



**NATIONAL SURVEY
OF
RESEARCH & EXPERIMENTAL DEVELOPMENT
2005/06**

Centre for Science, Technology and Innovation Indicators
(CeSTII)

Human Sciences Research Council

for

The Department of Science and Technology

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Executive Summary

1. This Report presents the results of the fourth R&D Survey that the Centre for Science, Technology and Innovation Indicators (CeSTII) has conducted for the Department of Science and Technology, namely the 2005/06 Survey of Inputs into Research and Experimental Development (R&D).
2. The 2005/06 R&D Survey is a benchmark survey in that it is the last before the enhanced R&D tax incentive that came into effect on 2 November 2006.
3. As previously, the survey methodology follows the OECD Frascati Manual guidelines.
4. The questionnaire included standard items as well as inquiring more deeply into staff demographics, R&D collaboration, higher education funding, research in the areas emphasized in the South African R&D Strategy of 2002, as well as in the emerging areas of biotechnology and nanotechnology.
5. 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 enterprises.
 - ii. The **Government Sector**: Departments in the three tiers of national, provincial and local government with an R&D component, government research institutions and museums.
 - iii. The **Higher Education Sector**: All public higher education institutions and one private higher education institutions with an R&D component
 - iv. The **Not-for-Profit Sector**: Non-governmental and other organisations formally registered as not-for-profit institutions.
 - v. The **Science Council Sector**: the nine science councils all established through Acts of Parliament.
6. 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.
7. In Table E1 we present the breakdown of the national total of R14,1 billion of intra-mural R&D expenditure by sector.

Table E1: Total In-house R&D expenditure per sector 2005/06 and 2004/05

Sector	2005/06		2004/05	
	R 000	%	R 000	%
Business Enterprise	8,243,776	58.3	6,766,361	56.3
Government	844,640	6.0	515,331	4.3
Higher Education	2,732,215	19.3	2,533,971	21.1
Not-for-profit	226,514	1.6	198,268	1.7
Science Councils	2,102,094	14.9	1,996,050	16.6
Grand Total	14,149,239	*100.0	12,009,981	100.0

*Subject to rounding error

The business sector accounts for 58,3% of total R&D expenditure and was the largest performer; government, combined with the science councils, accounts for 20,9% of expenditure; and higher education is responsible for 19,3%.

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

Table E2: Headcount of R&D personnel by sector 2005/06

Sector	Researchers	Technicians directly supporting R&D	Other personnel directly supporting R&D: Executive and management	Other personnel directly supporting R&D: Administrative and support staff	Grand total	%
Business enterprise	7480	4143	897	3801	16321	28.5
Government	874	495	125	507	2001	3.5
Higher education*	28879	1925	327	1658	32789	57.2
Not-for-profit	243	84	41	117	485	0.8
Science councils	1790	1678	332	1879	5679	9.9
Grand total	39266	8325	1722	7962	57275	100

*Including doctoral and post-doctoral students

9. 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 79% of their time on R&D while higher education researchers spend about 32% of their time on R&D, with the rest of their time devoted to teaching and administrative duties. A grand total of 28 798 FTE R&D personnel and 17 303 FTE researchers support the country's R&D effort. This translates into 2.4 R&D personnel per 1 000 total employment.
10. The Science and Industry Directorate of the OECD gave valuable advice toward submission of the 2004/05 R&D Survey results for inclusion in the *OECD Main S&T Indicators* and the accompanying *OECD Science, Technology and Industry Scoreboard*.
11. Statistics South Africa declared the 2001/02 Survey of Inputs into Research and Experimental Development as a component of Official Statistics on 13 June 2005.
12. 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.
13. The knowledge and expertise developed through the surveys have been codified in the CeSTII Survey Operations Manual
14. 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 competitiveness standing of organizations.

15. Reports and documents for the current and previous surveys are available in both PDF and Excel format at the following web sites: <http://www.dst.gov.za/publications/reports.php>
<http://www.hsrc.ac.za/CCUP-RnD-7.phtml>

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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.

This survey was carried out in parallel with the first official innovation survey, also undertaken by CeSTII, which caused some pressures on the staff.

We acknowledge all those staff that contributed to the conduct of the survey, especially the CeSTII administration staff, Valda West and Sumaya Abdullatief, and the IT help desk through Noor Fakier.

The steady increase in the number of requests for data extractions attests to the value of the R&D survey 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

¹ We note the departure to other posts of long-serving staff member Carly Steyn

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 Experimental 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
OEM	Original Equipment Manufacturer
R&D	Research and Development
SABS	South African Bureau of Standards
SCI	Science Councils
SIC	Standard Industrial Classification
SMRS	Survey Management and Results System
THRIP	Technology for Human Resources for Industry Programme
UOM	Unit of Measure

Chapter 1: Introduction to the Survey

1.1 Background

The Human Sciences Research Council (HSRC) Centre for Science, Technology and Innovation Indicators (CeSTII) conducts the Survey of Research and Experimental Development Inputs (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 government's Medium Term Expenditure Framework.

CeSTII is housed in the Knowledge Systems group of the HSRC in Cape Town that also provided baseline financial support to the survey.

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 is comprised of 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 Support Programme for Industrial Innovation (SPII), Technology and Human Resources for Industry Programme (THRIP) and the National Innovation Fund (NIF).

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 nine statutory science research councils, 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 the development and updates of appropriate sector sampling methodologies and sector specific questionnaires, the development of capacity and diversity in the survey team, and the 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 includes investment in people and systems and ongoing training in survey execution.

These sectors were surveyed over the period September 2006 to March 2007 to gather data on their R&D inputs for the financial year ending 28 February 2006 or nearest. For higher education this was the academic (calendar) year 2005.

For government departments this was the government financial year that ended 31 March 2006, while for business it was the nearest financial year to that coinciding with the tax year ending 28 February 2006.

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 February 2007, with final returns accepted up to the end of April 2007. Where necessary organisations were assisted in compiling and furnishing their returns.

The acquisition of data was relatively unproblematic, 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 in previous years.

The SMRS that is 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 retained.

1.2 Interpretation

The fourth 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 dominates employment. Accordingly the business sector coverage was further extended into the services sector.

To this end a set of case studies were conducted among the largest listed companies in financial services, retail and logistics with the aim of understanding what R&D they might perform. This mini survey provided invaluable information regarding the role of software development and the distributed nature of R&D in the services sector.

Future surveys will target other sectors of business, especially contract research organizations and the manufacturing sector.

As previously, the lists of Research Fields (RF) and Socio-Economic Objectives (SEO) are compatible with the systems used by OECD countries. The Standard Industrial Classification (SIC) codes are those provided by Statistics SA.

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 documented.

1.3 The Report and dissemination

The five sector reports are presented in chapters 2 through chapter 6. This is followed by concluding remarks in chapter 7.

This Report is published for wider dissemination both at <http://www.dst.gov.za/publications/reports.php> and <http://www.hsrc.ac.za/CCUP-RnD-7.phtml> 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.

More complex data extracts from the R&D Survey database are available on request and subject to the provisions of the Access Protocol.

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 1A) for year 2005/06 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 1A: Economic indicators 2005/06

Indicator	Value
GDP - Current prices (millions of Rands)	1 539 253
GDP – 2000 Constant prices (millions of Rands)	1 115 875
Purchasing power parity (Rands per US\$)	2.74
Value added in industry (millions of Rands)	1 063 509
Implicit GDP price index (Base year 2000 = 1.00)	1.379
National population (thousands)	46 888
Total employment (thousands)	11 907
Industrial employment (thousands)	8 339

Table 1B: Key R&D figures and indicators 2005/06

Gross domestic expenditure on R&D (GERD) Rand millions	14 149
GERD as a percentage of GDP	0.92
Total R&D personnel (FTE) ^a	28 798
Total researchers (FTE) ^b	17 303
Total researchers per 1000 total employment (FTE)	1.5
Total R&D personnel per 1000 total employment (FTE)	2.4
Civil GERD as a percentage of GDP	0.86
Total researchers (headcount)	39 266
Women researchers as a percentage of total researchers	39.2

^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 R&D High-Level Key Results booklet 2005/2006

Notes on multidisciplinary R&D

The survey included an item to determine expenditure on the two strategic areas of biotechnology and nanotechnology.

National Priority Areas

At the request of the Department an item was included to determine alignment of activity with the thrusts of the 2002 National R&D Strategy.

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 1.11) of the data parameters common across the five sectors.

Table 1.1: R&D expenditure by sector 2005/06

	Business enterprise	Government	Higher education	Not-for-profit	Science councils	GERD
Expenditure (R 000)	8,243,776	844,640	2,732,215	226,514	2,102,094	14,149,239
%	58.3	6.0	19.3	1.6	14.9	100.0

Table 1.2: R&D expenditure by accounting category 2005/06

Type Of expenditure	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Capital expenditure on R&D	1,446,650	17.5	151,234	17.9	150,224	5.5	10,092	4.5	209,013	9.9	1,967,213	13.9
<i>Land: Buildings and other structures</i>	199,088	2.4	47,768	5.7	21,622	0.8	2,336	1.0	76,528	3.6	347,342	2.5
<i>Vehicles, plant, machinery, equipment</i>	1,247,562	15.1	103,466	12.2	128,602	4.7	7,756	3.4	132,485	6.3	1,619,871	11.4
Current expenditure	6,797,126	82.5	693,406	82.1	2,581,991	94.5	216,422	95.5	1,893,081	90.1	12,182,026	86.1
<i>Labour costs</i>	3,703,277	44.9	311,959	36.9	1,202,172	44.0	85,511	37.8	875,467	41.6	6,178,386	43.7
<i>Total cost of R&D postgraduate students</i>	0	0.0	0	0.0	313,645	11.5	0	0.0	0	0.0	313,645	2.2
<i>Other current expenditure</i>	3,093,849	37.5	381,447	45.2	1,066,174	39.0	130,911	57.8	1,017,614	48.4	5,689,995	40.2
Total	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	100.0	14,149,239	100.0

Table 1.3: R&D expenditure by sources of funds 2005/06*

Source of funds	Business enterprise		Government		Higher education		Not-for-profit		Science councils	
	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Own funds	5,488,727	66.6	316,145	37.4	1,601,444	58.6	46,934	20.7	485,702	23.1
Internal resources	5,488,727	66.6	316,145	37.4	1,601,444	58.6	46,934	20.7	485,702	23.1
Government	1,331,740	16.2	439,511	52.0	491,784	18.0	28,470	12.6	1,105,832	52.6
Grants	919,488	11.2	433,842	51.4	N/A	N/A	16,295	7.2	629,237	29.9
Contracts	412,252	5.0	5,669	0.7	N/A	N/A	12,175	5.4	476,595	22.7
All government, research agencies, agency funding and science councils	N/A	N/A	N/A	N/A	491,784	18.0	N/A	N/A	N/A	N/A
Business	142,256	1.7	11,000	1.3	316,740	11.6	27,416	12.1	220,698	10.5
Local business	142,256	1.7	11,000	1.3	316,740	11.6	27,416	12.1	220,698	10.5
Other South African sources	84,282	1.0	19,270	2.3	16,657	0.6	21,354	9.4	35,679	1.7
Higher education	1,623	0.0	8,583	1.0	4,917	0.2	2,304	1.0	4,620	0.2
Not for profit organisations	14,158	0.2	687	0.1	9,423	0.3	16,379	7.2	30,006	1.4
Individual donations	68,501	0.8	10,000	1.2	2,317	0.1	2,671	1.2	1,053	0.1
Foreign	1,196,771	14.5	58,714	7.0	305,590	11.2	102,340	45.2	254,183	12.1
All sources	1,196,771	14.5	58,714	7.0	305,590	11.2	102,340	45.2	254,183	12.1
Total	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	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 2005/06*

Province	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Eastern Cape	242,692	2.9	84,071	10.0	214,701	7.9	6,589	2.9	123,956	5.9	672,008	4.7
Free State	476,346	5.8	41,856	5.0	146,823	5.4	3,687	1.6	50,197	2.4	718,908	5.1
Gauteng	4,643,864	56.3	291,639	34.5	1,030,801	37.7	104,002	45.9	1,103,284	52.5	7,173,590	50.7
KwaZulu-Natal	843,499	10.2	72,131	8.5	379,681	13.9	35,036	15.5	201,811	9.6	1,532,158	10.8
Limpopo	84,187	1.0	15,917	1.9	43,564	1.6	5,329	2.4	48,058	2.3	197,054	1.4
Mpumalanga	187,934	2.3	36,001	4.3	58,549	2.1	10,238	4.5	48,051	2.3	340,773	2.4
North-West	180,227	2.2	20,857	2.5	73,457	2.7	3,547	1.6	45,751	2.2	323,838	2.3
Northern Cape	14,691	0.2	42,539	5.0	15,263	0.6	1,650	0.7	64,284	3.1	138,426	1.0
Western Cape	1,570,336	19.0	239,630	28.4	769,378	28.2	56,436	24.9	416,702	19.8	3,052,483	21.6
Total	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	100.0	14,149,239	100.0

*Subject to rounding error

Table 1.5: R&D expenditure by research field (RF) 2005/06

	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
Main Research Field	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Division 1: Natural sciences, technology and engineering	7,919,744	96.1	661,594	78.3	1,846,022	67.6	54,740	24.2	1,922,728	91.5	12,404,828	87.7
Mathematical sciences	169,355	2.1	21,496	2.5	79,707	2.9	0	0.0	20,564	1.0	291,122	2.1
Physical sciences	312,246	3.8	27,205	3.2	97,252	3.6	0	0.0	114,723	5.5	551,426	3.9
Chemical sciences	441,138	5.4	10,711	1.3	117,914	4.3	0	0.0	21,494	1.0	591,258	4.2
Earth sciences	52,781	0.6	100,743	11.9	115,680	4.2	158	0.1	96,410	4.6	365,771	2.6
Information, computer and communication	1,635,321	19.8	42,093	5.0	105,873	3.9	789	0.3	82,238	3.9	1,866,314	13.2
Applied sciences and technologies	1,384,945	16.8	17,328	2.1	55,779	2.0	5,775	2.5	78,065	3.7	1,541,893	10.9
Engineering sciences	2,219,530	26.9	10,355	1.2	268,250	9.8	0	0.0	451,924	21.5	2,950,059	20.8
Biological sciences	163,796	2.0	79,402	9.4	195,380	7.2	1,630	0.7	265,202	12.6	705,410	5.0
Agricultural sciences	257,447	3.1	156,538	18.5	143,104	5.2	16,507	7.3	387,569	18.4	961,166	6.8
Medical and health sciences	1,073,854	13.0	137,909	16.3	582,798	21.3	23,748	10.5	270,090	12.8	2,088,399	14.8
Environmental sciences	52,492	0.6	39,867	4.7	42,719	1.6	3,531	1.6	56,259	2.7	194,867	1.4
Material sciences	146,886	1.8	150	0.0	29,348	1.1	0	0.0	69,742	3.3	246,125	1.7
Marine sciences	9,951	0.1	17,797	2.1	12,220	0.4	2,602	1.1	8,448	0.4	51,019	0.4
Division 2: Social sciences and humanities	324,032	3.9	183,046	21.7	886,193	32.4	171,774	75.8	179,366	8.5	1,744,411	12.3
Social sciences	323,673	3.9	139,536	16.5	594,579	21.8	170,126	75.1	165,557	7.9	1,393,471	9.8
Humanities	359	0.0	43,511	5.2	291,615	10.7	1,648	0.7	13,809	0.7	350,940	2.5
Total	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	100.0	14,149,239	100.0

Table 1.6: R&D expenditure by socio-economic objective (SEO) 2005/06

Socio-Economic Objective	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Division 1: Defence	747,523	9.1	0	0.0	2,423	0.1	1,161	0.5	155,066	7.4	906,174	6.4
Defence	747,523	9.1	0	0.0	2,423	0.1	1,161	0.5	155,066	7.4	906,174	6.4
Division 2: Economic development	6,384,780	77.4	322,819	38.2	923,990	33.8	58,983	26.0	1,126,651	53.6	8,817,223	62.3
Economic development unclassified	0	0.0	0	0.0	115,029	4.2	0	0.0	0	0.0	115,029	0.8
Plant production and plant primary products	273,503	3.3	54,523	6.5	91,790	3.4	13,747	6.1	297,626	14.2	731,188	5.2
Animal production and animal primary products	61,266	0.7	61,778	7.3	75,076	2.7	1,577	0.7	72,380	3.4	272,077	1.9
Mineral resources (excluding energy)	829,414	10.1	0	0.0	48,914	1.8	0	0.0	286,363	13.6	1,164,691	8.2
Energy resources	385,851	4.7	0	0.0	21,461	0.8	581	0.3	30,997	1.5	438,889	3.1
Energy supply	205,657	2.5	8,095	1.0	58,314	2.1	1,161	0.5	595	0.0	273,823	1.9
Manufacturing	1,603,753	19.5	75	0.0	145,485	5.3	0	0.0	110,467	5.3	1,859,779	13.1
Construction	631,698	7.7	3,386	0.4	20,407	0.7	0	0.0	90,143	4.3	745,634	5.3
Transport	391,173	4.7	12,833	1.5	16,440	0.6	0	0.0	18,401	0.9	438,848	3.1
Information and communication services	818,485	9.9	39,357	4.7	71,439	2.6	1,183	0.5	18,271	0.9	948,734	6.7
Commercial services	1,091,434	13.2	4,686	0.6	47,260	1.7	2,396	1.1	0	0.0	1,145,775	8.1
Economic framework	13,515	0.2	74,563	8.8	115,993	4.2	34,253	15.1	66,540	3.2	304,864	2.2
Natural resources	79,032	1.0	63,524	7.5	96,382	3.5	4,086	1.8	134,867	6.4	377,891	2.7
Division 3: Society	798,247	9.7	261,335	30.9	831,632	30.4	147,288	65.0	278,222	13.2	2,316,725	16.4
Society unclassified	0	0.0	0	0.0	115,029	4.2	0	0.0	0	0.0	115,029	0.8
Health	761,222	9.2	92,858	11.0	422,804	15.5	26,824	11.8	218,941	10.4	1,522,650	10.8
Education and training	11,199	0.1	97,773	11.6	149,270	5.5	72,160	31.9	51,704	2.5	382,105	2.7
Social development and community services	25,827	0.3	70,705	8.4	144,529	5.3	48,304	21.3	7,577	0.4	296,942	2.1
Division 4: Environment	109,803	1.3	99,112	11.7	223,302	8.2	3,870	1.7	168,682	8.0	604,769	4.3
Environment unclassified	0	0.0	0	0.0	38,343	1.4	0	0.0	0	0.0	38,343	0.3
Environmental knowledge	33,395	0.4	67,106	7.9	107,922	3.9	949	0.4	94,519	4.5	303,892	2.1
Environmental aspects of development	28,781	0.3	8,995	1.1	37,006	1.4	185	0.1	43,835	2.1	118,802	0.8
Environmental and other aspects	47,626	0.6	23,011	2.7	40,030	1.5	2,736	1.2	30,328	1.4	143,732	1.0
Division 5: Advancement of knowledge	203,423	2.5	161,373	19.1	750,868	27.5	15,211	6.7	373,473	17.8	1,504,349	10.6
Advancement of knowledge unclassified	0	0.0	0	0.0	115,029	4.2	0	0.0	0	0.0	115,029	0.8
Natural sciences, technologies and engineering	200,018	2.4	120,247	14.2	297,837	10.9	789	0.3	306,398	14.6	925,287	6.5
Social sciences and humanities	3,406	0.0	41,127	4.9	338,002	12.4	14,422	6.4	67,075	3.2	464,032	3.3
Total	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	100.0	14,149,239	100.0

Table 1.7: R&D personnel headcount by sector 2005/06*

	Business enterprise	Government	Higher education	Not-for-profit	Science councils	Total	%
Occupation							
Researchers	7480	874	*28879	243	1790	39266	18.1
Technicians	4143	495	1925	84	1678	8325	14.5
Other personnel directly supporting R&D: Executive and management	897	125	327	41	332	1722	3.0
Other personnel directly supporting R&D: Administrative and support staff	3801	507	1658	117	1879	7962	13.9
Total	16321	2001	32789	485	5679	57275	100
%	28.5	3.5	57.2	0.8	9.9	100	

*Including doctoral and post-doctoral students

Table 1.8: R&D personnel full-time equivalent (FTE) 2005/06*

	Business enterprise	Government	Higher education	Not-for-profit	Science councils	Total	%
Occupation							
Researchers	5895.74	651	*9234.79	199	1323.3	17303	60.1
Technicians	3050.04	353	535.03	59	1250.85	5248.2	18.2
Other personnel directly supporting R&D: Executive and management	458.63	72.7	68.46	29	223.1	851.9	3.0
Other personnel directly supporting R&D: Administrative and support staff	2831.51	406	772.9	78.3	1305.85	5395	18.7
Total	12235.92	1483	10611.18	365	4103.1	28798	100.0
%	42.5	5.1	36.8	1.3	14.2	100.0	

*Including doctoral and post-doctoral students

Table 1.9: Expenditure on multi-disciplinary areas of R&D 2005/06

Multi-disciplinary area of R&D	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Biotechnology	138,407	1.7	9,624	1.1	176,819	6.5	206	0.1	129,276	6.1	454,332	3.2
Nanotechnology	140,187	1.7	0	0.0	85,162	3.1	0	0.0	11,130	0.5	236,479	1.7
Total	278,595	3.4	9,624	1.1	261,980	9.6	206	0.1	140,406	6.7	690,812	4.9
Total R&D expenditure	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	100.0	14,149,239	100.0

Table 1.10: Expenditure on national priority areas of R&D 2005/06

National priority area of R&D	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%	R 000	%
Open source software	60,476	0.7	3	0.0	27,723	1.0	7700.6	3.4	6,035	0.3	101,937	0.7
New materials	160,859	2.0	686	0.1	106,912	3.9	0	0.0	40,343	1.9	308,800	2.2
Tuberculosis (TB), HIV/AIDS, malaria	274,236	3.3	8,775	1.0	276,591	10.1	3736.2	1.6	170,000	8.1	733,338	5.2
Total	495,571	6.0	9,463	1.1	411,226	15.1	11,437	5.0	216,377	10.3	1,144,075	8.1
Total R&D expenditure	8,243,776	100.0	844,640	100.0	2,732,215	100.0	226,514	100.0	2,102,094	100.0	14,149,239	100.0

*Subject to rounding error

Table 1.11: R&D personnel headcount by sector, personnel category, race and gender 2005/06 *

Qualification	Business enterprise		Government		Higher education**		Not-for-profit		Science councils		Total			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Overall	
Researchers														
African	480	316	164	140	2782	1689	54	29	260	173	3740	2347	6087	
Coloured	235	82	25	27	435	419	11	6	46	43	752	577	1329	
Indian	301	165	30	24	843	691	6	15	73	72	1253	967	2220	
White	4264	1637	284	180	6699	5319	62	60	732	391	12041	7587	19628	
Sub total	5280	2200	503	371	10759	8118	133	110	1111	679	17786	11478	29264	
Technicians directly supporting R&D														
African	578	289	118	112	311	131	27	17	460	361	1494	910	2404	
Coloured	228	99	28	9	260	98	4	7	73	37	593	250	843	
Indian	278	94	6	11	93	65	3	5	41	63	421	238	659	
White	1887	689	100	111	557	410	14	7	427	216	2985	1433	3906	
Sub total	2971	1171	252	243	1221	704	48	36	1001	677	5493	2831	7812	
Other personnel: Executive and management														
African	39	46	39	19	77	16	1	11	62	15	218	107	325	
Coloured	14	6	0	3	21	9	0	4	7	3	42	25	67	
Indian	32	21	3	1	16	3	2	2	21	2	74	29	103	
White	528	211	50	10	121	64	10	11	178	44	887	340	495	
Sub Total	613	284	92	33	235	92	13	28	268	64	1221	501	990	
Other personnel: Administrative and support staff														
African	1291	703	189	110	136	246	18	50	662	383	2296	1492	3788	
Coloured	121	154	51	32	84	193	3	17	94	118	353	514	867	
Indian	85	74	5	8	23	58	1	6	26	29	140	175	315	
White	654	719	28	84	159	759	4	18	146	421	991	2001	4970	
Sub total	2151	1650	273	234	402	1256	26	91	928	951	3780	4182	9940	
Grand total	11015	5305	1120	881	12617	10170	220	265	3308	2371	28280	18992	48006	

* Subject to rounding errors

**Excludes postgraduate students

Chapter 2: The Business Sector

2.1 Introduction

The 2005/06 R&D business sector survey once again benefited considerably from the accumulation of knowledge and experience of previous surveys. This was evident in the greater number of R&D performing firms measured, and the improved information and management systems that were used for fieldwork and analysis.

More lists of likely R&D performers (such as industry association membership lists) were interrogated, and more referrals were obtained from existing contacts and experts. The register therefore expanded from 2262 firms in 2004/05 to 2823 firms in 2005/06.

Statistical summaries were again used to profile industry sectors. This allowed for a greater understanding of the knowledge economies of specific sectors, and also enabled the imputation of data for incomplete responses. The use of previously submitted data to supplement current data was particularly important to this survey.

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

Historically the business sector has accounted for the major part of R&D activity in South Africa, and business expenditure on R&D (BERD) is steadily increasing. The current survey measured this contribution at 58.3%, up from the 56.3% recorded in 2004/05 and the 55.5% recorded in 2003/04.

Table B1: In-house R&D expenditure by sector 2005/06, 2004/05 and 2003/04

Sector	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Business enterprise	8,243,776	58.3	6,766,361	56	5,591,325	55.5
Higher education	2,732,215	19.3	2,533,971	21	2,071,351	20.5
Science councils	2,102,094	14.9	1,996,050	17	1,745,493	17.3
Government	844,640	6	515,331	4.3	465,367	4.6
Not-for-profit	226,514	1.6	198,268	1.7	209,023	2.1
Total	14,149,239	100	12,009,981	100	10,082,559	100

2.2 Key Results

Table B2: Main characteristics of the business sector (current Rands) 2005/06, 2004/05 and 2003/04

	2005/06	2004/05	2003/04
BERD (millions of Rands)	8,244	6,766	5,591
BERD as a %age of GDP	0.54%	0.49%	0.45%
%age of BERD financed by industry	68.3%	69.0%	80.5%
%age of BERD financed by government	16.2%	7.1%	6.2%
%age of BERD financed by other national sources	1.0%	6.1%	3.8%
%age of BERD financed from abroad	14.5%	17.9%	9.6%
Total business sector R&D personnel (FTE)	12 236	11 296.0	9 131.7
Total business sector researchers (FTE)	5 895.7	5 300.7	4 152.9

BERD as a %age of GDP has continued to grow. The %age of BERD financed by domestic industry has fallen to 68.3%, marginally down from 69.0% in 2004/05, while the proportion of government-funded R&D has more than doubled; now making up a substantial 16.2% of BERD. Government funding of a small number of specific projects accounts for a substantial portion of this expenditure. R&D financed from abroad has fallen somewhat, but remains above the 2003/04 level.

The business sector has seen sustained growth in its employment of R&D personnel, both in terms of headcounts and FTEs. The business sector R&D community, while performing 58.3% of GERD, employs 34.5% of R&D personnel.

Table B3: Headcount of R&D personnel by sector 2005/06 and 2004/05

	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D: Exec's and management	Other personnel directly supporting R&D: Admin and support staff	Total other personnel		Grand total		%	
	05/06	04/05	05/06	04/05			05/06	05/06	04/05	05/06	04/05	05/06
Higher education	18877	18270	1925	2801	327	1658	1985	2722	22787	23793	48.2	50.5
Business enterprise	7480	6575	4143	3724	897	3801	4698	4038	16321	14337	34.5	30.4
Science councils	1790	1846	1678	1582	332	1879	2211	2742	5679	6170	12.0	13.1
Government	874	692	495	494	125	507	632	1125	2001	2311	4.2	4.9
Not-for-profit	243	285	84	40	41	117	158	184	485	509	1.0	1.1
Grand total	29264	27668	8325	8641	1722	7962	9684	10811	47273	47120	100	100
Higher education doctoral and postdoctoral students	10002	9333							10002	9333		
Total	39266	37001							57275	56453		

2.3. Survey research methods

2.3.1. Measuring instrument (questionnaire) design & pilot

The 2005/06 business questionnaire was a slightly expanded version of the 2004/05 questionnaire in that it also sought information in two multi-disciplinary areas, namely biotechnology & nanotechnology and other national priority areas (see Tables B15 & B16 below).

The survey relied on an 'embedded' user guide that took the form of text boxes within the questionnaire. New questionnaire items were piloted at ten firms that were deliberately varied in their size, industry and previous expenditure, but where supplementary data indicated activity in the areas referred to in the newly included items. Minor improvements were made following the pilot.

2.3.2. Sample

The business sector survey sample took the previous survey register as a base and used a purposive sampling method to build on this. Contact information was then verified and updated as required, while also being supplemented and processed for field correspondence.

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 where possible also interviewed to obtain information on where concentrations of private sector R&D may occur. The search for R&D is supplemented by advice from experts on R&D performers and is further bolstered by scanning relevant media. Likely R&D performing companies are then included in the fieldwork process.

The above strategy is pragmatic in that it leverages known knowledge resources (the existing R&D survey register and experts in various sectors of the economy, as well as public information) and applies fieldwork resources to this data. It purposefully seeks all the major contributing R&D contributors while simultaneously measuring known R&D activity, and as such is likely to uncover a useful and pertinent lower bound for the total business expenditure on R&D.

It is desirable to have as extensive a sampling frame as possible to achieve defensible coverage of the most likely R&D Performers. Sampling beyond the initial base of the previous register included the following:

- Johannesburg Stock Exchange (JSE)
- Technology Top 100 Companies (Business Day)
- SPII (Support Programme for Industrial Innovation)
- THRIP (Technology and Human Resources for Industry Programme)
- Innovation Fund
- Expert referrals
- Business intelligence gathering

After several years of growth, the business register consists of 2823 companies. This figure excludes some purely foreign-based companies as well as entities from other survey sectors that are kept on the register purely so we have a record that they should *not* form part of the business sector sample. This saves time in evaluating these entities if they are referred to us.

Table B4: Business sector register and sample 2005/06

Full register	2823
less expired companies	273
less not traceable companies	159
less companies not surveyed	442
less non-units of measure	223
Sample	1726

Some of these companies have ‘expired’ (273) or are not traceable (159), while others still receive such low fieldwork priority that they were not surveyed (442).

Available fieldwork resources are primarily applied to known likely R&D performers, with an emphasis on obtaining quality data from these companies. Guided by the law of diminishing returns, fieldwork for companies that were seen to have a low probability of being R&D performers took a low priority, and such firms were in some cases not surveyed.

Other companies were measured indirectly in that they are the headquarters of group companies where group R&D is performed and measured through subsidiary units (or vice versa). There were 223 such non-units of measure.

After the removal of the above cases companies, a sample of 1726 companies remained.

2.3.3 Fieldwork Methods

The fieldwork methodology recognizes that most business R&D expenditure is concentrated in a small proportion of enterprises. Analysis of the firm-by-firm distribution of BERD shows a gini coefficient of 0,79 which is consistent with the shape of Lorenz curve for previous surveys. The equal gini-coefficients between surveys indicate that our sample is saturated with most of the new

firms having relatively low R&D expenditures. We are confident of the fieldwork methodology's success in seeking to ensure that all known large and medium sized R&D performers are surveyed while maintaining a reasonable spread of survey effort across all industry sectors.

In addition attention is concentrated on particular industries in the fieldwork phase and on an annual basis this focus is varied according to management's understanding of which sectors will benefit from more attention. For example the 2001/02 R&D survey focused on the defence industry, mining & banking services. The survey of 2003/04 focused on healthcare, pharmaceuticals and ICT companies, and 2004/05 focused on large retailers, logistics & financial service companies. The most recent survey had a specialist focus on the motor industry (see summary in 2.3.4 below).

Enterprises were systematically interrogated with varying degrees of emphasis according to their notional R&D spends and known historic information. This variable effort is justifiable in order to have the larger R&D amounts specified as precisely as resources permit.

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

The expanded business sector register generated a larger sample of surveyed companies (1726) and a greater number of non-nil-returns (607), up from 511 in the previous survey.

The objective of obtaining data from a greater number of smaller R&D performers has however come at a cost of obtaining no return at all from a greater portion of businesses (38.9% or 671 companies, up from 248 or 16.0% of companies 2004/05). These represent the companies who, in the field workers' assessments, are most likely not to be performing R&D.

Table B5: Business sector fieldwork sample 2005/06 and 2004/05

	2005/06		2004/05	
Sample	1726	100.0%	1546	100.0%
Response	1055	61.1%	1298	84.0%
R&D performed	607	35.2%	511	33.1%
No R&D	448	26.0%	787	50.9%
No response	671	38.9%	248	16.0%

In all, 1055 responses were obtained from individual companies constituting a 61.1% response rate. This figure was divided between 448 companies (26.0%) who advised of no R&D and 607 companies (35.2%) for whom completed returns were obtained.

Table B6: Business sector fieldwork returns 2005/06 and 2004/05

	Regular	Telephonic	Commute	Impute	TOTAL
2005/06	131	33	296	147	607
%	21.6%	5.4%	48.8%	24.2%	100.0%
2004/05	174	87	119	131	511
%	34.1%	17.0%	23.3%	25.6%	100.0%

Regular / fully completed questionnaires made up the 131 (or 21.6%) of the non-nil-returns.

Commuted returns use the detail of previously completed questionnaires as their base, often in conjunction with limited recent information from the companies concerned. Commuted questionnaires accounted for 296 (48.8%) questionnaires and made up the bulk of non-nil-returns.

Imputed returns use a statistically generated industry R&D profile made up from the previous survey database. This profile provides detail to complement known or estimated R&D expenditure provided for the company. A total of 147 (24.2%) of questionnaires were completed by the impute method.

Information obtained from company annual financial statements will often complement the commutation and imputation of data.

The surveying of SPII Companies (Support Program for Industrial Innovation) resulted in 89 imputed questionnaires. Detail on the agreed method for imputations and commutations can be viewed in the National R&D Survey Protocols Manual that is available from CeSTII.

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 was followed whereby programmed discrepancy checks were run on the data. Fieldworkers were then required to assist in cleaning data as applicable.

At the close of the survey 672 completed questionnaires were collected from the field representing 607 questionnaires with data on R&D performed (referred to as 'non-nil' returns), while 65 'nil-return' questionnaires were submitted (where company information is obtained, but no R&D is performed). In total, 705 Questionnaires were dispatched compared with 637 in the previous survey.

The business sector survey team continued to build and maintain relationships with the field despite capacity constraints occasioned by the growth of the survey. Most companies were cooperative and helpful, although some remain elusive.

In all, data from 607 non-nil questionnaires were entered into the survey results database.

2.3.4 SA Motor Industry Fieldwork

South Africa's automotive manufacturing industry forms the country's largest manufacturing sector and in 2005/06 additional fieldwork focus was concentrated on this sector. The automotive industry has seen sustained growth in output and exports since 1998, forming approximately 7% of South Africa's GDP and 13.5% of exports. Additional fieldwork included in-depth interviews with R&D and engineering executives from five of South Africa's seven large automotive assemblers. Some key findings of the field research are listed below.

The automotive industry spent R371 million on R&D activities in 2005/06. Of this R325 million (or 88% of the total) was spent by assemblers and R46 million (12%) by components manufacturers. This amounts to 4.5% of the national BERD.

High quality data obtained from assemblers provided confidence for a more detailed breakdown of R&D data for this segment, as demonstrated in Tables B7.1, B7.2, and B7.3 below:

Table B7.1: Key original equipment manufacturer (OEM) sector data 2005/06

Total BERD (R 000s)	325,121
Total headcount	552
Total FTE	497.6
Number of PhDs	3
% of R&D staff BEE	46.9%

Table B7.2: OEM R&D expenditure data 2005/06

Expenditure by category	R 000	%
Vehicles, plant, machinery	47,011	14.5
Land, buildings	1,356	0.4
Labour	121,341	37.3
Other current expenditure	155,383	47.8
TOTAL R&D expenditure	325,121	100

Table B7.3: OEM R&D location data 2005/06

Location	R 000	%
Eastern Cape	168,641	51.9
Free State	0	0
Gauteng	60,349	18.6
KwaZulu Natal	96,130	29.6
Limpopo	0	0
Mpumalanga	0	0
Northern Cape	0	0
North West	0	0
Western Cape	0	0

Table B7.4: OEM R&D personnel data 2005/06

		Number	%
Gender	Male	470	85.1
	Female	82	14.9
Race	African	52	9.5
	Coloured	165	29.9
	Indian	42	7.6
	White	293	53.1
HR category	Researchers	229	41.5
	Technicians	141	25.5
	Management & executive	28	5.1
	Administrative & support	154	27.9
Qualification	PhD	3	0.5
	Masters/bachelors	131	23.7
	Diploma/other	419	75.8

This year's sector analysis was therefore instructive in demonstrating the utility of R&D surveys for gaining further understanding of specific sectors of the economy. The tools exist to replicate the above findings for any particular set of firms according to need or interest.

2.4 Detailed Results

2.4.1 Financial

Table B8: BERD by accounting category 2005/06, 2004/05 and 2003/04

Type of Expenditure	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Capital expenditure on R&D	1,446,650	17.5	642,863	9.5	755,849	13.9
<i>Land: buildings and other structures</i>	199,088	2.4	97,982	1.4	638,957	11.4
<i>Vehicles, plant, machinery, equipment</i>	1,247,562	15.1	544,881	8.1	136,892	2.4
Current expenditure	6,797,126	82.5	6,123,498	90.5	4,815,476	86.1
<i>Labour costs</i>	3,703,277	44.9	3,341,011	49.4	2,488,458	44.5
<i>Other current expenditure</i>	3,093,849	37.5	2,782,487	41.1	2,327,018	41.6
Total	8,243,776	100.0	6,766,361	100.0	5,591,325	100.0

Data from the three most recent R&D surveys suggest that, in general, approximately 15% of BERD is allocated to capital expenditure while the remaining 85% is allocated to current expenditure. Labour costs account for about 45% of current expenditure. R&D expenditure directed at capital investment in vehicles, machinery and equipment has grown significantly, from only 2.4% of total BERD in 2004/05 to 8.1% in 2005/06.

Table B9: BERD by type of research 2005/06, 2004/05 and 2003/04

Type of Research	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Basic research	721,255	8.7	642,302	9.5	759,345	13.6
Applied research	2,409,266	29.2	2,223,955	32.9	1,883,082	33.7
Experimental research	5,113,256	62.0	3,900,103	57.6	2,948,898	52.7
Total	8,243,776	100.0	6,766,361	100.0	5,591,325	100.0

The proportion of BERD allocated to experimental development increased from 57.6% in 2003/04 to 62% in 2005/06. This has been offset by a reduction in the proportion of basic research, and to a smaller extent applied research.

Table B10: BERD by sources of funds 2005/06, 2004/05 and 2003/04

Source of funds	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Own funds	5,488,727	66.6	4,295,002	63.5	3,964,107	70.9
<i>Internal resources</i>	5,488,727	66.6	4,295,002	63.5	3,964,107	70.9
Government	1,331,740	16.2	481,519	7.1	345,504	6.2
<i>Grants</i>	919,488	11.2	187,396	2.8	345,504*	6.2
<i>Contracts</i>	412,252	5.0	294,123	4.3		
Other local business	142,256	1.7	371,362	5.5	535,549	9.6
<i>Contracts</i>	142,256	1.7	371,362	5.5	535,549	9.6
Other South African sources	84,282	1.0	410,168	6.1	206,396	3.7
<i>Higher education</i>	1,623	0.0	N/A		N/A	
<i>Not for profit organisations</i>	14,158	0.2	N/A		N/A	
<i>Individual donations</i>	68,501	0.8	N/A		N/A	
Foreign	1,196,771	14.5	1,208,310	17.9	534,636	9.6
<i>All sources</i>	1,196,771	14.5	1,208,310	17.9	534,636	9.6
Total	8,243,776	100.0	6,766,361	100.0	5,591,325	100.0

*not split by Grant & Contract categories in 2003/04.

The main source of funding for business R&D remains business itself, as two thirds of BERD was funded by internal resources in 2005/06. However the proportion of government funding of BERD has more than doubled since 2003/04. At 16.2% of all R&D funding in 2005/06, government has emerged as a substantial player here. A few key projects contribute a substantial amount of government spending on R&D.

Table B11: Provincial distribution of R&D activity (BUS) 2005/06 and 2004/05

Province	2005/06		2004/05	
	R 000	%	R 000	%
Eastern Cape	242,692	2.9	136,027	2.0
Free State	476,346	5.8	520,740	7.7
Gauteng	4,643,864	56.3	4,121,777	60.9
KwaZulu-Natal	843,499	10.2	615,437	9.1
Limpopo	84,187	1.0	49,948	0.7
Mpumalanga	187,934	2.3	178,452	2.6
North-West	180,227	2.2	184,691	2.7
Northern Cape	14,691	0.2	11,665	0.2
Western Cape	1,570,336	19.0	947,623	14.0
Total	8,243,776	100.0	6,766,361	100.0

Most (56.3%) business sector R&D occurs in Gauteng. The Western Cape (19.0%) and KwaZulu-Natal (10.2%) also feature prominently, followed by the Free State (5.8%).

2.4.2 Orientation of BERD

Table B12: BERD by research fields 2005/06, 2004/05 and 2003/04

Main research field	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Natural sciences, technology and engineering	7,919,744	96.1	6,536,764	96.6	5,456,725	97.6
Mathematical sciences	169,355	2.1	92,844	1.4	43,823	0.8
Physical sciences	312,246	3.8	211,921	3.1	208,386	3.7
Chemical sciences	441,138	5.4	469,211	6.9	410,939	7.3
Earth sciences	52,781	0.6	34,269	0.5	36,788	0.7
Information, computer and communication	1,635,321	19.8	1,279,325	18.9	944,070	16.9
Applied sciences and technologies	1,384,945	16.8	856,021	12.7	857,404	15.3
Engineering sciences	2,219,530	26.9	2,101,662	31.1	1,980,965	35.4
Biological sciences	163,796	2.0	127,322	1.9	52,867	0.9
Agricultural sciences	257,447	3.1	187,344	2.8	200,856	3.6
Medical and health sciences	1,073,854	13.0	997,182	14.7	571,171	10.2
Environmental sciences	52,492	0.6	73,775	1.1	56,473	1.0
Material sciences	146,886	1.8	96,525	1.4	86,627	1.5
Marine sciences	9,951	0.1	9,366	0.1	6,355	0.1
Division 2: Social sciences and humanities	324,032	3.9	229,597	3.4	134,600	2.4
Social sciences	323,673	3.9	229,522	3.4	134,600	2.4
Humanities	359	0.0	75	0.0	0	0.0
Total	8,243,776	100.0	6,766,361	100.0	5,591,325	100.0

Nominal expenditure on R&D increased in almost all research field categories, of which the largest is again the field of engineering sciences. However the proportional composition of BERD has seen some interesting changes in that research in the social sciences and humanities has increased from 2.4% (2003/04) to 3.9% (2005/06) of total BERD. Some of the smaller research fields, such as mathematical sciences and biological sciences, have seen sustained growth, as has the ICT field, while the traditionally stronger areas of engineering sciences and chemical sciences have in fact decreased.

Table B13: BERD by socio-economic objective (SEO) 2005/06, 2004/05 and 2003/04

	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Defence	747,523	9.1	718,491	10.6	849,574	15.2
Division 2: Economic development	6,384,780	77.4	4,895,638	72.4	3,935,136	70.4
Plant production & primary products	273,503	3.3	209,583	3.1	153,202	2.7
Animal production & primary products	61,266	0.7	38,024	0.6	21,967	0.4
Mineral resources (excluding energy)	829,414	10.1	711,661	10.5	469,983	8.4
Energy resources	385,851	4.7	301,603	4.5	277,337	5
Energy supply	205,657	2.5	292,545	4.3	279,093	5
Manufacturing	1,603,753	19.5	1,115,221	16.5	1,023,487	18.3
Construction	631,698	7.7	365,271	5.4	385,179	6.9
Transport	391,173	4.7	363,545	5.4	351,443	6.3
Information and communication services	818,485	9.9	588,233	8.7	355,231	6.4
Commercial services	1,091,434	13.2	718,856	10.6	486,682	8.7
Economic framework	13,515	0.2	11,280	0.2	14,803	0.3
Natural resources	79,032	1.0	179,816	2.7	116,730	2.1
Division 3: Society	798,247	9.7	911,606	13.5	502,865	9
Health	761,222	9.2	873,468	12.9	475,478	8.5
Education and training	11,199	0.1	20,087	0.3	16,672	0.3
Social development & community services	25,827	0.3	18,050	0.3	10,715	0.2
Division 4: Environment	109,803	1.3	145,034	2.1	151,043	2.7
Environmental knowledge	33,395	0.4	32,776	0.5	43,489	0.8
Environmental aspects of development	28,781	0.3	70,069	1.0	56,246	1.0
Environmental and other aspects	47,626	0.6	42,188	0.6	51,307	0.9
Division 5: Advancement of knowledge	203,423	2.5	95,593	1.4	152,708	2.7
Natural sciences, technologies & engineering	200,018	2.4	92,497	1.4	147,486	2.6
Social sciences and humanities	3,406	0.0	3,096	0.0	5,222	0.1
Total	8,243,776	100.0	6,766,361	100.0	5,591,325	100

South African BERD is highly concentrated by sector. The 2005/06 R&D survey shows that the six largest SEO categories absorbed over 70% of BERD. The largest of these was manufacturing (19.5% of the total), followed by commercial services, mineral resources (excluding energy), ICT, health, and defence.

However, the composition of South Africa's R&D activity has shifted over the last three years. Key growth areas have been in agriculture (both plant and animal production) and in the service

sector, where ICT and commercial services have experienced sustained growth that have seen these categories become more significant on a national scale. R&D in defence has noticeably declined, while energy supply, transport and environmental categories have also seen a proportional decline.

Table B14: BERD by standard industrial classification (SIC) code 2005/06 and 2004/05

SIC Classification	2005/06		2004/05	
	R 000	%	R 000	%
10000 Agriculture, Hunting, Forestry and Fishing	206,449	2.5	180,008	2.7
20000 Mining and Quarrying	428,066	5.2	425,917	6.3
30000 Manufacturing	3,367,640	40.9	2,981,267	44.1
<i>Manufacture of Food Products, Beverages and Tobacco Products</i>	194,900	2.4	145,848	2.2
<i>Manufacture of Textiles, Clothing and Leather Goods</i>	23,047	0.3	14,843	0.2
<i>Manufacture of Wood and Products of Wood and Cork, except furniture</i> <i>Manufacture of Articles of Straw and Plaiting Materials</i> <i>Manufacture of Paper & Paper Products</i> <i>Manufacture of Publishing, Printing and Reproduction of Recorded Material</i>	102,715	1.2	86,214	1.3
<i>Manufacture of Refined Petroleum, Coke and Nuclear Fuel</i> <i>Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals)</i> <i>Manufacture of Rubber and Plastic Products</i>	1,057,218	12.8	1,120,622	16.6
<i>Manufacture of Non-Metallic Mineral Products</i>	108,310	1.3	115,461	1.7
<i>Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment</i> <i>Manufacture of Office, Accounting and Computing Machinery</i>	600,305	7.3	428,409	6.3
<i>Manufacture of Electrical Machinery and Apparatus</i>	157,388	1.9	83,582	1.2
<i>Manufacture of Radio, Television and Communication Equipment and Apparatus</i> <i>Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks</i>	378,170	4.6	284,803	4.2
<i>Manufacture of Transport Equipment</i>	726,605	8.8	697,268	10.3
<i>Manufacture of Furniture, Recycling, Manufacturing not elsewhere classified</i>	18,983	0.2	4,218	0.1
40000 Electricity, Gas and Water Supply	1,067,428	12.9	270,538	4.0
50000 Construction	8,815	0.1	483,519	7.1
60000 Wholesale and Retail	274,743	3.3	23,469	0.3
70000 Transport, Storage and Communication	438,003	5.3	325,707	4.8
80000 Financial Intermediation, Real Estate and Business Services	2,080,840	25.2	1,912,951	28.3
90000 Community, Social and Personal Services	371,792	4.5	162,986	2.4
Total	8,243,776	100.0	6,766,361	100.0

Division by SIC code reveals the sectoral concentration of South African R&D. In 2005/06 manufacturing categories accounted for 40.9% of all BERD, or approximately 3.4 billion Rand. Of these categories, the largest was the fuels, chemicals and plastics sector, which had a BERD of

just over one billion Rand. Other major areas of R&D concentration were in electricity, gas and water supply (also just over one billion Rand), and the financial services sector, which had a BERD of over two billion Rand, or 25.2% of the total. Declining figures were evident for the chemicals, fuel and plastics sector and the construction sector.

The most striking growth area for R&D was in electricity, gas and water supply, which formed 4% of national BERD in 2004/05 but 12.9% in 2005/06. This is mostly due to the increased government expenditure on the Pebble Bed Modular Reactor demonstrator project. This project, that is part of state utility ESKOM, is funded by specific allocations from National Treasury. Since it is a prototype the bulk of expenditure of PBMR (Pty) Ltd may be regarded as R&D as defined in the Frascati Manual. Since this R&D expenditure is now approaching annual levels of close to one billion Rand it is obvious that a certain distortion will become evident in the detailed breakdowns. The injection of government funds to this end must be borne in mind when comparing data across surveys.

2.4.3 R&D personnel

Table B15: Business R&D personnel headcount & full-time equivalent (FTE) 2005/06, 2004/05 and 2003/04

Occupation	Headcount			Full-time equivalents	
	Male	Female	Total	FTE	FTE as % of headcount
2005/06					
Researchers	5280	2200	7480	5895.74	78.8
Technicians	2972	1171	4143	3050.04	73.6
Other personnel: Executive and management *	613	284	897	458.63	51.1
Other personnel: Administrative and support staff *	2151	1650	3801	2831.51	74.5
Total	11016	5305	16321	12235.92	75.0
2004/05					
Researchers	4814	1761	6575	5300.66	80.6
Technicians	2714	1010	3724	2856.53	76.7
Other personnel directly supporting R&D	2435	1603	4038	3138.8	77.7
Total	9963	4374	14337	11295.99	78.8
2003/04					
Researchers	3758	1300	5058	4153	82.1
Technicians directly supporting R&D	2491	939	3430	2605	75.9
Other personnel directly supporting R&D	1923	1197	3120	2374	76.1
Total	8172	3436	11608	9132	78.7

* 'Other personnel' in split into 'Executive and Management' and 'Administrative' support staff in the 2005/06 survey

Table B15 shows a headcount of 16,321 R&D personnel with associated 12,236 full-time equivalent's (FTEs). This is 8.3% higher than the 11296 FTEs recorded in the 2004/05 survey. The above data show that female employees make up 32.5% of the business sector R&D headcount, up from 30.5% in 2004/05 and 29.6% in 2003/04.

Table B16: Business R&D personnel headcount by race, qualification and gender 2005/06 and 2004/05

2005/06	African		Coloured		Indian		White		Gender total		Grand total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
<u>RESEARCHERS</u>												
Doctoral degree or equivalent	60	48	22	2	22	15	606	171	709	236	945	5.8%
Masters, honours, bachelor or equivalent	316	195	116	63	225	119	3043	1321	3700	1698	5397	33.1%
Diplomas and other qualifications	104	74	97	17	54	30	616	145	871	266	1137	7.0%
TOTAL	480	316	235	82	301	165	4264	1637	5280	2200	7480	45.8%
%age	6.4%	4.2%	3.1%	1.1%	4.0%	2.2%	57.0%	21.9%	70.6%	29.4%		
<u>TECHNICIANS</u>												
Doctoral degree or equivalent	0	9	0	0	2	0	19	21	21	31	52	0.3%
Masters, honours, bachelor or equivalent	89	85	72	42	79	40	789	451	1029	618	1647	10.1%
Diplomas and other qualifications	489	195	157	56	197	54	1079	216	1922	522	2444	15.0%
TOTAL	578	289	228	99	278	94	1887	689	2972	1171	4143	25.4%
%age	14.0%	7.0%	5.5%	2.4%	6.7%	2.3%	45.6%	16.6%	71.7%	28.3%		
<u>OTHER EXECUTIVES & MANAGEMENT</u>												
Doctoral degree or equivalent	11	3	0	0	7	0	79	37	97	40	137	0.8%
Masters, honours, bachelor or equivalent	18	21	9	0	19	6	305	110	351	137	488	3.0%
Diplomas and other qualifications	11	21	5	6	5	15	144	64	166	107	272	1.7%
TOTAL	39	46	14	6	32	21	528	211	613	284	897	5.5%
%age	1.0%	1.2%	0.4%	0.2%	0.8%	0.6%	13.9%	5.5%	68.3%	31.7%		
<u>OTHER ADMIN & SUPPORT STAFF</u>												
Doctoral degree or equivalent	15	21	0	0	13	15	31	57	59	94	153	0.9%
Masters, honours, bachelor or equivalent	32	213	1	26	6	14	156	171	196	423	619	3.8%
Diplomas and other qualifications	1243	469	119	128	66	45	467	491	1896	1134	3030	18.6%
TOTAL	1291	703	121	154	85	74	654	719	2151	1650	3801	23.3%
%age	7.9%	4.3%	0.7%	0.9%	0.5%	0.5%	4.0%	4.4%	56.6%	43.4%		
GRAND TOTAL												
	2387	1355	598	341	697	354	7334	3255	11016	5305	16321	100%
%age	14.6%	8.3%	3.7%	2.1%	4.3%	2.2%	44.9%	19.9%	67.5%	32.5%		

2004/05	African		Coloured		Indian		White		Gender total		Grand total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
RESEARCHERS												
Doctoral degree or equivalent	51	55	22	0	24	21	634	186	731	262	993	6.9%
Masters, honours, bachelor or equivalent	386	224	76	21	274	114	2779	883	3515	1242	4757	33.2%
Diplomas and other qualifications	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%
%age	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, honours, bachelor or equivalent	142	106	9	29	132	36	715	255	998	427	1425	9.9%
Diplomas and other qualifications	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%
%age	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, honours, bachelor or equivalent	26	178	2	24	2	13	211	122	241	337	578	4.0%
Diplomas and other qualifications	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%
%age	38.2%	19.8%	2.3%	3.1%	2.7%	2.2%	17.0%	14.5%	60.3%	39.7%		
GRAND TOTAL												
TOTAL	2609	1523	269	255	653	375	6432	2222	9963	4375	14338	100.0%
%age	18.2%	10.6%	1.9%	1.8%	4.6%	2.6%	44.9%	15.5%	69.5%	30.5%		

Not all companies provided race and qualification data. Table B16 represents a statistical extrapolation of race and qualification data obtained for 9149 R&D staff, accounting for 56.1% of total recorded business sector R&D personnel. This data was obtained for 40.5% of personnel in 2004/05.

In 2005/06, 327 R&D performing companies answered the question about collaborative partnerships. About two thirds (218) of R&D performers reported at least one collaborative partner. Of these 63% (206) reported collaborative partners in South Africa and 32.7% (107) reported foreign collaborative partners.

Table B17: Number of R&D collaborations 2005/06 and 2004/05

Partner	2005/06 Count		2004/05 Count	
	S A	Foreign	S A	Foreign
Higher education institutions	120	31	100	23
Science councils (e.g. CSIR, Mintek, MRC, ARC etc)	82	16	66	9
Government research institutes	43	14	22	9
Members of own company/ Affiliated companies	83	54	65	40
Other companies (including specialist consultants)	99	62	81	47
Not-for-profit organisations	15	4	5	3
TOTAL	442	181	339	131
NO COLLABORATION	111	79	no data*	no data*

* Question not asked in this survey.

R&D performing companies primarily seek out higher education partnerships in the domestic environment while preferring companies as partners in the international environment.

2.4.4 National priority areas

The 2005/06 survey included a new item on multi-disciplinary R&D. This inquiry was made to inform the roll out of strategies for R&D in biotechnology (driven through the Biotechnology Regional Innovation Centres) and the incipient nanotechnology strategy.

Such R&D is typically spread across several research fields and is often difficult to isolate. A total of 22 companies reported on biotechnology R&D while seven companies provided information on nanotechnology R&D.

Table B18: Multi-disciplinary R&D 2005/06

Multi-disciplinary area of R&D	R 000	%	Number of companies
Biotechnology	138,407	1.7	22
Nanotechnology	140,187	1.7	7
Total	278,595	3.4	29
Total R&D expenditure	8,243,776	100.0	n/a

Another new item was introduced on Business R&D in selected national priority areas delineated in the National R&D Strategy of 2002. This revealed significant business sector R&D activity in pursuit of these national priority goals. Further research into the funding of this R&D as well as the policy and environmental conditions that have lead to this R&D is recommended.

Table B19: National priority areas 2005/06

National priority areas of R&D	R 000	%	Number of companies
Open source software	60,476	0.7	20
New materials	160,859	2.0	20
Tuberculosis (TB), HIV/AIDS, malaria	274,236	3.3	19
Total	495,571	6.0	59
Total R&D expenditure	8,243,776	100.0	n/a

Chapter 3: The Government Sector

3.1 Introduction

The government sector covers the national and provincial departments, government research institutes and museums, as well as local government. Science councils and institutions that are classified as quasi-corporations owned by central government are not included in the government sector. State owned enterprises are surveyed under the business sector (chapter 2) while science councils are surveyed as a separate sector (see chapter 6).

There were no major changes in coverage between the 2005/06 R&D survey and the 2004/05 survey. Improvements were made in the return rate, the accuracy and consistency of the data and compliance with OECD R&D survey data reporting requirements. Stability of methodology allows comparisons with minimal discrepancies between the current and previously collected data.

Surveying the government sector presents specific problems in that many government departments (national and provincial) and some research institutes outsource portions of their R&D to other agencies or service providers. This may lead to under-estimation since these external service providers cannot easily be tracked. On the other hand the nil-returns and non-responses from smaller museums are usually due to a lack of capacity and/or funding to undertake research.

In addition it is often the case that the R&D budget is not separated from the budget for scientific and technological services and this situation creates limitations to the accuracy of the data collected. The high turnover of senior level employees in government departments leads to a lack of continuity among those responding to the survey and inconsistencies in the way the survey instrument is interpreted, which ultimately affects the quality of the information provided. The survey team has implemented procedures to deal with these problems as outlined in the next section.

In general, the number of returns is still below the expected levels despite a concerted effort made in assisting with and encouraging the completion of the questionnaires. Nonetheless government expenditure on R&D (GOVERD) has increased significantly.

3.2 Survey methodology and fieldwork

3.2.1 Questionnaire design

There were no major changes to the 2005/06 survey questionnaires except for the inclusion of two questions: Expenditure on multi-disciplinary R&D and the R&D expenditure on national priority areas.

The question on *Other R&D personnel directly supporting R&D* was split into executive and managerial level and the administrative and support staff level. A change was also made to the sources of funds question where *Other South African sources* of funds was split into higher education, not-for-profit organisations and donations from individuals.

3.2.2 Fieldwork methods

Prior to the survey, detailed registries were compiled for all departments and institutions. A registry for national and provincial departments was downloaded from the government website and was verified with the aid of relevant authorities. Registries for museums and research institutes were updated.

In the 2005/06 survey, units of measure at national level differed from department to department. Some departments have sections dedicated to research and others have research and development activities spread across different sections within the same department. The preferred respondents at national level were directors-general; the preferred contact persons within the provincial departments were head of departments. Questionnaires within research institutions and museums were forwarded to the respective directors.

Hard copy questionnaires as well as electronic versions were sent to all identified institutions and respondents during August /September 2006.

Almost 350 questionnaires were sent out and the highest number of returns (nil and non nil questionnaires) was from the research institutions. Provincial departments had the lowest return rates; in fact most did not return the questionnaire.

3.2.3 Data estimates

Efforts to improve return rates and obtain valid information included the following:

- i. A pilot survey was undertaken to ensure questionnaire validity and to remove any ambiguities before the rollout
- ii. The survey team sought to ensure that instructions and definitions accompanying the questionnaire were understandable and user friendly
- iii. Constant follow-up queries were made by electronic mail or telephone to offer reminders and support to respondents.

Some questionnaires were returned blank, some half or incorrectly completed and some were returned as nils. Where information was not provided, estimates for the missing data were made using the previous survey return.

In addition, at national level estimates of R&D expenditure were made using information from the estimates of national expenditure 2006-2007 provided by the National Treasury. The figures were then verified with relevant authorities to ensure that double counting did not occur.

Once the verification process was completed, all questionnaires including the nil-returns were captured in the SMRS.

3.3 Detailed results

3.3.1 Financial

Table G1: In-house R&D expenditure by sector 2005/06, 2004/05 and 2003/04

	2005/06			2004/05			2003/04		
	Subtotal			Subtotal			Subtotal		
Sector	R 000	R 000	%	R 000	R 000	%	R 000	R 000	%
Business enterprise		8,243,776	58.3		6,766,361	56.3		5,591,325	55.5
Higher education		2,732,215	19.3		2,533,971	21.1		2,071,351	20.5
Science councils		2,102,094	14.9		1,996,050	16.6		1,745,493	17.3
Government		844,640	6		515,331	4.3		465,367	4.6
<i>National departments</i>	304,709		2.2	268,843		2.2	189,738		1.9
<i>Provincial departments</i>	167,328		1.2	131,230		1.1	87,015		0.9
<i>Research institutes</i>	342,433		2.4	91,607		0.8	155,026		1.5
<i>Museums</i>	30,170		0.2	23,651		0.2	33,588		0.3
Not-for-profit		226,514	1.6		198,268	1.7		209,023	2.1
Grand total		14,149,239	100		12,009,981	100		10,082,559	100

The government sector R&D expenditure accounted for 6% or R 844 million of the total R&D expenditure. This figure has been increasing steadily since the 2001/02 R&D Survey.

Table G2: Main characteristics of the government sector 2005/06, 2004/05 and 2003/04

	2005/06	2004/05	2003/04
Expenditure on R&D (millions of Rands)	844.640	515.531	465.367
Expenditure on R&D as % of GDP	0.055	0.037	0.037
R&D personnel (FTE)	1483	1667	1428
Researchers (FTE)	651	491	443
% Expenditure financed by local industry	1.3	0.1	0.8
% Expenditure financed by Government	52.0	25.1	44.9

Table G3 shows the total number of R&D personnel in headcounts accounted for in 2005/06 across all the sectors. The government sector as a whole contributed 4% towards the total R&D personnel. This figure decreased from the 4.1% and 5.6% recorded in 2004/05 and 2003/04 respectively. The number of researchers increased from 692 in 2004/05 to 874 in 2005/06. The number of researchers in the research institutes increased from 118 to 462.

Table G3: Headcounts of R&D personnel by sector 2005/06 and 2004/05

	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D: Exec's and management	Other personnel directly supporting R&D: Admin and support staff	Total other personnel		Grand total		%	
	05/06	04/05	05/06	04/05			05/06	04/05	05/06	04/05	05/06	04/05
Higher education	18877	18270	1925	2801	327	1658	1985	2722	22787	23793	48.2	50.5
Business enterprise	7480	6575	4143	3724	897	3801	4698	4038	16321	14337	34.5	30.4
Science councils	1790	1846	1678	1582	332	1879	2211	2742	5679	6170	12.0	13.1
Government	874	692	495	494	125	507	632	1125	2001	2311	4.2	4.1
<i>National departments</i>	105	285	134	244	27	27	54		293		0.6	1.2
<i>Provincial departments</i>	185	193	116	159	54	207	261		562		1.2	1.8
<i>Government research institutes</i>	462	118	177	49	34	221	255		894		1.9	0.7
<i>Museums</i>	122	96	68	42	10	52	62		252		0.5	0.4
Not-for-profit	243	285	84	40	41	117	158	184	485	509	1.0	1.1
Grand total	29264	27668	8325	8641	1722	7962	9684	10811	47273	47120	100	100
Higher education doctoral and postdoctoral students	10002	9333							10002	9333		
Total	39266	37001							57275	56453		

Table G4: GOVERD by accounting category 2005/06, 2004/05 and 2003/04

Type of expenditure	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
National departments						
Capital Expenditure on R and D	55,321	18.2	44,144	16.4	7,092	3.7
Land: Buildings and Other Structures	67	0.0	30,000	11.2	0	0
Vehicles, Plant, Machinery, Equipment	55,254	18.1	14,144	5.3	7092	3.7
Current Expenditure	249,388	81.8	224,699	83.6	182,646	96.3
Labour Costs	51,747	17.0	91,508	34	44,053	23.2
Other Current Expenditure	197,641	64.9	133,191	49.5	138,593	73
Total	304,709	100.0	268,843	100	189,738	100
Provincial departments						
Capital Expenditure on R&D	21,912	13.1	35,508	27.1	33,190	38.1
Land: Buildings and Other Structures	9,196	5.5	13,779	10.5	10,296	26.3
Vehicles, Plant, Machinery, Equipment	12,716	7.6	21,729	16.6	22,894	11.8
Current Expenditure	145,416	86.9	95,722	72.9	53,825	61.9
Labour Costs	76,598	45.8	78,489	59.8	37,335	42.9
Other Current Expenditure	68,818	41.1	17,233	13.1	16,490	19
Total	167,328	100.0	131,230	100	87,015	100
Government research institutes						
Capital Expenditure on R&D	71,564	20.9	18,196	19.9	18,631	12
Land: Buildings and Other Structures	38,414	11.2	13,603	14.8	13,074	8.4
Vehicles, Plant, Machinery, Equipment	33,150	9.7	4,593	5	5,557	3.6
Current Expenditure	270,869	79.1	73,411	80.1	136,395	88
Labour Costs	160,554	46.9	47,749	52.1	86,932	56.1
Other Current Expenditure	110,315	32.2	25,662	28	49,463	31.9
Total	342,433	100.0	91,607	100	155,026	100
Museums						
Capital Expenditure on R&D	2,437	8.1	1,211	5.1	7,529	22.4
Land: Buildings and Other Structures	91	0.3	21	0.1	2,960	8.8
Vehicles, Plant, Machinery, Equipment	2,346	7.8	1,190	5	4,569	13.6
Current Expenditure	27,733	91.9	22,440	94.9	26,059	77.6
Labour Costs	23,060	76.4	18,743	79.2	19,995	59.5
Other Current Expenditure	4,673	15.5	3,697	15.6	6,064	18.1
Total	30,170	100.0	23,651	100	33,588	100
All government sectors						
Capital Expenditure on R&D	151,234	17.9	99,059	19.2	66,442	14.3
Land: Buildings and Other Structures	47,768	5.7	57,403	11.1	26,330	5.7
Vehicles, Plant, Machinery, Equipment	103,466	12.2	41,656	8.1	40,112	8.6
Current Expenditure	693,406	82.1	416,272	80.8	398,925	85.7
Labour Costs	311,959	36.9	236,489	45.9	188,315	40.5
Other Current Expenditure	381,447	45.2	179,783	34.9	210,610	45.3
Total	844,640	100.0	515,331	100.0	465,367	100

Table G4 shows that between 2004/05 and 2005/06, the total R&D performed within the government sector nominally increased by about 64%. Although the labour costs increased in nominal terms, this share of the total expenditure decreased from 45.9% to 36.9%. The main change in expenditure was in current costs, which increased by 112%.

The breakdown of the government sector into different categories shows that 40% of R&D performed in this sector was within the research institutes, closely followed by national departments at 36% and provincial departments at 20%. Museums performed least the R&D at 4% of the total expenditure.

Table G5: GOVERD by type of research 2005/06, 2004/05 and 2003/04

Type of Research	2005/06		2004/05		2004/03	
	R 000	%	R 000	%	R 000	%
Basic research	213,351	25.3	107,912	20.9	119,153	25.6
Applied research	459,042	54.3	319,040	61.9	283,958	61
Experimental research	172,247	20.4	88,379	17.1	62,256	13.4
Total	844,640	100	515,331	100	465,367	100

The expenditure on basic research increased again to 25.3% in 2005/06 after decreasing in 2004/03 from 25.6% to 20.9% in 2004/05. Applied research is still dominant in the government sector even though it declined by about 12% in 2005/06.

Table G6: GOVERD by sources of funds 2005/06, 2004/05 and 2003/04

Source of funds	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Organisation	316,145	37.4	308,487	59.9	195,312	42
Own funds	316,145	37.4	308,487	59.9	195,312	42
Government	439,511	52	129,685	25.1	208,904	44.9
Transfer payments	433,842	51.4	83,810	16.3	208,904	44.9
Contracts	5,669	0.7	45,875	8.9		
Business	11,000	1.3	274	0.1	3,758	0.8
Business (Domestic or contracts)	11,000	1.3	274	0.1	3,758	0.8
Other South African sources	19,270	2.3	2,666	0.5	12,326	2.6
Higher education	8,583	1	2,666	0.5	12,326	2.6
Not for profit organisations	687	0.1	16,454	3.2		
Individual donations	10,000	1.2	16,454	3.2		
Foreign	58,714	7	57,765	11.2	45,065	9.7
All sources	58,714	7	57,765	11.2	45,065	9.7
Total	844,640	100	515,331	100	465,365	100

Table G6 shows that in 2005/06, government funding of R&D amounted to 52 % of the total R&D expenditure, and 51% of this expenditure was in the form of transfer payments. This figure has increased significantly from the 16.3% recorded in 2005/06. Internally allocated funds to support R&D were also significant. Business enterprise support for R&D performed in the government sector increased from 0.5% to 2.3% while funds from the international community decreased slightly.

Table G7: Provincial distribution of R&D activity 2005/06 and 2004/05

Province	2005/06		2004/05	
	R 000	%	R 000	%
Eastern Cape	84,071	10.0	77,762	15.1
Free State	41,856	5.0	24,962	4.8
Gauteng	291,639	34.5	151,197	29.3
KwaZulu-Natal	72,131	8.5	31,213	6.1
Limpopo	15,917	1.9	9,568	1.9
Mpumalanga	36,001	4.3	29,240	5.7
North-West	20,857	2.5	13,401	2.6
Northern Cape	42,539	5.0	46,075	8.9
Western Cape	239,630	28.4	131,912	25.6
Total	844,641	100.0	515,331	100.0

In 2005/06, 34.5% of R&D performed in the government sector was in Gauteng Province, followed by the Western Cape at 28.4% and the Eastern Cape at 10.0%.

3.2.3 Orientation of GOVERD

Table G8: GERD by research field (RF) 2005/06, 2004/05 and 2003/04

Main research field	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Natural sciences, technology & engineering	661,594	78.3	450,456	87.4	372,373	80
Mathematical sciences	21,496	2.5	17,562	3.4	5,782	1.2
Physical sciences	27,205	3.2	8,256	1.6	0	0
Chemical sciences	10,711	1.3	8,709	1.7	493	0.1
Earth sciences	100,743	11.9	32,795	6.4	38,378	8.2
Information, computer & communication	42,093	5.0	14,180	2.8	3,494	0.8
Applied sciences and technologies	17,328	2.1	4,581	0.9	16,758	3.6
Engineering sciences	10,355	1.2	9,663	1.9	116	0
Biological sciences	79,402	9.4	53,988	10.5	64,611	13.9
Agricultural sciences	156,538	18.5	174,756	33.9	141,460	30.4
Medical and Health sciences	137,909	16.3	84,629	16.4	66,893	14.4
Environmental sciences	39,867	4.7	19,790	3.8	13,037	2.8
Material sciences	150	0.0	0	0.0	0	0
Marine sciences	17,797	2.1	21,547	4.2	21,352	4.6
Division 2: Social sciences & humanities	183,047	21.7	64,875	12.6	92,994	20
Social sciences	139,536	16.5	59,831	11.6	81,866	17.6
Humanities	43,511	5.2	5,044	1.0	11,128	2.4
Total	844,641	100.0	515,331	100.0	465,367	100.0

The breakdown of total R&D expenditure by field of science shows that the share of expenditure on natural sciences, technology and engineering has increased in real terms and has been increasing steadily in the past three years. There were significant increases in most fields, particularly the earth sciences, medical and health sciences, biological sciences, information, computer and communication as well as the applied sciences and technologies. The agricultural sciences show a 10% decrease. Compared to 2004/05, the social sciences and humanities almost doubled in nominal terms.

Table G9: GERD by socio-economic objective (SEO) 2005/06, 2004/05 and 2003/04

Socio-economic objective	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Defence	0	0.0	237	0.0	0	0
Defence	0	0.0	237	0.0	0	0
Division 2: Economic development	322,819	38.2	245,493	47.6	274,374	59
Plant production & primary products	54,523	6.5	57,072	11.1	44,609	9.6
Animal production & primary products	61,778	7.3	57,955	11.2	48,052	10.3
Mineral resources (excluding energy)	0	0.0	0	0.0	0	0
Energy resources	0	0.0	0	0.0	0	0
Energy supply	8,095	1.0	0	0.0	4,755	1
Manufacturing	75	0.0	0	0.0	0	0
Construction	3,386	0.4	620	0.1	1,501	0.3
Transport	12,833	1.5	3,140	0.6	0	0
Information and communication services	39,357	4.7	6,068	1.2	5,195	1.1
Commercial services	4,686	0.6	815	0.2	1,942	0.4
Economic framework	74,563	8.8	35,748	6.9	54,990	11.8
Natural resources	63,524	7.5	84,076	16.3	113,331	24.4
Division 3: Society	261,335	30.9	189,241	36.7	96,430	20.7
Health	92,858	11.0	76,373	14.8	66,844	14.4
Education and training	97,773	11.6	94,694	18.4	11,853	2.5
Social development and community services	70,705	8.4	18,174	3.5	17,732	3.8
Division 4: Environment	99,112	11.7	48,560	9.4	62,698	13.5
Environment unclassified	0	0.0	0	0.0	0	0
Environmental knowledge	67,106	7.9	37,663	7.3	49,295	10.6
Environmental aspects of development	8,995	1.1	5,252	1.0	4,679	1
Environmental and other aspects	23,011	2.7	5,645	1.1	8,724	1.9
Division 5: Advancement of knowledge	161,373	19.1	31,800	6.2	31,865	6.8
Advancement of knowledge unclassified	0	0.0	0	0.0	0	0
Natural sciences, technologies and engineering	120,247	14.2	22,797	4.4	16,619	3.6
Social sciences and humanities	41,127	4.9	9,002	1.7	15,245	3.3
Total	844,640	100.0	515,331	100.0	465,367	100.0

Table G9 indicates that in 2005/06 the government sector did not commit to defence R&D. The reason for this is that nearly all the work in this category is performed and counted in the business sector. However R&D expenditure related to economic development is steadily increasing. The R&D related to economic framework accounted for 8.8% in this category, natural resources accounted for 7.5% while animal and plant production accounted for a combined 13.8%. There were no major changes within the society division except for a large increase in R&D related to social development and community services. The expenditure related to the advancement of

knowledge increased significantly from 6.2% to 19.1%. This substantiates the increase in the basic research shown in table G4.

2.3.3 R&D personnel

Table G10: Gov R&D personnel headcount and full-time equivalent (FTE) 2005/06, 2004/05 and 2003/04

Occupation	Headcount			Full-time equivalents	
	Male	Female	Total	FTE	FTE as % of headcount
2005/06					
Researchers	503	371	874	650.61	74.4
Technicians	252	243	495	353.32	71.4
Other personnel: Executive and management *	92	33	125	72.67	58.1
Other personnel: Administrative and support staff *	273	234	507	406.42	80.2
Total	1120	881	2001	1483.02	74.1
2004/05					
Researchers	409	283	692	491.05	71
Technicians	274	220	494	376.25	76.2
Other personnel directly supporting R&D	833	292	1125	800.02	71.1
Total	1516	795	2311	1667.32	72.1
2003/04					
Researchers	599	330	929	443.31	47.7
Technicians directly supporting R&D	170	152	322	244.61	76
Other personnel directly supporting R&D	673	359	1032	740.23	71.7
Total	1442	841	2283	1428.15	62.6

In 2005/06, 1483.02 personnel in FTE were involved in R&D in the government sector. Of these 650.6 were researchers while executives and management count stood at 72.7. The number of researchers in FTE increased by 32% while other categories decreased significantly. On average researchers in government institutions spent 74.4% of their time on research.

The breakdown of R&D personnel by race, gender and qualification is illustrated in Table G11. The headcount number of researchers with postgraduate degrees increased across races and gender when compared to the 2004/05 data. Female researchers make up 42% of the total; the same figure was recorded in the 2004/05 survey.

There are 299 R&D personnel that hold PhD or equivalent degrees in the government sector, making up 27.8% of the total government researcher headcount. Males predominate at the executive and management levels, accounting for 74% of the total number in this category.

Table G11: Government sector R&D personnel headcounts by race, qualifications and gender 2005/06

Qualification	African		Coloured		Indian		White		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Overall
Researchers											
Doctoral degree or equivalent	29	13	3	1	10	3	129	55	171	72	243
Masters, honours, bachelor or equivalent	132	124	22	26	20	21	151	122	325	293	618
Diplomas and other qualifications	3	3	0	0	0	0	4	3	7	6	13
Subtotal	164	140	25	27	30	24	284	180	503	371	874
Technicians directly supporting R&D											
Doctoral degree or equivalent	8	2	1	0	0	0	8	0	17	2	19
Masters, honours, bachelor or equivalent	58	61	9	6	2	5	42	66	111	138	249
Diplomas and other qualifications	52	49	18	3	4	6	50	45	124	103	227
Subtotal	118	112	28	9	6	11	100	111	252	243	495
Other personnel: Administrative and support staff											
Doctoral degree or equivalent	0	0	0	0	0	0	0	6	0	6	6
Masters, honours, bachelor or equivalent	11	26	4	5	0	3	7	10	22	44	66
Diplomas and other qualifications	178	84	47	27	5	5	21	68	251	184	435
Subtotal	189	110	51	32	5	8	28	84	273	234	507
Other personnel: Executive and management											
Doctoral degree or equivalent	9	2	0	0	0	0	19	1	28	3	31
Masters, honours, bachelor or equivalent	29	17	0	3	3	1	28	7	60	28	88
Diplomas and other qualifications	1	0	0	0	0	0	3	2	4	2	6
Subtotal	39	19	0	3	3	1	50	10	92	33	125
Grand total	510	381	104	71	44	44	462	385	1120	881	2001

Table G12: Government sector R&D personnel headcounts by race, qualifications and gender 2004/05

Qualification	African		Coloured		Indian		White		Total		
	Male	Female	Male	Female	Male	Female	Male	F	Male	Female	Overall
Government											
Researchers											
Doctoral degree or equivalent	12	6	1	1	2	1	103	46	118	54	172
Masters, honours, 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
Subtotal	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, honours, 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
Subtotal	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, honours, 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
Subtotal	588	133	162	50	11	7	73	102	833	292	1125
Grand total	834	323	212	79	28	43	442	351	1516	795	2311

In terms of race, white males account for 32% of the researchers, followed by white females at 21%, African males account for 19% and African females account for 16% of the total researchers. The coloured female and male researchers are at 3%; this is also the case for the Indian researchers.

2.3.4 National priority areas

Table G13: GOVERD by multi-disciplinary R&D 2005/06

Multi-disciplinary area of R&D	R 000	%
Biotechnology	9,624	1.1
Nanotechnology	0	0.0
Total	9,624	1.1
Total R&D expenditure	844,640	100.0

The amount of R&D performed by the government sector in the field of biotechnology is low as shown by the expenditure in table G11. No R&D was reported in nanotechnology.

Table G14: GERD by national priority of R&D 2005/06

Multi-disciplinary area of R&D	R 000	%
Open source software	3	0.0
New materials	686	0.1
Tuberculosis (TB), HIV/AIDS, malaria	8,775	1.0
Total	9,464	1.1
Total R&D expenditure	844,640	100.0

Government R&D expenditure by national priority yields similar results to the previous question. That is, little or no research is performed in these areas in the government sector.

Chapter 4: The Higher Education Sector

4.1. Introduction

As a sector, higher education 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 as 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.”

The higher education landscape has undergone significant changes over the past year due to further institutional mergers. While most institutions were surveyed in their pre-merger forms during the 2004/05 survey, the current 2005/06 survey for the first time reflects the new higher education landscape in its entirety. All universities and universities of (science) and technology were surveyed, as well as all private higher education institutions with a research component.

4.2. Results

Higher Education expenditure on Research and Experimental Development (HERD) increased by approximately 7.8% in nominal terms from that reported in 2004/05 from R 2 534 million in 2004 to R 2 732 million in 2005/06.

4.3. Methodology

The 2005/06 survey questionnaire did not differ significantly from that used in 2004/05. Following two successful workshops held with respondents in Cape Town and Pretoria in June 2006, minor changes were made to the *Sources of Funds* item. Upon request from DST, two additional items on multi-disciplinary R&D and National priority areas were included in the questionnaire. The revised questionnaire was piloted in July and eventually disseminated to respondents in September 2006.

As an experiment the services of an external consultant were employed to extract researcher and student headcount and FTE data per institution from available HEMIS records. It was hoped that this would considerably decrease the burden on respondents and reduce the lengthy explanatory notes used in the 2004/05 survey. This strategy proved to be unsuccessful, since the majority of respondents preferred to extract their own researcher and student headcount and FTE data from their own databases.

Once again, the majority of higher education institutions made use of the electronic questionnaire. As a result, the use of hard-copy questionnaires in the higher education sector will be phased out during the 2006/07 survey.

Choice of unit of measure again varied across the sector, although the majority of institutions preferred to collect data centrally. Some institutions preferred that data be collected at the level of faculty, with staff, student and financial data often provided centrally.

Response rates to the survey have once again improved since the previous survey and respondents took significantly less time to complete the questionnaire. This, it seems, is largely due to the fact that most respondents now anticipate the R&D Survey and have incorporated R&D survey specific fields into their institutional data collection mechanisms. Reliability of the data has also significantly improved.

In total, twenty three institutions were surveyed. These included one technikon, six universities of (science) and technology and fifteen universities in the public sector and one private higher education institution.

Table H0: Higher Education overview 2005/06

	R 000
Private Universities	
Monash University	9,149
Technikons	
Mangosuthu Technikon	4,449
Universities	
University of the Witwatersrand	385,583
University of Cape Town	383,431
University of KwaZulu Natal	358,613
University of Stellenbosch	307,827
University of Pretoria	305,783
University of South Africa	132,400
University of the Free State	129,300
University of Johannesburg	114,150
North West University	95,427
Rhodes University	82,437
Nelson Mandela Metropolitan University	80,187
University of the Western Cape	80,000
University of Limpopo	31,583
University of Zululand	11,429
University of Fort Hare	10,703
Universities of (Science) and Technology	
Tshwane University of Technology	60,670,000
Vaal University of Technology	36,145,000
Durban Institute of Technology	33,653,000
Cape Peninsula University of Technology	29,939,000
Walter Sisulu University of Technology and Science	21,672,000
Central University of Technology	21,184,000
University of Venda for Science and Technology	6,501,000
TOTAL	2,732,215,000

As mentioned previously the responses to the 2005/06 survey improved considerably from those reported in previous years and only three very 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, 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.

4.4 Detailed results

4.4.1 Financial

Table H1: In-house R&D expenditure per sector 2005/06, 2004/05 and 2003/04

Sector	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Business enterprise	8,243,776	58.3	6,766,361	56.3	5,591,325	55.5
Higher education	2,732,215	19.3	2,533,971	21.1	2,071,351	20.5
<i>Technikons</i>	4,449	0	73,273	0.6	65,566	0.7
<i>Universities of technology</i>	209,764	1.5	120,028	1	113,137	1.1
<i>Universities</i>	2,508,853	17.7	2,330,189	19.4	1,888,727	18.7
<i>Private higher education</i>	9,149	0.1	10,481	0.1	3,921	0
Science councils	2,102,094	14.9	1,996,050	16.6	1,745,493	17.3
Government	844,640	6	515,331	4.3	465,367	4.6
Not-for-profit	226,514	1.6	198,268	1.7	209,023	2.1
Grand Total	14,149,239	100	12,009,981	100	10,082,559	100

Higher education accounts for 19.3% of GERD and comprises the second largest of the five components.

Table H2: Main characteristics of the higher education sector 2005/06, 2004/05 and 2003/04

	2005/06	2004/05	2003/04
HERD (million of Rands)	2, 732	2, 533	2, 071
HERD as a % of GDP	0.17%	0.18%	0.16%
Total HE researchers* (FTE)	3555	3506	3373
% HERD financed by Industry	11.6%	16.8%	23.1%

* Excluding postgraduate students

Table H3: Headcount of R&D personnel by sector 2005/06 and 2004/05

Sector	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D: Executive and management	Other personnel directly supporting R&D: Administrative and support staff	Total other personnel		Grand total		%	
	2005/06	2004/05	2005/06	2004/05	2005/06	2005/06	2005/06	2004/05	2005/06	2004/05	2005/06	2004/05
Higher education*	18877	18270	1925	2801	327	1658	1985	2722	22787	23793	48.2	50.5
<i>Technikons</i>	37	992	2	180	6	9	15	193	54	1,365	0.1	2.9
<i>Universities of technology</i>	3,142	1,462	294	140	82	221	303	192	3,739	1,794	7.9	3.8
<i>Universities</i>	15,642	15,761	1,629	2,481	235	1,426	1,661	2,326	18,932	20,568	40.0	43.7
<i>Private higher education</i>	56	55	0	0	4	2	6	11	62	66	0.1	0.1
Business enterprise	7480	6575	4143	3724	897	3801	4698	4038	16321	14337	34.5	30.4
Science councils	1790	1846	1678	1582	332	1879	2211	2742	5679	6170	12.0	13.1
Government	874	692	495	494	125	507	632	1125	2001	2311	4.2	4.9
Not-for-profit	243	285	84	40	41	117	158	184	485	509	1.0	1.1
Grand total	29264	27668	8325	8641	1722	7962	9684	10811	47273	47120	100	100
Higher education doctoral and postdoctoral students	10002	9333							10002	9333		
Total	39266	37001							57275	56453		

*Excluding postgraduate and postdoctoral students

The higher education sector accounts for 47.9% of R&D human resources in the country. Of the 39 264 researchers in South Africa, 48% are found in the higher education sector .

Table H4: HERD by accounting category 2005/06, 2004/05 and 2003/04

Type of expenditure	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Capital expenditure on R&D	150,224	5.5	193,536	7.6	162,380	7.8
Land: Buildings and other structures	21,622	0.8	16,693	0.7	8,825	0.4
Vehicles, plant, machinery, equipment	128,602	4.7	176,843	7.0	153,555	7.4
Current expenditure	2,581,991	94.5	2,340,435	92.4	1,908,971	92.2
Labour costs	1,202,172	44.0	1,097,488	43.3	925,255	44.7
Total cost of R&D postgraduate students	313,645	11.5	308,454	12.2	190,892	9.2
Other current expenditure	1,066,174	39.0	934,493	36.9	792,824	38.3
Total	2,732,215	100.0	2,533,971	100.0	2,071,351	100.0

According to the data presented in Table H4 current expenditure (labour costs and other current expenditure) accounted for 94.5% of higher education expenditure of R&D, with fewer than 6% investment in infrastructure and research equipment. This pattern has been the same in the previous two surveys.

Table H5: HERD by type of research 2005/06, 2004/05 and 2003/04

Type of research	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Basic research	1,134,411	41.5	1,049,330	41.4	915,972	44.2
Applied research	1,045,483	38.3	979,626	38.7	827,209	39.9
Experimental research	552,321	20.2	505,014	19.9	328,170	15.8
Total	2,732,215	100.0	2,533,971	100.0	2,071,351	100

Higher education expenditure by type of research represents no significant change from the figures reported in the last three surveys. The sector spent the largest proportion of R&D expenditure on basic research (41.5%), followed by applied research (38.3%) and experimental research (20.2%).

Table H6: HERD by source of funds 2005/06, 2004/05 and 2003/04

Type of expenditure	2005/06		2005/04		2003/04	
	R 000	%	R 000	%	R 000	%
General university funds	1,601,444	58.6	1,107,695	43.7	799,408	38.6
External sources	1,130,771	41.4	1,426,276	56.3	1,271,943	61.4
National, provincial and local government	19,955	0.7	170,616	6.7	23,217	1.1
Government research institutes	29,457	1.1				
Agency funding (e.g. NRF, MRC, ARC, etc.)	397,587	14.6	402,925	15.9	* 395,278	16.0
Science councils	44,785	1.6	29,052	1.1		
Domestic business	316,740	11.6	426,135	16.8	478,734	23.1
Other South African sources*	16,657	0.6	* 156,640	6.2	* 173,900	8.4
Higher education institutions	4,917	0.2				
Not for profit organisations	9,423	0.3				
Individual donations	2,317	0.1				
Foreign sources	305,590	11.2	240,908	9.5	224,031	10.8
Total	2,732,215	100.0	2,533,971	100.0	2,071,351	100.0

* No clear split between Agency funding & Science council funding in 2003/04

* Other SA sources: No split between HEIs, NPO organisations & Individual donations in 2003/04 and 2004/05

General university funds (comprising of *own funds* and the higher education vote) constitute the largest portion of higher education R&D funds (58.6%). Almost 15% of higher education expenditure is derived from agency funding, while 11.6% comes from the domestic business sector. The data show a decrease in funding from business to higher education from 2003/04 until 2005/06. Just over 11% of HE expenditure on research and development is derived from foreign sources.

Table H7: Provincial distribution of R&D activity 2005/06 and 2004/05

Province	2005/06		2004/05	
	R 000	%	R 000	%
Eastern Cape	214,701	7.9	184,868	7.3
Free State	146,823	5.4	139,497	5.5
Gauteng	1,030,801	37.7	885,288	34.9
KwaZulu-Natal	379,681	13.9	373,595	14.7
Limpopo	43,565	1.6	63,508	2.5
Mpumalanga	58,548	2.1	47,379	1.9
North-West	73,456	2.7	123,817	4.9
Northern Cape	15,263	0.6	21,152	0.8
Western Cape	769,377	28.2	694,867	27.4
Total	2,732,215	100.0	2,533,971	100.0

The largest proportion of higher education R&D expenditure was in Gauteng (37.7%) followed by the Western Cape (28.2%) and KwaZulu Natal (13.9%).

4.4.2 Orientation of HERD

Table H8: HERD by research field (RF) 2005/06, 2004/05 and 2003/04

Main research field	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Natural sciences, technology and engineering	1,846,022	67.6	1,646,731	65.0	1,424,560	68.8
Mathematical sciences	79,707	2.9	81,251	3.2	127,344	6.1
Physical sciences	97,252	3.6	100,761	4.0	52,552	2.5
Chemical sciences	117,914	4.3	101,808	4.0	71,479	3.5
Earth sciences	115,680	4.2	101,262	4.0	94,833	4.6
Information, computer and communication	105,873	3.9	98,240	3.9	58,014	2.8
Applied sciences and technologies	55,779	2.0	43,653	1.7	54,238	2.6
Engineering sciences	268,250	9.8	307,141	12.1	198,163	9.6
Biological sciences	195,380	7.2	192,658	7.6	159,708	7.7
Agricultural sciences	143,104	5.2	97,248	3.8	97,996	4.7
Medical and health sciences	582,798	21.3	440,249	17.4	433,504	20.9
Environmental sciences	42,719	1.6	40,388	1.6	37,358	1.8
Material sciences	29,348	1.1	29,918	1.2	31,685	1.5
Marine sciences	12,220	0.4	12,154	0.5	7,685	0.4
Division 2: Social sciences and humanities	886,193	32.4	887,240	35.0	646,791	31.2
Social sciences	594,579	21.8	577,653	22.8	445,031	21.5
Humanities	291,615	10.7	309,587	12.2	201,761	9.7
Total	2,732,215	100.0	2,533,971	100.0	2,071,351	100.0

The natural, technology and engineering sciences account for the largest percentage of R&D expenditure (67.6%), while the social sciences and the humanities account for 32.4%. Within Division 1, the health sciences once again constitute the largest component of R&D expenditure (21.3%), followed by the engineering sciences (9.8%) and the biological sciences (7.2%). The social sciences and humanities have experienced a slight decrease (2.6%) in expenditure devoted to R&D, compared to that of last year, while the natural, technology and engineering sciences have experienced a slight increase.

Table H9: HERD by socioeconomic objective (SEO) 2005/06, 2004/05 and 2003/04

Socio-economic objective	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Defence	2,423	0.1	2,069	0.1	1,679	0.1
Division 2: Economic development	923,990	33.8	735,329	29.0	628,565	30.3
Economic development unclassified	115,029	4.2	102,936	4.1	93,498	4.5
Plant production and plant primary products	91,790	3.4	60,922	2.4	69,061	3.3
Animal production & primary products	75,076	2.7	72,192	2.8	58,674	2.8
Mineral resources (excluding energy)	48,914	1.8	15,898	0.6	67,831	3.3
Energy resources	21,461	0.8	16,709	0.7	17,402	0.8
Energy supply	58,314	2.1	31,871	1.3	30,186	1.5
Manufacturing	145,485	5.3	102,001	4.0	78,679	3.8
Construction	20,407	0.7	26,956	1.1	19,548	0.9
Transport	16,440	0.6	14,347	0.6	12,109	0.6
Information and communication services	71,439	2.6	50,745	2.0	26,125	1.3
Commercial services	47,260	1.7	41,588	1.6	27,868	1.3
Economic framework	115,993	4.2	93,107	3.7	65,539	3.2
Natural resources	96,382	3.5	106,057	4.2	62,045	3.0
Division 3: Society	831,632	30.4	722,819	28.5	634,216	30.6
Society unclassified	115,029	4.2	102,936	4.1	93,498	4.5
Health	422,804	15.5	328,251	13.0	292,029	14.1
Education and training	149,270	5.5	132,616	5.2	110,531	5.3
Social development and community services	144,529	5.3	159,016	6.3	138,158	6.7
Division 4: Environment	223,302	8.2	226,063	8.9	197,632	9.5
Environment unclassified	38,343	1.4	34,312	1.4	31,166	1.5
Environmental knowledge	107,922	3.9	94,667	3.7	68,443	3.3
Environmental aspects of development	37,006	1.4	40,122	1.6	43,021	2.1
Environmental and other aspects	40,030	1.5	56,963	2.2	55,002	2.7
Division 5: Advancement of knowledge	750,868	27.5	847,691	33.5	609,259	29.4
Advancement of knowledge unclassified	115,029	4.2	102,936	4.1	93,498	4.5
Natural sciences, technologies and engineering	297,837	10.9	427,087	16.9	311,137	15.0
Social sciences and humanities	338,002	12.4	317,668	12.5	204,623	9.9
Total	2,732,215	100.0	2,533,971	100.0	2,071,351	100.0

The largest proportion of higher education R&D expenditure is devoted to economic development (33.8%), followed by the development of society (30.4%) and the advancement of knowledge (27.5%).

4.4.3 R&D personnel

Table H10: HE R&D personnel headcount and full-time equivalent (FTE)* 2005/06, 2004/05 and 2003/04

Occupation	Headcount			Full-time equivalents	
	Male	Female	Total	FTE	FTE as % of headcount
2005/06					
Researchers	10759	8118	18877	3555.19	18.8
Technicians	1221	704	1925	535.03	27.8
Other personnel: Executive and management	235	92	327	68.46	20.9
Other personnel: Administrative and support staff	402	1256	1658	772.9	46.6
Total	12617	10170	22787	4931.58	21.6
2004/05					
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
2003/04					
Researchers	8276.38	5778.16	14054.54	3373.78	24.0
Technicians directly	1531	1063	2594	763.33	29.4
Other personnel directly	1170	1558.5	2728.5	416.88	15.3
Total	10977.38	8399.66	19377.04	4553.99	23.5

*Excluding Post-graduates

Other personnel not split into 'Executive and Management' and 'Administrative' support staff in the 2003/04 survey

The number of researchers employed in the higher education sector has increased by approximately 3% since the last survey. Similarly, the number of researcher FTE's has increased by approximately 1%. Time spent on research by researchers in the sector has, however declined slightly from the 19.2% reported last year.

The representation of women researchers in the sector has improved slightly from 40% in 2004/05 to 44% in 2005/06. Women are however poorly represented amongst technicians and executive/management personnel.

Table H11: HE postgraduate student headcount and FTE by gender and qualification 2005/06, 2004/05 and 2003/04

Qualification	Headcount			Full-Time Equivalents	
	Male	Female	Total	FTE	FTE as % of headcount
2005/06					
Post-doctoral fellows	308	197	505	494.7	98.0
Doctoral students	5574	3923	9497	5184.9	54.6
Masters students	13573	12442	26015	9145.39	35.2
Total	19455	16562	36017	14824.99	41.2
2004/05					
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
2003/04					
Post-doctoral fellows	225	132	357	313.3	87.8
Doctoral degree or equivalent	4537	3053	7590	3690.03	48.6
Masters degree or equivalent	10422	8046	18468	6411.42	34.7
Total	15184	11231	26415	10414.75	39.4

According to the data, post-doctoral fellows spend almost 100% of their time on research, while doctoral students spend just over 50% of their time on research.

Further work will be needed to establish an agreed FTE standard for PhD students since any inconsistencies in this large group will introduce distortions.

As expected, masters students with a research component, spend 35% of their time doing research. This also takes into account that many students study on a part-time basis. As agreed with the OECD Masters students are not counted as researchers.

Just over 54% of postgraduate students are male. Women are especially poorly represented amongst the post-doctoral fellows, where only 39% are female.

Table H12.1: HE R&D personnel headcount by gender, population group and qualification 2005/06

Qualification	African		Coloured		Indian		White		Gender Total		Grand total	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Headcount	%
Researchers												
Doctoral degree or equivalent	585	271	111	65	142	134	2298	1150	3136	1620	4756	20.9
Masters, honours, bachelor or equivalent	1239	841	152	147	371	329	2329	2148	4091	3465	7556	33.2
Diplomas and other qualifications	958	577	172	207	330	228	2072	2021	3532	3033	6565	28.8
Subtotal	2782	1689	435	419	843	691	6699	5319	10759	8118	18877	82.8
Technicians directly supporting R&D												
Doctoral degree or equivalent	0	0	0	1	1	1	8	13	9	15	24	0.1
Masters, honours, bachelor or equivalent	69	30	20	12	17	21	72	80	178	143	321	1.4
Diplomas and other qualifications	242	101	240	85	75	43	477	317	1034	546	1580	6.9
Subtotal	311	131	260	98	93	65	557	410	1221	704	1925	8.4
Other personnel: Administrative and support staff												
Doctoral degree or equivalent	4	6	1	2	4	3	20	14	29	25	54	0.2
Masters, honours, bachelor or equivalent	28	49	15	27	10	22	57	197	110	295	405	1.8
Diplomas and other qualifications	104	191	68	164	9	33	82	548	263	936	1199	5.3
Subtotal	136	246	84	193	23	58	159	759	402	1256	1658	7.3
Other personnel: Executive and management												
Doctoral degree or equivalent	51	9	16	4	10	2	90	41	167	56	223	1.0
Masters, honours, bachelor or equivalent	21	4	5	5	5	1	26	20	57	30	87	0.4
Diplomas and other qualifications	5	3	0	0	1	0	5	3	11	6	17	0.1
Subtotal	77	16	21	9	16	3	121	64	235	92	327	1.4
Grand Total	3306	2082	800	719	975	817	7536	6552	12617	10170	22787	100.0

Of the total researcher component, Africans make up 24% of researchers in the higher education sector. Four percent of researchers in the sector are Coloured, while 8 % are Indian. Whites represent the majority of researchers in the sector (64%). A similar ratio was also observed in the 2004/05 data. Approximately 44% of researchers in the sector are women.

Table H12.2: HE R&D personnel headcount by gender, population group and qualification 2004/05

Qualification	African		Coloured		Indian		White		Gender Total		Grand total	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Headcount	%
Researchers												
Doctoral degree or equivalent	549	212	121	60	188	113	2909	1430	3767	1815	5582	23.5
Masters, honours, bachelor or equivalent	1189	765	166	160	418	278	2560	2359	4333	3562	7895	33.2
Diplomas and other qualifications	646	385	86	100	382	184	1751	1259	2865	1928	4793	20.1
Sub-Total	2384	1362	373	320	988	575	7220	5048	10965	7305	18270	76.8
Technicians directly supporting R&D												
Doctoral degree or equivalent	0	1	1	0	0	0	3	5	4	6	10	0.0
Masters, honours, bachelor or equivalent	68	46	49	49	14	13	136	118	267	226	493	2.1
Diplomas and other qualifications	308	140	318	158	67	22	791	494	1484	814	2298	9.7
Sub-Total	376	187	368	207	81	35	930	617	1755	1046	2801	11.8
Other personnel: Administrative and support staff												
Doctoral degree or equivalent	6	6	1	1	1	0	25	21	33	28	61	0.3
Masters, honours, bachelor or equivalent	37	47	8	19	3	17	65	136	113	219	332	1.4
Diplomas	124	138	25	65	5	15	65	289	219	507	726	3.1
Other qualifications (incl. non-formal)	78	119	6	33	19	35	296	390	399	577	976	4.1
Sub-Total	245	310	40	118	28	67	451	836	764	1331	2095	8.8
Other personnel: Executive and management												
Doctoral degree or equivalent	72	20	24	4	20	4	143	57	259	85	344	1.4
Masters, honours, bachelor or equivalent	35	17	13	5	9	3	79	49	136	74	210	0.9
Diplomas	15	4	4	3	1	0	14	9	34	16	50	0.2
Other qualifications (incl. non-formal)	3	0	0	0	0	0	6	14	9	14	23	0.1
Sub-Total	125	41	41	12	30	7	242	129	438	189	627	2.6
Grand Total	3130	1900	822	657	1127	684	8843	6630	13922	9871	23793	100.0

4.4.4 National priority areas

Table H13: HERD By multi-disciplinary R&D 2005/06

Multi-disciplinary area of R&D	R 000	%
Biotechnology	176,818	6.5
Nanotechnology	85,162	3.1
Total	261,980	9.6
Total R&D expenditure	2,732,215	100.0

Slightly less than 10% of higher education R&D expenditure is dedicated to the multidisciplinary R&D areas of biotechnology and nanotechnology. Of this 6.5% is dedicated to biotechnology and 3.1% to nanotechnology.

Table H14: HERD by national priority area of R&D 2005/06

Multi-Disciplinary area of R&D	R 000	%
Open source software	27,723	1.0
New materials	106,912	3.9
Tuberculosis (TB), HIV/AIDS, malaria	276,591	10.1
Total	411,226	15.1
Total R&D expenditure	2,732,215	100.0

Just over 15% of higher education R&D expenditure is devoted to the national priority areas of open source software; new materials; tuberculosis, HIV/AIDS and malaria. As expected, research on health related issues consume the bulk of this expenditure (10.1%).

Chapter 5: The Not-for-profit Sector

5.1 Introduction

Identifying R&D performers in the NPO sector remains a challenge due to the spread of the sector as well as a relatively poor understanding among respondents of what defines R&D. Many respondents are still of the opinion that most NPOs specialize in the social sciences whilst the Frascati definition of R&D is biased towards the natural sciences and engineering. The complexity of the survey instrument requires significant allocation of time and resources to complete the questionnaire, all of which may not be readily available. These factors result in hesitance to participate in the survey. Regardless of the remaining challenges we are confident that we are able to identify and approach important R&D performers in the NPO sector, always keeping in mind that there is still a pool of undetected organizations that have yet to be included.

As expected this sector still accounts for the smallest proportion (1.6 %) of the total R&D expenditure across all sectors in South Africa. For 2005/06 Not-for profit R&D personnel make up below 1% of the total R&D workforce, which is lower than the 2% reflected in 2003/04. The Survey found that the NPO sector accounted for 243 researchers, which constitutes 0.8% of the national total of 39,264 researchers.

A slight increase in NPO R&D expenditure and a drop in R&D personnel were noted in this survey. This may be attributed to some shuffling that occurred within the sector. Some NPOs that previously contributed significantly were shifted to the higher education sector. Due to the small size of the sector, any changes have a significant impact on the sector. On the whole most of the R&D performing NPOs seem to be doing fairly well but some long-established NPOs closed down and there were high staff turnover rates in some organisations.

5.2 Key results

Table N1: In-house R&D expenditure by sector 2005/06, 2004/05, 2003/04

Sector	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Business enterprise	8,243,776	58.3	6,766,361	56	5,591,325	55.5
Higher education	2,732,215	19.3	2,533,971	21	2,071,351	20.5
Science councils	2,102,094	14.9	1,996,050	17	1,745,493	17.3
Government	844,640	6	515,331	4.3	465,367	4.6
Not-for-profit	226,514	1.6	198,268	1.7	209,023	2.1
Grand total	14,149,239	100	12,009,981	100	10,082,559	100

A steady increase in the nominal R&D spend was noticeable in this survey. The total R&D expenditure for the NPO sector increased from R198 million in 2004/05 to R226 million in 2005/06. The NPO sector still accounts for the smallest proportion (1.6%) of the total R&D expenditure across all sectors in South Africa.

Table N2: Main characteristics of the NPO sector 2005/06, 2004/05, 2003/04

	2005/06	2004/05	2003/04
Not for profit domestic expenditure on R&D (millions of Rands)	226, 514	198, 28	209,023
Not for profit expenditure on R&D as a % of GDP	0.01%	0.01%	0.02%
Total not for profit R&D personnel (FTE)	286.62	362.68	684
Total not for profit researchers (FTE)	198.58	234.18	258
% of NPO expenditure on R&D financed by industry	12.10%	9.30%	9.40%
% of NPO expenditure on R&D financed by government	12.60%	19.10%	16.70%

Table N3: Headcount of R&D personnel by sector 2005/06 and 2004/05

Sector	Researchers		Technicians directly supporting R&D		Other Personnel Directly supporting R&D: Executive and management	Other Personnel directly supporting R&D: Administrative and support staff	Total other personnel		Grand total		%	
	2005/06	2004/05	2005/06	2004/05	2005/06	2005/06	2005/06	2004/05	2005/06	2004/05	2005/06	2004/05
Higher education*	18877	18270	1925	2801	327	1658	1985	2722	22787	23793	48.2	50.5
Business enterprise	7480	6575	4143	3724	897	3801	4698	4038	16321	14337	34.5	30.4
Science councils	1790	1846	1678	1582	332	1879	2211	2742	5679	6170	12.0	13.1
Government	874	692	495	494	125	507	632	1125	2001	2311	4.2	4.9
Not-for-profit	243	285	84	40	41	117	158	184	485	509	1.0	1.1
Grand total	29264	27668	8325	8641	1722	7962	9684	10811	47273	47120	100.0	100
Higher education doctoral and postdoctoral students	10002	9333							10002	9333		
Total	39266	37001							57275	56453		

*Excluding postgraduate students

R&D personnel of the NPO sector make up only 0.8% of the total R&D workforce. The survey found that the NPO sector accounted for 243 researchers.

5.3 Survey methodology and fieldwork methods

In the 2005/06 R&D survey of the NPO sector, the same methodology was used as in the previous three surveys. A purposive sample method was followed where NPOs, who were considered likely to undertake R&D activities, as well as organizations whose primary activities had not yet been clarified, were surveyed.

The baseline registry compiled for the first survey (2001/02) is continuously updated and expanded for each R&D survey using various resources such as internet searches, newspaper

reports, journals, referrals, etc. In the 2003/04 survey 120 units of measure were surveyed, in the 2004/05 survey 107 were surveyed while the 2005/06 survey covered 108 organisations.

Registry updates and additions for the 2005/06 survey once again brought to our attention that several organisations had become untraceable or had closed down. Several of the organisations previously surveyed informed that their information would be captured through another institution (e.g. HEI's). Due to the continuously changing environment of the NPO sector we find that for the last three surveys, the NPO register appears to be more or less static in number, because even when new organizations are added, the list does not grow as several existing entities had to be moved to a different sector or became untraceable.

The 108 organisations surveyed in 2005/06 survey represent a small proportion of the thousands of registered NPOs. Therefore the challenge to identify and include the yet unknown NPOs that conduct research is ongoing.

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.

Questionnaires were sent to 108 NPOs via post and e-mail. 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 to use data collected from the previous survey, which were adjusted for inflation. Towards the end of the survey the response was very poor and we had to commute questionnaires for outstanding known R&D players based on historic information from previous R&D surveys, annual reports and some telephonic information. Returned questionnaires were checked for completeness and accuracy of data before uploading into the SMRS.

Of the 108 questionnaires sent, 40 returns were obtained. Of the returns, 28 questionnaires (26%) were non-nil returns of which 16 were commuted based on historic data and 12 were nil returns.

When looking back at the last four surveys it has become easier to identify organizations that will participate successfully in the R&D Survey. However, many known R&D performers did not respond for various reasons such as time constraints, staff turnover issues, etc. Respondent fatigue was definitely more noticeable during this survey.

The 2005/06 survey still shows a lower return rate than the previous years. However it is encouraging to see that we are able to compile information for organisations based on good historical data we have collected over the last four years. This increased knowledge helps to ensure that the quality of each survey improves.

5.4 Detailed results

5.4.1 Financial

Table N4: NPO R&D by accounting category 2005/06, 2004/05 and 2003/04

Type Of expenditure	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Capital expenditure on R&D	10,092	4.5	13,069	6.6	12,308	5.9
Land: Buildings and other structures	2,336	1.0	4,593	2.3	5,173	2.5
Vehicles, plant, machinery, equipment	7,756	3.4	8,476	4.3	7,135	3.4
Current expenditure	216,422	95.5	185,199	93.4	196,715	94.1
Labour costs	85,511	37.8	77,502	39.1	106,521	51.0
Other current expenditure	130,911	57.8	107,697	54.3	90,194	43.2
Total	226,514	100.0	198,268	100.0	209,023	100.0

Current expenditure totalled R216 million and comprised labour costs and other operational expenses. Current expenditure accounts for the greater portion (95.5%) of the total NPO expenditure on R&D. Only a small proportion (4.5%) accounts for the cost of infrastructure, equipment and buildings and maintenance of physical plants. The trend in the percentage breakdown of capital and current expenditure remains the same as was recorded for the last three R&D surveys.

Table N5: NPO R&D expenditure by type of research 2005/06, 2004/05 and 2003/4

Type of Research	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Basic research	57,877	25.5	58,514	29.5	65,277	31.2
Applied research	123,609	54.6	100,137	50.5	118,698	56.8
Experimental research	45,026	19.9	39,617	20.0	25,048	12.0
Total	226,514	100.0	198,268	100.0	209,023	100.0

Table N5 shows that just over half (54.6%) of the total R&D expenditure in the NPO sector supports applied research. This is followed by basic research (25.5%) and experimental research (19.9%). The amount spent on applied research in the NPO sector 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 2005/06, 2004/05 and 2003/4

Source of funds	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Organisation						
Own funds	46,934	20.7	50,617	25.5	19,182	9.2
Internal resources	46,934	20.7	50,617	25.5	19,182	9.2
Government	28,470	12.6	37,892	19.1	34,817	16.7
Grants	16,295	7.2	12,094	6.1	* 34,817	16.7
Contracts	12,175	5.4	25,798	13		
Business	27,416	12.1	18,411	9.3	19,547	9.4
Business (Domestic only)	27,416	12.1	18,411	9.3	19,547	9.4
Other South African sources	21,354	9.4	20,067	10.1	14,544	7.0
Higher education	2,304	1	586	0.3	1,184	0.6
Not for profit organisations	16,379	7.2	# 19,481	9.8	# 13360	6.4
Individual donations	2,671	1.2				
Foreign	102,340	45.2	71,281	36	120,933	57.9
All sources	102,340	45.2	71,281	36	120,933	57.9
Total	226,514	100	198,268	100	209,023	100

*Not split by Grant & Contract categories in 2003/04

No split between NPO organisations & Individual donations in 2003/04 and 2004/05

It is a characteristic of the NPO sector that the largest source of funding is derived from international development agencies. The 2005/06 survey shows an increase in funding from foreign entities (from 36.0% in 2004/05 to 45.2% in 2005/06). There is also a noticeable decrease in funding from government, which was 19.1% in 2004/05 survey, to 12.1% in 2005/06 survey.

Table N 7: Provincial distribution of R&D activity 2005/06 and 2004/5

Province	2005/06		2004/05	
	R 000	%	R 000	%
Eastern Cape	6,589	2.9	8,151	4.1
Free State	3,687	1.6	4,301	2.2
Gauteng	104,002	45.9	82,581	41.7
KwaZulu-Natal	35,036	15.5	37,729	19.0
Limpopo	5,329	2.4	4,201	2.1
Mpumalanga	10,238	4.5	9,029	4.6
North-West	3,547	1.6	4,810	2.4
Northern Cape	1,650	0.7	1,298	0.7
Western Cape	56,436	24.9	46,169	23.3
Total	226,514	100.0	198,268	100.0

R&D expenditure is mainly concentrated in Gauteng (45.9%), followed by the Western Cape (24.9%) and KwaZulu-Natal (15.5%).

5.4.2 NPO R&D Orientation

Table N8: NPO R&D expenditure by research fields (RF) 2005/06, 2004/05 and 2003/04

Main research field	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Natural sciences, technology and engineering	54,740	24.2	53,198	26.8	100,388	48.0
Mathematical sciences	0	0.0	0	0.0	0	0.0
Physical sciences	0	0.0	0	0.0	0	0.0
Chemical sciences	0	0.0	0	0.0	0	0.0
Earth sciences	158	0.1	1,386	0.7	0	0.0
Information, computer and communication	789	0.3	924	0.5	0	0.0
Applied sciences and technologies	5,775	2.5	5,250	2.6	0	0.0
Engineering sciences	0	0.0	0	0.0	0	0.0
Biological sciences	1,630	0.7	766	0.4	907	0.4
Agricultural sciences	16,507	7.3	12,705	6.4	13,646	6.5
Medical and health sciences	23,748	10.5	20,096	10.1	79,775	38.2
Environmental sciences	3,531	1.6	6,067	3.1	4,940	2.4
Material sciences	0	0.0	0	0.0	0	0.0
Marine sciences	2,602	1.1	6,005	3.0	1,120	0.5
Division 2: Social sciences and humanities	171,774	75.8	145,070	73.2	108,635	52.0
Social sciences	170,126	75.1	143,351	72.3	108,155	51.7
Humanities	1,648	0.7	1,719	0.9	480	0.2
Total	226,514	100.0	198,268	100.0	209,023	100.0

The 2001/02 and 2003/04 surveys indicated that the focus of R&D spending is equally split between research in the social sciences and natural sciences, technology and engineering.

Both the 2004/05 and 2005/06 surveys show a slightly different picture where there is a stronger emphasis on social sciences (75.8% for 2005/06) with the remainder of 24.2% spent on natural sciences. This trend is expected to continue as most NPOs are of the opinion that they mostly specialize in social sciences.

Table N9: NPO R&D expenditure by socio-economic objective (SEO) 2005/06, 2004/05 and 2003/04

Socio-economic objective	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Division 1: Defence	1,161	0.5	1,441	0.7	1,564	0.7
Defence	1,161	0.5	1,441	0.7	1,564	0.7
Division 2: Economic development	58,983	26.0	56,356	28.4	47,946	22.9
Economic development unclassified	0	0.0	0	0.0	0	0.0
Plant production and plant primary products	13,747	6.1	942	0.5	13,023	6.2
Animal production and animal primary products	1,577	0.7	13,647	6.9	1,376	0.7
Mineral resources (excluding energy)	0	0.0	0	0.0	0	0.0
Energy resources	581	0.3	490	0.2	920	0.4
Energy supply	1,161	0.5	1,164	0.6	718	0.3
Manufacturing	0	0.0	0	0.0	0	0.0
Construction	0	0.0	0	0.0	0	0.0
Transport	0	0.0	0	0.0	0	0.0
Information and communication services	1,183	0.5	0	0.0	0	0.0
Commercial services	2,396	1.1	2,994	1.5	3,729	1.8
Economic framework	34,253	15.1	33,695	17.0	22,604	10.8
Natural resources	4,086	1.8	3,425	1.7	5,577	2.7
Division 3: Society	147,288	65.0	125,674	63.4	144,673	69.2
Society unclassified	0	0.0	0	0.0	0	0.0
Health	26,824	11.8	23,471	11.8	76,295	36.5
Education and training	72,160	31.9	66,400	33.5	30,217	14.5
Social development and community services	48,304	21.3	35,803	18.1	38,162	18.3
Division 4: Environment	3,870	1.7	10,632	5.4	6,418	3.1
Environment unclassified	0	0.0	0	0.0	0	0.0
Environmental knowledge	949	0.4	4,641	2.3	3,883	1.9
Environmental aspects of development	185	0.1	5,704	2.9	1,395	0.7
Environmental and other aspects	2,736	1.2	286	0.1	1,140	0.5
Division 5: Advancement of knowledge	15,211	6.7	4,165	2.1	8,423	4.0
Advancement of knowledge unclassified	0	0.0	0	0.0	0	0.0
Natural sciences, technologies and engineering	789	0.3	0	0.0	5,514	2.6
Social sciences and humanities	14,422	6.4	4,165	2.1	2,909	1.4
Total	226,514	100.0	198,268	100.0	209,023	100.0

The research with the strongest socio-economic objectives within this sector is Division 3 (Society at 65%) followed by Division 2 (Economic development at 26%). This pattern has remained throughout all four R&D surveys.

Within the Society division the main thrust observed was Education and Training (31.9%) followed by Social Development and Community Services (21.3%) & Health (11.8%).

5.4.3 R&D personnel

Table N10: NPO R&D personnel headcount and full-time equivalent (FTE) 2005/06, 2004/05 and 2003/4

Occupation	Headcount			Full-time equivalents	
	Male	Female	Total	FTE	FTE as % of headcount
2005/06					
Researchers	133	110	243	198.58	81.7
Technicians	48	36	84	59	70.2
Other personnel: Executive and management *	13	28	41	29.04	70.8
Other personnel: Administrative and support staff *	26	91	117	78.27	66.9
Total	220	265	485	286.62	59.1
2004/05					
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
2003/04					
Researchers	149	156	305	257.98	84.6
Technicians directly supporting R&D	67	168	235	226.05	96.2
Other personnel directly supporting R&D	93	182	275	199.49	72.5
Total	309	506	815	683.52	83.9

* 'Other personnel' in split into 'Executive and Management' and 'Administrative' support staff in the 2005/06 survey

Table N10 indicates the NPO sector accounted for 243 researchers, 84 technicians and 158 other personnel directly supporting R&D. In the 2004/05 survey the NPO sector accounted for 285 researchers, 40 technicians and 184 other personnel directly supporting R&D.

In the NPO sector there are 198 FTE researchers who on average spend about 82% of their time on research, which is much lower than the 234 FTE researchers measured in 2005.

The technicians FTE increased to 59 FTEs and spend approximately 70 % of their time on R&D while support staff increased to a total of 107.31 (97.8 FTE) and dedicate 66.9% of their time to R&D.

The 2005/06 survey once again saw a drop in researcher headcount and FTE numbers, although an increase in headcount and FTE numbers were noticeable in the technician category and other personnel directly supporting research shows a drop in headcounts but an increase in FTEs.

Throughout the four R&D surveys conducted the FTE and the time spent on R&D in the other personnel directly supporting research has fluctuated from year to year. In the current survey respondents indicated that staff spend more time on activities supporting research. When one takes a closer look at the data, the decline in numbers of researchers could again be due to shifting of organizations to other sectors. In the past, investigations revealed that the organizations that were shifted were ones with high R&D expenditures and an even bigger labour force. In terms of representivity, females were once again well represented and accounted for 55% of the total headcounts.

Table N11.1: NPO R&D personnel headcount by gender, population group and qualification level 2005/06

2005/06	African		Coloured		Indian		White		Gender total		Grand total	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Headcount	%
Researchers												
Doctoral degree or equivalent	5	1	3	0	1	0	16	5	25	6	31	6.4
Masters, honours, bachelor or equivalent	49	26	8	6	5	15	45	55	107	102	209	43.1
Diplomas and other qualifications	0	2	0	0	0	0	1	0	1	2	3	0.6
Subtotal	54	29	11	6	6	15	62	60	133	110	243	50.1
Technicians directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0	0.0
Masters, honours, bachelor or equivalent	9	11	3	3	0	4	8	4	20	22	42	8.7
Diplomas and other qualifications	18	6	1	4	3	1	6	3	28	14	42	8.7
Subtotal	27	17	4	7	3	5	14	7	48	36	84	17.3
Other personnel: Administrative and support staff												
Doctoral degree or equivalent	0	0	0	0	0	0	0	1	0	1	1	0.2
Masters, honours, bachelor or equivalent	6	14	1	6	1	2	4	4	12	26	38	7.8
Diplomas and other qualifications	12	36	2	11	0	4	0	13	14	64	78	16.1
Subtotal	18	50	3	17	1	6	4	18	26	91	117	24.1
Other personnel: Executive and management												
Doctoral degree or equivalent	0	0	0	0	0	0	1	1	1	1	2	0.4
Masters, honours, bachelor or equivalent	1	8	0	4	1	2	8	9	10	23	33	6.8
Diplomas and other qualifications	0	3	0	0	1	0	1	1	2	4	6	1.2
Subtotal	1	11	0	4	2	2	10	11	13	28	41	8.5
Grand Total	100	107	18	34	12	28	90	96	220	265	485	100.0

* 'Other personnel' in split into 'Executive and Management' and 'Administrative' support staff in the 2005/06 survey

Table N11.2: NPO R&D personnel headcount by gender, population group and qualification level 2004/05

2004/05 Qualification and personnel categories	African		Coloured		Indian		White		Gender total		Grand total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
Researchers												
Doctoral degree or equivalent	7	2	3	0	2	0	22	4	33	5	39	7.6
Masters, honours, bachelor or equivalent	45	39	10	14	5	12	63	82	123	147	270	53.1
Diplomas	2	2	0	2	0	0	2	0	3	4	7	1.3
Sub-Total	53	43	13	16	7	12	86	85	159	156	316	62.0
Technicians directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0	0.0
Masters, honours, bachelor or equivalent	0	7	0	0	0	0	6	5	6	13	19	3.8
Diplomas	6	0	1	5	3	2	8	0	18	7	25	5.0
Sub-Total	6	7	1	5	3	2	14	5	24	20	44	8.7
Other personnel directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	2	1	2	1	3	0.6
Masters, honours, bachelor or equivalent	8	5	5	3	2	1	8	16	23	25	48	9.5
Diplomas	31	15	5	0	2	3	0	15	38	32	70	13.7
Other qualifications (incl. non-formal)	3	13	2	4	0	0	0	5	5	23	28	5.4
Sub-Total	43	33	12	7	3	4	10	37	68	82	149	29.3
GRAND TOTAL	102	83	26	28	13	18	110	128	251	258	509	100

The 2005/06 R&D survey shows that for the first time whites do not comprise of the greater portion of R&D personnel. Of the total R&D personnel in the NPO sector, Africans (43%) makes up the bigger portion followed by Whites (38%), Coloureds (11%) and Indians (8%).

Only half of the R&D personnel (50%) are comprised of researchers. This is a decline compared to the previous R&D surveys, where researchers were the majority.

Of the total researcher component, 50% of researchers with doctoral and masters degrees are represented by whites, whilst the other half are represented by the group of black researchers [Blacks (34%), Coloureds (7%) & Indians (9%)]. This trend remains the same as previously noted in the 2001/02 and the 2004/05 R&D surveys.

Gender representivity in the NPO sector seems to be on par, with females accounting for just over half (55%) of the R&D personnel. Males account for 55% of the researchers.

5.4.4 National priority areas

Table N12: NPO expenditure by multi-disciplinary R&D 2005/06

Multi-disciplinary area of R&D	R 000	%
Biotechnology	206	0.1
Nanotechnology	0	0.0
Total	206	0.1
Total R&D expenditure	226,514	100.0

The data in Table N12 shows that the NPO sector does not specialize in technology related research as only 0.1% of the total R&D expenditure was devoted to research in a biotechnology related field.

Table N13: NPO expenditure by national priority area of R&D 2005/06

Multi-disciplinary area of R&D	R 000	%
Open source software	7,700	3.4
New materials	0	0.0
Tuberculosis (TB), HIV/AIDS, malaria	3,736	1.6
Total	11,436	5.0
Total R&D expenditure	226,514	100.0

The NPO sector spends about 5% of its R&D on health-related research and on open source software development.

Chapter 6: The Science Council Sector

6.1 Introduction

The South African science council sector comprises nine statutory organizations that conduct and perform sector specific 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 sub-divisional structure. CSIR is the largest with more than ten research units, ARC has eleven research units following the recent merger of three of its units, MRC has six units and the NRF oversees six research facilities.

The Science Councils report to different line departments and are now funded by department core budgets. Additional funding is generated by research contracts with government, the private sector both local and international, foundations and other national sources.

The strong R&D focus and the close relationship between government and science councils makes it relatively easy to survey this sector.

6.2. Methodology

Methodology essentially followed that of the previous surveys. The main change to the instrument was the inclusion of items on multi-disciplinary R&D (biotechnology and nanotechnology), and on R&D expenditure related to national priority areas as stipulated in the National R&D Strategy of 2002.

A second change was that in the section dealing with R&D personnel the item *Other R&D personnel directly supporting R&D* was split into two levels: the executive and managerial level and the administrative and support staff level.

A change was also made to the sources of funds item where *Other South African sources* of funds was split into higher education, not for profit organisations and donations from individuals.

Science councils account for a large proportion of the national R&D expenditure but from the survey perspective present a 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 previous three surveys yielded a 100% return rate and with this background there was no need to change the fieldwork methodology. The questionnaire design was followed by a brief pilot, mainly on the changed sections of the questionnaire.

Once the questionnaire was approved, the rest of the science councils were contacted to alert them to the forthcoming survey. 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. In the previous surveys, questionnaires were sent to the ARC head office where the appointed contact person distributed them among the units. To facilitate a speedy return of questionnaires, a decision was taken that for the current survey, CeSTII staff would directly liaise with the respective directors of the units.

Twenty eight hardcopy questionnaires were sent to the field during September 2006 and these were shortly followed by an electronic version. The respondents were given two months to complete and return the questionnaire. On average it took 4 to 6 telephone calls and 4 electronic mails to send, and to receive the questionnaires back from the councils within the stipulated deadline.

Of the 28 questionnaires sent out, 27 were returned as non nil and only one questionnaire was outstanding. The outstanding questionnaire was commuted using the 2004/05 corresponding data of the same organisation. Where necessary follow-ups were made regarding queries and adjustments were made to completed questionnaires as appropriate. The questionnaires were checked and verified for accuracy and completeness before being uploaded on the SMRS.

6.3. Key results

Table S1: In-house R&D expenditure by sector 2005/06, 2004/05 and 2003/04

	2005/06		2004/05		2003/04	
Sector	R 000	%	R 000	%	R 000	%
Business enterprise	8,243,776	58.3	6,766,361	56.3	5,591,325	55.5
Higher education	2,732,215	19.3	2,533,971	21.1	2,071,351	20.5
Science councils	2,102,094	14.9	1,996,050	16.6	1,745,493	17.3
Government	844,640	6	515,331	4.3	465,367	4.6
Not-for-profit	226,514	1.6	198,268	1.7	209,023	2.1
Grand total	14,149,239	100	12,009,981	100	10,082,559	100

Table S1 shows that between 2004/05 and 2005/06 total GERD increased by R2.1 billion and that business contributed 69% towards that increase. Science council expenditure on R&D increased by a mere R106 million (5% increase of the total increase in R&D expenditure) and its share of the total expenditure continues to decline (17.3% in 2003/04).

The 2005/06 survey shows that of the 47 580 personnel active in R&D (excluding postgraduate students), 29 262 were researchers. The number of researchers has slightly risen to 62% of the total R&D personnel from 59% in 2004/05. The breakdown of researchers by sector of employment shows that the highest increase in researchers was observed in the business sector, followed by higher education. As observed in the previous two surveys the number of researchers in the science councils continues to decline.

Table S2: R&D personnel headcount by sector 2005/06 and 2004/05

Sector	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D: Executive & management	Other personnel directly supporting R&D: Administrative & support staff	Total other personnel		Grand total		%	
	2005/06	2004/05	2005/06	2004/05	2005/06	2005/06	2005/06	2004/05	2005/06	2004/05	2005/06	2004/05
Higher education*	18877	18270	1925	2801	327	1658	1985	2722	22787	23793	48.2	50.5
Business enterprise	7480	6575	4143	3724	897	3801	4698	4038	16321	14337	34.5	30.4
Science councils	1790	1846	1678	1582	332	1879	2211	2742	5679	6170	12.0	13.1
Government	874	692	495	494	125	507	632	1125	2001	2311	4.2	4.9
Not-for-profit	243	285	84	40	41	117	158	184	485	509	1.0	1.1
Grand total	29264	27668	8325	8641	1722	7962	9684	10811	47273	47120	100.0	100
Higher education doctoral & postdoctoral students	10002	9333							10002	9333		
Total	39266	37001							57275	56453		

Table S3: Main characteristics of the science council sector 2005/06, 2004/05 and 2003/04

	2005/06	2004/05	2003/04
Expenditure on R&D (millions of Rands)	2,102	1,996	1,745
Expenditure on R&D as % of GDP	0.136	0.14	0.14
R&D personnel (FTE)	4103.1	4989.6	5389
Researchers (FTE)	1323.3	1548.8	1899.5
% Expenditure financed by local industry	10.5	12.7	14.6
% Expenditure financed by Government	52.6	54.9	54.4

The expenditure of the science councils as a % age of GDP remained relatively constant at 0.14%.

6.4. Detailed results

6.4.1 Financial

Table S4: R&D expenditure by accounting category 2005/06, 2004/5 and 2003/4

	2005/06		2004/05		2003/04	
Type of expenditure	R 000	%	R 000	%	R 000	%
Capital expenditure on R&D	209,013	9.9	127,465	6.4	117,439	6.7
<i>Land: Buildings and other structures</i>	76,528	3.6	29,299	1.5	104,247	6
<i>Vehicles, plant, machinery, equipment</i>	132,485	6.3	98,166	4.9	13,192	0.7
Current expenditure	1,893,081	90.1	1,868,585	93.6	1,628,054	93.3
<i>Labour costs</i>	875,467	41.6	968,610	48.5	900,397	51.6
<i>Other current expenditure</i>	1,017,614	48.4	899,975	45.1	727,657	41.7
Total	2,102,094	100	1,996,050	100	1,745,493	100

The 2004/05 survey results showed that 94% expenditure on R&D by the science council was on current costs. Of these costs 48.5% of these costs were on labour while 45.1% were on other current costs. The 2005/06 survey shows that the current costs have decreased from 94% to 90%. Capital expenditure increased from 6.4% to 9.9%, implying that the science councils are still spending relatively little on R&D infrastructure and general R&D equipment.

Table S5: Science council R&D expenditure by type of research 2005/06, 2004/05, 2003/04

Type of Research	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Basic research	522,861	24.9	379,044	19	575,616	33
Applied research	1,018,979	48.5	1,028,770	51.5	752,489	43.1
Experimental research	560,254	26.7	588,236	29.5	417,388	23.9
Total	2,102,094	100	1,996,050	100	1,745,493	100

Table S5 shows that about 49% of R&D expenditure is on applied research, a slight decrease from 2004/05. Experimental research also decreased from 29.5% to 26.7%. On the other hand basic research increased from 19% to 24.9%. The fluctuating results make it difficult to assess the trends on the type of research and/or research activities performed by the science councils.

Table S6: Science council R&D expenditure by sources of funds 2005/06, 2004/05 and 2003/04

Source of funds	2005/06		2004/05		2003/04	
	R 000	%	R 000	%	R 000	%
Organisation	485,702	23.1	190,521	9.5	233,598	13.4
Own funds	485,702	23.1	190,521	9.5	233,598	13.4
Government	1,105,832	52.6	1,096,818	54.9	950,130	54.4
Grants	629,237	29.9	900,005	45.1	844,533	48.4
Contracts	476,595	22.7	196,813	9.9	105,597	6
Business	220,698	10.5	293,030	14.7	254,668	14.6
Business (Domestic only)	220,698	10.5	293,030	14.7	254,668	14.6
Other South African sources	35,679	1.7	161,394	8.2	136,021	7.8
Higher education	4,620	0.2				
Not for profit organisations	30,006	1.4				
Individual donations	1,053	0.1				
Foreign	254,183	12.1	254,287	12.7	171,076	9.8
All sources	254,183	12.1	254,287	12.7	171,076	9.8
Total	2,102,094	100	1,996,050	100	1,745,493	100

Table S6 shows R&D expenditure by sources of funds. The 2004/05 survey showed that science councils spent about 10% of their own funds on R&D. The current survey shows that the figure has more than doubled to 23.1%. There are significant changes as far as government funding is concerned; support in terms of grants has decreased significantly from 55% of the total government support to 30% in 2005/06. Money received as a result of government contracts increased from 10% to 23%. Support from the local businesses decreased slightly from 14.7% to

the current 10.5% while funds from abroad remained almost unchanged, 12.7% in 2004/05 and 12.1% in 2005/06.

Table S7: Provincial distribution of R&D activity 2005/06 and 2004/05

Province	2005/06		2004/05	
	R 000	%	R 000	%
Eastern Cape	123,956	5.9	75,170	3.8
Free State	50,197	2.4	33,725	1.7
Gauteng	1,103,284	52.5	1,312,041	65.7
KwaZulu-Natal	201,811	9.6	171,424	8.6
Limpopo	48,058	2.3	23,887	1.2
Mpumalanga	48,051	2.3	35,580	1.8
North-West	45,751	2.2	43,581	2.2
Northern Cape	64,284	3.1	20,051	1
Western Cape	416,702	19.8	280,591	14.1
Total	2,102,094	100	1,996,050	100

Although R&D expenditure by science councils is still largely in Gauteng, the total share has decreased from 65.7% in 2004/05 to 52.5% in 2005/06. With the exception of the North West province where expenditure remained at 2.2% in both 2004/05 and 2005/06, all other provinces experienced slight increases, from 0.5% (Mpumalanga) to 5.7% in the Western Cape.

6.4.2 Science council R&D orientation

Table S8: Science Council R&D expenditure by research field (RF) 2005/06, 2004/05 and 2003/04

	2005/06		2004/05		2003/04	
Main research field	R 000	%	R 000	%	R 000	%
Division 1: Natural sciences, technology and engineering	1,922,728	91.5	1,829,632	91.7	1,538,663	88.2
Mathematical sciences	20,564	1	13,629	0.7	15,492	0.9
Physical sciences	114,723	5.5	58,292	2.9	87,967	5
Chemical sciences	21,494	1	28,710	1.4	50,159	2.9
Earth sciences	96,410	4.6	96,474	4.8	84,880	4.9
Information, computer and communication	82,238	3.9	141,363	7.1	55,045	3.2
Applied sciences and technologies	78,065	3.7	63,696	3.2	101,620	5.8
Engineering sciences	451,924	21.5	450,079	22.5	321,668	18.4
Biological sciences	265,202	12.6	208,812	10.5	226,256	13
Agricultural sciences	387,569	18.4	393,682	19.7	287,632	16.5
Medical and Health sciences	270,090	12.8	237,103	11.9	206,749	11.8
Environmental sciences	56,259	2.7	61,022	3.1	34,615	2
Material sciences	69,742	3.3	65,398	3.3	47,011	2.7
Marine sciences	8,448	0.4	11,372	0.6	19,570	1.1
Division 2: Social sciences and humanities	179,366	8.5	166,418	8.3	206,830	11.8
Social sciences	165,557	7.9	148,758	7.5	198,138	11.4
Humanities	13,809	0.7	17,660	0.9	8,692	0.5
Total	2,102,094	100	1,996,050	100	1,745,493	100

Table S8 shows R&D expenditure by fields of science. The R&D expenditure in this category follows the same trend as in the previous surveys where activities are largely concentrated in the natural sciences, technology and engineering. There are minor changes in expenditure across all fields within this category. The changes in R&D expenditure between 2004/05 and 2005/06 surveys on the social sciences and humanities categories are also insignificant.

Table S9: Science council expenditure by socio-economic objective (SEO) 2005/06, 2004/05 and 2003/04

	2005/06		2004/05		2003/04	
Socio-economic objective	R 000	%	R 000	%	R 000	%
Division 1: Defence	155,066	7.4	160,864	8.1	153,196	8.8
Defence	155,066	7.4	160,864	8.1	153,196	8.8
Division 2: Economic development	1,126,651	53.6	1,057,410	53	879,229	50.4
Economic development unclassified	0	0	0	0	0	0
Plant production and plant primary products	297,626	14.2	198,256	9.9	188,451	10.8
Animal production and animal primary products	72,380	3.4	118,171	5.9	141,996	8.1
Mineral resources (excluding energy)	286,363	13.6	251,953	12.6	150,228	8.6
Energy resources	30,997	1.5	16,916	0.8	16,961	1
Energy supply	595	0	542	0	3,125	0.2
Manufacturing	110,467	5.3	138,792	7	128,057	7.3
Construction	90,143	4.3	61,761	3.1	36,433	2.1
Transport	18,401	0.9	41,935	2.1	54,906	3.1
Information and communication services	18,271	0.9	22,090	1.1	7,176	0.4
Commercial services	0	0	2,086	0.1	7,234	0.4
Economic framework	66,540	3.2	50,045	2.5	35,116	2
Natural resources	134,867	6.4	154,861	7.8	109,546	6.3
Division 3: Society	278,222	13.2	324,973	16.3	205,207	11.8
Society unclassified	0	0	0	0	0	0
Health	218,941	10.4	203,178	10.2	134,099	7.7
Education and training	51,704	2.5	68,755	3.4	31,227	1.8
Social development and community services	7,577	0.4	53,040	2.7	39,881	2.3
Division 4: Environment	168,682	8	144,737	7.3	137,520	7.9
Environment unclassified	0	0	0	0	0	0
Environmental knowledge	94,519	4.5	87,752	4.4	83,067	4.8
Environmental aspects of development	43,835	2.1	20,436	1	17,175	1
Environmental and other aspects	30,328	1.4	36,549	1.8	37,279	2.1
Division 5: Advancement of knowledge	373,473	17.8	308,067	15.4	370,340	21.2
Advancement of knowledge unclassified	0	0	0	0	0	0
Natural sciences, technologies and engineering	306,398	14.6	246,359	12.3	274,691	15.7
Social sciences and humanities	67,076	3.2	61,708	3.1	95,649	5.5
Total	2,102,094	100	1,996,050	100	1,745,493	100

Table S9 shows that R&D expenditure in areas aligned to economic development barely increased from 53% in 2004/05 to 53.6% in 2005/06. The expenditure on environment (8%) and advancement of knowledge (17.8%) increased while the expenditure related to defence and society decreased respectively. The previous 2004/05 survey showed a strong relationship between the expenditure related to the advancement of knowledge and basic research. This survey shows a similar pattern where there is an increase in both basic research expenditure and the expenditure related to the advancement of knowledge.

9.4.3 R&D personnel

Table S10: Science council R&D personnel headcount and full-time equivalent (FTE) 2005/06, 2004/05 and 2003/04

Occupation	Headcount			Full-time equivalents	
	Male	Female	Total	FTE	FTE as % of headcount
2005/06					
Researchers	1111	679	1790	1323.3	73.9
Technicians	1001	677	1678	1250.85	74.5
Other personnel: Executive and management *	268	64	332	223.1	67.2
Other personnel: Administrative and support staff *	928	951	1879	1305.85	69.5
Total	3308	2371	5679	4103.1	72.3
2004/05	Male	Female	Total	FTE	FTE as % of headcount
Researchers	1141	705	1846	1548.83	83.9
Technicians	984	598	1582	1344.13	85
Other personnel directly supporting R&D	1482	1260	2742	2096.6	76.5
Total	3607	2563	6170	4989.56	80.9
2003/04	Male	Female	Total	FTE	FTE as % of headcount
Researchers	1505	909	2414	1899.5	78.7
Technicians directly supporting R&D	760	852	1612	1303.73	80.9
Other personnel directly supporting R&D	1626	870	2496	2186.18	87.6
Total	3891	2631	6522	5389.41	82.6

The current survey shows that the numbers of R&D personnel in the science council sector continues to decline while the total R&D expenditure increased in nominal terms. The researcher headcount decreased from 1 846 in 2004/05 to 1 790 in 2005/06. The total researcher FTE also decreased from 1 548.83 to 1 323.3. The results further show that the average time researchers spent on R&D decreased from 84% to 74%.

The breakdown of the R&D personnel in the science councils by race, qualifications and gender (table S11) shows that the headcount of African researchers increased to 24% from 21% in 2004/05. The numbers of Coloured and Indian researchers remain unchanged while the total number of white researchers decreased from 66% to 63%.

The total number of R&D personnel holding a doctoral or equivalent degree increased slightly from 655 in 2004/05 to 683 in 2005/06.

The results show that research is still male dominated in the science councils. Female R&D personnel were in minorities as researchers, technicians and executives and or managers. In 2005/06 female employees working on R&D as administrators and support staff accounted for 80% of the total employees in that category.

Table S11: Science council R&D personnel headcount by gender, population group and qualification level 2005/06

Qualification	African		Coloured		Indian		White		Total		Overall
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	71	41	11	5	27	18	268	111	377	175	552
Masters, honours, bachelor or equivalent	187	126	35	37	46	53	453	273	721	489	1210
Diplomas and other qualifications	2	6	0	1	0	1	11	7	13	15	28
Subtotal	260	173	46	43	73	72	732	391	1111	679	1790
Technicians directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	1	0	1	0	1
Masters, honours, bachelor or equivalent	92	147	15	13	23	36	139	89	269	285	554
Diplomas and other qualifications	368	214	58	24	18	27	287	127	731	392	1123
Subtotal	460	361	73	37	41	63	427	216	1001	677	1678
Other personnel: Administrative and support staff											
Doctoral degree or equivalent	1	0	0	0	0	0	4	0	5	0	5
Masters, honours, bachelor or equivalent	30	49	4	8	4	7	33	67	71	131	202
Diplomas and other qualifications	631	334	90	110	22	22	109	354	852	820	1672
Subtotal	662	383	94	118	26	29	146	421	928	951	1879
Other personnel: Executive and management											
Doctoral degree or equivalent	24	3	0	1	7	0	73	17	104	21	125
Masters, honours, bachelor or equivalent	27	9	6	2	9	2	72	11	114	24	138
Diplomas and other qualifications	11	3	1	0	5	0	33	16	50	19	69
Subtotal	62	15	7	3	21	2	178	44	268	64	332
Grand total	1444	932	220	201	161	166	1483	1072	3308	2371	5679

Table S12: Science Council's R&D personnel by race, gender and qualifications 2004/05

Qualification	African		Coloured		Indian		White		Subtotal		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, honours, 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
Subtotal	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, honours, 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
Subtotal	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, honours, 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
Subtotal	965	540	139	133	37	42	341	545	1482	1260	2742
Total	1541	942	289	211	172	178	1605	1234	3607	2565	6172

6.4.4 National priority areas

Table S13: Science council expenditure by multi-disciplinary R&D 2005/06

Multi-disciplinary area of R&D	R 000	%
Biotechnology	129,276	6.1
Nanotechnology	11,130	0.5
Total	140,406	6.7
Total R&D expenditure	2,102,094	100.0

The R&D expenditure on biotechnology accounted for 6.1% of all R&D expenditure while 0.5% was spent on nanotechnology in 2005/06. This is the first time R&D expenditure on biotechnology and nanotechnology was estimated through the R&D Survey.

Table S14: Science council expenditure by national priority area 2005/06

Multi-disciplinary area of R&D	R 000	%
Open source software	6,035	0.3
New materials	40,343	1.9
Tuberculosis (TB), HIV/AIDS, malaria	170,000	8.1
Total	216,378	10.3
Total R&D expenditure	2,102,094	100.0

R&D expenditure on TB, HIV/AIDS and Malaria research in the science councils accounted for 8.1% of the total R&D expenditure.

Table S15: Science council overview 2005/06

	Total R&D expenditure	Researchers	Basic Research	Capital Expenditure
Science Councils	(R 000s)	(FTE)	(R 000s)	(R 000s)
African Institute of South Africa	2,146	14.0	15,023	293
Agricultural Research Council	553,682	384.4	59,997	59,726
Council for Scientific and Industrial Research	603,452	380.2	138,191	70,425
Council for Geoscience	68,053	70.0	47,637	16,833
Human Sciences Research Council	197,268	87.2	29,590	4,743
Medical Research Council	233,294	200.0	139,976	5,807
Mintek	274,844	85.0	27,484	21,818
National Research Foundation	147,063	100.5	64,962	29,368
South African Bureau of Standards	2,976	2.0	0	0
Total	2,082,778	1,323.3	522,861	209,013

Chapter 7: Concluding Remarks and Acknowledgements

The 2005/06 survey is the fourth 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 2007. The Minister released the first results of the survey in his budget vote speech on 23 May 2007.

The coverage attained in this fourth survey is a further improvement on that of the 2004/05 survey. This increased response is a result of improved survey capability and capacity, and the interest and commitment of many organisations and firms that were approached to provide the required information.

National Treasury, in cooperation with the Department of Science and Technology, introduced a new tax incentive for the conduct of R&D effective from 2 November 2006. Accordingly the 2005/06 R&D survey provides a datum level against which the impact of this new incentive may be measured.

That is a matter for the future that is expected to make an impact on the returns to the 2006/07 R&D Survey.

The now robust series of R&D survey data is proving to be a valuable resource for informing emerging innovation policy. In particular the R&D data underpins the Department of Science and Technology Ten Year Plan recently submitted to cabinet, and informs many studies undertaken by the National Advisory Council on Innovation, notably the recent background report for the *OECD Review of South Africa's Innovation Policy*.