B 12: BERD by Standard Industrial Classification (SIC) 2004/5

SIC Classification	R 000s	%	R 000s	%
10000 Agriculture, Hunting, Forestry and Fishing			180,008	2.7
20000 Mining and Quarrying			425,917	6.3
30000 Manufacturing			2,981,267	44.1
Manufacture of Food Products, Beverages and Tobacco Products	145,848	2.2		
Manufacture of Textiles, Clothing and Leather Goods	14,843	0.2		
Manufacture of Wood and Products of Wood and Cork, except furniture				
Manufacture of Articles of Straw and Plaiting Materials	86,214	1.3		
Manufacture of Paper & Paper Products				
Manufacture of Publishing, Printing and Reproduction of Recorded Material				
Manufacture of Refined Petroleum, Coke and Nuclear Fuel				
Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals)	1,120,622	16.6		
Manufacture of Rubber and Plastic Products				
Manufacture of Non-Metallic Mineral Products	115,461	1.7		
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment	428,409	6.3		
Manufacture of Office, Accounting and Computing Machinery				
Manufacture of Electrical Machinery and Apparatus	83,582	1.2		
Manufacture of Radio, Television and Communication Equipment and Apparatus				
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	284,803	4.2		
Manufacture of Transport Equipment	697,268	10.3		
Manufacture of Furniture, Recycling, Manufacturing not elsewhere classified	4,218	0.1		
40000 Electricity, Gas and Water Supply			270,538	4.0
50000 Construction			483,519	7.1
60000 Wholesale and Retail			23,469	0.3
70000 Transport, Storage and Communication			325,707	4.8
80000 Financial Intermediation, Real Estate and Business Services			1,912,951	28.3
90000 Community, Social and Personal Services			162,986	2.4
Total			6,766,361	100.0

Manufacturing industry accounted for 44.1% of all BERD, made up dominantly of:

- SIC Division 33000 (Fuels, chemicals & related products) (16.6%)
- SIC Division 38000 (Transport equipment) (10.3%)
- SIC Division 35000 (Basic & fabricated metals) (6.3%)
- SIC Division 37000 (Radio, TV & precision equipment) (4.2%)

The above four Divisions account for 84.8% of Manufacturing expenditure on R&D or 37.4 % of all BERD).

After Manufacturing, the next largest R&D sector was Financial Intermediation and Business Services at 28.3%, showing a significant increase on the 2003/4 figure of 19.6%. This was followed by Construction (7.1%) and Mining and Quarrying (6.3 %) that was down from 12.9% in 2003/4. Other significant industries contributing to BERD for the period included Transportation, Storage & Communication at 4.8% and Electricity, Gas & Water Supply at 4.0%. Agriculture, Forestry & Fishing has recovered to 2.7% of BERD for the current survey from 1.8% in 2003/4 (this figure being below the 3.0% recorded in 2001/2).

**Table B 13: Business R&D personnel Headcount & Full-time equivalent (FTE)
2004/05**

	Headcount			FTE	FTE as % of Headcount
	Male	Female	Total		
Occupation					
Researchers	4814	1761	6575	5300.66	80.6
Technicians directly	2714	1010	3724	2856.53	76.7
Other personnel directly	2435	1603	4038	3138.8	77.7
Total	9963	4374	14337	11295.99	78.8

Table B13 shows a head count of 14,337 R&D personnel with associated 11,295 Full-Time Equivalent's (FTE's). This is 23 % higher than the 9,132 FTE's recorded in the 2003/4 survey. The above data show that Female employees make up 30.5% of the Business Sector R&D Headcount (29.6% in 2003/4).

**Table B 14: Business R&D personnel Headcount by Race, Qualification and Gender
2004/05**

2004/5	African		Coloured		Indian		White		Total		Total	%
	M	F	M	F	M	F	M	F	M	F		
Researchers												
Doctoral Degree or Equivalent	51	55	22	0	24	21	634	186	731	262	993	6.9%
Masters, Hons, Bachelor or equivalent	386	224	76	21	274	114	2779	883	3515	1242	4757	33.2%
Diplomas	64	89	12	17	32	51	460	101	568	258	825	5.8%
TOTAL	501	367	110	38	330	186	3872	1170	4814	1761	6575	45.9%
Percentage	7.6%	5.6%	1.7%	0.6%	5.0%	2.8%	58.9%	17.8%	73.2%	26.8%		
Technicians												
Doctoral Degree or Equivalent	0	0	0	0	0	0	12	0	12	0	12	0.1%
Masters, Hons, Bachelor or equivalent	142	106	9	29	132	36	715	255	998	427	1425	9.9%
Diplomas	422	248	55	62	80	62	1146	212	1704	584	2288	16.0%
TOTAL	564	354	65	91	213	99	1873	467	2714	1011	3725	26.0%
Percentage	15.1%	9.5%	1.7%	2.4%	5.7%	2.6%	50.3%	12.5%	72.9%	27.1%		
Other												
Doctoral Degree or Equivalent	16	19	0	0	14	13	38	52	68	83	151	1.1%
Masters, Hons, Bachelor or equivalent	26	178	2	24	2	13	211	122	241	337	578	4.0%
Diplomas	84	185	10	20	10	31	178	148	283	385	668	4.7%
Other Qualifications (incl. Non-Formal)	1418	420	82	81	84	33	259	263	1843	798	2641	18.4%
TOTAL	1544	802	94	126	110	91	686	585	2435	1603	4038	28.2%
Percentage	38.2%	19.8%	2.3%	3.1%	2.7%	2.2%	17.0%	14.5%	60.3%	39.7%		
GRAND TOTAL	2609	1523	269	255	653	375	6432	2222	9963	4375	14338	
Percentage	18.2%	10.6%	1.9%	1.8%	4.6%	2.6%	44.9%	15.5%	69.5%	30.5%		100.0%

Not all companies provided race & qualification data. Table B14 represents a statistical extrapolation of race & qualification data obtained on 5803 R&D staff or 40.5% of recorded business sector R&D personnel. Race & qualification of R&D personnel was last measured in 2001/2.

The group mix recorded in the business sector was as follows: 60.4% of all R&D Personnel were white (down from 66.0% in 2001/2), 28.8% were African (up from 20.0% in 2001/2), 7.2% were Indian (down from 8.4% in 2001) and 3.7% are Coloured (down from 5.7% in 2001/2).

Chapter 3: The Government Sector

3.1 Introduction

The government sector for the 2004/2005 Survey was divided into National Departments, Provincial Departments, Research Institutes and Museums.

This sector consists of a clearly defined universe; hence it was decided to do a census, and not a sample survey. It was found to be most realistic to survey the four sections at the level of department whether national or provincial, and at the institutional level. The basic information required for the survey was in most cases only available at these levels. The decision to survey on a departmental level meant that a registry had to be created for all the government sector departments and institutions.

The 2004/2005 survey did not use the Lite questionnaire as in 2003/2004, but included additional questions on demographics. A pilot survey was undertaken to ensure the validity of the survey instrument. The institutions that were piloted were the Western Cape Department of Environmental Affairs and Development Planning and the South African Sports Commission. The valuable responses from the pilot surveys contributed to the improvement of the final questionnaire.

3.2 Key Results

Table G1: In-house R&D expenditure by sector

	Subtotal	Amount	
Sector		R 000s	%
Business enterprise		6,766,361	56.3
Government		515,331	4.3
<i>National departments</i>	268,843		2.2
<i>Provincial Departments</i>	131,230		1.1
<i>Government research institutes</i>	91,607		0.8
<i>Museums</i>	23,651		0.2
Higher education		2,533,971	21.1
Not-for-profit		198,268	1.7
Science Councils		1,996,050	16.6
Grand Total		12,009,981	100.0

The total government R&D expenditure for 2004/2005 was R515.3 million, or 4.3 % of the total R&D expenditure. Although there was an increase in the government R&D expenditure in Rand value for the 2004/2005 survey, there was a slight decrease of 0.3 % in the government sector proportion of GERD. The National Departments contributed 52.3 % to R&D in this sector, followed by 25.4 % to Provincial Departments, 17.7 % to Government Research Institutes and 4.6 % to Museums.

Table G2: R&D personnel headcount by sector

Sector	Researchers	Technicians Directly Supporting R&D	Other Personnel Directly Supporting R&D	Sector Total	Grand Total	%
Business enterprise	6575	3724	4038		14337	25.4
Government	692	494	1125		2311	4.1
<i>National departments</i>	285	244	158	687		1.2
<i>Provincial Departments</i>	193	159	662	1014		1.8
<i>Government research institutes</i>	118	49	240	407		0.7
<i>Museums</i>	96	42	65	203		0.4
Higher education*	27603	2801	2722		33126	58.7
Not-for-profit	285	40	184		509	0.9
Science Councils	1846	1582	2742		6170	10.9
Grand Total	37001	8641	10811		56453	100.0

*Including Doctoral and Post-Doctoral Students

A total of 44% of R&D personnel were concentrated in the Provincial Departments, followed by 30% in the National Department, 18% in Government Research Institutes, and 8% Museums. Support staff represents 49% of the R&D personnel in this sector; Researchers represent 30% and Technicians 21%.

3.3 Survey Methodology and Fieldwork

National Departments

The most recent government directory was downloaded and a registry was constructed with the contact details for all National departments. It was decided to send the survey questionnaire to the highest level in the departments, that is, the Director-Generals (DG). Some of the offices of the DG's responded by informing us who the responsible official would be to complete the survey

questionnaire. In other cases we were informed that were not involved in any kind of R&D. The fieldwork method used was frequently to encourage officials by telephone to complete the questionnaire. In total 41 departments received questionnaires but only sixteen were returned. Of the sixteen questionnaires returned, seven were nil-returns. The feedback given by the departments varied from; not involved in any R&D; involved in policy-related research not included under the Frascati definition of R&D; to only outsourcing of R&D.

Provincial Departments

All provincial departments were surveyed at the level of Head of Department (HOD). The nine provinces were contacted for details of the HOD in every department. A registry with their details was created. Questionnaires were then sent to the HOD's. In total 93 departments were identified in the nine provinces. This section of the government sector had a very low response rate that can be attributed to the fact that the administrations are mainly involved in policy-related research, which is not Frascati compliant.

Museums

Respondents from the previous survey were contacted to verify their postal addresses, and to request their participation in the 2004/2005 survey. In this section of the government sector 105 museums were surveyed. Only 40 questionnaires were returned with more than 50% indicating a nil. The low response rate is due to the fact that many of the museums surveyed are small in size and do not have the capacity or funds to undertake research. Such research as may be required is requested of the central Museum Scientific Service office, which then conducts the research on behalf of the smaller museums.

Research Institutes

Respondents were also contacted to verify their postal addresses. Questionnaires were sent to those who were identified as the person to complete the questionnaire. In total fifty research institutes were surveyed in the 2004/2005 survey. Only 21 questionnaires were returned and 10 indicated a nil. Even though the government sector R&D expenditure for the 2004/2005 survey increased, there has been a drop in the number of questionnaires returned, despite a concerted effort made in assisting and encouraging the completion of the questionnaires.

Table G3: GERD by Accounting Category

National departments			
Type Of Expenditure	Amount		
	R 000s	R 000s	%
Capital Expenditure on R&D	44,144		16.4
<i>Land: Buildings and Other Structures</i>		30,000	11.2
<i>Vehicles, Plant, Machinery, Equipment</i>		14,144	5.3
Current Expenditure	224,699		83.6
<i>Labour Costs</i>		91,508	34.0
<i>Other Current Expenditure</i>		133,191	49.5
Total	268,843		100.0
Provincial Departments			
Type Of Expenditure	Amount		
Capital Expenditure on R&D	35,508		27.1
<i>Land: Buildings and Other Structures</i>		13,779	10.5
<i>Vehicles, Plant, Machinery, Equipment</i>		21,729	16.6
Current Expenditure	95,722		72.9
<i>Labour Costs</i>		78,489	59.8
<i>Other Current Expenditure</i>		17,233	13.1
Total	131,230		100.0
Government research institutes			
Type Of Expenditure	Amount		
Capital Expenditure on R&D	18,196		19.9
<i>Land: Buildings and Other Structures</i>		13,603	14.8
<i>Vehicles, Plant, Machinery, Equipment</i>		4,593	5.0
Current Expenditure	73,411		80.1
<i>Labour Costs</i>		47,749	52.1
<i>Other Current Expenditure</i>		25,662	28.0
Total	91,607		100.0
Museums			
Type Of Expenditure	Amount		
Capital Expenditure on R&D	1,211		5.1
<i>Land: Buildings and Other Structures</i>		21	0.1
<i>Vehicles, Plant, Machinery, Equipment</i>		1,190	5.0
Current Expenditure	22,440		94.9
<i>Labour Costs</i>		18,743	79.2
<i>Other Current Expenditure</i>		3,697	15.6
Total	23,651		100.0
All Government Sectors			
Type Of Expenditure	Amount		
Capital Expenditure on R&D	99,059		19.2
<i>Land: Buildings and Other Structures</i>		57,403	11.1
<i>Vehicles, Plant, Machinery, Equipment</i>		41,656	8.1
Current Expenditure	416,272		80.8
<i>Labour Costs</i>		236,489	45.9
<i>Other Current Expenditure</i>		179,783	34.9
Total	515,331		100.0

Table G3 illustrates the in-house expenditure by type of expenditure (i.e. capital and current expenditure) for each component of government. The current expenditure for all government components amounted to 81% compared to 19% to capital expenditure. Most of the current expenditure comprised of labour cost (46%), while capital expenditure was mainly comprised of buildings and other structures (11%).

Table G4: GERD by type of research

Type of Research	Amount	
	R 000s	%
Basic Research	107,912	20.9
Applied Research	319,040	61.9
Experimental	88,379	17.1
Total	515,331	100.0

Table G4 illustrates the type of research undertaken by government. The largest part of government expenditure was on Applied Research (62%), followed by Basic Research (21%) and Experimental Research (17%).

Table G5: GERD by Sources of Funds

Source of Funds	Amount		
	R 000s	R 000s	%
Own Funds	308,487		59.9
Internal Resources		308487	59.9
Government	129,685		25.1
Grants		83810	16.3
Contracts		45875	8.9
Higher Education	274		0.1
University Technikon/College		274	0.1
Other Local Business	2,666		0.5
Contracts		2,666	0.5
Other South African Sources	16,454		3.2
South African Sources		16,454	3.2
Foreign	57,765		11.2
All Sources		57,765	11.2
Total	515,331	515,331	100.0

The largest component, (85%) of government R&D expenditure was funded by government itself, through: internal resources, national & provincial government as well as science councils and agency funding. International funding was R57, 7 million, or 11.2% of the total.

Table G6: Government R&D Expenditure by location

Province	Amount	
	R 000s	%
Eastern Cape	77,762	15.1
Free State	24,962	4.8
Gauteng	151,197	29.3
KwaZulu-Natal	31,213	6.1
Limpopo	9,568	1.9
Mpumalanga	29,240	5.7
North-West	13,401	2.6
Northern Cape	46,075	8.9
Western Cape	131,912	25.6
Total	515,331	100.0

Table G6 indicates that the largest proportion of government R&D expenditure by province was spent in Gauteng (29.3%), followed by Western Cape (25.6%) and the Eastern Cape (15.1%).

Table G7: GERD by Research Field

Main Research Field	2004/05		2003/04	
	Amount R 000s	%	Amount R 000s	%
Division 1: Natural Sciences, Technology and Engineering	450,456	87.4	372,373	80.0
Mathematical Sciences	17,562	3.4	5,782	1.2
Physical Sciences	8,256	1.6	0	0.0
Chemical Sciences	8,709	1.7	493	0.1
Earth Sciences	32,795	6.4	38,378	8.2
Information, Computer and Communication	14,180	2.8	3,494	0.8
Applied Sciences and Technologies	4,581	0.9	16,758	3.6
Engineering Sciences	9,663	1.9	116	0.0
Biological Sciences	53,988	10.5	64,611	13.9
Agricultural Sciences	174,756	33.9	141,460	30.4
Medical and Health Sciences	84,629	16.4	66,893	14.4
Environmental Sciences	19,790	3.8	13,037	2.8
Material Sciences	0	0.0	0	0.0
Marine Sciences	21,547	4.2	21,352	4.6
Division 2: Social Sciences and Humanities	64,875	12.6	92,994	20.0
Social Sciences	59,831	11.6	81,866	17.6
Humanities	5,044	1.0	11,128	2.4
Total	515,331	100.0	465,367	100.0

In the 2004/2005 survey the largest component in (87.4%) of government R&D expenditure was spent in the division Natural Sciences, Technology and Engineering compared to 80% in the 2003/2004 survey. The largest contributors in this division for both 2003/2004 and 2004/2005

surveys were: Agricultural Sciences (30.4%), Medical & Health Sciences (14.4%), and Biological Sciences (13.9%). The division Social Sciences and Humanities spent 12.6% of government expenditure in the 2004/2005 survey compared to 20% in 2003/2004 survey. There has been a significant drop in the Social Sciences from 17.6 in 2003/2004 to 11.6 in 2004/2005.

Table G8: GERD by Socio-Economic Objective (SEO)

Socio-Economic Objective	2004/05		2003/04	
	R 000s	%	R 000s	%
Division 1: Defence	237	0.0	0	0.0
Defence	237	0.0	0	0.0
Division 2: Economic Development	245,493	47.6	274,374	59.0
Economic Development Unclassified	0	0.0	0	0.0
Plant Production And Plant Primary Products	57,072	11.1	44,609	9.6
Animal Production and Animal Primary Products	57,955	11.2	48,052	10.3
Mineral Resources (Excluding Energy)	0	0.0	0	0.0
Energy Resources	0	0.0	0	0.0
Energy Supply	0	0.0	4,755	1.0
Manufacturing	0	0.0	0	0.0
Construction	620	0.1	1,501	0.3
Transport	3,140	0.6	0	0.0
Information and Communication Services	6,068	1.2	5,195	1.1
Commercial Services	815	0.2	1,942	0.4
Economic Framework	35,748	6.9	54,990	11.8
Natural Resources	84,076	16.3	113,331	24.4
Division 3: Society	189,241	36.7	96,430	20.7
Society Unclassified	0	0.0	0	0.0
Health	76,373	14.8	66,844	14.4
Education and Training	94,694	18.4	11,853	2.5
Social Development and Community Services	18,174	3.5	17,732	3.8
Division 4: Environment	48,560	9.4	62,698	13.5
Environment Unclassified	0	0.0	0	0.0
Environmental Knowledge	37,663	7.3	49,295	10.6
Environmental Aspects of Development	5,252	1.0	4,679	1.0
Environmental and Other Aspects	5,645	1.1	8,724	1.9
Division 5: Advancement of Knowledge	31,800	6.2	31,865	6.8
Advancement of Knowledge Unclassified	0	0.0	0	0.0
Natural Sciences, Technologies and Engineering	22,797	4.4	16,619	3.6
Social Sciences and Humanities	9,002	1.7	15,245	3.3
Total	515,331	100.0	465,367	100.0

Table G8 indicates that Division 2: Economic Development displayed the highest expenditure by SEO of 47.6% in 2004/2005. This also indicated a drop of 11.4% when compared to the figures

of 2003/2004. In turn Division 3: Society, showed a significant increase from 20.7% in 2003/2004 to 36.7% in 2004/2005.

Table G9: Government R&D personnel Headcount and Full-time equivalent (FTE)

	Headcount			FTE	FTE as % of Headcount
	Male	Female	Total		
Occupation					
Researchers	409	283	692	491.05	71.0
Technicians directly	274	220	494	376.25	76.2
Other personnel directly	833	292	1125	800.02	71.1
Total	1516	795	2311	1667.32	72.1

Table G9 indicates that 491 FTE researchers in government spend an average of 71% of their time on research. There has been a significant increase from 2003/2004 figure of 48%. Although the total headcount for 2003/2004 and 2004/0025 show little variation, researchers have significantly decreased from 929 to 692 in 2004/2005.

Table G10: Government Sector Demographic Information*

Qualification	African		Coloured		Indian		White		Total		Overall
	M	F	M	F	M	F	M	F	M	F	
Government											
Researchers											
Doctoral Degree or Equivalent	12	6	1	1	2	1	103	46	118	54	172
Masters, Hons, Bachelor or equivalent	111	85	18	18	12	18	138	104	279	225	504
Diplomas	7	1	0	0	0	0	6	2	12	3	15
Sub-Total	130	93	19	19	14	19	246	152	409	283	692
Technicians Directly Supporting R&D											
Doctoral Degree or Equivalent	1	0	0	0	0	0	1	0	2	0	2
Masters, Hons, Bachelor or equivalent	57	52	13	6	1	11	31	46	102	115	217
Diplomas	58	45	18	3	2	6	91	51	169	105	275
Sub-Total	117	97	31	10	3	17	123	97	274	220	494
Other Personnel Directly Supporting R&D											
Doctoral Degree or Equivalent	2	1	0	0	0	0	2	0	3	1	4
Masters, Hons, Bachelor or equivalent	17	4	6	4	0	1	18	15	41	24	65
Diplomas	5	24	3	9	6	1	11	9	24	44	69
Other Qualifications (incl. Non-Formal)	565	104	153	36	5	4	42	78	765	222	987
Sub-Total	588	133	162	50	11	7	73	102	833	292	1125
Overall Total	834	323	212	79	28	43	442	351	1516	795	2311

* Totals may not add up exactly due to imputation and rounding errors.

In Table G10, 87% of the total researchers at doctoral level are represented by whites (males 60%; females 27%), compared to the 13% made up of blacks, coloureds and Indians. The technicians directly supporting R&D are represented by 43% blacks, 8% coloureds, 4% Indians and 45% whites. Other personnel directly supporting R&D is represented by 64% blacks, 19% coloureds, 2% Indians and 16% whites. Personnel working in the agricultural sector, largely make up the 64% representing blacks in the latter category.

Chapter 4: The Higher Education Sector

4.1. Introduction

As a sector, the higher education sector is well-defined in size and scope, and it was therefore surveyed as a census. The Frascati Manual (OECD, 2002) describes the Higher Education Sector composed of

- “All universities, colleges of technology and other institutions of post-secondary education, whatever their source of funding or legal status.
- It also includes all research institutes, experimental stations and clinics operating under the direct control of or administered by or associated with higher education institutions.”

Although the Higher Education landscape has undergone significant changes over the past year due to institutional mergers, the Higher Education Sector registry has remained relatively unchanged from that of the 2003/04 survey. All private higher education institutions with a research component, technikons, universities and newly established Universities of (Science) and Technology were surveyed. Due to the fact that data pertaining to the 2004 academic year was of relevance to the current survey, most institutions were surveyed in their original form (i.e. form/structure prior to the institutional mergers). The 2005/06 R&D Survey should fully reflect the new institutional landscape more closely.

4.2. Results

Higher Education expenditure on Research and Experimental Development increased in real terms from that reported in 2002/03 by approximately 22 percent. It is believed that this increase can largely be attributed to improved reporting procedures on the part of the higher education institutions.

4.3. Methodology

It was decided that the 2004/05 R&D Survey would take the form of a “semi-light” questionnaire by incorporating the collection of race, gender, occupational and educational qualification data into the questionnaire. Considerable time was spent refining key definitions and concepts included in the questionnaire and use was made of extended explanatory notes and definitions as agreed upon with the sector representatives at regional workshops. A particular area in which improved reliability across the sector was achieved was with regards to FTE reporting. This was primarily achieved through a thorough verification process using HEMIS data. Improved reporting with regards to current costs related to research represents a further area of improvement. The calculation of current costs was extensively work-shopped with respondents and has resulted in greater convergence between labour cost and current expenditure across the sector. The revised questionnaire and User Guide were piloted across the sector during the month of June, and eventually released to respondents during September 2005.

Although hard-copy questionnaires still proved to be the primary method of data collection, an electronic questionnaire that incorporated the additional feature of being able to calculate totals was introduced to survey respondents. This method of data collection proved especially popular amongst the Higher Education respondents.

Choice in terms of unit of measure was again varied across the sector, although the majority of institutions preferred to collect data centrally. Other institutions preferred that data be collected at the level of Faculty, while a minority of institutions collected data at the level of department or Research Focus area.

Response rates to the survey have generally improved since last year and respondents took significantly less time to complete the questionnaire. This, it seems, is largely due to improved explanatory notes included in the questionnaire and strengthened relationships with the Higher Education respondents. Prior to the launch of the survey, workshops were held in both Cape Town and Pretoria to sensitise respondents to the survey. It appears that this initiative has paid

off since most respondents believe the data for 2004/05 to be more reliable than that collected previously.

In total, 33 institutions were surveyed. These included three Private Higher Education Institutions, seven Technikons, 18 universities (North West Mafikeng and North West Potchefstroom were surveyed separately) and five Universities of Technology.

The Higher Education Sector
Private Higher Education Institutions
<ul style="list-style-type: none"> • Damelin International College • Milpark Business School • Monash University
Technikons
<ul style="list-style-type: none"> • Border Technikon • Cape Technikon • Eastern Cape Technikon • Mangosuthu Technikon • Peninsula Technikon • Port Elizabeth Technikon • Technikon Witwatersrand
Universities
<ul style="list-style-type: none"> • Medical University of South Africa • North West University – Mafikeng • North West University – Potchefstroom • Rand Afrikaans University • Rhodes University • University of Cape Town • University of Fort Hare • University of KwaZulu Natal • University of Port Elizabeth • University of Pretoria • University of South Africa (including Technikon SA) • University of Stellenbosch • University of the Free State • University of the North • University of the Western Cape • University of the Witwatersrand • University of Transkei • University of Zululand
Universities of Technology
<ul style="list-style-type: none"> • Central University of Technology • Durban Institute of Technology • Tshwane University of Technology • University of Venda for Science and technology • Vaal University of Science and Technology

Seven relatively low research-intensive institutions failed to submit returns. The primary reason for this seems to be that the data are simply not available in the form required by the survey. In these cases, use was once again made of supplementary data sources including HEMIS, the NRF,

MRC, THRIP and the Innovation Fund. Once questionnaires for these institutions had been populated, they were sent to the Research Dean at the particular institution for signing off. In most cases, it appears that the supplementary data calculations done by HSRC staff have closely approximated the total R&D expenditures suggested by the Research Deans.

A thorough data verification process was also initiated in November 2005, where data received from all institutions was compared against data received from HEMIS, the NRF, Innovation Fund and THRIP. Again, data calculations done by HSRC staff closely approximated the R&D expenditures received from the HE institutions. The verification process has also revealed greater consistency within the sector in terms of interpretation of the questionnaire and fewer outliers within the data.

Table H1: In-house R&D expenditure per sector

	Subtotal	Amount	
Sector	R 000s	R 000s	%
Business enterprise		6,766,361	56.3
Government		515,331	4.3
Higher education		2,533,971	21.1
<i>Technikons</i>	<i>73,273</i>		<i>0.6</i>
<i>Universities of Technology</i>	<i>120,028</i>		<i>1.0</i>
<i>Universities</i>	<i>2,330,189</i>		<i>19.4</i>
<i>Private Higher Education</i>	<i>10,481</i>		<i>0.1</i>
Not-for-profit		198,268	1.7
Science Councils		1,996,050	16.6
Grand Total		12,009,981	100.0

Higher Education accounts for 21.1 percent of GERD and comprise its second largest component. Universities account for just over 91 percent of higher education expenditure on R&D (HERD).

Main Characteristics of the Higher Education sector

HERD	2 533 million
HERD as a percentage of GDP	0.18
Total HE Researchers (FTE)	3506
% HERD financed by Industry	16.8

Table H2: Headcount of R&D personnel by sector

Sector	Researchers	Technicians Directly Supporting R&D	Other Personnel Directly Supporting R&D	Sector Total	Grand Total	%
Business enterprise	6575	3724	4038		14337	25.4
Government	692	494	1125		2311	4.1
Higher education*	27603	2801	2722		33126	58.7
<i>Technikons*</i>	1122	180	193	1495		2.6
<i>Universities of Technology*</i>	1713	140	192	2045		3.6
<i>Universities*</i>	24713	2481	2326	29520		52.3
<i>Private Higher Education*</i>	55	0	11	66		0.1
Not-for-profit	285	40	184		509	0.9
Science Councils	1846	1582	2742		6170	10.9
Grand Total	37001	8641	10811		56453	100.0

*Including Doctoral and Post-Doctoral Students

The higher education sector accounts for 50.5 percent of R&D human resources in the country. Of the 18 270 researchers within the sector, 86 percent work at universities.

Table H3: HERD by accounting category

Type of Expenditure	R 000s	R 000s	%
Capital Expenditure on R&D	193,536		7.6
<i>Land: Buildings and Other Structures</i>		16,693	0.7
<i>Vehicles, Plant, Machinery, Equipment</i>		176,843	7.0
Current Expenditure	2,340,435		92.4
<i>Labour Costs</i>		1,097,488	43.3
<i>Total cost of R&D postgraduate students</i>		308,454	12.2
<i>Other Current Expenditure</i>		934,493	36.9
Total	2,533,971	2,533,971	100.0

According to the data presented in Table H3, current expenditure (labour costs and other current expenditure) accounted for 92.4 percent of higher education expenditure of R&D, with just under 8 percent investment in infrastructure and research equipment.

Table H4: HERD by type of research

	Amount	
Type of Research	R 000s	%
Basic Research	1,049,330	41.4
Applied Research	979,626	38.7
Experimental Research	505,014	19.9
Total	2,533,971	100.0

The higher education sector spent the largest proportion of their R&D expenditure on basic research (41.4 %). This percentage does, however, represent a decline in the proportion expenditure on basic research compared to that of last year (44.2%). Applied research constitutes 38.7 percent expenditure on R&D, while Experimental Development constitutes just under 20 percent.

Table H5: HERD by sources of funding

Source of Funds	Amount		
	R 000s	R 000s	%
General University Funds	1,107,695		43.7
Own Funds		1,107,695	43.7
External Sources	1,426,276		56.3
Government		170,616	6.7
Local Business		364,041	14.4
Other South African Sources		156,640	6.2
Foreign		303,002	12.0
Agency Funding		402,925	15.9
Science Councils		29,052	1.1
Total	2,533,971	2,533,971	100.0

General University Funds (comprising of “Own Funds” and the Higher Education Vote) constitute the largest portion of higher education R&D funds (43.7%). Just under 15 percent of higher education funding is derived from South African businesses, while almost 16 percent comes from Agency Funding.

Table H6: Provincial Split of HERD

Province	Amount	
	R 000s	%
Eastern Cape	184,868	7.3
Free State	139,497	5.5
Gauteng	885,288	34.9
KwaZulu-Natal	373,595	14.7
Limpopo	63,508	2.5
Mpumalanga	47,379	1.9
North-West	123,817	4.9
Northern Cape	21,152	0.8
Western Cape	694,867	27.4
Total	2,533,971	100.0

The largest proportion of higher education R&D expenditure was in Gauteng (34.9%) followed by the Western Cape (27.4%) and KwaZulu Natal (14.7%).

Table H7: HERD by Research Field (RF)

Main Research Field	2004/05		2003/04	
	Amount		Amount	
	R 000s	%	R 000s	%
Division 1: Natural Sciences, Technology and Engineering	1,646,731	65.0	1,424,560	68.8
Mathematical Sciences	81,251	3.2	127,344	6.1
Physical Sciences	100,761	4.0	52,552	2.5
Chemical Sciences	101,808	4.0	71,479	3.5
Earth Sciences	101,262	4.0	94,833	4.6
Information, Computer and Communication	98,240	3.9	58,014	2.8
Applied Sciences and Technologies	43,653	1.7	54,238	2.6
Engineering Sciences	307,141	12.1	198,163	9.6
Biological Sciences	192,658	7.6	159,708	7.7
Agricultural Sciences	97,248	3.8	97,996	4.7
Medical and Health Sciences	440,249	17.4	433,504	20.9
Environmental Sciences	40,388	1.6	37,358	1.8
Material Sciences	29,918	1.2	31,685	1.5
Marine Sciences	12,154	0.5	7,685	0.4
Division 2: Social Sciences and Humanities	887,240	35.0	646,791	31.2
Social Sciences	577,653	22.8	445,031	21.5
Humanities	309,587	12.2	201,761	9.7
Total	2,533,971	100.0	2,071,351	100.0

Natural, Technology and Engineering Sciences account for the largest expenditure (65%), with the Social Sciences and the Humanities at 35%. Within Division 1, the Health Sciences once

again are largest (17.4%), followed by Engineering Sciences (12.1%) and Biological Sciences (7.6%). Proportional spending on Social Sciences increased slightly (3.8%), while proportional spending in the Natural, Technology and Engineering Sciences has declined.

Table H8: R&D Expenditure by socio-economic objective (SEO)

	2004/05		2003/04	
	Amount		Amount	
Socio-Economic Objective	R 000s	%	R 000s	%
Division 1: Defence	2,069	0.1	1,679	0.1
Defence	2,069	0.1	1,679	0.1
Division 2: Economic Development	735,329	29.0	628,565	30.3
Economic Development Unclassified	102,936	4.1	93,498	4.5
Plant Production And Plant Primary Products	60,922	2.4	69,061	3.3
Animal Production and Animal Primary Products	72,192	2.8	58,674	2.8
Mineral Resources (Excluding Energy)	15,898	0.6	67,831	3.3
Energy Resources	16,709	0.7	17,402	0.8
Energy Supply	31,871	1.3	30,186	1.5
Manufacturing	102,001	4.0	78,679	3.8
Construction	26,956	1.1	19,548	0.9
Transport	14,347	0.6	12,109	0.6
Information and Communication Services	50,745	2.0	26,125	1.3
Commercial Services	41,588	1.6	27,868	1.3
Economic Framework	93,107	3.7	65,539	3.2
Natural Resources	106,057	4.2	62,045	3.0
Division 3: Society	722,819	28.5	634,216	30.6
Society Unclassified	102,936	4.1	93,498	4.5
Health	328,251	13.0	292,029	14.1
Education and Training	132,616	5.2	110,531	5.3
Social Development and Community Services	159,016	6.3	138,158	6.7
Division 4: Environment	226,063	8.9	197,632	9.5
Environment Unclassified	34,312	1.4	31,166	1.5
Environmental Knowledge	94,667	3.7	68,443	3.3
Environmental Aspects of Development	40,122	1.6	43,021	2.1
Environmental and Other Aspects	56,963	2.2	55,002	2.7
Division 5: Advancement of Knowledge	847,691	33.5	609,259	29.4
Advancement of Knowledge Unclassified	102,936	4.1	93,498	4.5
Natural Sciences, Technologies and Engineering	427,087	16.9	311,137	15.0
Social Sciences and Humanities	317,668	12.5	204,623	9.9
Total	2,533,971	100.0	2,071,351	100.0

Just over 90 percent of higher education expenditure on R&D is relatively evenly split across Division 2: Economic Development, Division 3: Society and Division 5: The Advancement of Knowledge.

Table H9: Higher education postgraduate student headcount by gender and qualification

	Male	Female	Total
Qualification			
Post-doctoral fellows	294	188	482
Doctoral Students	5082	3769	8851
Masters Students	12186	10640	22826
Total	17562	14597	32159

Just fewer than 55 percent of postgraduate students are male. Women are especially badly represented amongst the post-doctoral fellows, where only 39 percent are female.

Table H10: Higher education postgraduate student headcount by gender and qualification

	Male	Female	Total	FTE	FTE as % of Headcount
Qualification					
Post-doctoral fellows	294	188	482	472.6	98.0
Doctoral Students	5082	3769	8851	6360.71	71.9
Masters Students	12186	10640	22826	11510.96	50.4
Total	17562	14597	32159	18344.27	57.0

According to the data, Post-Doctoral fellows spend almost 100 percent of their time on research, while Doctoral students spend just over 70 percent of their time on research. As expected, Masters students with a research component, spent 50.4 percent of their time doing research.

Table H11: Higher education R&D personnel headcount and full-time equivalent (FTE)*

	Headcount				
	Male	Female	Total	FTE	FTE as % of Headcount
Occupation					
Researchers	10965	7305	18270	3506.48	19.2
Technicians	1755	1046	2801	568.1	20.3
Other Personnel:Executive and management	438	190	628	66.47	10.6
Other Personnel:Administrative and support staff	764	1330	2094	406.57	19.4
Total	13922	9871	23793	4547.62	19.1

*Excluding Post-graduates

Just over 76 percent of R&D employees in the Higher Education Sector are researchers. Of these, approximately 40 percent are women. The data presents an increase of 133 researcher FTE's from that reported last year. This increase in FTE's has, however, not kept pace with the increase in headcounts, resulting in a drop in terms of percentage time spent on research by researchers from 24 percent to 19.2 percent.

Table H12: Higher education R&D personnel headcount by gender, population group and qualification level

	African		Coloured		Indian		White		Total		
Qualification	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	TOTAL
Researchers											
<i>Doctoral Degree or Equivalent</i>	549	212	121	60	188	113	2909	1430	3767	1815	5582
<i>Masters, Hons, Bachelor or equivalent</i>	1189	765	166	160	418	278	2560	2359	4333	3562	7895
<i>Diplomas</i>	646	385	86	100	382	184	1751	1259	2865	1928	4793
Sub-Total	2384	1362	373	320	988	575	7220	5048	10965	7305	18270
Technicians Directly Supporting R&D											
<i>Doctoral Degree or Equivalent</i>	0	1	1	0	0	0	3	5	4	6	10
<i>Masters, Hons, Bachelor or equivalent</i>	68	46	49	49	14	13	136	118	267	226	493
<i>Diplomas</i>	308	140	318	158	67	22	791	494	1484	814	2298
Sub-Total	376	187	368	207	81	35	930	617	1755	1046	2801
Other Personnel:Administrative and support staff											
<i>Doctoral Degree or Equivalent</i>	6	6	1	1	1	0	25	21	33	28	61
<i>Masters, Hons, Bachelor or equivalent</i>	37	47	8	19	3	17	65	136	113	219	332
<i>Diplomas</i>	124	138	25	65	5	15	65	289	219	507	726
<i>Other Qualifications (incl. Non-Formal)</i>	78	119	6	33	19	35	296	390	399	577	976
Sub-Total	245	310	40	118	28	67	451	836	764	1331	2095
Other Personnel:Executive and management											
<i>Doctoral Degree or Equivalent</i>	72	20	24	4	20	4	143	57	259	85	344
<i>Masters, Hons, Bachelor or equivalent</i>	35	17	13	5	9	3	79	49	136	74	210
<i>Diplomas</i>	15	4	4	3	1	0	14	9	34	16	50
<i>Other Qualifications (incl. Non-Formal)</i>	3	0	0	0	0	0	6	14	9	14	23
Sub-Total	125	41	41	12	30	7	242	129	438	189	627
GRAND TOTAL	3130	1900	822	657	1127	684	8843	6630	13922	9871	23793

Africans make up 20.5 percent of researchers in the higher education sector. Just fewer than four percent of researchers in the sector are Coloured, while 8.5 percent are Indian. Whites represent the majority of researchers in the sector (67%). Approximately 40 percent of researchers in the sector are women.

H13: HERD by Institution, Researcher Headcount and Full-time equivalent (FTE)

Public Higher Education Institutions	R&D Expenditure	Researcher Headcount	Researcher FTEs
<i>Border Technikon</i>	1,508,000	26	2.9
<i>Cape Technikon</i>	20,123,000	243	26.2
<i>Central University of Technology, Free State</i>	15,764,000	122	25.0
<i>Durban Institute of Technology (DIT)</i>	29,854,000	538	80.7
<i>Eastern Cape Technikon</i>	7,031,000	156	22.6
<i>Mangosuthu Technikon</i>	2,263,000	30	6.0
<i>Medical University of South Africa (MEDUNSA)</i>	10,127,000	217	28.5
<i>North West University</i>	103,447,000	542	181.1
<i>Peninsula Technikon</i>	8,441,000	46	9.2
<i>Port Elizabeth Technikon</i>	14,379,000	119	22.5
<i>Rand Afrikaans University</i>	75,532,000	442	159.0
<i>Rhodes University</i>	78,821,000	306	102.5
<i>Technikon Witwatersrand</i>	19,528,000	372	30.6
<i>Tshwane University of Technology</i>	45,257,000	393	62.6
<i>University of Cape Town</i>	343,119,000	1,361	326.0
<i>University of Fort Hare</i>	21,369,000	290	57.4
<i>University of KwaZulu Natal</i>	343,115,000	1,882	432.9
<i>University of Port Elizabeth</i>	31,736,000	293	44.6
<i>University of Pretoria</i>	310,000,000	2,712	465.8
<i>University of South Africa</i>	102,040,000	2,618	301.5
<i>University of Stellenbosch</i>	283,402,000	1,610	322.0
<i>University of the Free State</i>	117,037,000	701	155.0
<i>University of the North</i>	23,089,000	612	58.2
<i>University of the Western Cape</i>	73,354,000	368	118.5
<i>University of the Witwatersrand</i>	394,527,000	1,423	356.0
<i>University of Transkei</i>	7,285,000	203	25.0
<i>University of Venda for Science and Technology</i>	7,400,000	269	13.2
<i>University of Zululand</i>	12,189,000	181	29.4
<i>Vaal University of Technology</i>	21,753,000	140	28.5
Sub Total	2,523,490,000	18,215	3493.3
Private Institutions			
<i>Damelin International College of Post Graduate Business</i>	1,594,000	15	6.0
<i>Milpark Business School</i>	843,000	4	1.2
<i>Monash University</i>	8,044,000	36	6.0
Sub Total	10,481,000	55	13.2
GRAND TOTAL	2,533,971,000	18,270	3506.5

Chapter 5: The Not-for-profit Sector

5.1 Introduction

Defining and identifying R&D in the NPO sector remains a challenge due to the vastness of the sector itself as well as predisposed perceptions among respondents of what exactly R&D is. Many respondents are still of the opinion that most NPOs specialize in social sciences whilst the Frascati definition of R&D are biased towards natural science, hence their reluctance to complete a questionnaire.

As expected this sector still accounts for the smallest proportion (1.7 %) of the total R&D expenditure across all sectors in South Africa. Not-for profit R&D personnel make up only 1.1% of the total R&D workforce, which is lower than the 2.0% reflected in 2003/04. The Survey found that the NPO sector accounted for 285 researchers, which constitutes a meagre 1.0% of the national total of 27668 researchers.

A decrease in R&D expenditure and R&D personnel was noted in this survey. However, this can mainly be attributed to the shuffling that occurred within the sector. Several NPO's who previously contributed significantly, had to be shifted from the NPO sector to the Business and Higher education sector. This is probably the greatest factor responsible for the noticeable drop in R&D expenditure and personnel figures. On the whole most of the R&D performing NPO's seem to doing fairly well, with the exceptions of some well established NPO's that closed down permanently.

Despite a better understanding of the sector, it remains somewhat problematic to survey the NPO sector as some respondents still reported a lack of capacity to participate in surveys. The length and complexity of the survey instrument requires them to allocate significant time and resources towards completion of the questionnaire, which may not be readily available.

5.2 Key results

Table N1: In-house R&D expenditure by sector

Sector	2004/05		2003/04	
	R 000s	%	R 000s	%
Business enterprise	6,766,361	56.3	5,591,325	55.5
Government	515,331	4.3	465,367	4.6
Higher education	2,533,971	21.1	2,071,351	20.5
Not-for-profit	198,268	1.7	209,023	2.1
Science Councils	1,996,050	16.6	1,745,493	17.3
Grand Total	12,009,981	100.0	10,082,559	100.0

A decrease in the amount of R&D spent was evident. The total R&D expenditure for the NPO sector dropped from R209million in 2003/04 to R198 million in 2004/05. Table N1 confirms the fact the NPO sector still accounts for the smallest proportion (1.7%) of the total R&D expenditure across all sectors in South Africa.

Table N2: Main Characteristics of the NPO Sector

	2004/05	2003/04
Not for Profit domestic expenditure on R&D:	R198, 28 million	R 209,023 million
Not for Profit expenditure on R&D as a percentage of GDP:	0.01 %	0.02%
Total Not for Profit R&D personnel (FTE)	362.68	684
Total Not for Profit researchers (FTE)	234.18	258
% Of NPO expenditure on R&D financed by industry	9.30%	9.40%
% Of NPO expenditure on R&D financed by government:	19.1%	16.70%

Table N3: Headcount of R&D personnel by sector

Sector	Researchers		Technicians Directly Supporting R&D		Other Personnel Directly Supporting R&D		Grand Total		%	
	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04
Business enterprise	6575	5058	3724	3430	4038	3120	14337	11608	30.4	28.6
Government	692	929	494	322	1125	1032	2311	2283	4.9	5.6
Higher education*	18270	14055	2801	2594	2722	2728.5	23793	19378	50.5	47.7
Not-for-profit	285	305	40	235	184	275	509	815	1.1	2.0
Science Councils	1846	2414	1582	1612	2742	2496	6170	6522	13.1	16.1
Grand Total	27668	22761	8641	8193	10811	9651.5	47120	40606	100.0	100.0
Higher Education Doctoral and Post-Doctoral Students	9333						9333			
Total Including Doctoral and Post-Doctoral Students	37001						56453			

* Excluding Postgraduate Students

R&D personnel of the NPO sector make up only 1.1% of the total R&D workforce. The Survey found that the NPO sector accounted for 285 researchers, which constitutes 1.0% of the national total of 27668 researchers.

5.3 Survey Methodology and Fieldwork Methods

Methodology for the NPO sector remained primarily unchanged. A purposive sample method was followed where mostly NPO's, who were considered likely to undertake R&D activities as well as organizations whose primary activities had not yet been clarified, were surveyed.

5.3.1 Registry:

The registry compiled for the first survey [2001/02 R&D survey] is continuously updated and expanded using various resources such as Internet searches, newspapers, journals, referrals, etc. In the 2003/04 survey the NPO sector registry was extended to approximately 120 entities to allow for greater representation. Due to the continuously changing environment of the NPO sector, the registry update process alerted us to the fact that several entities had become untraceable or had closed down. Once the non-active entities were removed the new register for the 2004/05 survey consisted of approximately 107 entities, despite the fact that several new NPO's had been identified and added to the register.

5.3.2 Piloting:

A pilot survey was conducted with three organisations. They were provided with the necessary background information on the survey and its overall objective. Telephonic interviews were conducted with these respondents and based on their feedback the relevant documents (questionnaire & codes books) were subsequently modified.

5.3.3 Fieldwork:

Questionnaires were sent to 107 NPO's via post and or email. These were followed up with intensive telephonic support and reminders. At a later stage in the survey a few questionnaires were completed telephonically. Some respondents informed that very little had changed in their organization and gave their permission for us to use data collected from the previous survey which were adjusted to the current inflation scenario. Unfortunately imputed data did not provide information on demographics, which resulted in poorly populated tables. In order to accommodate these factors, data sets were extrapolated statistically to give a more realistic picture of the demographics in the NPO sector. Returned questionnaires were checked for completeness and accuracy of data before it was uploaded into the database.

Of the hundred-and-seven questionnaires sent, 37 (35%) were returned. Of these, only six were "nil" returns. Hence, a total of 31 (84%) of the 37 returned questionnaires reported R&D expenditures for 2004/05.

When comparing the questionnaires returned for both the 2003/04 and the 2004/05 survey, majority of the NPOs believed to be doing R&D participated in the survey. However, a few known R&D performers did not respond for various reasons such as time constraints, respondent fatigue, etc. For these known R&D players, questionnaires were created using imputed data based on data and information obtained from previous R&D surveys as well as annual reports.

The 2004/05 survey shows a somewhat lower return rate than the previous year. This could be attributed to the fact that some respondents who previously advised no R&D, simply chose not to respond or return a completed nil questionnaire. Furthermore the NPO sector also underwent some shuffling as some organisations had to be reallocated to other sectors namely the Business and Higher Education sectors. Approximately four NPO organizations were integrated into other

sectors. It has become apparent that there is some confusion amongst NPO's who are housed or located on university premises, whether there is a need for them to complete a questionnaire as there is a possibility that their information may already have been captured by the resident institution who may also be participating in the survey. This uncertainty has been brought to our attention and requires some further work to provide enough clarity to respondents.

5.4 Detailed results

Table N4: NPO R&D by accounting category

Type Of Expenditure	Amount		
	R 000s	R 000s	%
Capital Expenditure on R&D	13,069		6.6
<i>Land: Buildings and Other Structures</i>		4,593	2.3
<i>Vehicles, Plant, Machinery, Equipment</i>		8,476	4.3
Current Expenditure	185,199		93.4
<i>Labour Costs</i>		77,502	39.1
<i>Other Current Expenditure</i>		107,697	54.3
Total	198,268		100.0

Current expenditure of R185 million on labour costs and other related expenses accounts for the greater portion (93.4%) of the total NPO expenditure on R&D. Only a small proportion (6.6%) accounts for the cost of infrastructure, equipment and buildings and maintenance of physical plants. The percentage breakdown of capital and current expenditure is similar to the ratios seen in both the 2001/02 and 2003/04 survey.

Table N5: NPO R&D expenditure by type of research

Type of Research	2004/05		2003/04	
	R 000s	%	R 000s	%
Basic Research	58,514	29.5	65,277	31.2
Applied Research	100,137	50.5	118,698	56.8
Experimental Research	39,617	20.0	25,048	12.0
Total	198,268	100.0	209,023	100.0

The data presented in table N5 shows that approximately half (50.5%) of the total R&D expenditure in the NPO sector supports applied research. This is followed by basic research

(29.5%) and experimental research (20%). The amount spent on applied research in the NPO sector vastly exceeds expenditure on other types of research. This remains true for the last three R&D surveys.

Table N6: NPO R&D expenditure by sources of funds.

Source of Funds	Amount		%
	R 000s	R 000s	
Own Funds	50,617		25.5
Internal Resources		50,617	25.5
Government	37,892		19.1
Grants		12,094	6.1
Contracts		25,798	13.0
Other Local Business	18,411		9.3
Contracts		18,411	9.3
Higher Education	586		0.3
Universities, Technikons, Colleges		586	0.3
Other South African Sources	19,481		9.8
South African Sources		19,481	9.8
Foreign	71,281		36.0
All Sources		71,281	36.0
Total	198,268	198,268	100.0

It is a characteristic of the NPO sector that the largest source of funding is derived from international development agencies. The data also reflects that there appears to be an increase in internally generated funds.

Table N7: Provincial split of NPO R&D

Province	Amount		%
	R 000s	R 000s	
Eastern Cape	8,151		4.1
Free State	4,301		2.2
Gauteng	82,581		41.7
KwaZulu-Natal	37,729		19.0
Limpopo	4,201		2.1
Mpumalanga	9,029		4.6
North-West	4,810		2.4
Northern Cape	1,298		0.7
Western Cape	46,169		23.3
Total	198,268		100.0

R&D expenditure is mainly concentrated in Gauteng (41.7%), followed by the Western Cape (23.3%) and Kwazulu-Natal (19%).

Table N8: NPO R&D expenditure by research fields (RF)

Main Research Field	2004/05		2003/04	
	Amount R 000s	%	Amount R 000s	%
Division 1: Natural Sciences, Technology and Engineering	53,198	26.8	100,388	48.0
Mathematical Sciences	0	0.0	0	0.0
Physical Sciences	0	0.0	0	0.0
Chemical Sciences	0	0.0	0	0.0
Earth Sciences	1,386	0.7	0	0.0
Information, Computer and Communication	924	0.5	0	0.0
Applied Sciences and Technologies	5,250	2.6	0	0.0
Engineering Sciences	0	0.0	0	0.0
Biological Sciences	766	0.4	907	0.4
Agricultural Sciences	12,705	6.4	13,646	6.5
Medical and Health Sciences	20,096	10.1	79,775	38.2
Environmental Sciences	6,067	3.1	4,940	2.4
Material Sciences	0	0.0	0	0.0
Marine Sciences	6,005	3.0	1,120	0.5
Division 2: Social Sciences and Humanities	145,070	73.2	108,635	52.0
Social Sciences	143,351	72.3	108,155	51.7
Humanities	1,719	0.9	480	0.2
Total	198,268	100.0	209,023	100.0

Findings of the 2003/04 survey indicated that the focus of R&D spending is equally supportive of research in the Social Sciences (52%) and Natural Sciences, Technology and Engineering (48%). The 2004/05 survey shows a slightly different picture where more funds were spent on Social Sciences (73.2%) with a remainder of 26.8% spent on Natural Sciences. This is representative of the perceptions amongst most NPOs that they mostly specialize in social sciences.

Table N9: NPO R&D expenditure by socio-economic objective (SEO)

	2004/05		2003/04	
	Amount		Amount	
Socio-Economic Objective	R 000s	%	R 000s	%
Division 1: Defence	1,441	0.7	1,564	0.7
Defence	1,441	0.7	1,564	0.7
Division 2: Economic Development	56,356	28.4	47,946	22.9
Economic Development Unclassified	0	0.0	0	0.0
Plant Production And Plant Primary Products	942	0.5	13,023	6.2
Animal Production and Animal Primary Products	13,647	6.9	1,376	0.7
Mineral Resources (Excluding Energy)	0	0.0	0	0.0
Energy Resources	490	0.2	920	0.4
Energy Supply	1,164	0.6	718	0.3
Manufacturing	0	0.0	0	0.0
Construction	0	0.0	0	0.0
Transport	0	0.0	0	0.0
Information and Communication Services	0	0.0	0	0.0
Commercial Services	2,994	1.5	3,729	1.8
Economic Framework	33,695	17.0	22,604	10.8
Natural Resources	3,425	1.7	5,577	2.7
Division 3: Society	125,674	63.4	144,673	69.2
Society Unclassified	0	0.0	0	0.0
Health	23,471	11.8	76,295	36.5
Education and Training	66,400	33.5	30,217	14.5
Social Development and Community Services	35,803	18.1	38,162	18.3
Division 4: Environment	10,632	5.4	6,418	3.1
Environment Unclassified	0	0.0	0	0.0
Environmental Knowledge	4,641	2.3	3,883	1.9
Environmental Aspects of Development	5,704	2.9	1,395	0.7
Environmental and Other Aspects	286	0.1	1,140	0.5
Division 5: Advancement of Knowledge	4,165	2.1	8,423	4.0
Advancement of Knowledge Unclassified	0	0.0	0	0.0
Natural Sciences, Technologies and Engineering	0	0.0	5,514	2.6
Social Sciences and Humanities	4,165	2.1	2,909	1.4
Total	198,268	100.0	209,023	10.1

The research with the strongest socio-economic objectives within this sector is Division 3 (Society 63.4%) followed by Division 2 (Economic Development 28.4%). This pattern was also noted in both the 2001/02 and 2003/04 R&D surveys.

Within the Society division the main thrust observed was Education and Training (33.5%) followed by Social Development and Community Services (18.1%) & Health (11.8%).

Table N10: NPO R&D personnel Headcount and Full-time equivalent (FTE)

	Male	Female	Total	FTE	FTE as % of Headcount
Occupation					
Researchers	144	141	285	234.18	82.2
Technicians	22	18	40	30.69	76.7
Other personnel directly Supporting R&D	62	122	184	97.81	53.2
Total	228	281	509	362.68	71.3

Table N10 indicates that in the NPO sector there are 234 FTE Researchers who on average spend about 82% of their time on research.

Technicians (30.69 FTE) spend approximately 76.7 % of their time on R&D while support staff (97.8 FTE) dedicates 53% of their time to R&D.

The NPO sector accounted for 285 researchers, 40 technicians and 184 other personnel directly supporting R&D. The 2004/05 survey saw a huge drop in headcount and FTE numbers, especially in the technicians and other personnel directly supporting research. Females were well represented and accounted for 55% of the total headcounts. This picture is very different to what was observed in the two previous surveys.

When one takes a closer look at the data, the decline in numbers is due to removal of organizations to other sectors. Further investigations revealed that the organizations that were shifted were ones with high R&D expenditures and an even bigger labour force. The personnel data of the sector also revealed that established R&D performers indicated slight decreases in their R&D personnel.

Table N11: NPO R&D personnel headcount by group, gender and education level *

2004/5 Qualification and Personnel Categories	African		Coloured		Indian		White		Total		TOTAL	%
	M	F	M	F	M	F	M	F	M	F		
Researchers												
Doctoral Degree or Equivalent	6	2	3	0	2	0	20	3	30	5	35	76.9
Masters, Hons, Bachelor or equivalent	41	35	9	13	5	11	57	74	111	133	244	48.0
Diplomas	2	2	0	2	0	0	2	0	3	4	7	1.3
Sub-Total	48	39	12	14	6	11	78	77	144	141	286	56.1
Technicians directly supporting R&D												
Doctoral Degree or Equivalent	0	0	0	0	0	0	0	0	0	0	0	0.0
Masters, Hons, Bachelor or equivalent	0	7	0	0	0	0	6	5	6	11	17	3.4
Diplomas	6	0	1	5	2	2	7	0	16	7	23	4.5
Sub-Total	6	7	1	5	2	2	13	5	22	18	40	7.9
Other personnel directly supporting R&D												
Doctoral Degree or Equivalent	0	0	0	0	0	0	1	2	1	2	3	0.7
Masters, Hons, Bachelor or equivalent	7	8	4	4	1	2	7	24	21	38	59	11.6
Diplomas	28	22	4	0	1	4	0	22	34	48	82	16.2
Other Qualifications (incl. Non-Formal)	3	20	1	6	0	0	0	8	4	34	39	7.6
Sub-Total	39	50	10	10	3	6	9	56	61	122	183	36.0
GRAND TOTAL	93	95	24	29	11	19	100	138	227	282	509	100

2004/5 Qualification and Personnel Categories	African		Coloured		Indian		White		Total		TOTAL	%
	M	F	M	F	M	F	M	F	M	F		
Researchers	48	39	12	14	6	11	78	77	144	141	286	56.1
Technicians directly supporting R&D	6	7	1	5	2	2	13	5	22	18	40	7.9
Other personnel directly supporting R&D	39	50	10	10	3	6	9	56	61	122	183	36.0
TOTAL	93	95	24	29	11	19	100	138	227	282	509	100

2001\02 Qualification and Personnel Categories	African		Coloured		Indian		White		Total		TOTAL	%
	M	F	M	F	M	F	M	F	M	F		
Researchers	51	32	13	9	8	10	51	55	123	106	229	55.3
Technicians Directly Supporting R&D	22	17	0	3	2	2	11	5	35	27	62	15.0
Other Personnel Directly Supporting R&D	19	50	11	12	1	1	7	22	38	85	123	29.7
Total	92	99	24	24	11	13	69	82	196	218	414	100.0

* Totals may not add up exactly due to imputation and rounding errors.

Of the total R&D personnel in the NPO sector, whites (47%) still make up the largest portion followed by Blacks (37%), Coloureds (10%) and Indians (6%).

Majority of the R&D personnel (56%) are comprised of researchers. Of the researcher component, more than half of researchers with doctoral and masters degrees are represented by whites (55%) whilst the group representing non-whites (Blacks (30%), Coloureds (9%) & Indians (6%)) accounts for the other (46%). This trend remains the same as previously noted in the 2001/02 R&D survey.

Gender representivity in the NPO sector favours females overall, with woman representing over half (55%) of all R&D Personnel. However within the researcher category both sexes are almost equally represented.

Chapter 6: The Science Council Sector

6. 1 Introduction

The South African Science Council sector comprises nine statutory organizations that conduct and perform specialized research. The sector includes the Africa Institute of South Africa (AISA), Agricultural Research Council (ARC), Council for Geosciences (CGS), Council for Scientific and Industrial Research (CSIR), Human Science Research Council (HSRC), Council for Minerals Technology (MINTEK), Medical Research Council (MRC), National Research Foundation (NRF), and South African Bureau of Standards (SABS). From the survey perspective, the small number of science councils belies the complexity of the sector as many of the councils are relatively large with a divisional structure. CSIR is the largest with more than ten research units, ARC has 13 research units, MRC has 6 units and the NRF has 6 research facilities.

The councils report to different line departments and are now funded off department core budgets. Additional funding is generated from research contracts with government, the private sector both local and abroad and other national sources.

The relationship between government and science councils makes it relatively easy to survey this sector.

6.2 Survey Methodology and fieldwork methods

2.1 The questionnaire

The design of the questionnaire took into account that the data requested must be suitable for international benchmarking and as such the OECD Frascati Manual was used for guidelines and definitions. The 2003/4 “Lite” questionnaire was extended to include questions on race and qualification profiles of R&D personnel as well the provincial expenditure on R&D. A template for an electronic questionnaire was also designed.

2.2 Fieldwork methods

Science councils account for a large proportion of the national R&D expenditure but from the survey perspective present a relatively small set of respondents. Most of the councils are large

organizations with a complex structure. They are usually given the option to determine the unit of measure to suit themselves.

The 2001/2 and 2003/4 surveys yielded a 100% return rate and with this background the 2004/5 survey was approached in a similar manner. A decision was made to pilot the questionnaire within institutions where problems were experienced in the previous survey.

The pilot exercise was followed by contacting the rest of the science councils alerting them to the forthcoming survey. There were new contact persons in some of the institutions. All but the ARC and NRF still used the top organization as the unit of measure. The NRF and ARC completed the questionnaire at the level of the unit or facility. Twenty-eight hardcopy questionnaires were sent to the field during the month of August and these were shortly followed by the electronic (e-) versions. The respondents were given about two months to complete and return the questionnaire.

Initially, all but two science councils provided completed questionnaires. The outstanding questionnaires were sourced by CeSTII staff through liaising directly with the executive directors. Of the 28 questionnaires sent out, two were nil (the institutions advised that they do not perform R&D) and 26 were completed. The questionnaires were checked and verified for accuracy and completeness before being uploaded on the SMRS. Necessary follow-ups were made regarding queries and adjustments were made to completed questionnaires as appropriate.

6.3. Key results

Table S1: In-house R&D expenditure by sector

	2004/05	%	2003/04	%
Sector	R 000s	%	R 000s	%
Business enterprise	6,766,361	56.3	5,591,325	55.5
Government	515,331	4.3	465,367	4.6
Higher education	2,533,971	21.1	2,071,351	20.5
Not-for-profit	198,268	1.7	209,023	2.1
Science Councils	1,996,050	16.6	1,745,493	17.3
Grand Total	12,009,981	100.0	10,082,559	100.0

The Science Council expenditure on R&D increased in nominal terms from R1.745 billion in 2003/4 period to 1.996 billion in 2004/5. However, the Science council's share of R&D expenditure as percentage of GDP decreased by 0.7 %.

Table S2: R&D personnel headcount by sector

Sector	Researchers		Technicians Directly Supporting R&D		Other Personnel Directly Supporting R&D		Grand Total		%	
	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04
Business enterprise	6575	5058	3724	3430	4038	3120	14337	11608	30.4	28.6
Government	692	929	494	322	1125	1032	2311	2283	4.9	5.6
Higher education*	18270	14055	2801	2594	2722	2728.5	23793	19378	50.5	47.7
Not-for-profit	285	305	40	235	184	275	509	815	1.1	2.0
Science Councils	1846	2414	1582	1612	2742	2496	6170	6522	13.1	16.1
Grand Total	27668	22761	8641	8193	10811	9651.5	47120	40606	100.0	100.0
Higher Education Doctoral and Post-Doctoral Students	9333						9333			
Total Including Doctoral and Post-Doctoral Students	37001						56453			

* Excluding Postgraduate Students

The Science council sector accounts for 13.1% of the total R&D human resources. The figure decreased by 3% from 16.1% recorded in 2003/04 survey. The higher education sector continues to lead with 66% researchers, followed by business (23.8%) and science councils (6.7%).

Table S3: Main characteristics of the science council sector

	2003/4 R'000	2004/5 R'000
Expenditure on R&D (millions)	1,745	1,996
Expenditure on R&D as % of GDP	0.14	0.14
R&D personnel (FTE)	5389	4989.6
Researchers (FTE)	1899.5	1548.8
% Expenditure financed by local industry	14.6	12.7
% Expenditure financed by Government	54.4	54.9

The expenditure of the science councils as a percentage of GDP remained at 0.14%. The expenditure in real terms increased by about R251 million.

4. Detailed results

Table S4: R&D expenditure by accounting category

Type of Expenditure	Amount		%
	R 000s	R 000s	
Capital Expenditure on R&D	127,465		6.4
Land: Buildings and Other Structures		29,299	1.5
Vehicles, Plant, Machinery, Equipment		98,166	4.9
Current Expenditure	1,868,585		93.6
Labour Costs		968,610	48.5
Other Current Expenditure		899,975	45.1
Total	1,996,050		100.0

Table S4 shows that 94% of R&D expenditure by science council was on current costs. Labour costs accounted for 48.5% of the expenditure while other current costs accounted for 45.1%. Investment in infrastructure and general equipments is still low at 6.4%. In 2001/2 survey, capital expenditure was 4.6% and it increased to 6.7% during the 2003/4 period.

Table S5: Science council R&D expenditure by type of research

Type of Research	2004/5	2004/5	2003/4	2003/4
	R 000s	%	R 000s	%
Basic Research	379,044	19.0	575,616	33.0
Applied Research	1,028,770	51.5	752,489	43.1
Experimental	588,236	29.5	417,388	23.9
Total	1,996,050	100.0	1,745,493	100.0

Table S5 shows that more than half of R&D expenditure in this sector is on applied research, followed by experimental research at 29.5%. Expenditure on applied research increased by 8.4% while experimental research increased by 5.6%. Basic research accounted for 33% of the science councils R&D activities in 2003/4 and the figure decreased to 19% in 2004/5.

Table S6: Science council R&D expenditure by sources of funds

Source of Funds	Amount		%
	R 000s	R 000s	
Own Funds	190,521		9.5
Internal Resources		190,521	9.5
Government	1,096,818		54.9
Grants		900,005	45.1
Contracts		196,813	9.9
Other Local Business	293,030		14.7
Contracts		293,030	14.7
Higher Education	1,438		0.7
Universities, Technikons, Colleges		1,438	0.1
Other South African Sources	159,956		8.0
South African Sources		159,956	8.0
Foreign	254,287		12.7
All Sources		254,287	12.7
Total	1,996,050	1,996,050	100.0

Although government continues to be the major funder of R&D activities in science councils, the funds used for research and development increased by a mere 0.5% from 54.4% in 2003/4 to 54.9% in 2004/5. 45% of the funds were grants and only 9.9% were in the form of contracts. Local businesses contributed 14.7% (14.6% in 2003/4), while a further 12.7% was from foreign sources. The data collected from 2001/2 to date show that funds from abroad have been on the increase, 4.8% in 2001/2 and 9.8% in 2003/4.

Table S7: Provincial Split of Science Council R&D

Province	Amount	
	R 000s	%
Eastern Cape	75,170	3.8
Free State	33,725	1.7
Gauteng	1,312,041	65.7
KwaZulu-Natal	171,424	8.6
Limpopo	23,887	1.2
Mpumalanga	35,580	1.8
North-West	43,581	2.2
Northern Cape	20,051	1.0
Western Cape	280,591	14.1
Total	1,996,050	100.0

Science councils (head offices and research sites) are largely based in Gauteng province and this is reflected by the highest expenditure in that province. The nature of the provincial economies also plays a role on the pattern of R&D expenditure. R&D performed in Gauteng accounts for 65.7% of the total science councils' expenditure. This figure has increased from 55.95% recorded in 2001/2 survey. The Western Cape follows at 14.1% while 8.6% was spent in Kwa-Zulu Natal. The comparison of the 2001/2 data with the latest results show that, except for Gauteng and Western Cape provinces, R&D expenditure has decreased in all other provinces.

Table S8: Science council R&D expenditure by research field (RF)

Main Research Field	2004/05		2003/04	
	Amount		Amount	
	R 000s	%	R 000s	%
Division 1: Natural Sciences, Technology & Engineering	1,829,632	91.7	1,538,663	88.2
Mathematical Sciences	13,629	0.7	15,492	0.9
Physical Sciences	58,292	2.9	87,967	5.0
Chemical Sciences	28,710	1.4	50,159	2.9
Earth Sciences	96,474	4.8	84,880	4.9
Information, Computer and Communication	141,363	7.1	55,045	3.2
Applied Sciences and Technologies	63,696	3.2	101,620	5.8
Engineering Sciences	450,079	22.5	321,668	18.4
Biological Sciences	208,812	10.5	226,256	13.0
Agricultural Sciences	393,682	19.7	287,632	16.5
Medical and Health Sciences	237,103	11.9	206,749	11.8
Environmental Sciences	61,022	3.1	34,615	2.0
Material Sciences	65,398	3.3	47,011	2.7
Marine Sciences	11,372	0.6	19,570	1.1
Division 2: Social Sciences & Humanities	166,418	8.3	206,830	11.8
Social Sciences	148,758	7.5	198,138	11.4
Humanities	17,660	0.9	8,692	0.5
Total	1,996,050	100.0	1,745,493	100.0

Most of the R&D spending in the science councils is on natural sciences, technologies and engineering. Within this category, the expenditure on engineering sciences increased to 22.5%, Agricultural sciences increased from 16.5% to 19.7% while Information, Computer and Communication expenditure increased from 3.2 to 7.1%. Expenditure on Mathematical, Physical, Chemical, Marine and Biological sciences as well as Medical and Health sciences decreased during 2004/5 period. The expenditure on the Social Sciences decreased by about 4% while Humanities increased by 0.4%.

Table S9: Science council expenditure by socio-economic objective (SEO)

	2004/05		2003/4	
	R 000s	%	R 000s	%
Division 1: Defence	160,864	8.1	153,196	8.8
Defence	160,864	8.1	153,196	8.8
Division 2: Economic Development	1,057,410	53.0	879,229	50.4
Economic Development Unclassified	0	0.0	0	0.0
Plant Production And Plant Primary Products	198,256	9.9	188,451	10.8
Animal Production and Animal Primary Products	118,171	5.9	141,996	8.1
Mineral Resources (Excluding Energy)	251,953	12.6	150,228	8.6
Energy Resources	16,916	0.8	16,961	1.0
Energy Supply	542	0.0	3,125	0.2
Manufacturing	138,792	7.0	128,057	7.3
Construction	61,761	3.1	36,433	2.1
Transport	41,935	2.1	54,906	3.1
Information and Communication Services	22,090	1.1	7,176	0.4
Commercial Services	2,086	0.1	7,234	0.4
Economic Framework	50,045	2.5	35,116	2.0
Natural Resources	154,861	7.8	109,546	6.3
Division 3: Society	324,973	16.3	205,207	11.8
Society Unclassified	0	0.0	0	0.0
Health	203,178	10.2	134,099	7.7
Education and Training	68,755	3.4	31,227	1.8
Social Development and Community Services	53,040	2.7	39,881	2.3
Division 4: Environment	144,737	7.3	137,520	7.9
Environment Unclassified	0	0.0	0	0.0
Environmental Knowledge	87,752	4.4	83,067	4.8
Environmental Aspects of Development	20,436	1.0	17,175	1.0
Environmental and Other Aspects	36,549	1.8	37,279	2.1
Division 5: Advancement of Knowledge	308,067	15.4	370,340	21.2
Advancement of Knowledge Unclassified	0	0.0	0	0.0
Natural Sciences, Technologies and Engineering	246,359	12.3	274,691	15.7
Social Sciences and Humanities	61,708	3.1	95,649	5.5
Total	1,996,050	100.0	1,745,493	100.0

Table S9 shows that 53% of science council R&D expenditure is in areas aligned to economic development while 16.3% is on those focused in the advancement of knowledge. There were decreases in expenditure related to the advancement of knowledge (5.8%) and environment (0.4%). The decrease in expenditure devoted to the advancement of knowledge ties with the

decrease in expenditure on basic research (Table S5). Expenditure on R&D that impacts on society increased from 11.8% to 16.3%.

Table S10: Science council R&D personnel headcount and full-time equivalent (FTE)

Occupation	Headcount			Full-Time Equivalent	
	Male	Female	Total	FTE	FTE as % of Headcount
Researchers	1141	705	1846	1548.83	83.9
Technicians	984	598	1582	1344.13	85.0
Other personnel directly Supporting R&D	1482	1260	2742	2096.6	76.5
Total	3607	2563	6170	4989.56	80.9

Table S10 shows that 4989.6 full-time equivalent R&D personnel were recorded for the science councils during the 2004/5 period. The figure recorded in 2001/2 was 3998.6 and the 2003/4 figure stood at 5389.4.

Researcher FTE decreased by 350 between 2003/4 and 2004/5 while technicians went up by 40.4 in the same period. The average time spent on R&D by researchers in 2003/4 was reported at 78.7%. Despite the decrease in the actual headcounts and FTE, the latest data suggest that on average, researchers spend more time (84%) on R&D.

Of the total 6172 R&D personnel reported in 2004/5, only 10.6% possess a PhD degree or equivalent. Most of the personnel with PhD are researchers and only a few have a supporting role. R&D personnel with other degree qualification (MSc, Hons etc) make up 35.4% of the total R&D personnel while those with diplomas and other qualifications account for 54% of R&D human resources directly involved or supporting R&D. The researcher and technician categories are still dominated by the white males while most women are still concentrated in the supporting role category and generally without degrees. White females with PhD dominate the rest of the female group except in the support role.

Table S11: Science Council's R&D personnel by race, gender and qualifications

Qualification	African		Coloured		Indian		White		Sub-Total		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral Degree or Equivalent	80	21	12	7	24	14	320	134	436	176	612
Masters, Hons, Bachelor or equivalent	152	115	31	30	43	65	440	282	666	492	1158
Diplomas	13	14	8	0	1	3	17	22	39	39	78
Sub-Total	245	150	51	37	68	82	777	438	1141	707	1848
Technicians Directly Supporting R&D											
Doctoral Degree or Equivalent	0	0	0	0	0	0	1	0	1	0	1
Masters, Hons, Bachelor or equivalent	94	73	26	13	31	34	194	114	345	234	579
Diplomas	237	179	73	28	36	20	292	137	638	364	1002
Sub-Total	331	252	99	41	67	54	487	251	984	598	1582
Other Personnel Directly Supporting R&D											
Doctoral Degree or Equivalent	9	2	2	0	0	0	26	3	37	5	42
Masters, Hons, Bachelor or equivalent	81	95	2	17	7	11	103	131	193	254	447
Diplomas	93	83	11	10	8	13	74	111	186	217	403
Other Qualifications (incl. Non-Formal)	782	360	124	106	22	18	138	300	1066	784	1850
Sub-Total	965	540	139	133	37	42	341	545	1482	1260	2742
Total	1541	942	289	211	172	178	1605	1234	3607	2565	6172

Table S12: Science Councils

Science Council	Total R&D Expenditure (Rands)	Researchers (FTE)	Applied Research (Rands)	Capital Expenditure (Rands)
African Institute of South Africa	22,233	21.0	6,670	1,298
Agricultural Research Council	482,687	475.1	293,601	45,068
Council for Geoscience	69,548	93.0	17,387	16,760
CSIR	710,770	455.8	312,739	38,247
Human Sciences Research Council	176,595	102.4	141,276	1,680
Medical Research Council	219,426	174.0	87,770	10,145
Mintek	241,523	150.0	147,329	8,922
National Research Foundation	70,556	74.6	19,828	5,345
South African Bureau of Standards	2,712	3.0	2,170	0
TOTAL/ AVERAGE	1,996,050	1,548.8	1,028,770	127,465

Chapter 7: Concluding Remarks and Acknowledgements¹

The 2004/05 Survey is the third that the Centre for Science, Technology and Innovation Indicators has conducted for the Department of Science and Technology. The survey design and fieldwork took less than a year to perform with the completion of the work in April 2006. The Minister released the Key High-Level Results on 22 June 2006.

The coverage attained in this third survey is a further improvement on that of the 2003/04 survey. This may be attributed to the experience gained in the previous surveys as well as the dedication of the CeSTII staff and associates. In this context tribute must be made of the late Mrs. Alanta Lachmann who passed away on 2 July 2006. Mrs. Lachmann played a pivotal role in bridging the methodology of the survey of 1991/92 to the resumed survey series that CeSTII commence in 2002. Mrs. Lachmann worked with us as an external consultant specializing in the Higher Education sector. She provided consistently solid advice, always kept to project timelines and served as a mentor to many of the staff. Her wise counsel will be sadly missed.

Performing the R&D Survey has a parallel with the work of tax collectors: they know the taxes are out there, but how to collect? The secret lies in a judicious mix of persuasion and detection, and that is what the CeSTII survey team does. We continue to learn and believe that our respondents learn with us.

The attainment of the status of Official Statistics serves as a compliment and encouragement to CeSTII – having earned that status it must be maintained into the future. It is especially gratifying to find the South African data now included in the OECD *Main S&T Indicators* and *S&T Scoreboard* publications, both of which serve to enhance understanding of this economy and its importance in the world.

The introduction of an enhanced tax incentive for companies that perform R&D may in due course lead not only to an increase in R&D performance but also to better collection of data. That is a matter for the future and will begin to make an impact on the 2006/07 R&D Survey.

¹ We note the departure to other posts of long-serving staff members Nkosikho Batatu, Simone Esau, Sagren Moodley, Yolisa Nogenga and Stanley Ntakumba