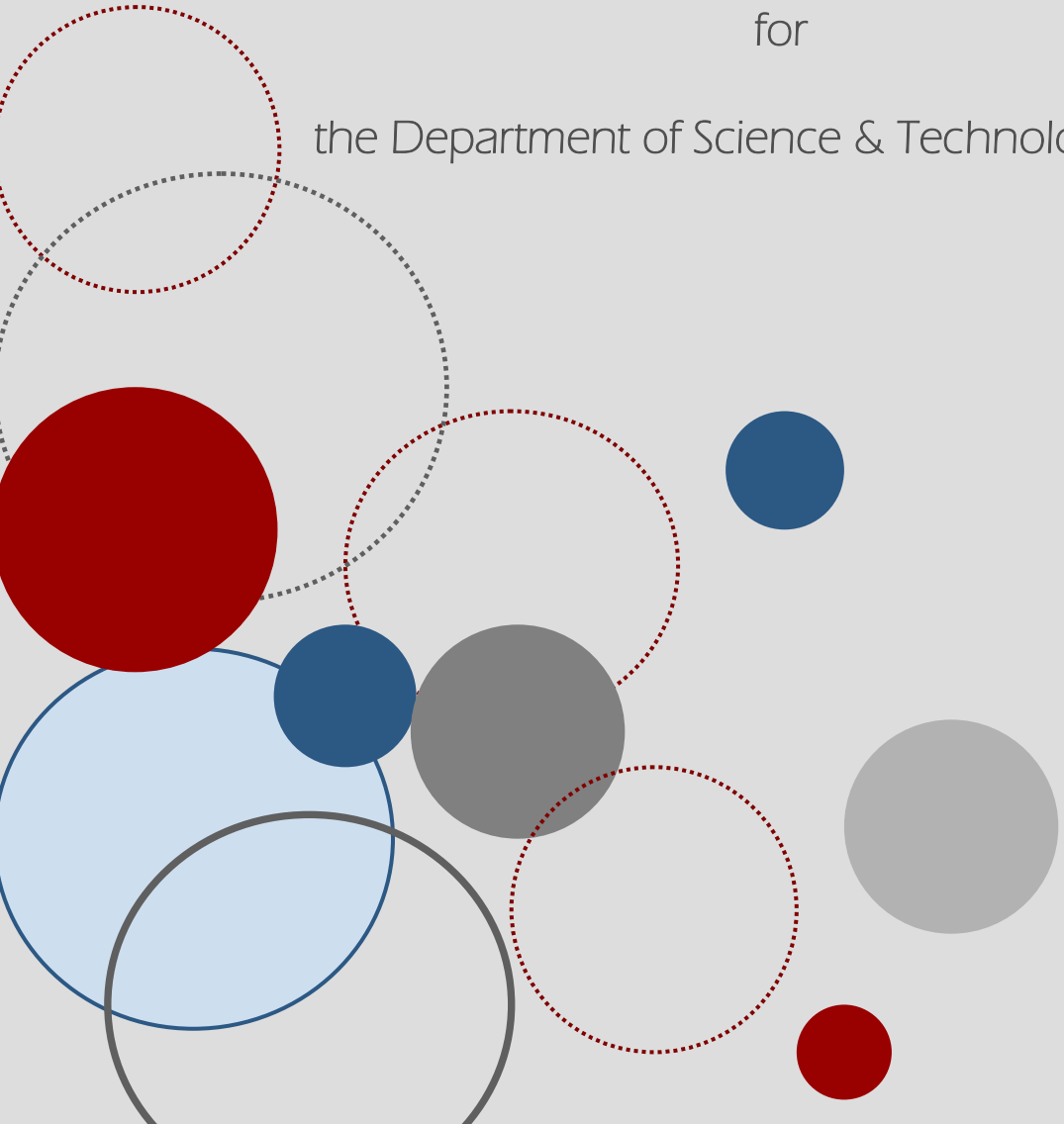
South African National Survey of Research & Experimental Development, 2007/08

Centre for Science, Technology and Innovation Indicators (CeSTII),
Human Sciences Research Council (HSRC)

for

the Department of Science & Technology (DST)



science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

HSRC
Human Sciences
Research Council

REPUBLIC OF SOUTH AFRICA
STATISTICIAN-GENERAL
NSS
National Statistics System
QUALITY APPROVED

Project team

The annual National Survey of Research and Experimental Development (R&D) is conducted on behalf of the Department of Science and Technology (DST) by the Centre for Science, Technology and Innovation Indicators (CeSTII) at the Human Sciences Research Council (HSRC).

The CeSTII project team comprised: Prof Demetre Labadarios, William Blankley, Dr Neo Molotja, Julien Rumbelow, Natalie Vlotman, Weziwe Sikaka, Saahier Parker, Irma Booyens, Hangwelani Magidimisha, Karen Heath, Vaughan Lieberum, Natasha Saunders, Prudence Sotashe, Mtembukazi Sibindlana, Aeysha Semaar, Mamela Siwendu, Lezaan Muller and Anthony Burns.

Acknowledgements

The Department of Science and Technology (DST) supports CeSTII by means of a ring-fenced grant in the government's Medium-term Expenditure Framework (MTEF). CeSTII is housed in the Knowledge Systems Group of the HSRC in Cape Town. The HSRC also provides baseline financial support to the survey.

The project team extends its appreciation to Dr Phil Mjwara, Director-General of the DST, and to Dr Olive Shisana, CEO and President of the HSRC, for supporting the R&D Survey. The support and contributions of Marjorie Pyoos, Godfrey Mashamba, Tshidi Mamogobo and other staff of the DST are appreciated.

The inputs and advice from Statistics South Africa during the finalisation of the report helped improve the quality of the publication. Their continued support and commitment towards ensuring quality R&D statistics is highly appreciated.

Interaction with, and feedback from, the Organisation for Economic Cooperation and Development (OECD) and the Working Party of National Experts on Science and Technology Indicators (NESTI) have been invaluable in assisting in improving quality and standards in conducting the South African R&D Surveys and analysing the results.

We are grateful to the respondents, whose cooperation we acknowledge, especially those that attended to the questionnaire under pressure and even outside working hours.

We acknowledge all the staff that contributed to conducting the survey, especially the CeSTII administration staff Valda West, Sumaya Abdullatief and the IT help desk operated by Noor Fakier.

Endorsement by Statistics South Africa

The methodology and data provided in this report have been approved by Statistics South Africa and awarded the seal of approval by the Statistician-General.

Foreword – Statistics South Africa

As part of the series of the National Survey of Research and Experimental Development (R&D Survey), the 2007/08 report has maintained the tradition both of substantively informing on national investment in scientific research activities and of providing the required data for monitoring levels of investment in R&D in South Africa. In particular, it provides the estimates of expenditure required for populating Indicator 10, expenditure on R&D as a percentage of GDP, in the *Development Indicators 2009* publication by the Presidency. The report is also consistently aligned with the previous two R&D Survey reports (2006/07 and 2005/06), apart from minor adjustments to the sampling methodology in the not-for-profit sector. The minor adjustments involved the introduction of a short questionnaire, which was administered together with the usual long questionnaire, in order "to collect the minimum information from those respondents that preferred a condensed version of the questionnaire to a long questionnaire". There are no noticeable contradictions either in the data provided or the trends between the results of the two questionnaires. The information coverage of the five sectors – the business enterprise, government, higher education, not-for-profit and science council sectors – is adequate. The methodology is adequate for the purpose, pending further refinement of sampling in the not-for-profit sector with support from Statistics South Africa. Given the very small size of the not-for-profit sector, relatively negligible bias in the results can be expected.

In the foreword to the report on the 2006/07 R&D Survey, I mentioned a pending review of the R&D Survey as part of the prescriptions of the South African Statistical Quality Assessment Framework (SASQAF) for statistical series with the status of official statistics as well as for initial alignment of the series with SASQAF requirements, as the series had been given the status of official statistics before the evolution of SASQAF in its present form. I am happy to report that the review has been completed and that we are awaiting the recommendations of the Data Quality Assessment Team (DQAT). Pending the implementation of the recommendations of the Department of Science and Technology (DST), supported by the Centre for Science, Technology and Innovation Indicators (CeSTII) of the Human Sciences Research Council (HSRC), the series retains its status as official statistics. The review report is due to be published in the near future.

The R&D Survey is part of the new strategic direction of Statistics South Africa. The series contributes specifically to three of the six strategic objectives of Stats SA. The first strategic objective is to lead the development and coordination of statistical production within the South African National Statistical System (NSS). This strategic objective is realised with respect to the R&D Survey through such measures as the development of statistical policy and regulation; strategy and planning (particularly the National Strategy for the Development of Statistics [NSDS]); coordination through a clearing house, standards setting, governance, as well as the provision of technical support in methodology, data management and quality improvement. The second objective is to expand the statistical information base by increasing its depth, breadth and geographical spread

through the coordination of a decentralised system of statistical production. The third objective is to enhance public confidence and trust in statistics by rolling out a quality management framework, promoting the development and maintenance of the framework, conducting independent quality assessments, and designating statistics as official. The enhancement of public confidence and trust in statistics provides the rationale for publication of the review of the quality of the R&D Survey.

Once again, I take pleasure in congratulating the DST on the leadership that the department has shown in furthering the cause of official statistics in South Africa.

Pali J Lehohla
Statistician-General
Republic of South Africa

Preface – Department of Science and Technology

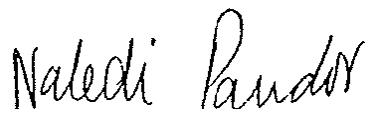
The National Survey of Research and Experimental Development (R&D) is conducted annually by the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicators (CeSTII) on behalf of the Department of Science and Technology.

R&D surveys provide data, collected under strict conditions of confidentiality that are essential for planning at system and institutional level and provide snapshots of key indicators of national competitiveness. The R&D Surveys involve the collection of primary data from the public and private sectors. The public sector includes universities, science councils and government department-based research institutes, and the private sector includes firms and not-for-profit organisations.

Between 2001 and 2006, there was a steady increase in South Africa's gross expenditure on R&D (GERD), which rose from 0.73% to 0.95% of GDP. However, the current survey points to a slight decrease in GERD to 0.93% of GDP. Over the same period, the South African economy performed favourably, attaining a GDP growth rate of around 5% and sustained employment growth from the beginning of 2005, which peaked in the third quarter of 2008. The R&D Survey results indicate that both the investment in R&D and the growth in the number of researchers lagged behind these important developments. These observations will be carefully analysed to identify any emerging trends and to inform appropriate policy responses that may be needed, especially if we are to attain the target of GERD reaching 1% of GDP.[1]

The next R&D Survey will cover the period 2008/09. The R&D Surveys, together with the findings of the Innovation Survey, provide the necessary data to assist my department in making informed decisions and fulfilling its leadership role in the national system of innovation.

We extend our appreciation to the CeSTII project team for their continued efforts. I would like to issue a special word of thanks to all the survey respondents in the higher education sector, science council, government and not-for-profit sectors, as well as the many senior executives in the business sector, who give their time so readily to make this survey a success.



Mrs GNM Pandor, MP
Minister of Science and Technology

[1] DST 2008. Ten Year Innovation Plan: innovation towards a knowledge-based economy 2008-2018. Pretoria: DST.

List of abbreviations

AIDS	Acquired immune deficiency syndrome
AISA	Africa Institute of South Africa
ARC	Agricultural Research Council
BERD	Business expenditure on R&D
BUS	Business
CEO	Chief executive officer
CeSTII	Centre for Science, Technology and Innovation Indicators
CGS	Council for Geoscience
CSIR	Council for Scientific and Industrial Research
DQAT	Data Quality Assessment Team
DG	Director-General
DST	Department of Science and Technology
FTE	Full-time equivalent
GDP	Gross domestic product
GERD	Gross expenditure on research and development
GOV	Government
GOVERD	Government expenditure on research and experimental development
GUF	General university funds
HEMIS	Higher Education Management Information System
HERD	Higher education expenditure on R&D
HIV	Human immunodeficiency virus
HoD	Head of Department
HSRC	Human Sciences Research Council
ICT	Information and communication technology
IT	Information technology
Mintek	Council for Mineral Technology
MRC	Medical Research Council
NESTI	National Experts on Science and Technology Indicators
NSDS	National Strategy for the Development of Statistics
MTEF	Medium-term Expenditure Framework
NPO	Not-for-profit organisation
NRF	National Research Foundation
NSS	National Statistical System
OECD	Organisation for Economic Co-operation and Development
R	Rand (South African currency)
RF	Research field
R&D	Research and experimental development
S&T	Science and technology
SABS	South African Bureau of Standards
SARB	South African Reserve Bank
SASQAF	South African Statistics Quality Assessment Framework
SEO	Socio-economic objective

SIC	Standard Industrial Classification
SMRS	Survey Management and Results System
SPII	Support Programme for Industrial Innovation
Stats SA	Statistics South Africa
TB	Tuberculosis
THRIP	Technology and Human Resources for Industry Programme
VAT	Value-added tax

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List of Tables & Figures

Executive Summary

A brief summary of the key findings of CeSTII's sixth National Survey of Research and Experimental Development (R&D), for the financial year 2007/08, is provided in this section. This summary includes important background information and the key findings of the 2007/08 survey.

Background information

The National Surveys of Research and Experimental Development are conducted annually by CeSTII and are submitted to the Department of Science and Technology (DST) and Statistics South Africa (Stats SA) for approval.[2] The 2007/08 survey results discussed in this document are endorsed by Stats SA as official statistics.

The survey methodology follows the Organisation for Economic Co-operation and Development's (OECD) *Frascati Manual* guidelines (OECD 2002). The survey measures inputs into R&D. The indicators and data tables provided in this report comprise the main subset of the science and technology (S&T) indicators and data tables specified by the OECD for R&D surveys. Once these results are officially approved, they are submitted to the OECD on an annual basis for inclusion in OECD publications such as the *OECD Main S&T Indicators* and the accompanying *OECD Science, Technology and Industry Scoreboard*. The Directorate for Science, Technology and Industry of the OECD provides ongoing advice with regard to the R&D Survey and related work at CeSTII. Through this process, the South African R&D Survey results have become compliant with international best practice, as recommended by the OECD, and can be reliably compared with the results of surveys from other countries.

Summary of key findings

Over the past few years, there has been a steady increase in gross expenditure on R&D (GERD) as a percentage of the gross domestic product (GDP). However, the 2007/08 survey points to a slight decrease in GERD relative to GDP. During this survey period, the South African economy performed favourably, with a GDP growth rate of around 5% and sustained employment growth since 2005. There was real growth in R&D expenditure in the country over the period. There was also growth in R&D personnel in terms of both headcounts and full-time equivalents (FTEs). However, the growth in R&D personnel lagged behind the relatively high GDP growth rate and employment growth during the reference period. For the first time, the 2007/08 R&D Survey recorded that more than 40% of all researchers in South Africa were women in 2007/08. A summary of the key findings follows:

- R&D expenditure in South Africa has shown steady growth in both nominal and real terms over the last few years. GERD increased from R16.520 billion to R18.624 billion between 2006/07 and 2007/08. This represents a nominal annual increase of 12.8% (compared with a 16.8% increase between 2005/06 and 2006/07). In real terms (constant year 2000 Rand), R&D expenditure increased by 3.1% which is less than the 8.7% increase between 2005/06 and 2006/07. Table E1 and Figure E.1 provide a breakdown by sector of national in-house or intra-mural R&D, which totalled R18.6 billion in 2007/08.

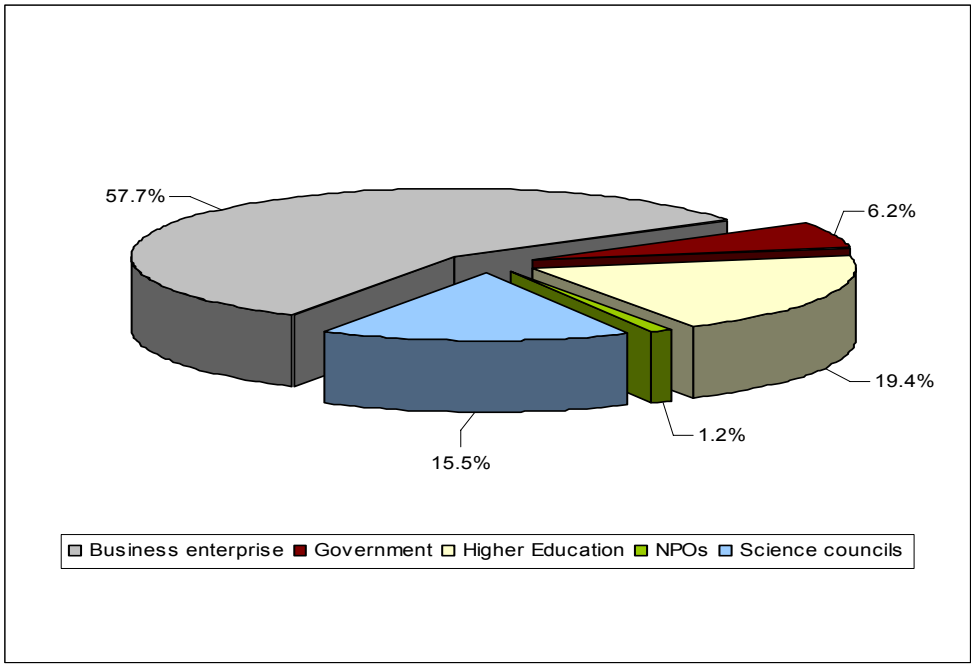
[2] Note that the R&D Survey is under review by Stats SA as part of the South African Statistics Quality Assessment Framework (SASQAF), which is aimed at ensuring that the R&D Survey produces quality statistics.

Table E1: Total in-house R&D expenditure by sector (2007/08 and 2006/07)

Sector	2007/08		2006/07	
	R'000	%	R'000	%
Business enterprise	10 738 456	57.7	9 243 165	55.9
Government	1 154 399	6.2	1 021 355	6.2
Higher education	3 621 862	19.4	3 298 808	20.0
Not-for-profit	223 202	1.2	212 538	1.3
Science councils	2 886 094	15.5	2 744 718	16.6
Total GERD	18 624 013	100*	16 520 584	100*

*Subject to rounding error

Figure E1: Total in-house R&D expenditure by sector (2007/08)



- GERD expressed as a percentage of GDP provides an indication of the concentration or intensity of R&D in an economy. GERD as a percentage of GDP had been increasing steadily since 2001/2, but the current figures show that GERD as a percentage of GDP decreased slightly from 0.95% in 2006/07 to 0.93% in 2007/08.

- South Africa had a total of 1.5 FTE researchers per 1 000 total employment in 2007/08. Compared with OECD other countries, this key indicator remain at a relatively low level. Table E2 depicts the main findings with respect to human resources by sector (by headcount).

Table E2: Headcount of R&D personnel by sector (2007/08)

Sector	Researchers	Technicians	Other personnel directly supporting R&D	Total	Percentage
Business enterprise	8 336	5 303	4 312	17 951	36.9
Government	1 138	739	917	2 794	5.7
Higher education*	17 008	2 006	2 351	21 365	44.0
Not-for-profit	264	77	161	502	1.0
Science councils	2 594	1 351	2 043	5 988	12.3
Total	29 340	9 476	9 784	48 600	100*

*Subject to rounding error

- The number of women researchers as a percentage of total researchers in South Africa increased slightly from 39.7% in 2006/07 to 40.3% in 2007/08.[3]

- The business enterprise sector is the largest R&D-performing sector in South Africa. Business expenditure on R&D (BERD) as a percentage of total R&D expenditure amounted to 57.7% in 2007/08, increasing from 55.9% the previous year. The share of R&D performed by the higher education sector dropped slightly from 20.0% in 2006/07 to 19.4% in 2007/08. The government sector's share of R&D expenditure remained constant at 6.2%. The not-for-profit sector's share of R&D performance dropped from 1.3% in 2006/07 to 1.2% in 2007/08.

- The business sector's expenditure on R&D (BERD) amounted to R10.74 billion in 2007/08, followed by expenditure by higher education at R3.62 billion; science councils at R2.88 billion; government at R1.15 billion and NPOs at R223 202. In 2007/08, business provided R&D funding amounting to R7.95 billion, or 42.7% of the total. Between 2006/07 and 2007/08, government funding of R&D increased from R6.67 billion to R8.51 billion. Foreign funding of R&D increased from R1.75 billion (or 10.6%) in 2006 to R1.99 billion (or 10.7%) in 2007.

- R&D expenditure in the engineering sciences increased from 20.9% of total R&D expenditure in 2006/07 to 22.5% in 2007/08. The social sciences and humanities also increased their share of R&D performance from 11.8% of the total in 2006/07 to 12.4% in 2007/08. R&D expenditure on the natural sciences increased slightly from 20.3% in 2006/07 to 20.4% in 2007/08. R&D expenditure on information, computer and communication technologies remained constant at 14.0% of the total. The medical and health sciences, agricultural sciences, and applied sciences and technologies all showed a slight decrease in their shares of R&D expenditure.

- R&D expenditure on experimental development accounted for 45.2% of total R&D expenditure in 2007/08, down from 46.3% in 2006/07. The share of R&D expenditure on applied research also dropped, from 35.1% to 34.2%. The share of R&D expenditure devoted to basic research increased from 18.6% in 2006/07 to 20.6% in 2007/08.

[3] Note that these figures include doctoral students and postdoctoral fellows, but excludes masters students as researchers, as per the OECD definitions.

Chapter 1: Introduction to the Survey

This chapter includes important background information and the key findings of the 2007/08 survey.

1.1 Methodology

This section provides a definition of R&D and brief comments regarding the methodology, sampling and fieldwork aspects of the survey. The R&D Survey is carried out according to the guidelines of the OECD's *Frascati Manual*. The survey adheres to the definition of R&D given in the *Frascati Manual* (OECD, 2002).

> *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.*

Within the boundaries of this definition, shifts in the nature of R&D occur continually, particularly as industrialised societies progress to become 'knowledge economies', in which employment is dominated by the service sector.

Following the *Frascati Manual*, the survey covered the following sectors:

- The ***business enterprise sector***, comprising large, medium and small enterprises, including state-owned enterprises. Note that in accordance with OECD methodology, state-owned enterprises were also included in the business sector data and accounted for approximately 20% of business expenditure on R&D (BERD)
- The ***government sector***, comprising departments with an R&D component in the three tiers of government (national, provincial and local), government research institutes and museums
- The ***higher education sector***, comprising all public higher education institutions and one private higher education institution with an R&D component
- The ***not-for-profit sector***, comprising non-governmental and other organisations formally registered as not-for-profit institutions
- The ***science council sector***, comprising the nine science councils established through Acts of Parliament.

The survey data were captured using a questionnaire that was largely common across the five sectors. The work of the survey relies on the development and updating of appropriate sector sampling methodologies and sector-specific questionnaires, the development of capacity and diversity in the project team, and the modification of the database in which the data are captured, namely the Survey Management and Results System (SMRS).

The sectors were surveyed during the period November 2008 to June 2009. For science councils and all government departments, the survey covered expenditure in the year starting on 1 April 2007 and ending on 31 March 2008. The business enterprise and not-for-profit sectors gathered data for the financial year ending on 28 February 2008 (or for the nearest complete financial year).

For higher education, this was the 2007 academic (calendar) year. The bulk of R&D activities recorded for all sectors thus occurred during 2007 or the 2007/08 fiscal year.

Questionnaires were administered by several means, including the post, face-to-face interviews, electronically and telephonically. Returns were similarly gathered, and telephonic follow-ups were used for the completion and verification of information recorded in the questionnaires. Where necessary, organisations were assisted in compiling and submitting their returns.

As in previous R&D Surveys, the lists of research fields and socio-economic objectives are compatible with the systems used by OECD countries. The Standard Industrial Classification (SIC) codes that were used are those provided by Statistics South Africa.

Note that the R&D Survey template, which is available in *Annexure I*, contains all the relevant definitions.

1.2 Sampling

The business sector draws a purposive sample from the business register developed and maintained by CeSTII since 2002.[4] Business rankings such as the Technology Top 100 and the JSE 100, as well as other available information, are used to build the business register on an ongoing basis.

Government departments are surveyed by using a census approach. All national government departments, associated research institutes and museums performing R&D at national, provincial and local levels are accordingly included in the government sector sample.

Higher education institutions (namely, universities, universities of science and technology, institutes of education and private higher education institutions) are included in the higher education sector sample. All public higher education institutions are sampled through a census survey, while private institutions are surveyed purposively.

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

The nine statutory science councils, which have been established through Acts of Parliament, are surveyed following a census approach.

1.3 Key indicators

The data tables and indicators provided in this section comprise the main subset of S&T indicators specified for R&D surveys by the OECD. Economic indicators for 2006/07 and 2007/08 are shown in Table 1.1.

[4] Note that this is the in-house CeSTII business register, which has been developed by CeSTII from a variety of sources.

Table 1.1 Economic indicators (2007/08 and 2006/07)

Indicator	Value 2007/08	Value 2006/07
GDP: Current prices (Rand million)	1 999 086	1 745 217
GDP: 2000 Constant prices (Rand million)	1 233 930*	1 174 078*
Purchasing power parity (Rands per US$)	4.27	4.01
Value added in industry (Rand million)	1 349 883	1 144 097
Implicit GDP price index (base year 2000 = 1.00)	1.620	1.481
National population (thousands)	48 577	47 892
Total employment (thousands)	13 234	12 451
Industrial employment (thousands)	10 024	9 590

* Stats SA P0441. Gross Domestic Product (GDP), 2Q 2009.

Source: OECD Main Science and Technology Indicators (2009/1).

GDP increased between 2006/07 and 2007/08, and there was real economic growth of approximately 5% in 2007/08, which was lower than the growth of 5.4% recorded for 2006 (SARB, 2008). The Consumer Price Inflation Index accelerated in 2007 and reached a rate of 8.8% in January 2008, which was the highest level since 2003 (SARB, 2008). As a result, domestic expenditure slowed considerably in 2007. Table 1A indicates that employment creation took place in 2007 in terms of both total and industrial employment. It is clear that the economic environment was relatively favourable in 2007. Table 1.2 shows the key R&D figures and indicators for South Africa for 2007/08 compared with 2006/07.

Table 1.2 Key R&D figures and indicators (2007/08 and 2006/07)

Indicator	Value 2007/08	Value 2006/07
Gross domestic expenditure on R&D (GERD) (Rand million)	18 624.0	16 520.6
GERD as a percentage of GDP	0.93	0.95
Total R&D personnel (FTE)[a]	31 352	30 986
Total researchers (FTE)[b]	19 320	18 572
Total researchers per 1 000 total employment (FTE)[c]	1.5	1.5
Total R&D personnel per 1 000 total employment (FTE)	2.4	2.5
Civil GERD as a percentage of GDP*	0.87	0.89
Total researchers (headcount)	40 084	39 591
Women researchers as a percentage of total researchers	40.3	39.7

a. FTE: Full-time equivalent

b. Following OECD practice, doctoral students and postdoctoral fellows are included as researchers

c. Sourced from OECD *Main Science and Technology Indicators (2009/1)*

* Civil GERD excludes R&D on defence.

Table 1B indicates that gross domestic expenditure on R&D (GERD) amounted to R18 264 million in 2007/08. This figure increased by R2 103.4 million from the previous survey in 2006/07. GERD as a percentage of GDP, however, decreased slightly from 0.95% in 2006/07 to 0.93% in 2008/09.

The positive developments reflected in the key 2007/08 results include growth in total R&D personnel both in terms of headcounts and full-time equivalents (FTEs). Women researchers as a percentage of total researchers comprised more that 40% of the total R&D workforce. This indicator increased by 0.6% from the previous survey round.

Summary tables presenting indicators for parameters common across the five sectors follow (Tables 1.3 to 1.13).

*Table 1.3: R&D expenditure by sector (2007/08) (current and constant year 2000 prices, R'000)**

Expenditure	Business enterprise	Government	Higher education	Not-for-profit	Science councils	GERD
Current (R'000)	10 738 456	1 154 399	3 621 862	223 202	2 886 094	18 624 013
Constant 2000 prices (R'000)	6 420 499	709 455	2 291 422	147 633	1 906 539	11 475 549
Percentage	55.9	6.2	20.0	1.3	16.6	100

*Subject to rounding error

*Table 1.4: R&D expenditure by accounting category (2007/08)**

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	1 445 305	13.5	100 324	8.7	295 813	8.2	7 025	3.1	205 857	7.1	2 054 324	11.0
Land: Buildings and other structures	262 994	2.4	19 366	1.7	51 734	1.4	2 959	1.3	30 704	1.1	367 757	2.0
Vehicles, plant, machinery, equipment	1 182 311	11.0	80 958	7.0	244 079	6.7	4 066	1.8	175 153	6.1	1 686 567	9.1
Current expenditure	9 293 151	86.5	1 054 075	91.3	3 326 049	91.8	216 177	96.9	2 680 237	92.9	16 569 689	89.0
Labour costs	4 881 074	45.5	464 160	40.2	1 466 379	40.5	109 147	48.9	1 250 480	43.3	8 171 240	43.9
Total cost of R&D postgraduate students	0	0.0	0	0.0	495 128	13.7	0	0.0	0	0.0	495 128	2.7
Other current expenditure	4 412 077	41.1	589 915	51.1	1 364 542	37.7	107 030	48.0	1 429 757	49.5	7 903 321	42.4
Total	10 738 456	100	1 154 399	100.	3 621 862	100	223 202	100	2 886 094	100	18 624 013	100

*Subject to rounding error

*Table 1.5: R&D expenditure by source of funds (2007/08)**

Source of funds	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R'000	%	R'000	%	R'000	%	R'000	%	R'000	%	R'000	%
Own funds	6 916 974	64.4	727 996	63.1	1 734 903	47.9	6 325	2.8	422 811	14.6	9 809 009	52.7
Internal resources	6 916 974	64.4	727 996	63.1	1 734 903	47.9	6 325	2.8	422 811	14.6	9 809 009	52.7
Government	2 326 728	21.7	363 053	31.4	1 026 654	28.3	33 399	15.0	1 874 511	64.9	5 624 345	30.2
Grants	1 829 489	17.0	361 416	31.3	N/A	N/A	18 301	8.2	1 086 663	37.7	3 295 869	17.7
Contracts	497 239	4.6	1 637	0.1	N/A	N/A	15 098	6.8	787 848	27.3	1 301 822	7.0
All government, research agencies, agency funding and science councils	N/A	N/A	N/A	N/A	1 026 654	28.3	N/A	N/A	N/A	N/A	1 026 654	5.5
Business	216 939	2.0	5 343	0.5	519 804	14.4	23 791	10.7	263 098	9.1	1 028 975	5.5
Local business	216 939	2.0	5 343	0.5	519 804	14.4	23 791	10.7	263 098	9.1	1 028 975	5.5
Other South African sources	97 622	0.9	1 835	0.2	20 215	0.6	28 162	12.6	26 768	0.9	174 602	0.9
Higher education	1 816	0.0	0	0.0	7 010	0.2	3 134	1.4	3 353	0.1	15 313	0.1
Not-for-profit organisations	18 900	0.2	278	0.0	10 171	0.3	18 758	8.4	21 608	0.7	69 715	0.4
Individual donations	76 906	0.7	1 557	0.1	3 034	0.1	6 270	2.8	1 807	0.1	89 574	0.5
Foreign	1 180 193	11.0	56 172	4.9	320 286	8.8	131 525	58.9	298 906	10.4	1 987 082	10.7
Parent company	424 409	4.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	424 409	2.3
Foundations	5	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5	0.0
All sources	755 779	7.0	56 172	4.9	278 708	7.7	131 525	58.9	298 906	10.4	1 521 090	8.2
Total	10 738 456	100	1 154 399	100	3 621 862	100	223 202	100	2 886 094	100	18 624 013	100

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

*Table 1.6: Provincial split of R&D (2007/08)**

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	283 488	2.6	122 191	10.6	276 740	7.6	6 164	2.8	138 342	4.8	826 925	4.4
Free State	786 225	7.3	62 116	5.4	180 713	5.0	1 255	0.6	67 901	2.4	1 098 210	5.9
Gauteng	6 142 233	57.2	292 757	25.4	1 260 991	34.8	115 499	51.7	1 809 272	62.7	9 620 752	51.7
KwaZulu-Natal	1 302 260	12.1	76 458	6.6	459 299	12.7	42 141	18.9	201 009	7.0	2 081 166	11.2
Limpopo	71 687	0.7	40 217	3.5	79 716	2.2	4 602	2.1	67 562	2.3	263 784	1.4
Mpumalanga	196 368	1.8	74 690	6.5	105 629	2.9	9 930	4.4	66 333	2.3	452 950	2.4
North-West	193 339	1.8	42 500	3.7	166 137	4.6	2 207	1.0	49 390	1.7	453 574	2.4
Northern Cape	7 450	0.1	66 921	5.8	48 277	1.3	2 038	0.9	45 250	1.6	169 937	0.9
Western Cape	1 755 404	16.3	376 550	32.6	1 044 360	28.8	39 367	17.6	441 036	15.3	3 656 717	19.6
Total	10 738 456	100	1 154 399	100	3 621 862	100	223 203	100	2 886 094	100	18 624 014	100

*Subject to rounding error

Table 1.7: R&D expenditure by research field (2007/08)

Main research field	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: Natural sciences, technology and engineering	**10 357 433**	**96.5**	**874 425**	**75.7**	**2 389 525**	**65.98**	**61 494**	**27.6**	**2 623 455**	**90.9**	**16 306 332**	**87.6**
Mathematical sciences	176 077	1.6	20, 43	1.8	109 354	3.0	0	0.0	35 551	1.2	341 624	1.8
Physical sciences	507 646	4.7	45 052	3.9	146 726	4.1	0	0.0	93 583	3.2	793 006	4.3
Chemical sciences	580 146	5.4	22 672	2.0	143 897	4.0	0	0.0	37 430	1.3	784 145	4.2
Earth sciences	93 014	0.9	161 815	14.0	121 419	3.4	459	0.2	147 427	5.1	524 133	2.8
Information, computer and communication technologies	2 182 253	20.3	82 123	7.1	119 600	3.3	1 446	0.6	212 796	7.4	2 598 218	14.0
Applied sciences and technologies	1 581 438	14.7	15 286	1.3	96 972	2.7	0	0.0	138 849	4.8	1 832 546	9.8
Engineering sciences	3 237 265	30.1	14 164	1.2	294 630	8.1	0	0.0	643 349	22.3	4 189 408	22.5
Biological sciences	161 058	1.5	113 409	9.8	271 216	7.5	2 005	0.9	175 592	6.1	723 280	3.9
Agricultural sciences	311 287	2.9	208 662	18.1	159 793	4.4	18 324	8.2	566 561	19.6	1 264 628	6.8
Medical and health sciences	1 268 551	11.8	173 929	15.1	785 630	21.7	29 603	13.3	358 726	12.4	2 616 439	14.0
Environmental sciences	62 355	0.6	8 589	0.7	58 793	1.6	7 363	3.3	85 414	3.0	222 514	1.2
Material sciences	184 625	1.7	637	0.1	72 484	2.0	0	0.0	108 068	3.7	365 813	2.0
Marine sciences	11 719	0.1	7 445	0.6	9 013	0.2	2 294	1.0	20 108	0.7	50 579	0.3
Division 2: Social sciences and humanities	**381 023**	**3.5**	**279 974**	**24.3**	**1 232 337**	**34.02**	**161 708**	**72.4**	**262 639**	**9.1**	**2 317 681**	**12.4**
Social sciences	380 554	3.5	235 299	20.4	796 281	22.0	159 155	71.3	238 019	8.2	1 809 308	9.7
Humanities	469	0.0	44 676	3.9	436 056	12.0	2 553	1.1	24 620	0.9	508 373	2.7
Total	**10 738 456**	**100**	**1 154 399**	**100.**	**3 621 862**	**100**	**223 202**	**100**	**2 886 094**	**100**	**18 624 013**	**100**

Table 1.8: R&D expenditure by socio-economic objective (2007/08)

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	**900 909**	**8.4**	**0**	**0.0**	**4 328**	**0.1**	**1 438**	**0.6**	**228 603**	**7.9**	**1 135 278**	**6.1**
Defence	900 909	8.4	0	0.0	4 328	0.1	1 438	0.6	228 603	7.9	1 135 278	6.1
Division 2: Economic development	**8 399 187**	**78.2**	**429 646**	**37.2**	**1 271 620**	**35.1**	**63 450**	**28.4**	**1 560 688**	**54.1**	**11 724 590**	**63.0**
Economic development unclassified	0	0.0	0	0.0	171 520	4.7	0	0.0	0	0.0	171 520	0.9
Plant production and plant primary products	279 437	2.6	79 290	6.9	123 126	3.4	16 030	7.2	433 850	15.0	931 733	5.0
Animal production and animal primary products	786 57	0.7	79 997	6.9	95 219	2.6	918	0.4	25 124	0.9	279 914	1.5
Mineral resources (excluding energy)	937 628	8.7	0	0.0	74 725	2.1	0	0.0	63 469	2.2	10 75 821	5.8
Energy resources	585 453	5.5	0	0.0	84 459	2.3	1 000	0.4	38 979	1.4	709 891	3.8
Energy supply	252 064	2.3	14 290	1.2	96 209	2.7	1 438	0.6	874	0.0	364 876	2.0
Manufacturing	2 117 823	19.7	318	0.0	172 947	4.8	0	0.0	385 822	13.4	2 676 911	14.4
Construction	1 017 969	9.5	3 219	0.3	28 313	0.8	0	0.0	101 232	3.5	1 150 733	6.2
Transport	523 022	4.9	15 386	1.3	22 770	0.6	70	0.0	33 817	1.2	595 065	3.2
Information and communication services	1 087 198	10.1	69 318	6.0	67 026	1.9	0	0.0	17 429	0.6	1 240 972	6.7
Commercial services	1 347 470	12.5	6 897	0.6	93 285	2.6	782	0.4	8 975	0.3	1 457 410	7.8
Economic framework	41 756	0.4	98 537	8.5	164 759	4.5	36 588	16.4	206 878	7.2	548 517	2.9
Natural resources	130 711	1.2	62 394	5.4	77 260	2.1	6 624	3.0	244 239	8.5	521 228	2.8
Division 3: Society	**915 567**	**8.5**	**265 948**	**23.0**	**1 149 091**	**31.7**	**129 159**	**57.9**	**368 010**	**12.8**	**2 827 775**	**15.2**
Society unclassified	0	0.0	0	0.0	171 520	4.7	0	0.0	0	0.0	171 520	0.9
Health	857 364	8.0	69 493	6.0	556 914	15.4	33 549	15.0	272 905	9.5	1 790 225	9.6
Education and training	12 204	0.1	111 407	9.7	195 917	5.4	32 161	14.4	37 449	1.3	389 138	2.1
Social development and community services	45 999	0.4	85 048	7.4	224 740	6.2	63 449	28.4	57 656	2.0	476 892	2.6
Division 4: Environment	**164 552**	**1.5**	**103 372**	**9.0**	**317 863**	**8.8**	**5 885**	**2.6**	**263 325**	**9.1**	**854 997**	**4.6**
Environment unclassified		0.0		0.0	57 173	1.6	0	0.0	0	0.0	57 173	0.3
Environmental knowledge	62 551	0.6	71 734	6.2	108 189	3.0	2 553	1.1	130 041	4.5	375 069	2.0
Environmental aspects of development	33 901	0.3	20 797	1.8	93 853	2.6	559	0.3	46 190	1.6	195 300	1.0
Environmental and other aspects	68 100	0.6	10 841	0.9	58 648	1.6	2 773	1.2	87 094	3.0	227 455	1.2
Division 5: Advancement of knowledge	**358 242**	**3.3**	**355 434**	**30.8**	**878 959**	**24.3**	**23 271**	**10.4**	**465 468**	**16.1**	**2 081 375**	**11.2**
Advancement of knowledge unclassified	0	0.0	0	0.0	171 520	4.7	0	0.0	0	0.0	171 520	0.9
Natural sciences, technologies and engineering	353 694	3.3	324 409	28.1	416 081	11.5	459	0.2	361 714	12.5	1 456 357	7.8
Social sciences and humanities	4 548	0.0	31 025	2.7	291 359	8.0	22 812	10.2	103 754	3.6	453 498	2.4
Total	10 738 457	100	1 154 400	100	3 621 862	100	223 203	100	2 886 094	100	18 624 015	100

Table 1.9: R&D personnel: headcount by sector (2007/08)

Occupation	Business enterprise	Govern-ment	Higher education*	Not-for-profit	Science council	Total	%
Researchers	8 336	1 138	27 752	264	2 594	40 084	67.5
Technicians	5 303	739	2 006	77	1 351	9 476	16.0
Other personnel directly supporting R&D	4 312	917	2 351	161	2 043	9 784	16.5
Total	17 951	2 794	32 109	502	5 988	59 344	100
Percentage	30.2	4.7	54.1	0.8	10.1	100	

*Including doctoral and postdoctoral students

Table 1.10: R&D personnel: Full-time equivalent by sector (2007/08)

Occupation	Business enterprise	Govern-ment	Higher education*	Not-for-profit	Science councils	Total	%
Researchers	6 047.5	757.6	9 999.4	215.6	2 300.2	19 320.3	61.6
Technicians	3 796.4	495.6	612.8	56.5	1 099.2	6 060.5	19.3
Other personnel directly supporting R&D	2 617.4	696.9	893.0	107.0	1 659.4	5 973.7	19.1
Total	12 461	1 950	11 505	379	5 059	31 354	100
Percentage	39.7	6.2	36.7	1.2	16.1	100	

*Including doctoral and postdoctoral students

Table 1.11: Expenditure on multidisciplinary R&D areas (2007/08)

Multidisciplinary R&D area	Business enterprise		Government		Higher education		Not-for-profit		Science councils		Total	
	R'000	%	R'000	%	R'000	%	R'000	%	R'000	%	R'000	%
Biotechnology	169 410	1.6	8 639	0.7	253 872	7.0	491	0.2	216 292	7.5	648 704	3.5
Nanotechnology	30 314	0.3	0	0.0	170 405	4.7	0	0.0	47 802	1.7	248 521	1.3
Total	199 724	1.9	8 639	0.7	424 277	11.7	491	0.2	264 094	9.2	897 225	4.8
Total R&D expenditure	10 738 456	100	1 154 399	100	3 621 862	100	223 202	100.	2 886 094	100	18 624 013	100

*Table 1.12: Expenditure on national R&D priority areas (2007/08)**

National R&D priority area	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	114 195	1.1	21 494	1.9	41 234	1.1	0	0.0	77 885	2.7	254 808	1.4
New materials	72 992	0.7	630	0.1	160 993	4.4	0	0.0	64 131	2.2	298 746	1.6
Tuberculosis (TB), HIV//AIDS, malaria	302 122	2.8	263	0.0	583 726	16.1	0	0.0	233 917	8.1	1 120 028	6.0
Total	489 309	4.6	22 387	1.9	785 953	21.7	0	0.0	375 933	13.0	1 673 582	9.0
Total R&D expenditure	10 738 456	100	1 154 399	100	3 621 862	100	223 202	100	2 886 094	100	18 624 013	100

*Subject to rounding error

*Table 1.13: R&D personnel: headcount by personnel category, race, gender and qualification (2007/08)**

Qualification	African		Coloured		Indian		White		Subtotal		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	842	382	224	131	323	176	3 891	1 787	5 281	2 476	7 756
Masters, honours, bachelors or equivalent	2 377	1 670	407	348	766	609	6 342	4 241	9 892	6 869	16 762
Diplomas	681	636	189	96	282	273	1 706	960	2 857	1 965	4 822
Subtotal	3 900	2 688	820	575	1 371	1 058	11 938	6 988	18 030	11 310	29 340
Technicians directly supporting R&D											
Doctoral degree or equivalent	9	14	0	1	0	1	62	47	71	63	134
Masters, honours, bachelors or equivalent	446	430	137	86	141	100	1 111	769	1 835	1 386	3 221
Diplomas	1 401	828	518	184	271	192	1 939	787	4 129	1 992	6 121
Subtotal	1 856	1 272	656	271	412	294	3 112	1 604	6 035	3 441	9 476
Other personnel directly supporting R&D											
Doctoral degree or equivalent	69	45	10	4	13	28	111	95	203	171	374
Masters, honours, bachelors or equivalent	258	362	41	88	47	46	389	499	735	994	1 729
Diplomas	2 611	1 293	516	443	198	156	864	1 599	4 190	3 491	7 681
Subtotal	2 939	1 699	568	536	258	230	1 364	2 192	5 128	4 656	9 784
Total	8 694	5 660	2 044	1 382	2 041	1 581	16 414	10 784	29 193	19 407	48 600

* Note that this table excludes postgraduate students and postdoctoral fellows (see Tables H4 and H11 for such figures).

1.4 Outline of the report

The five sector reports are presented in Chapters 2 to 6, which are structured according to the following sections:

- Introduction
- Survey methods
- Key results
- Detailed results.

Chapter 2: Business Sector

2.1 Introduction

This section presents the business sector survey results from the last three survey rounds: 2007/08, 2006/07 and 2005/06.

Table B1: In-house R&D expenditure by sector (2007/08, 2006/07 and 2005/06)

Sector	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Business enterprise	10 738 456	57.7	9 243 165	55.9	8 243 776	58.3
Government	1 154 399	6.2	1 021 355	6.2	844 640	6.0
Higher education	3 621 862	19.4	3 298 808	20.0	2 732 215	19.3
Not-for-profit	223 202	1.2	212 538	1.3	226 514	1.6
Science councils	2 886 094	15.5	2 744 718	16.6	2 102 094	14.9
Grand total	18 624 013	100	16 520 584	100	14 149 239	100

Table B1 indicates that the business sector remained the largest contributor to GERD. Business sector expenditure on research and development (BERD) comprised 57.7% of GERD in 2007/08, compared with 55.9% in 2006/07. BERD increased from R9 243 million in 2006/07 to R10 738 million in 2007/08.

2.2 Survey methods

The 2007/08 business sector survey questionnaire was not changed from the 2006/07 format; except for excluding one question on collaborative R&D. The business survey register, developed by CeSTII, was used to draw a purposive sample for the questionnaire. All known R&D performers were thus surveyed. The register is continually maintained and updated; contact details are verified, and the number of businesses that might be involved in R&D is expanded by using register-building techniques. The sample therefore comprised:

- Known R&D performers surveyed in the pervious survey round
- New contacts obtained through systematic intelligence-gathering. Business rankings such as the Technology Top 100 and the JSE 100 are considered, and other available information (including information from THRIP, SPII, the Innovation Fund, the media; trade publications and referrals) is used to build the business register on an ongoing basis.

In addition to the use of the questionnaire, major R&D performers were also interviewed. For this survey round, interviews were conducted with healthcare, pharmaceutical, software, and information and communication technology (ICT) companies. The research effort focused on surveying all major R&D contributors, while simultaneously aiming to expand the sample by identifying new companies that might be performing R&D, as well as surveying smaller companies with R&D activity in order to determine total business expenditure on R&D.

Enterprises are systematically interrogated to varying degrees of emphasis according to their R&D expenditure and known historic data. It should be noted in this regard that the majority of R&D expenditure is incurred by a small proportion of the largest R&D performers.

The business sector register contains 3 190 companies. Concerted efforts were made in the 2007/08 survey round to expand the register, obtain the correct contact details of companies on the register and determine which of these companies were actively involved in R&D. This is a continuous process.

After all expired, non-traceable companies, which are non-units of measure, as well as companies purposively not surveyed had been removed from the sample; the business sector sample totalled 1 767 companies, as indicated in Table B2.[5]

Table B2: Business sector fieldwork sample (2007/08, 2006/07 and 2005/06)

Business sector sample	2007/08		2006/07		2005/06	
Sample	1 767	100%	1 699	100%	1 726	100%
Response	1 116	63.2%	1 055	61.1%	1 298	84.0%
No R&D	393	22.2%	360	21.2%	448	26.0%
R&D performed	723	40.9%	677	39.8%	607	35.2%
No response	651	36.8%	622	39.0%	671	38.9%

2.3 Key results

The main characteristics of the business sector are provided in Table B3.

Table B3: Main characteristics of R&D (Rand current) (2007/08, 2006/07 and 2005/06)

Main characteristics	2007/08	2006/07	2005/06
BERD (Rand million)	10 738	9 243	8 244
BERD as % of GDP	0.54%	0.53%	0.54%
% of BERD financed by industry	66.4%	69.4%	68.3%
% of BERD financed by government	21.7%	19.1%	16.2%
% of BERD financed by other national sources	0.9%	0.9%	1.0%
% of BERD financed from abroad	11.0%	10.6%	14.5%
Total business sector R&D personnel (FTE)	12 461	12 595	12 236
Total business sector researchers (FTE)	6 047	6 111	5 896

The main characteristics of R&D indicate that BERD increased by R1 495 million between 2006/07 and 2007/08. BERD as a percentage of GDP increased from 0.53% in 2006/07 to 0.54% in 2007/08.

[5] Note that: the sample increased from the previous years, the response rate increased to 63.2% in 2007/08 from 61.1% in 2006/07 and the number of companies that performed R&D also increased from the 2006/07 and 2005/06 survey rounds.

An interesting trend is that BERD financed by industry declined by 3% between 2006/07 and 2007/08, while government financial support for R&D performed by businesses increased by 2.6% over the same period.

The percentage of BERD financed from other national sources remained at 0.9%, while BERD financed from abroad increased from 10.6% of BERD in 2006/07 to 11.0% in 2007/08. This is nevertheless still lower than the 14.5% recorded in 2005/06. Total business sector R&D personnel and business sector researchers both declined slightly from 2006/07 by 134 and 64 FTEs respectively. Table B4 indicates the headcount of R&D personnel by sector.

Table B4: Headcount of R&D personnel by sector (2007/08 and 2006/07)

Sector	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D		Grand total		Percentage	
	07/08	06/07	07/08	06/07	07/08	06/07	07/08	06/07	07/08	06/07
Business enterprise	8 336	8 227	5 303	5 113	4 312	4 127	17 951	17 467	36.9	36.1
Government	11 38	1 111	739	831	917	982	2 794	2 924	5.7	6.0
Higher education	17 008	17 459	2 006	2 170	2 351	2 117	21 365	21 746	44.0	44.9
Not-for-profit	264	252	77	77	161	155	502	484	1.0	1.0
Science councils	2 594	2 255	1 351	1 570	2 043	1 973	5 988	5 798	12.3	12.0
Grand total	29 340	29 304	9 476	9 761	9 784	9 354	48 600	48 419	100	100
Higher education doctoral and postdoctoral students	10 744	10 287	0	0	0	0	10 744	10 287	0	0
Total	40 084	39 591	9 476	9 761	9 784	9 354	59 344	58 706	100	100

In terms of headcount, the total number of R&D personnel increased by 484 between 2006/07 and 2007/08, despite declining FTE numbers. Increased numbers were experienced in all personnel categories (namely, researchers, technicians and support personnel). The business sector employed 36.9% of all R&D personnel in 2007/08, compared with 36.1% in 2006/07. The business sector is thus the second largest employer of R&D personnel after the higher education sector.

2.4 Detailed results

This section provides results pertaining to: financial data; the orientation of BERD; R&D personnel and national R&D priority areas.

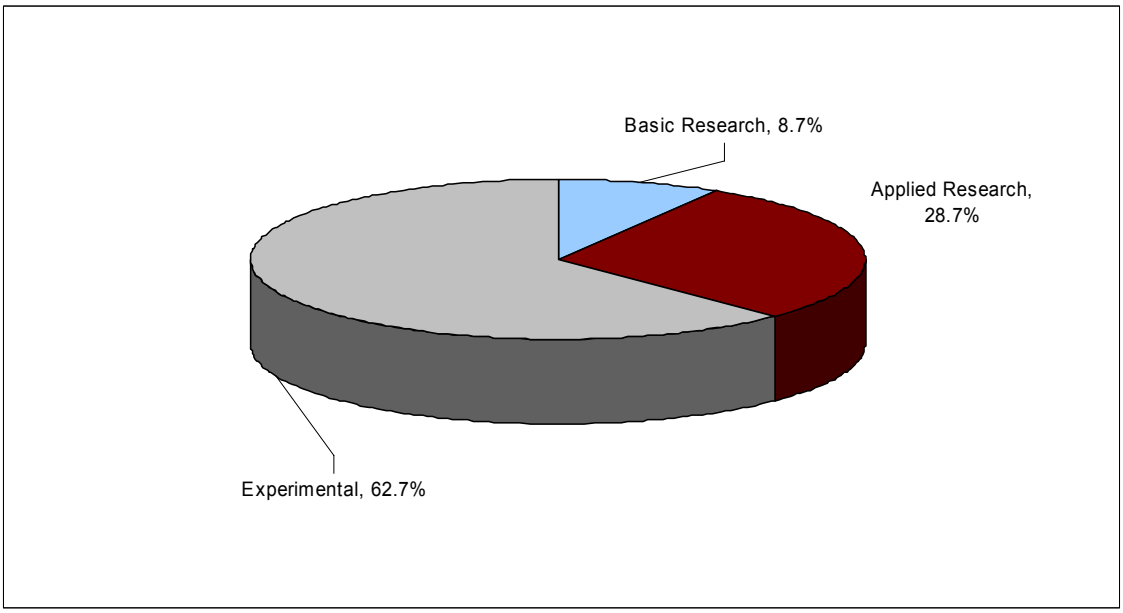
2.4.1 Financial data

Table B5 indicates that capital expenditure increased by R325 million from 2006/07 and current R&D expenditure by R1 171 million. The proportions of capital and current expenditure, in terms of total BERD, did not differ significantly between 2006/07 and 2007/08. It should be mentioned, however, that labour costs as a percentage of BERD decreased from 48.3% in 2006/07 to 45.5% in 2007/08. BERD by type of research is indicated in Figure B1.

Table B5: BERD by accounting category (2007/08, 2006/07 and 2005/06)

Type of expenditure	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Capital expenditure on R&D	1 445 305	13.5	1 120 589	12.1	1 446 650	17.5
Land: Buildings and other structures	262 994	2.4	154 129	1.7	199 088	2.4
Vehicles, plant, machinery, equipment	1 182 311	11.0	966 460	10.5	1 247 562	15.1
Current expenditure	9 293 151	86.5	8 122 576	87.9	6 797 126	82.5
Labour costs	4 881 074	45.5	4 461 218	48.3	3 703 277	44.9
Other current expenditure	4 412 077	41.1	3 661 358	39.6	3 093 849	37.5
Total	10 738 456	100	9 243 165	100	8 243 776	100

Figure B1: BERD by type of research (2007/08)



In 2007/08, 8.7% of BERD was spent on basic research and 28.7% on applied research. The largest proportion of BERD was allocated to experimental development (62.7%) during this period.

The proportions of expenditure on basic research (8.7%), applied research (27.6%) and experimental development (63.8%) remained relatively stable from 2006/07 to 2007/08. BERD by source of funds is indicated in Table B6.

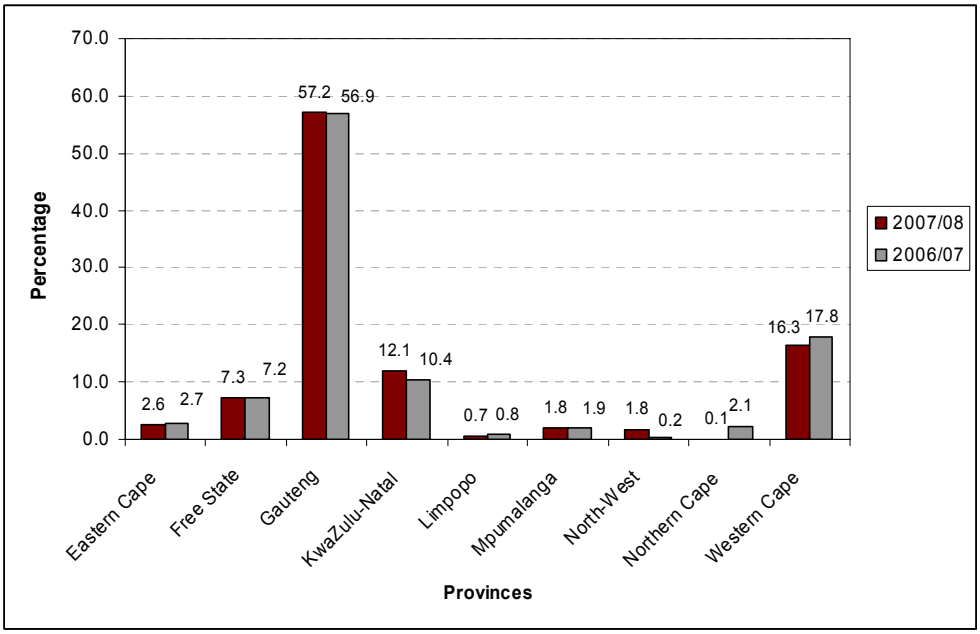
Table B6: BERD by source of funds (2007/08, 2006/07 and 2005/06)

Source of funds	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Own funds	6 916 974	64.4	6 185 887	66.9	5 488 727	66.6
Internal resources	6 916 974	64.4	6 185 887	66.9	5 488 727	66.6
Government	2 326 728	21.7	1 764 448	19.1	1 331 740	16.2
Grants	1 829 489	17.0	1 299 208	14.1	919 488	11.2
Contracts	497 239	4.6	465 240	5.0	412 252	5.0
Other local business	216 939	2.0	228 432	2.5	142 256	1.7
Contracts	216 939	2.0	228 432	2.5	142 256	1.7
Other South African sources	97 622	0.9	87 311	0.9	84 282	1.0
Higher education	1 816	0.0	1 657	0.0	1 623	0.0
Not-for-profit organisations	18 900	0.2	18 239	0.2	14 158	0.2
Individual donations	76 906	0.7	67 415	0.7	68 501	0.8
Foreign	1 180 193	11.0	977 087	10.6	1 196 771	14.5
Parent company	424 409	4.0	337 919	3.7	0	0.0
Foundations	5	0.0	4	0.0	0	0.0
All other sources	755 779	7.0	639 164	6.9	1 196 771	14.5
Total	10 738 456	100	9 243 165	100	8 243 776	100

The main source of funding for business remained business itself, although the business sector's funding contribution dropped from 66.9% of BERD in 2006/07 to 64.4% in 2007/08. The contribution of other local businesses also decreased, from 2.5% in 2006/07 to 2.0% in 2007/08. During the same period, the government's contribution grew from 19.1% to 21.7%. The proportion of funding provided by other national sources remained unchanged at 0.9%, while the contribution of foreign sources increased by 0.4% between 2006/07 and 2007/08.

The provincial distribution of BERD is indicated in Figure B2.

Figure B2: Provincial distribution of BERD activity (2007/08 and 2006/07)



It is clear from Figure B2 that the provincial distribution of R&D remained relatively stable between 2006/07 and 2007/08. The largest proportion of R&D in 2007/08 occurred in Gauteng (57.2%), followed by the Western Cape (16.3%) and KwaZulu-Natal (12.1%).

2.4.2 Orientation of BERD

BERD by research field is indicated in Table B7. Expenditure on R&D, as a percentage of BERD, increased in the following research fields between 2005/06 and 2007/08: physical sciences; earth sciences; information, computer and communication technologies, and engineering sciences. A decline in expenditure on R&D as a percentage of BERD was observed in the following research fields between 2005/06 and 2007/08: mathematical sciences; applied science and technologies; biological sciences; agricultural sciences; medical and health sciences; material sciences and social sciences. In many cases, the increases or decreases in spending have been nominal. The largest component of BERD was spent in the field of engineering sciences (30.1%), followed by information, computer and communication technologies (20.3%), and applied sciences and technologies (14.7%).

Table B7: BERD by research field (2007/08, 2006/07 and 2005/06)

Main research field	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Natural sciences, technology and engineering	**10 357 433**	**96.5**	**8 881 904**	**96.1**	**7 919 744**	**96.1**
Mathematical sciences	176 077	1.6	159 496	1.7	169 355	2.1
Physical sciences	507 646	4.7	382 551	4.1	312 246	3.8
Chemical sciences	580 146	5.4	438 969	4.7	441 138	5.4
Earth sciences	93 014	0.9	66 244	0.7	52 781	0.6
Information, computer and communication technologies	2 182 253	20.3	1 980 630	21.4	1 635 321	19.8
Applied sciences and technologies	1 581 438	14.7	1 551 885	16.8	1 384 945	16.8
Engineering sciences	3 237 265	30.1	2 439 092	26.4	2 219 530	26.9
Biological sciences	161 058	1.5	160 584	1.7	163 796	2.0
Agricultural sciences	311 287	2.9	277 889	3.0	257 447	3.1
Medical and health sciences	1 268 551	11.8	1 225 114	13.3	1 073 854	13.0
Environmental sciences	62 355	0.6	42 315	0.5	52 492	0.6
Material sciences	184 625	1.7	146 588	1.6	146 886	1.8
Marine sciences	11 719	0.1	10 547	0.1	9 951	0.1
Division 2: Social sciences and humanities	**381 023**	**3.5**	**36 261**	**3.9**	**324 032**	**3.9**
Social sciences	380 554	3.5	360 856	3.9	323 673	3.9
Humanities	469	0.0	405	0.0	359	0.0
Total	10 738 456	100	9 243 165	100	8 243 776	100

Table B8 shows BERD by socio-economic objective. It is clear that Division 2 (economic development) absorbed the vast majority of BERD at 78.2% in 2007/08. The subdivisions with the largest shares included manufacturing (19.7%), commercial services (12.5%), information and communication services (10.1%), construction (9.5%), mineral resources (excluding energy) (8.7%) and health (8.0%). Growth was observed in the following areas since 2005/06: energy resources; construction; information and communication services; economic framework; natural resources; social development and community services; environmental knowledge; and natural sciences, technologies and engineering.

BERD by Standard Industrial Classification (SIC) codes are shown in Table B9. In 2007/08, R&D in manufacturing accounted for 39.3% of BERD, having increased from 38.3% in 2006/07. This was followed by financial and business services, which accounted for 25.7% of BERD, and electricity, gas and water supply, which accounted for 16.2%. As a sub-classification, the manufacture of petroleum and other fuel; chemical and chemical products and rubber and plastic products was responsible for 14.7% of BERD in 2007/08, increasing from 14.1% in 2006/07. Other areas of R&D growth since 2006/07 included: the manufacture of non-metallic mineral products; the manufacture of metals, machinery and equipment; the manufacture of radio, television, communication equipment and medical, precision and optical instruments; the manufacture of transport equipment; and electricity, gas and water supply.

*Table B8: BERD by socio-economic objective (2007/08, 2006/07 and 2005/06)**

Socio-economic objective	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Defence	900 909	8.4	777 139	8.4	747 523	9.1
Division 2: Economic development	8 399 187	78.2	7 233 003	78.3	6 384 780	77.4
Plant production and plant primary products	279 437	2.6	279 937	3.0	273 503	3.3
Animal production and animal primary products	78 657	0.7	67 619	0.7	61 266	0.7
Mineral resources (excluding energy)	937 628	8.7	779 765	8.4	829 414	10.1
Energy resources	585 453	5.5	470 735	5.1	385 851	4.7
Energy supply	252 064	2.3	239 018	2.6	205 657	2.5
Manufacturing	2 117 823	19.7	1 846 199	20.0	1 603 753	19.5
Construction	1 017 969	9.5	756 166	8.2	631 698	7.7
Transport	523 022	4.9	446 162	4.8	391 173	4.7
Information and communication services	1 087 198	10.1	895 714	9.7	818 485	9.9
Commercial services	1 347 470	12.5	1 329 972	14.4	1 091 434	13.2
Economic framework	41 756	0.4	16 243	0.2	13 515	0.2
Natural resources	130 711	1.2	105 475	1.1	79 032	1.0
Division 3: Society	915 567	8.5	839 908	9.1	798 247	9.7
Society unclassified	0	0.0	0	0.0	0	0.0
Health	857 364	8.0	799 201	8.6	761 222	9.2
Education and training	12 204	0.1	12 913	0.1	11 199	0.1
Social development and community services	45 999	0.4	27 794	0.3	25 827	0.3
Division 4: Environment	164 552	1.5	113 821	1.2	109 803	1.3
Environment unclassified	0	0.0	0	0.0	0	0.0
Environmental knowledge	62 551	0.6	39 233	0.4	33 395	0.4
Environmental aspects of development	33 901	0.3	28 327	0.3	28 781	0.3
Environmental and other aspects	68 100	0.6	46 261	0.5	47 626	0.6
Division 5: Advancement of knowledge	358 242	3.3	279 295	3.0	203 423	2.5
Advancement of knowledge unclassified	0	0.0	0	0.0	0	0.0
Natural sciences, technologies and engineering	353 694	3.3	275 446	3.0	200 018	2.4
Social sciences and humanities	4 548	0.0	3 848	0.0	3 406	0.0
Total	10 738 457	100	9 243 165	100	8 243 776	100

*Subject to rounding to the nearest R'000

Table B9: BERD by Standard Industrial Classification (SIC) code (2007/08 and 2006/07)

SIC classification	2007/08		2006/07	
	R'000	%	R'000	%
10000 Agriculture, Hunting, Forestry and Fishing	213 808	2.0	199 959	2.2
20000 Mining and Quarrying	559 332	5.2	518 262	5.6
30000 Manufacturing	4 222 127	39.3	3 537 433	38.3
Manufacture of food products, beverages and tobacco products	196 238	1.8	183 391	2.0
Manufacture of textiles, clothing and leather goods	17 888	0.2	21 899	0.2
Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; manufacture of paper and paper products; manufacture of publishing, printing and reproduction of recorded material	118 535	1.1	110 631	1.2
Manufacture of refined petroleum, coke and nuclear fuel; manufacture of chemicals and chemical products (including pharmaceuticals); manufacture of rubber and plastic products	1 579 382	14.7	1 301 947	14.1
Manufacture of non-metallic mineral products	183 758	1.7	127 714	1.4
Manufacture of basic metals, fabricated metal products, machinery and equipment; manufacture of office, accounting and computing machinery	500 715	4.7	386 605	4.2
Manufacture of electrical machinery and apparatus	187 612	1.7	189 554	2.1
Manufacture of radio, television and communication equipment and apparatus manufacture of medical, precision and optical instruments; watches and clocks	506 497	4.7	425 585	4.6
Manufacture of transport equipment	924 053	8.6	784 209	8.5
Manufacture of furniture, recycling, manufacturing not elsewhere classified	7 449	0.1	5 898	0.1
40000 Electricity, Gas and Water Supply	1 737 511	16.2	1 292 925	14.0
50000 Construction	6 043	0.1	4 559	0.0
60000 Wholesale and Retail	317 780	3.0	324 666	3.5
70000 Transport, Storage and Communication	490 138	4.6	453 715	4.9
80000 Financial Intermediation, Real Estate and Business Services	2 759 550	25.7	2 477 423	26.8
90000 Community, Social and Personal Services	432 167	4.0	434 223	4.7
Total	10 738 456	100	9 243 165	100

2.4.3 R&D personnel

Table B10 indicates a headcount of 17 951 R&D personnel, with an associated 12 461 full-time equivalents (FTEs), in the business sector during 2007/08. The personnel headcounts are slightly higher than the 17 467 R&D personnel recorded in 2006/07, but the FTEs were slightly lower than those recorded in the 2006/07 survey. The data indicate that women comprised 33.2% of the business sector R&D personnel headcount; having increased from 32.6% in 2006/07 and 32.5% in 2005/06.

Table B10: Business R&D personnel: headcount and full-time equivalent (2007/08, 2006/07 and 2005/06)

Occupation	Headcount			Full-time equivalent	
2007/08	Male	Female	Total	FTE	FTE as % of headcount
Researchers	5 924	2 412	8 336	6 047.5	72.5
Technicians directly supporting R&D	3 615	1 688	5 303	3 796.4	71.6
Other personnel directly supporting R&D	2 458	1 854	4 312	2 617.4	60.7
Total	11 997	5 954	17 951	12 461	69.4
2006/07	Male	Female	Total	FTE	FTE as % of headcount
Researchers	5 857	2 370	8 227	6 110.9	74.3
Technicians directly supporting R&D	3 517	1 596	5 113	3 735	73.0
Other personnel directly supporting R&D	2 398	1 729	4 127	2 749.4	66.6
Total	11 772	5 695	17 467	12 595	72.1
2005/06	Male	Female	Total	FTE	FTE as % of headcount
Researchers	5 280	2 200	7 480	5 895.7	78.8
Technicians	2 972	1 171	4 143	3 050	73.6
*Other personnel: Executive and management**	2 764	1 934	4 698	3 290.1	70.0
Total	11 016	5 305	16 321	12 236	75.0

*'Other personnel' were divided between 'executive and management' and 'administrative support staff' in the 2005/06 survey.

Tables B11.1 and B11.2 provide R&D personnel by race, qualification and gender for 2007/08 and 2006/07.

Table B11.1: Business R&D personnel: headcount by race, gender and qualification (2007/08)

Qualification	African		Coloured		Indian		White		Subtotal		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	63	57	19	5	28	26	653	181	763	269	1 032
Masters, honours, bachelors or equivalent	440	299	126	40	284	169	3 157	1 255	4 007	1 763	5 770
Diplomas	165	128	102	19	89	55	799	178	1 154	380	1 534
Subtotal	667	485	247	64	401	250	4 609	1 614	5 924	2 412	8 336
Technicians directly supporting R&D											
Doctoral degree or equivalent	0	13	0	0	0	0	40	30	40	43	83
Masters, honours, bachelors or equivalent	152	178	89	45	103	49	868	513	1 212	786	1 998
Diplomas	690	322	237	77	184	122	1 252	337	2 363	859	3 222
Subtotal	842	513	327	122	287	172	2 160	881	3 615	1 688	5 303
Other personnel directly supporting R&D											
Doctoral degree or equivalent	28	26	0	0	5	21	33	31	66	77	143
Masters, honours, bachelors or equivalent	74	159	8	9	23	14	218	173	323	354	677
Diplomas	1 269	567	115	121	137	77	547	658	2 069	1 423	3 492
Subtotal	1 372	752	124	130	165	111	798	861	2 458	1 854	4 312
Total	2 880	1 750	697	316	853	532	7 567	3 355	11 997	5 954	17 951

*Table B11.2: Business R&D personnel: headcount by race, gender and qualification (2006/07)**

Qualification	African		Coloured		Indian		White		Subtotal		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	48	40	13	2	23	20	605	191	689	253	942
Masters, honours, bachelors or equivalent	382	288	118	42	285	166	3 240	1 267	4 025	1 763	5 789
Diplomas	165	99	100	20	66	52	809	184	1 141	355	1 496
Subtotal	596	427	231	65	375	238	4 653	1 642	5 855	2 372	8 227
Technicians directly supporting R&D											
Doctoral degree or equivalent	0	11	0	0	0	0	37	36	37	47	84
Masters, honours, bachelors or equivalent	142	156	80	45	107	42	914	545	1 243	789	2 032
Diplomas	608	264	200	83	178	76	1 251	338	2 236	760	2 996
Subtotal	750	431	280	127	284	118	2 203	919	3 517	1 596	5 113
Other personnel directly supporting R&D											
Doctoral degree or equivalent	24	23	0	0	8	18	35	25	67	66	134
Masters, honours, bachelors or equivalent	59	137	6	8	14	12	181	134	261	291	553
Diplomas	1 302	542	120	131	130	79	518	619	2 069	1 371	3 441
Subtotal	1 385	702	127	139	152	109	734	778	2 398	1 729	4 127
Total	2 730	1 561	638	331	811	466	7 590	3 339	11 770	5 697	17 467

*Note that not all companies provided race and qualification data. These tables represent a statistical extrapolation of race and qualification data.

2.4.4 Collaborations

Table B12 indicates that R&D-performing companies mostly sought out higher education institutions as collaboration partners in 2007/08.[6] This was followed by collaborations with other companies, including specialist consultants; members of own or affiliated company, and government research institutes. The number of foreign collaborations increased slightly from 2006/07, while the number of national collaborations decreased over the same period.

Table B12: Number of Business R&D collaborations (2007/08 and 2006/07)

Partner	2007/08		2006/07	
	South Africa	Foreign	South Africa	Foreign
Higher education institutions	92	23	85	23
Science councils*	18	5	19	12
Government research institutes	24	17	31	13
Members of own company / Affiliated companies	38	12	55	14
Other companies (including specialist consultants)	80	35	175	20
Not-for-profit organisations	17	2	19	4
Total	269	94	384	86

*See Table S13 for the full list of science councils.

[6] Note that the data in Table B12 contain commuted responses from 2005/06, while 2007/08 data do not. The figures for 2006/07 were thus relatively inflated by data carried forward from the previous year. The project team has agreed not to commute the collaborations data in future R&D Surveys.

2.4.5 National priority areas

This section reports on the multidisciplinary R&D and national priority areas outlined in South Africa's National Research and Development Strategy *(DST, 2002), namely,* biotechnology; nanotechnology; open source software; new materials; and tuberculosis, HIV/AIDS and malaria.

Table B13: Business sector expenditure by multidisciplinary R&D area (2007/08 and 2006/07)

Multidisciplinary R&D area	2007/08			2006/07		
	R'000	Percentage	Number of companies	R'000	Percentage	Number of companies
Biotechnology	169 410	1.6	35	132 641	1.4	28
Nanotechnology	30 314	0.3	7	155 049	1.7	8
Total	199 724	1.9	42	287 690	3.1	36
Total R&D expenditure	10 738 456	100	N/A	9 243 165	100	N/A

Table B13 indicates that the number of companies conducting R&D in biotechnology and nanotechnology increased from 36 in 2006/07 to 42 in 2007/08. The business sector spent R169 million on biotechnology R&D and R30 million on nanotechnology R&D in 2007/08.

Table B14 outlines business sector expenditure on the national R&D priority areas. The number of companies conducting research in these areas increased from 64 in 2006/07 to 80 in 2007/08. However, the growing number of companies involved was not reflected in expenditure patterns, since business sector expenditure on the priority areas dropped from R528.8 million in 2006/07 to R489.3 million in 2007/08. The only priority area in which growth in expenditure was evident was tuberculosis (TB), HIV/AIDS and malaria.

Table B14: Business sector expenditure by national R&D priority area (2007/08 and 2006/07)

National R&D priority area	2007/08			2006/07		
	R'000	Percentage	Number of companies	R'000	Percentage	Number of companies
Open source software	114 195	1.1	32	118 858	1.3	26
New materials	72 992	0.7	23	115 339	1.2	18
Tuberculosis (TB), HIV/AIDS, malaria	302 122	2.8	25	294 689	3.2	20
Total	489 309	4.6	80	528 886	5.7	64
Total R&D expenditure	10 738 456	100	N/A	9 243 165	100	N/A

Chapter 3: Government Sector

3.1 Introduction

The government sector consists of the national, provincial and local departments; government research institutes; and museums. 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 as part of the business sector (see Chapter 2), while science councils are surveyed as a separate sector (see Chapter 6). The government sector is surveyed as a census, but this approach does not eliminate all data-collection problems. Most government departments, especially at national level, as well as some research institutes outsource all or part of their R&D to other agencies or service providers. Problems of under-counting may arise, because the respondents do not always disclose the identity of such agencies or service providers.

Furthermore, the internal reporting systems of many organisations are not always set up to meet the requirements of the survey. The R&D budget is often not separated from the budget for scientific and technological services. In such cases, respondents are inclined to return a questionnaire as a nil even when the institution concerned performs R&D. The nil-returns and non-responses from smaller museums are usually due to a lack of capacity and/or funding to undertake research. The high turnover of senior employees in government departments leads to a lack of continuity among those responding to the survey as well as inconsistencies in the way in which the survey instrument is interpreted, which ultimately affects the quality of the information provided. The project team has implemented procedures to address these problems, as described in the next section.

3.2 Survey methods

Note that there were no changes to the 2007/08 survey questionnaire. The survey methods for the national, provincial and local departments, as well as museums are outlined below, followed by data aspects.

National, provincial and local departments

The 2006/07 registry for national departments was updated using the *Estimates of National Expenditure* book, which National Treasury publishes annually. Registries and contact details for the provincial and local departments were updated using the 2006/07 registries, and the departments' websites were used to access missing contact information. The units of measure in the government sector differ at all levels. Some departments have directorates dedicated to R&D, while others spread these activities across different sections within the same department. In order to secure buy-in, the preferred respondents were directors-general (DGs) at national level and heads of department (HoDs) at provincial department level. All departments were initially sent hard-copy questionnaires through the post, and follow-ups were done by sending the electronic versions of the questionnaire by electronic

mail. National departments were sent 37 questionnaires, and 17 responses were returned, which represented a response rate of 46%. Provincial and local departments collectively were sent 64 questionnaires, and 27 responses were returned, which represented a response rate of 42%.

Research institutes and museums

Forty questionnaires were sent to research managers at research institutes and 25 responses were returned, which represented a response rate of 62%. The 71 questionnaires sent to directors of museums resulted in 45 responses (a response rate of 63%).

Data estimates

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

- The project team sought to ensure that instructions and definitions accompanying the questionnaire were understandable and user-friendly.
- Repeated follow-ups were made by electronic mail or telephone to offer reminders and support to respondents.
- Where necessary, questionnaires were completed over the telephone.
- The project team engaged with parent departments to coordinate the survey within their provincial departments.

Some questionnaires were returned blank, some only partially or incorrectly completed, while others were returned as nil. Where information was not provided, telephone follow-ups were effected, or estimates for the missing data were made using the previous survey return data. The project team requested the approval of institutions/departments for data in cases where the questionnaires were completed using the latter means. In addition, estimates of R&D expenditure at national government level were made using information from the estimates of national expenditure for 2007/08 provided by National Treasury.[7] The figures were then verified with the relevant authorities to ensure that double- or under-counting did not occur. Once the verification process had been completed, all responses, including the nil-returns, were captured in the Survey Management Research System (SMRS).

3.3 Detailed results

This section provides results pertaining to financial data; the orientation of government sector R&D expenditure (GOVERD), R&D personnel and national R&D priority areas.

[7] National Treasury figures are broken down at project level and provide an indication of where R&D is likely to take place in national government departments. These figures are used to guide CeSTII's estimations of R&D expenditures based on total reported expenditures.

3.3.1 Financial data

Table G1: In-house R&D expenditure by sector (2007/08, 2006/07 and 2005/06)

Sector	2007/08			2006/07			2005/06		
	Subtotal	Total		Subtotal	Total		Subtotal	Total	%
	R'000	R'000	%	R'000	R'000	%	R'000	R'000	
Business enterprise		10 738 456	57.7		9 243 165	55.9		8 243 776	58.3
Government		1 154 399	6.2		1 021 355	6.2		844 640	6.0
National departments	499 085		2.7	489 971		3.0	304 709		2.2
Provincial departments	253 418		1.4	174 860		1.1	167 328		1.2
Research institutes	365 468		1.9	327 065		1.9	342 433		2.4
Museums	36 428		0.2	29 459		0.2	30 170		0.2
Higher education		3 621 862	19.4		3 298 808	20.0		2 732 215	19.3
Not-for-profit		223 202	1.2		212 538	1.3		226 514	1.6
Science councils		2 886 094	15.5		2 744 718	16.6		2 102 094	14.9
Grand total		18 624 013	100		16 520 584	100		14 149 239	100

The survey results reported in Tables G1 and G2 show that GOVERD increased by about 13.0% between 2006/07 and 2007/08, but remained stable at approximately 6.2% of GERD. In 2007/08, GOVERD totalled R1.15 billion. The largest increase was by provincial departments, which raised their R&D expenditure by 45.0%, followed by museums at 23.7%. National government departments and research institutes also contributed to the growth by increasing their contributions by 1.9% and 11.7% respectively.

Table G2: Main characteristics of R&D in the government sector (2007/08, 2006/07 and 2005/06)

Main characteristics	2007/08	2006/07	2005/06
Government expenditure on R&D (Rand million)	1 154.4	1 021.4	844.6
GOVERD as % of GDP	0.07%	0.07%	0.06%
Total government sector R&D personnel (FTE)	1 950	2 068	1 483
Total government R&D researchers (FTE)	758	785	651
% of expenditure financed by local industry	0.5	1.3	1.3
% of expenditure financed by government	31.4	37.9	52

The results indicate that in 2007/08, the government sector as a whole spent R1.15 billion on R&D, which was an increase of 13.0% over expenditure in 2006/07. R&D intensity increased by 0.07% over the same period.

Table G3 shows that in 2007/08, the government sector employed 1 138 R&D personnel (by headcount), which was 2.4% higher than in 2006/07. Despite the overall growth in employment of R&D personnel in the government sector, there was a decline of 18.9% in the numbers employed in national departments and a decline of 7.2 % in provincial departments. The government sector as a whole contributed 2.8% towards total R&D personnel, which is the same percentage as in 2006/07.

Table G3: Headcount of R&D personnel by sector (2007/08 and 2006/07)

Sector	Researchers		Technicians: directly supporting R&D		Total other personnel		Grand total		Percentage	
	07/08	06/07	07/08	06/07	07/08	06/07	07/08	06/07	07/08	06/07
Business enterprise	8 336	8 227	5 303	5 113	4 312	4 127	17 951	17 467	36.9	36.1
Government	1 138	1 111	739	831	917	982	2 794	2 924	5.7	6.0
National departments	265	327	344	131	49	186	658	644	1.4	1.3
Provincial departments	244	263	117	77	631	30	992	370	2.0	0.8
Government research institutes	523	427	191	503	202	198	916	1 128	1.9	2.3
Museums	106	94	87	120	35	568	228	782	0.5	1.6
Higher education	17 008	17 459	2 006	2 170	2 351	2 117	21 365	21 746	44.0	44.9
Not-for-profit	264	252	77	77	161	155	502	484	1.0	1.0
Science councils	2 594	2 255	1 351	1 570	2 043	1 973	5 988	5 798	12.3	12.0
Grand total	29 340	29 304	9 476	9 761	9 784	9 354	48 600	48 419	100	100
Higher education doctoral and postdoctoral students	10 744	10 287	-	-	-	-	10 744	10 287	-	-
Total	40 084	39 591	9 476	9 761	9 784	9 354	59 344	58 706	100	100

Table G4 indicates that the government sector spent little on R&D infrastructure: approximately 8.7% of GOVERD was spent on capital goods. Labour costs decreased slightly from 41.9% of GOVERD in 2006/07 to 40.2% in 2007/08, and other current costs increased from 46.3% to 51.1% over the same period.

Table G4: GOVERD by accounting category (2007/08, 2006/07 and 2005/06)

Type of expenditure	2007/08			2006/07			2005/06		
	R'000		%	R'000		%	R'000		%
National departments									
Capital expenditure	22 507		4.5	48 920		10.0	55 321		18.2
Land: buildings and other		0	0.0		3 701	0.8		67	0.0
Vehicles, plant, machinery, equipment		22 507	4.5		45 219	9.2		55 254	18.1
Current expenditure	476 578		95.5	441 051		90.0	249 388		81.8
Labour costs		120 257	24.1		158 890	32.4		51 747	17.0
Other current expenditure		356 321	71.4		282 161	57.6		197 641	64.9
Total	499 085		100	489 971		100	304 709		100
Provincial departments									
Capital expenditure on R&D	37 336		14.7	12 706		7.3	21 912		13.1
Land: Buildings and other structures		8 681	3.4		4 495	2.6		9 196	5.5
Vehicles, plant, machinery, equipment		28 655	11.3		8 211	4.7		12 716	7.6
Current expenditure	216 082		85.3	162 154		92.7	145 416		86.9
Labour costs		135 695	53.5		100 676	57.6		76 598	45.8
Other current expenditure		80 387	31.7		61 478	35.2		68 818	41.1
Total	253 418		100	174 860		100	167 328		100
Government research institutes									
Capital expenditure on R&D	38 837		10.6	57 343		17.5	71 564		20.9

Type of expenditure	2007/08			2006/07			2005/06		
	R'000		%	R'000		%	R'000		%
Land: Buildings and other structures		10 225	2.8		31 602	9.7		38 414	11.2
Vehicles, plant, machinery, equipment		28 612	7.8		25 741	7.9		33 150	9.7
Current expenditure	326 631		89.4	269 722		82.5	270 869		79.1
Labour costs		183 167	50.1		148 117	45.3		160 554	46.9
Other current expenditure		143 464	39.3		121 605	37.2		110 315	32.2
Total	365 468		100	327 065		100	342 433		100
Museums									
Capital expenditure on R&D	1 644		4.5	1 908		6.5	2 437		8.1
Land: Buildings and other		460	1.3		481	1.6		91	0.3
Vehicles, plant, machinery, equipment		1 184	3.3		1 427	4.8		2 346	7.8
Current expenditure	34 784		95.5	27 551		93.5	27 733		91.9
Labour costs		25 041	68.7		20 197	68.6		23 060	76.4
Other current expenditure		9 743	26.7		7 354	25.0		4 673	15.5
Total	36 428		100	29 459		100	30 170		100
All government sectors									
Capital expenditure on R&D	100 324		8.7	120 877		11.8	151 234		17.9
Land: Buildings and other structures		19 366	1.7		40 279	3.9		47 768	5.7
Vehicles, plant, machinery, equipment		80 958	7.0		80 598	7.9		103 466	12.2
Current expenditure	1 054 075		91.3	900 478		88.2	693 406		82.1
Labour costs		464 160	40.2		427 880	41.9		311 959	36.9
Other current expenditure		589 915	51.1		472 598	46.3		381 447	45.2
Total	1 154 399		100	1 021 355		100	844 640		100

Table G5: GOVERD by type of research (2007/08, 2006/07 and 2005/06)

Type of Research	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Basic research	322 270	27.9	224 774	22.0	213 351	25.3
Applied research	599 162	51.9	521 845	51.1	459 042	54.3
Experimental development	232 967	20.2	274 736	26.9	172 247	20.4
Total	1 154 399	100	1 021 355	100	844 640	100

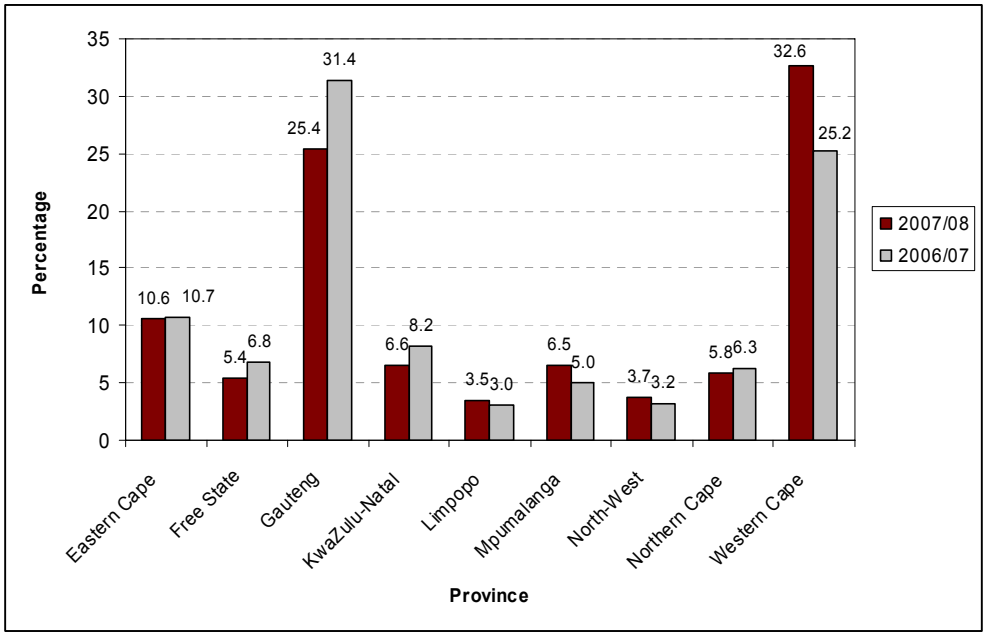
GOVERD by type of research is indicated in Table G5. Basic research as a proportion of government investment in R&D increased from 22.0% in 2006/07 to 27.9% in 2007/08. Experimental development research accounted for 20.2% of total government R&D expenditure in 2007/08, having dropped from 26.9% in 2006/07. Applied research accounted for 51.9% of GOVERD in 2007/08, with expenditure having increased by 4.8%, from R521.8 million in 2006/07 to R599.1 million in 2007/08.

Table G6: GOVERD by source of funds (2007/08, 2006/07 and 2005/06)

Source of funds	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Organisation	727 996	63.1	549 896	53.8	316 145	37.4
Own funds	727 996	63.1	549 896	53.8	316 145	37.4
Government	363 053	31.4	387 109	37.9	439 511	52.0
Grants	361 416	31.3	356 130	34.9	433 842	51.4
Contracts	1 637	0.1	30 979	3.0	5 669	0.7
Business	5 343	0.5	13 067	1.3	11 000	1.3
Business (domestic)	5 343	0.5	13 067	1.3	11 000	1.3
Other South African sources	1 835	0.2	19 623	1.9	19 270	2.3
Higher education	0	0.0	9 351	0.9	8 583	1.0
Not-for-profit organisations	278	0.0	260	0.0	687	0.1
Individual donations	1 557	0.1	10 012	1.0	10 000	1.2
Foreign	56 172	4.9	51 660	5.1	58 714	7.0
All sources	56 172	4.9	51 660	5.1	58 714	7.0
Total	1 154 399	100	1 021 355	100	844 640	100

The government sector funds most of its own R&D activities, as shown in Table G6. In 2007/08, government's contribution towards funding its own R&D (own funds, grants and contracts) amounted to R1.1 billion, which represented an increase of 16.4% between 2006/07 and 2007/08. Funding from the business sector and other South African sources was low in 2007/08 at 0.5% and 0.2% respectively. Funding from abroad was slightly higher than in 2006/07.

Figure G1: Provincial distribution of government R&D activity (2007/08 and 2006/07)



For the first time since the inclusion in the R&D Survey of the section on R&D by province, the Western Cape (at 32.6%) accounted for a larger proportion of government R&D expenditure than Gauteng province (25.4%) (Figure G1). The results for 2007/08 show that GOVERD in Gauteng decreased by 8.8%, while GOVERD in Kwa-Zulu Natal and the Free State provinces also declined, by 9.2% and 10.4% respectively. The other provinces recorded an increase in government R&D expenditure over the same period.

3.3.2 Orientation of GOVERD

Table G7: GOVERD by research field (2007/08, 2006/07 and 2005/06)

Main research field	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Natural sciences, technology and engineering	874 425	75.7	808 404	79.2	661 594	78.3
Mathematical sciences	20 643	1.8	24 823	2.4	21 496	2.5
Physical sciences	45 052	3.9	24 726	2.4	27 205	3.2
Chemical sciences	22 672	2.0	16 622	1.6	10 711	1.3
Earth sciences	161 815	14.0	109 959	10.8	100 743	11.9
Information, computer and communication	82 123	7.1	56 323	5.5	42 093	5.0
Applied sciences and technologies	15 286	1.3	31 603	3.1	17 328	2.1
Engineering sciences	14 164	1.2	26 008	2.5	10 355	1.2
Biological sciences	113 409	9.8	99 841	9.8	79 402	9.4
Agricultural sciences	208 662	18.1	170 347	16.7	156 538	18.5
Medical and health sciences	173 929	15.1	187 741	18.4	137 909	16.3
Environmental sciences	8 589	0.7	40 851	4.0	39 867	4.7
Material sciences	637	0.1	158	0.0	150	0.0
Marine sciences	7 445	0.6	19 402	1.9	17 797	2.1
Division 2: Social sciences and humanities	279 974	24.3	212 951	20.8	183 047	21.7
Social sciences	235 299	20.4	189 155	18.5	139 536	16.5
Humanities	44 676	3.9	23 796	2.3	43 511	5.2
Total	1 154 399	100	1 021 355	100	844 641	100

GOVERD by research field is provided in Table G7. The breakdown of total R&D expenditure by field of science shows that in 2007/08, R&D expenditure in the government sector was highest in the field of social sciences, which accounted for 20.4% of total expenditure. Other significant increases in R&D expenditure, between 2006/07 and 2007/08, included: agricultural sciences (which increased by 22.5%), earth sciences (up by 47.2%), humanities (up by 87.7%), and information, computer and communication technologies (up by 45.8%). Between 2006/07 and 2007/08, R&D expenditure on medical and health sciences decreased by about R14 million (down by 7.4%). Other research fields in which expenditure dropped were environmental sciences (down by 79.0%), marine sciences (down by 61.6%) and mathematical sciences (down by 16.8%).

Table G8: GOVERD by socio-economic objective (2007/08, 2006/07 and 2005/06)

Socio-economic objective	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Defence	0	0.0	50 000	4.9	0	0.0
Defence	0	0.0	50 000	4.9	0	0.0
Division 2: Economic development	429 646	37.2	350 497	34.3	322 820	38.2
Plant production and primary products	79 290	6.9	45 951	4.5	54 523	6.5
Animal production and primary products	79 997	6.9	66 655	6.5	61 778	7.3
Mineral resources (excluding energy)	0	0.0	0	0.0	0	0.0
Energy resources	0	0.0	0	0.0	0	0.0
Energy supply	14 290	1.2	8 905	0.9	8 095	1.0
Manufacturing	318	0.0	79	0.0	75	0.0
Construction	3 219	0.3	3 911	0.4	3 386	0.4
Transport	15 386	1.3	21 710	2.1	12 833	1.5
Information and communication services	69 318	6.0	32 858	3.2	39 357	4.7
Commercial services	6 897	0.6	4 908	0.5	4 686	0.6
Economic framework	98 537	8.5	76 965	7.5	74 563	8.8
Natural resources	62 394	5.4	88 558	8.7	63 524	7.5
Division 3: Society	265 948	23.0	341 911	33.5	261 336	30.9
Health	69 493	6.0	150 704	14.8	92 858	11.0
Education and training	111 407	9.7	112 042	11.0	97 773	11.6
Social development and community services	85 048	7.4	79 165	7.8	70 705	8.4
Division 4: Environment	103 372	9.0	105 792	10.4	99 112	11.7
Environment unclassified	0	0.0	0	0.0	0	0.0
Environmental knowledge	71 734	6.2	74 710	7.3	67 106	7.9
Environmental aspects of development	20 797	1.8	8 112	0.8	8 995	1.1
Environmental and other aspects	10 841	0.9	22 970	2.2	23 011	2.7
Division 5: Advancement of knowledge	355 434	30.8	173 155	17.0	161 374	19.1
Advancement of knowledge unclassified	0	0.0	0	0.0	0	0.0
Natural sciences, technologies and engineering	324 409	28.1	149 847	14.7	120 247	14.2
Social sciences and humanities	31 025	2.7	23 309	2.3	41 127	4.9
Total	1 154 400	100	1 021 355	100	844 642	100

Table G8 indicates that in 2005/06, the government sector did not perform any defence-related R&D. Almost all the R&D in this category was performed and accounted for in the business sector. This pattern was repeated in 2007/08. The results further show that R&D expenditure in areas aligned with economic development increased by 22.6% between 2006/07 and 2007/08, following a minor increase of 8.6% between 2005/06 and 2006/07. Expenditure on research related to society decreased by 22.2% and expenditure on environment-related research by 2.3%, while expenditure related to the advancement of knowledge more than doubled between 2006/07 and 2007/08. The major contributor within the advancement of knowledge division was R&D related to the natural sciences, technologies and engineering.

Previous R&D Surveys in 2004/05, 2005/06, 2006/07 indicated a strong relationship between expenditure related to the advancement of knowledge and basic research. The 2007/08 results show the same pattern in that there was an increase in both basic research expenditure and expenditure related to the advancement of knowledge.

3.3.3 R&D personnel

Table G9: Government R&D personnel: headcount and FTEs (2007/08, 2006/07 and 2005/06)

Occupation	Headcount			Full-time equivalent	
2007/08	Male	Female	Total	FTE	FTE as % of headcount
Researchers	616	522	1 138	757.6	66.6
Technicians	404	335	739	495.6	67.1
Other personnel directly supporting R&D	633	284	917	696.9	76.0
Total	1 653	1 141	2 794	1 950	69.8
2006/07	Male	Female	Total	FTE	FTE as % of headcount
Researchers	624	487	1 111	784.6	70.6
Technicians	493	338	831	555.7	66.9
Other personnel directly supporting R&D	665	317	982	728	74.1
Total	1 782	1 142	2 924	2 068	70.7
2005/06	Male	Female	Total	FTE	FTE as % of headcount
Researchers	503	371	874	650.6	74.4
Technicians	252	243	495	353.3	71.4
*Other personnel: Executive and management**	92	33	125	72.7	58.1
*Other personnel: Administrative and support staff**	273	234	507	406.4	80.2
Total	1 120	881	2 001	1 483.	74.1

*'Other personnel' were divided between 'executive and management' and 'administrative support staff' in the 2005/06 survey.

Government R&D personnel are presented in Table G9. Total R&D personnel (FTE) in the government sector increased by 39.5% from 1 483 in 2005/06) to 2 068 in 2006/07), but there was a decrease in R&D personnel between 2006/07 and 2007/08. Researchers (FTE) decreased by 3.4%; technicians decreased by 10.8%, and other research support staff decreased by 4.3% during the same period. The percentage of their time that government researchers spent on research decreased from 70.6% in 2006/07 to 66.6% in 2007/08.

The breakdown of R&D personnel by race, gender and qualification is shown in Tables G10.1 and G10.2. In 2007/08, the government sector employed 2 794 R&D personnel (by headcount); 1 138 (or 40.7%) of whom were researchers. Of the total of 1 138 researchers, 228 (20.0%) had a doctorate, compared with 25.4% in 2006/07. Women researchers made up 39.5 % of the researchers with a doctorate, compared with 33.9% in 2006/07. The rest of the researchers (910, or 80.0%) held qualifications other than a doctoral degree. Women researchers accounted for 45.8% of all researchers in the government sector, compared with 43.9% in 2006/07. Of the 522 women researchers, 44.6% were White, 39.3% African, 8.0% Coloured and 8.0% Indian.

Table G10.1: Government sector R&D personnel: headcount by race, gender and qualifications (2007/08)

Qualification	African		Coloured		Indian		White		Subtotal		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	29	14	3	2	7	8	101	64	140	88	228
Masters, honours, bachelors or equivalent	219	165	22	38	29	26	176	161	446	390	836
Diplomas	17	26	7	2	1	8	5	8	30	44	74
Subtotal	265	205	32	42	37	42	282	233	616	522	1 138
Technicians directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	2	0	2	0	2
Masters, honours, bachelors or equivalent	137	87	11	9	8	15	74	95	230	206	436
Diplomas	109	86	19	8	5	4	39	31	172	129	301
Subtotal	246	173	30	17	13	19	115	126	404	335	739
Other personnel directly supporting R&D											
Doctoral degree or equivalent	5	0	0	0	0	0	1	0	6	0	6
Masters, honours, bachelors or equivalent	27	24	2	9	1	5	10	17	40	55	95
Diplomas	325	111	233	36	2	12	27	70	587	229	816
Subtotal	357	135	235	45	3	17	38	87	633	284	917
Total	868	513	297	104	53	78	435	446	1 653	1 141	2 794

Table G10.2: Government sector R&D personnel: headcount by race, gender and qualification (2006/07)

Qualification	African		Coloured		Indian		White		Subtotal		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	30	11	2	1	9	4	146	80	187	96	283
Masters, honours, bachelors or equivalent	182	170	28	35	24	27	193	153	427	385	812
Diplomas	6	6	1	0	0	0	2	1	9	7	16
Subtotal	218	187	31	36	33	31	341	234	623	488	1 111
Technicians directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	2	0	2	0	2
Masters, honours, bachelors or equivalent	127	63	21	8	4	4	75	91	227	166	393
Diplomas	153	100	28	12	9	9	74	51	264	172	436
Subtotal	280	163	49	20	13	13	151	142	493	338	831
Other personnel directly supporting R&D											
Doctoral degree or equivalent	1	0	0	0	0	0	2	1	3	1	4
Masters, honours, bachelors or equivalent	12	19	0	5	0	4	12	10	24	38	62
Diplomas	277	145	312	45	4	8	44	81	637	279	916
Subtotal	290	164	312	50	4	12	58	92	664	318	982
Total	788	514	392	106	50	56	550	468	1 780	1 144	2 924

3.3.4 National priority areas

Table G11: GOVERD by multidisciplinary R&D area (2007/08 and 2006/07)

Multidisciplinary R&D area	2007/08		2006/07	
	R'000	%	R'000	%
Biotechnology	8 639	0.7	21 911	2.1
Nanotechnology	0	0.0	0	0.0
Total	8 639	0.7	21 911	2.1
Total R&D expenditure	1 154 399	100	1 021 355	100

For the second year in a row, government institutions reported no R&D in nanotechnology, as indicated in Table G11. R&D performed in biotechnology decreased significantly from R21.9 million in 2006/07 to R8.6 million in 2007/08.

Table G12: GERD by national R&D priority area (2007/08 and 2006/07)

National R&D priority area	2007/08		2006/07	
	R'000	%	R'000	%
Open source software	21 494	1.9	4	0.0
New materials	630	0.1	1 054	0.1
Tuberculosis (TB), HIV/AIDS, malaria	263	0.0	64 750	6.3
Total	22 387	1.9	65 808	6.4
Total R&D expenditure	1 154 399	100	1 021 355	100

Research and development expenditure on national priority areas decreased by R43 million in 2007/08, as shown in Table G12. The research areas of new materials and TB, HIV/AIDS and malaria were the most affected by the decline in expenditure. R&D expenditure in the area of open source software increased by R21.4 million between 2006/07 and 2007/08.

Chapter 4: Higher Education Sector

4.1 Introduction

The higher education sector is well-defined in size and scope, and is 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, teaching hospitals, experimental stations and clinics operating under the direct control of, or administered by, or associated with higher education institutions.

The higher education landscape underwent significant changes in the recent past due to institutional mergers. The institutions surveyed between the 2005/06 and 2007/08 surveys reflect the new higher education landscape in its entirety. All public universities, as well as all private higher education institutions with a research component, were surveyed by means of a census.

> *A key finding of the 2007/08 survey is that higher education expenditure on research and experimental development (HERD) increased by approximately 9.8% in nominal terms from the figure of R3 298.8 million reported in 2006 to R3 621.8 million in 2007.*

This is a modest increase compared with the 20.7% increase observed in the 2006 academic year (see Table H2).

Table H1: Overview of higher education R&D personnel (2007/08)

Higher education institutions	Total R&D expenditure (R' 000)	Researcher (headcount)	Researcher (FTE)	Doctoral students and postdoctoral fellows (headcount)	Doctoral students and postdoctoral fellows (FTE)
Private universities	9 611	47	19	0	0
Monash University	9 611	47	18.8	0	0
Universities	3 377 829	14 720	3 334	10 305	6 063
Nelson Mandela Metropolitan University	97 347	444	69.5	346	166.6
North West University	223 315	1 328	434.4	866	469.3
Rhodes University	94 799	291	104	256	256
Stellenbosch University	361 824	1 034	299.3	1 001	516.5
University of Cape Town	571 733	2 321	545.9	1 203	760.6
University of Fort Hare	11 291	292	16.4	155	97
University of Johannesburg	149 209	683	153	565	565
University of KwaZulu–Natal	465 412	1 910	476.4	1 162	602.5
University of Limpopo	46 563	745	149	154	77.1
University of Pretoria	415 735	1 996	360.6	1 585	722.1
University of South Africa	125 854	1 106	273.4	771	462.6
University of the Free State	142 419	193	63.8	632	266.5
University of the Western Cape	89 451	516	103.2	353	234.8
University of the Witwatersrand	561 564	1 630	245	1 105	776
University of Zululand	21 313	231	39.96	151	90.6
Universities of (science &) technology	234 422	2 241	320	439	264
Cape Peninsula University of Technology	42 396	171	34.2	90	90
Central University of Technology	26 687	134	28.9	59	36.7
Mangosuthu Technikon	3 974	37	7.4	0	0
Durban Institute of Technology	33 738	299	40.1	53	20.8
Tshwane University of Technology	70 003	509	82.4	146	58.7
University of Venda for Science and Technology	8 682	278	19.99	49	29.4
Vaal University of Technology	18 741	287	26.8	29	19.4
Walter Sisulu University for Technology and Science	30 201	526	79.96	13	9
Total	3 621 862	17 008	3 672	10 744	6 327

4.2 Survey methods

The 2007/08 survey questionnaire was identical to that used in 2006/07. Previously, workshops were held with respondents in Cape Town and Pretoria with the aim of building relationships with respondents, and discussing the questionnaire and fieldwork processes. No workshops were held for the 2007/08 survey, but many respondents indicated that workshops would be of great interest to them. The workshops will therefore definitely be included again in the future as part of the fieldwork practices for the survey of the higher education sector.[8]

[8] It should be mentioned that the primary aim of the workshops was to assist CeSTII with fieldwork and to build relationships with contact persons. It is unlikely that not conducting the workshop would have affected the quality of the data.

Previously, the services of an external consultant were employed to extract researcher and student headcount and FTE data per institution from available HEMIS records with the intention of decreasing the burden on respondents.

This strategy proved to be unsuccessful, however, because the majority of respondents preferred to extract researcher and student headcount and FTE data from their own databases. The questionnaire included updated detailed explanatory notes on the use of the HEMIS data.

The use of hard-copy questionnaires in the higher education sector was phased out during the 2006/07 survey. All the higher education institutions made use of the electronic questionnaire, which proved to be an appropriate method for surveying the sector. An electronic version of the questionnaire was generated and sent to all respondents. The Excel version proved very popular among respondents.

The 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 faculty level, with staff, student and financial data often provided centrally.

In total, 24 institutions were surveyed. These included eight universities of (science and) technology,[9] 15 universities in the public sector and one private higher education institution.

The response rate for this sector was relatively good during this survey round. Respondents that regularly submit questionnaires took less time to complete the questionnaire, largely because they take steps to anticipate the data requirements of the R&D Survey and have become accustomed to completing the questionnaires. Some institutions have also incorporated R&D Survey-specific fields into their institutional data collection mechanisms. The reliability of the data has improved significantly over the years. Despite the good response rate to the 2007/08 survey, some institutions required far more time than others to complete the questionnaire. Five medium-to-low research-intensive institutions failed to submit returns. Their primary reason for this seems to have been that the data required are simply not available in the format stipulated in the survey instrument. Several of these institutions had new respondents, who had to take responsibility for completing the survey questionnaire without any previous experience of the R&D Surveys. The DST addressed an official letter to those institutions that had not yet submitted questionnaires by the deadline date in an attempt to increase the response rate. Supplementary data sources (namely, HEMIS, the NRF, MRC, THRIP and the Innovation Fund) were once again used to further populate questionnaires that had missing information, as well to create responses for institutions that did not submit a return. Once questionnaires for those institutions had been populated, they were sent to the Research Deans of the institutions for signing off.

[9] This includes the Mangosuthu University of Technology, which was previously the Mangosuthu Technikon. The name change of this institution was gazetted on 16 November 2007.

4.3 Detailed results

This section provides results pertaining to financial data; the orientation of HERD; R&D personnel and national R&D priority areas.

4.3.1 Financial data

Table H2: In-house R&D expenditure by sector (2007/08, 2006/07 and 2005/06)

Sector	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Business enterprise	10 738 456	57.7	9 243 165	55.9	8 243 776	58.3
Government	1 154 399	6.2	1 021 355	6.2	844 640	6
Higher education	3 621 862	19.4	3 298 808	20.0	2 732 215	19.3
Technikons	3 974	0.0	5 682	0.0	4 449	0
Universities of technology	230 448	1.2	224 554	1.4	209 764	1.5
Universities	3 377 829	18.1	3 059 362	18.5	2 508 853	17.7
Private higher education	9 611	0.1	9 210	0.1	9 149	0.1
Not-for-profit	223 202	1.2	212 538	1.3	226 514	1.6
Science councils	2 886 094	15.5	2 744 718	16.6	2 102 094	14.9
Grand total	18 624 013	100	16 520 584	100	14 149 239	100

Tables H1 and H2 shows that the higher education sector accounted for 19.4% of GERD. This amounted to R3 622 million in 2007/08, which was a slight increase over the R3 299 million recorded for 2006/07, as indicated in Table H3. HERD as a percentage of GDP, however, decreased from 0.19% in 2006/07 to 0.18% in 2007/08.

Table H3: Main characteristics of R&D the higher education sector (2007/08, 2006/07 and 2005/06)

Main characteristics	2007/08	2006/07	2005/06
HERD (Rand million)	3 622	3 299	2 732
HERD as a % of GDP	0.18%	0.19%	0.17%
Total higher education R&D personnel (FTE)	5 178	5 169	4 932
Total higher education researchers* (FTE)	9 999	3 658	3 555
% HERD financed by industry	14.4%	20.7%	11.6%

* Including doctoral students and postdoctoral fellows

Table H4 indicates R&D personnel headcount by sector. The higher education sector accounted for 54.1% of R&D human resources in the country in 2007/08 (including. doctoral students and postdoctoral fellows).[10] Of the 40 084 researchers in South Africa, 69.2% are found in the higher education sector.

[10] Note that the figures include doctoral students and postdoctoral fellows as researchers. These figures are reported separately in Table H4.

Table H4: Headcount of R&D personnel by sector (2007/08 and 2006/07)

Sector	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D		Grand total		Percentage	
	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07
Business enterprise	8 336	8 227	5 303	5 113	4 312	4 127	17 951	17 467	30.2	29.8
Government	1 138	1 111	739	831	917	982	2 794	2 924	4.7	5.0
Higher education*	17 008	17 459	2 006	2 170	2 351	2 117	21 365	21 746	36.0	37.0
Technikons	37	56	1	2	12	16	50	74	0.1	0.1
Universities of technology	2 204	2 524	330	368	281	326	2 815	3 218	4.7	5.5
Universities	14 720	14 828	1 675	1 800	2 056	1 773	18 451	18 401	31.1	31.3
Private higher education	47	51	0	0	2	2	49	53	0.1	0.1
Not-for-profit	264	252	77	77	161	155	502	484	0.8	0.8
Science councils	2 594	2 255	1 351	1 570	2 043	1 973	5 988	5 798	10.1	9.9
Grand total	29 340	29 304	9 476	9 761	9 784	9 354	48 600	48 419	81.9	82.5
Higher education doctoral and postdoctoral students	10 744	10 287	-	-	-	-	10 744	10 287	18.1	17.5
Total	40 084	39 591	9 476	9 761	9 784	9 354	59 344	58 706	100	100

*Excluding doctoral students and postdoctoral fellows. These figures are presented separately in the last row of the table.

According to the data presented in Table H5, current expenditure (labour costs and other current expenditure) accounted for 91.8% of higher education expenditure of R&D (HERD), and investment in infrastructure and research equipment amounted to just over 8%. These percentages are similar to the results of previous surveys.

Table H5: HERD by accounting category (2007/08, 2006/07 and 2005/06)

Type of expenditure	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Capital expenditure on R&D	295 813	8.2	216 037	6.5	150 224	5.5
Land: Buildings and other structures	51 734	1.4	69 123	2.1	21 622	0.8
Vehicles, plant, machinery, equipment	244 079	6.7	146 914	4.5	128 602	4.7
Current expenditure	3 326 049	91.8	3 082 771	93.5	2 581 991	94.5
Labour costs	1 466 379	40.5	1 376 395	41.7	1 202 172	44.0
Total cost of R&D postgraduate students	495 128	13.7	438 486	13.3	313 645	11.5
Other current expenditure	1 364 542	37.7	1 267 890	38.4	1 066 174	39.0
Total	3 621 862	100	3 298 808	100	2 732 215	100

Basic research accounted for the largest proportion of HERD at 47.2%, followed by applied research (34.9%) and experimental development (17.9%), as indicated in Table H6. An increase in basic research was evident, as well as a slight decrease in applied and experimental development, compared with the last three R&D Surveys.

Table H6: HERD by type of research (2007/08, 2006/07 and 2005/06)

Type of research	2007/08		2006/07		2005/06	Total
	R'000	%	R'000	%	R'000	%
Basic research	1 709 334	47.2	1 348 299	40.9	1 134 411	41.5
Applied research	1 262 425	34.9	1 282 627	38.9	1 045 483	38.3
Experimental development	650 102	17.9	667 882	20.2	552 321	20.2
Total	3 621 861*	100	3 298 808	100	2 732 215	100

*Subject to rounding to the nearest R'000

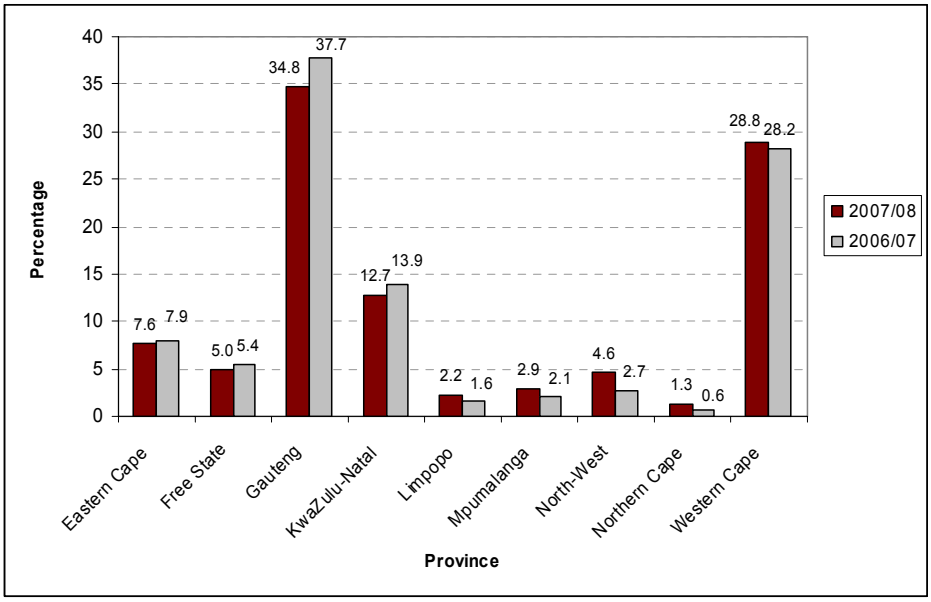
General university funds (GUF) (comprising own funds and the higher education vote) constitute the largest proportion of higher education R&D funds (47.9%), as indicated in Table H7. Data from the last three surveys indicate that the proportion of GUF appears to be decreasing, although actual expenditure increased over the period. Approximately 13.5% of higher education expenditure is derived from agency funding, while 14.4% comes from the domestic business sector. In 2006/07, an increase in funding from domestic business to higher education was reported for the first time when herd from that source reached 20.7%, but the 2007/08 results showed this figure dropping to 14.4%. The percentage of funding from foreign sources (at 8.8%) remained similar to the percentage reported the previous year.

Table H7: HERD by source of funds (2007/08, 2006/07 and 2005/06)

Type of expenditure	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
General university funds (GUF)	1 734 903	47.9	1 759 499	53.3	1 601 444	58.6
External sources	1 546 458	42.7	1 250 128	37.9	808 524	29.6
National, provincial and local government	64 900	1.8	22 666	0.7	19 955	0.7
Government research institutes	53 150	1.5	41 483	1.3	29 457	1.1
Agency funding (e.g. NRF, MRC, ARC, etc.)	489 580	13.5	449 738	13.6	397 587	14.6
Science councils	419 024	11.6	53 748	1.6	44 785	1.6
Domestic business	519 804	14.4	682 493	20.7	316 740	11.6
Other South African sources*	20 215	0.6	10 473	0.3	16 657	0.6
Higher education institutions	7 010	0.2	5 265	0.2	4 917	0.2
Not-for-profit organisations	10 171	0.3	4 378	0.1	9 423	0.3
Individual donations	3 034	0.1	830	0.0	2 317	0.1
Foreign sources	320 286	8.8	278 708	8.4	305 590	11.2
Total	3 621 862	100	3 298 808	100	2 732 215	100

* Other South African sources: Funding from higher education institutions, NPOs and individual donations were reported together in 2004/05.

Figure H1: Provincial distribution of HERD (2007/08 and 2006/07)



The largest proportion of higher education R&D expenditure was in Gauteng (34.8%) followed by the Western Cape (28.8%) and KwaZulu-Natal (12.7%), as indicated in Figure H1.

4.3.2 Orientation of HERD

Table H8: HERD by research field (2007/08, 2006/07 and 2005/06)

Main research field	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Natural sciences, technology and engineering	2 389 525	65.98	2 294 479	69.6	1 846 024	67.6
Mathematical sciences	109 354	3.0	104 323	3.2	79 707	2.9
Physical sciences	146 726	4.1	121 559	3.7	97 252	3.6
Chemical sciences	143 897	3.97	106 214	3.2	117 914	4.3
Earth sciences	121 419	3.4	119 682	3.6	115 680	4.2
Information, computer and communication technologies	119 600	3.3	143 037	4.3	105 873	3.9
Applied sciences and technologies	96 972	2.7	101 400	3.1	55 779	2.0
Engineering sciences	294 630	8.1	349 889	10.6	268 250	9.8
Biological sciences	271 216	7.5	230 480	6.99	195 380	7.2
Agricultural sciences	159 793	4.4	151 950	4.6	143 104	5.2
Medical and health sciences	785 630	21.7	710 386	21.5	582 798	21.3
Environmental sciences	58 793	1.6	58 256	1.7	42 719	1.6
Material sciences	72 484	2.0	86 764	2.6	29 348	1.1
Marine sciences	9 013	0.3	10 539	0.3	12 220	0.5
Division 2: Social sciences and humanities	1 232 337	34.0	1 004 329	30.5	886 194	32.4
Social sciences	796 281	21.99	658 419	19.96	594 579	21.8
Humanities	436 056	12.0	345 910	10.5	291 615	10.7
Total	3 621 862	100	3 298 808	100	2 732 218	100

Table H8 shows HERD by research field. The natural, technology and engineering sciences accounted for the largest percentage of R&D expenditure (65.9%) in 2007/08, while the social sciences and humanities accounted for 34.0%. Within Division 1, the medical and health sciences once again constituted the largest component of R&D expenditure (21.7%), followed by the engineering sciences (8.1%) and the biological sciences (7.5%).

Table H9: HERD by socio-economic objective (2007/08, 2006/07 and 2005/06)

Socio-economic objective	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Defence	4 328	0.1	2 711	0.1	2 423	0.1
Division 2: Economic development	1 271 620	35.1	1 199 956	36.4	923 990	33.8
Economic development unclassified	171 520	4.7	150 668	4.6	115 029	4.2
Plant production and plant primary products	123 126	3.4	119 949	3.6	91 790	3.4
Animal production and primary products	95 219	2.6	85 256	2.6	75 076	2.7
Mineral resources (excluding energy)	74 725	2.1	89 559	2.7	48 914	1.8
Energy resources	84 459	2.3	51 923	1.6	21 461	0.8
Energy supply	96 209	2.7	90 365	2.7	58 314	2.1
Manufacturing	172 947	4.8	210 910	6.4	145 485	5.3
Construction	28 313	0.8	27 521	0.8	20 407	0.7
Transport	22 770	0.6	16 447	0.5	16 440	0.6
Information and communication services	67 026	1.9	80 322	2.4	71 439	2.6
Commercial services	93 285	2.6	41 037	1.2	47 260	1.7
Economic framework	164 759	4.5	133 600	4.0	115 993	4.2
Natural resources	77 260	2.1	102 399	3.1	96 382	3.5
Division 3: Society	1 149 091	31.7	1 062 182	32.2	831 632	30.4
Society unclassified	171 520	4.7	150 668	4.6	115 029	4.2
Health	556 914	15.4	507 767	15.4	422 804	15.5
Education and training	195 917	5.4	199 056	6.0	149 270	5.5
Social development and community services	224 740	6.2	204 691	6.2	144 529	5.3
Division 4: Environment	317 863	8.8	261 464	7.9	223 301	8.2
Environment unclassified	57 173	1.6	50 223	1.5	38 343	1.4
Environmental knowledge	108 189	3.0	112 319	3.4	107 922	3.9
Environmental aspects of development	93 853	2.6	42 619	1.3	37 006	1.4
Environmental and other aspects	58 648	1.6	56 303	1.7	40 030	1.5
Division 5: Advancement of knowledge	878 959	24.3	772 495	23.4	750 868	27.5
Advancement of knowledge unclassified	171 520	4.7	150 668	4.6	115 029	4.2
Natural sciences, technologies and engineering	416 081	11.5	329 497	10.0	297 837	10.9
Social sciences and humanities	291 359	8.0	292 330	8.9	338 002	12.4
Total	3 621 862	100	3 298 808	100	2 732 214	100

The largest proportion of higher education R&D expenditure was devoted to economic development (35.1%), followed by the development of society (31.7%) and the advancement of knowledge (24.3%), as indicated in Table H9, which reflects HERD by socio-economic objective.

4.3.3 R&D personnel

*Table H10: Higher education R&D personnel: headcount and FTEs (2007/08, 2006/07 and 2005/06)**

Qualification	Headcount			Full-time equivalent	
2007/08	Male	Female	Total	FTE	FTE as % of headcount
Researchers	9 754	7 254	17 008	3 672.3	21.6
Technicians	1 231	775	2 006	612.8	30.5
Other personnel	791	1 560	2 351	893.0	38.0
Total	11 776	9 589	21 365	5 178.1	24.2
2006/07	Male	Female	Total	FTE	FTE as % of headcount
Researchers	9 900	7 559	17 459	3 657.8	21.0
Technicians	1 356	814	2 170	643.8	29.7
Other personnel	725	1 392	2 117	867.3	41.0
Total	11 981	9 765	21 746	5 168.9	23.8
2005/06	Male	Female	Total	FTE	FTE as % of headcount
Researchers	10 759	8 118	18 877	3 555.2	18.8
Technicians	1 221	704	1 925	535.0	27.8
*Other personnel: Executive and management***	235	92	327	68.5	20.9
*Other personnel: Administrative and support staff***	402	1 256	1 658	772.9	46.6
Total	12 617	10 170	22 787	4 931.6	21.6

*Excluding postgraduate students and postdoctoral fellows
**'Other personnel' were divided between 'executive and management' and 'administrative support staff' in the 2005/06 survey.

The number of researchers, excluding postgraduate students and postdoctoral fellows, employed in the higher education sector decreased by 2.6% between 2006/07 and 2007/08, as indicated in Table H10. Despite the drop in the researcher headcounts in the last three surveys, the number of FTE researchers increased by approximately 5% in 2006/07 and remained virtually unchanged in 2007/08. The time spent on research by researchers in the sector also remained almost constant between 2006/07 and 2008/09 at about 21%. The representation of women researchers in the sector remained static at about 43% in the last three surveys.

Table H11 indicates an increase in the headcounts and FTEs for postdoctoral fellows in 2007/08. There was also a slight increase in the doctoral headcounts and FTEs.

According to the data, postdoctoral fellows spend almost 100% of their time on research, while doctoral students spend just over 50% of their time on research. This trend appears to have been consistent for over last three surveys. However, it is important to note that an agreed FTE standard for doctoral students must be used, as any inconsistencies in this large group may introduce distortions, as seen in the 2004/05 data.

Table H11: HE postgraduate headcount and FTE by gender and qualification (2007/08, 2006/07, 2005/06)

Qualification	Headcount			Full-time equivalents	
2007/08	Male	Female	Total	FTE	FTE as % of headcount
Postdoctoral fellows	346	269	615	599.2	97.4
Doctoral students	5 554	4 575	10 129	5 728.0	56.6
Masters students	13 113	11 898	25 011	11 154.8	44.6
Total	19 013	16 742	35 755	17 481.86	48.9
2006/07	Male	Female	Total	FTE	FTE as % of headcount
Postdoctoral fellows	323	219	542	501.3	92.5
Doctoral students	5 621	4 124	9 745	5 331.8	54.7
Masters students	13 036	11 955	24 991	11 039.8	44.2
Total	18 980	16 298	35 278	16 873.0	47.8
2005/06	Male	Female	Total	FTE	FTE as % of headcount
Postdoctoral fellows	308	197	505	494.7	98.0
Doctoral students	5 574	3 923	9 497	5 184.9	54.6
Masters students	13 573	12 442	26 015	9 145.39	35.2
Total	19 455	16 562	36 017	14 824.99	41.2

Interestingly, masters students with a research component reported an increase in the time spent conducting research, from 35.2 full-time equivalents (FTEs) in 2005/06 to 44.6 in 2007/08. This takes into account that many students study on a part-time basis.[11] Just over 53% of postgraduate students (at masters and doctoral levels) and postdoctoral fellows are male. Women are especially poorly represented among postdoctoral fellows and doctoral students, where only 44% and 45% respectively are women.

[11] Note that masters students are not counted as researchers, as indicated by the OECD.

Table H12.1: HE R&D personnel: headcount by race, gender and qualification (2007/08)

Qualification	African		Coloured		Indian		White		Subtotal		Total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
Researchers												
Doctoral degree or equivalent	632	271	183	117	263	124	2 790	1 404	3 868	1 916	5 784	27.1
Masters, honours, bachelors or equivalent	1 373	932	216	233	382	331	2 483	2 454	4 454	3 950	8 404	39.3
Diplomas	387	388	66	63	178	193	801	744	1 432	1 388	2 820	13.2
Subtotal	2 392	1 591	465	413	823	648	6 074	4 602	9 754	7 254	17 008	79.6
Technicians directly supporting R&D												
Doctoral degree or equivalent	1	1	0	1	0	1	8	15	9	18	27	0.1
Masters, honours, bachelors or equivalent	62	42	18	18	17	13	75	100	172	173	345	1.6
Diplomas	320	175	195	75	71	37	464	297	1 050	584	1 634	7.6
Subtotal	383	218	213	94	88	51	547	412	1 231	775	2 006	9.4
Other personnel directly supporting R&D												
Doctoral degree or equivalent	29	18	9	4	3	5	60	55	101	82	183	0.9
Masters, honours, bachelors or equivalent	83	88	24	45	10	17	96	229	213	379	592	2.8
Diplomas	208	266	84	179	33	42	152	612	477	1 099	1 576	7.4
Subtotal	320	372	117	228	46	64	308	896	791	1 560	2 351	11.0
Total	3 095	2 181	795	735	957	763	6 929	5 910	11 776	9 589	21 365	100

Table H12.2: HE R&D personnel: headcount by race, gender and qualification (2006/07)

Qualification	African		Coloured		Indian		White		Subtotal		Total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
Researchers												
Doctoral degree or equivalent	523	191	135	73	195	97	2 537	1 239	3 390	1 600	4 990	22.9
Masters, honours, bachelors or equivalent	1 236	808	164	169	344	338	2 247	2 353	3 991	3 668	7 659	35.2
Diplomas	660	495	175	196	294	239	1 390	1 361	2 519	2 291	4 810	22.1
Subtotal	2 419	1 494	474	438	833	674	6 174	4 953	9 900	7 559	17 459	80.3
Technicians directly supporting R&D												
Doctoral degree or equivalent	2	0	0	1	0	1	13	15	15	17	32	0.1
Masters, honours, bachelors or equivalent	79	48	22	18	17	17	91	97	209	180	389	1.8
Diplomas	329	148	235	76	82	44	486	349	1 132	617	1 749	8.0
Subtotal	410	196	257	95	99	62	590	461	1 356	814	2 170	10.0
Other personnel directly supporting R&D												
Doctoral degree or equivalent	26	16	9	4	6	4	76	47	117	71	188	0.9
Masters, honours, bachelors or equivalent	74	82	24	38	14	16	100	220	212	356	568	2.6
Diplomas	161	210	72	149	31	32	132	574	396	965	1 361	6.3
Subtotal	261	308	105	191	51	52	308	841	725	1 392	2 117	9.7
Total	3 090	1 998	836	724	983	788	7 072	6 255	11 981	9 765	21 746	100

The breakdown of researcher personnel by race in the higher education sector was as follows: Whites represented the majority of researchers in the sector in 2007/08 at 60.1%, followed by Africans at 24.7%, Coloureds 7.2% and Indians at 8.1% (Table H 12.1). A similar ratio was also observed in the 2004/05, 2005/06 and 2006/07 data (H12.2). Women made up 42.7% of researchers in 2007/08. The percentage of women researchers remained largely unchanged for the last three surveys.

4.3.4 National priority areas

Table H13: HERD by multidisciplinary R&D area (2008/07 and 2006/07)

Multidisciplinary R&D area	2007/08		2006/07	
	R'000	%	R'000	%
Biotechnology	253 872	7.0	215 606	6.5
Nanotechnology	170 405	4.7	140 998	4.3
Total	424 277	11.7	356 604	10.8
Total R&D expenditure	3 621 862	100	3 298 808	100

Approximately 12% of higher education R&D expenditure is dedicated to the multidisciplinary R&D areas of biotechnology and nanotechnology. This expenditure is broken down in Table H13. Of the multidisciplinary R&D, 7.0% is dedicated to biotechnology and 4.7% to nanotechnology.

Table H14: HERD by national R&D priority area (2007/08 and 2006/07)

National R&D priority area	2007/08		2006/07	
	R'000	%	R'000	%
Open source software	41 234	1.1	41 441	1.3
New materials	160 993	4.4	135 803	4.1
Tuberculosis (TB), HIV/AIDS, malaria	583 726	16.1	391 002	11.9
Total	785 953	21.7	568 246	17.2
Total R&D expenditure	3 621 862	100	3 298 808	100

Table H14 shows that just over 21% 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 indicated, research on health-related issues consumes the bulk of this expenditure (16.1%).

Chapter 5: Not-for-profit Sector

5.1 Introduction

Identifying R&D performers in the not-for-profit (NPO) sector and ensuring participation in the R&D Survey is an ongoing task that requires considerable effort and exploration. The relatively poor understanding among respondents of what constitutes and defines R&D activity remains a challenge. Irrespective of the remaining challenges, the project team remains confident of its ability to identify and approach important R&D performers in the NPO sector, taking into consideration that there is still a pool of undetected organisations that have yet to be included.

As in the previous surveys, the NPO sector still accounts for the smallest proportion (1.2%) of total R&D expenditure across all sectors in South Africa. The 2007/08 survey measured an R&D workforce of 48 600 (excluding postgraduate students) of whom 29 340 were researchers. In both 2007/08 and 2006/07, NPO R&D personnel made up a very small proportion of the total R&D workforce (1.7% and 1.0% respectively). NPO researchers (264) constitute only 0.9% of the national total of 29 340 researchers.

A slight increase in NPO R&D expenditure and human resources was noted in the 2007/08 survey.

5.2 Key results

The key results for the NPO sector follow.

Table N1: In-house R&D expenditure by sector (2007/08, 2006/07 and 2005/06)

Sector	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Business enterprise	10 738 456	57.7	9 243 165	55.9	8 243 776	58.3
Government	1 154 399	6.2	1 021 355	6.2	844 640	6
Higher education	3 621 862	19.4	3 298 808	20.0	2 732 215	19.3
Not-for-profit	223 202	1.2	212 538	1.3	226 514	1.6
Science councils	2 886 094	15.5	2 744 718	16.6	2 102 094	14.9
Grand total	18 624 013	100	16 520 584	100	14 149 239	100

The 2007/08 R&D Survey indicated an increase in nominal R&D expenditure in the NPO sector, unlike the decrease observed between 2005/06 and 2006/07, as shown in Table N1. The total R&D expenditure measured for the NPO sector was R223 million in 2007/08. The NPO sector still accounted for the smallest proportion (1.2%) of the total R&D expenditure across all sectors in South Africa (see Table N2).

Table N2: Main characteristics of the NPO sector (2007/08, 2006/07 and 2005/06)

Main characteristics	2007/08	2006/07	2005/06
Not-for-profit domestic expenditure on R&D (Rand million)	223 202	212 538	226 514
Not-for-profit expenditure on R&D as a % of GDP	0.01%	0.01%	0.01%
Total not-for-profit R&D personnel (FTE)	379	363	287
Total not-for-profit researchers (FTE)	216	204	199
% of NPO expenditure on R&D financed by industry	10.7%	11.5%	12.10%
% of NPO expenditure on R&D financed by government	15.0%	14.0%	12.60%

An indication of R&D personnel in the NPO sector is provided in Table N3. In the last three consecutive surveys, R&D personnel in the NPO sector made up approximately 1% of the total R&D workforce.

Table N3: Headcount of R&D personnel by sector (2007/08 and 2006/07)

Sector	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D		Grand total		Percentage	
	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07
Business enterprise	8 336	8 227	5 303	5 113	4 312	4 127	17 951	17 467	30.2	29.8
Government	1 138	1 111	739	831	917	982	2 794	2 924	4.7	5.0
Higher education*	17 008	17 459	2 006	2 170	2 351	2 117	21 365	21 746	36.0	37.0
Not-for-profit	264	252	77	77	161	155	502	484	0.8	0.8
Science councils	2 594	2 255	1 351	1 570	2 043	1 973	5 988	5 798	10.1	9.9
Grand total	29 340	29 304	9 476	9 761	9 784	9 354	48 600	48 419	81.9	82.5
Higher education doctoral and postdoctoral students	10 744	10 287	-	-	-	-	10 744	10 287	18.1	17.5
Total	40 084	39 591	9 476	9 761	9 784	9 354	59 344	58 706	100	100

*Excluding postgraduate students and postdoctoral fellows

5.3 Survey methods

The methodology used for the NPO sector in the 2007/08 R&D Survey remained similar to previous years, but was adjusted slightly with the aim of ensuring a better response rate. A purposive sampling method was followed whereby NPOs that were considered likely to undertake R&D activities, as well as organisations whose primary activities had not yet been clarified, were surveyed.

The baseline register compiled for the first survey (2001/02) is continuously updated and expanded for each R&D Survey using various sources, including internet searches, newspaper reports, journals and referrals. Despite these efforts, the number of organisations surveyed in each round keeps decreasing; the reasons for this include that organisations have closed down or have become untraceable. In the 2003/04 survey, 120 NPOs were surveyed, 107 in the 2004/05 survey and 108 in the 2005/06 survey. In the 2007/08 survey, questionnaires were sent to 90 NPOs. The project team decided to focus on the top 51 organisations that were most likely to complete the questionnaire based on past performance. These NPOs were organisations that had previously completed a questionnaire, as well as organisations in the not-for-profit sector that were likely to perform R&D. Experience with previous surveys showed that only about 20–30 NPOs actually took the time and made the effort to complete the R&D questionnaire.

The NPO register appears to be more or less static in number, because the number of organisations added is balanced against the number of entities that had to be removed because they had closed down or become untraceable. The task at hand is to continuously identify and include the as-yet-unknown NPOs that conduct research.

Questionnaires were sent by post and electronic mail to the 90 NPOs identified and selected for the 2007/08 survey. These were followed up with intensive telephonic support and reminders. A shortened electronic questionnaire was created to collect the minimum information from those respondents that would not otherwise have responded. Attempts were made to complete some questionnaires telephonically. Another strategy was to contact respondents to enquire if their information or R&D activities had changed much in the last financial year. If not, the project team received permission to re-use their information collected in the previous survey and adjusted by current inflation ratios.

Despite all these efforts, the 2007/08 survey recorded the lowest response rate yet for the NPO sector. Of the 90 questionnaires sent, a return rate of 10% was obtained. Respondent fatigue was more noticeable and was probably another major contributor to the low response rate. A total of 34 questionnaires accounted for the 2007/08 NPO expenditure.

Of the total, the majority (74%) were commuted. Commuted questionnaires for known R&D players were compiled based on historic information from previous R&D Surveys, annual reports and some telephonic enquiries. Returned questionnaires were checked for completeness and accuracy of data before uploading into the Survey Management and Results System (SMRS).

The poor return rate makes it imperative that new strategies be found to survey the NPO sector, as the current method or survey instrument is not adequate for measuring R&D in this sector. However, the project team has succeeded in compiling a comprehensive register of NPOs and collecting good historical data over the last six years. New efforts will be put in place to considerably extend the register for future surveys, which will improve efforts to gain more insight into this sector and to ensure that the quality of each survey improves.

5.4 Detailed results

This section provides results pertaining to financial data; the R&D orientation; R&D personnel and national R&D priority areas.

5.4.1 Financial data

Table N4: NPO R&D by accounting category (2007/08, 2006/07 and 2005/06)

Type of expenditure	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Capital expenditure on R&D	7 025	3.1	6 974	3.3	10 092	4.5
Land: Buildings and other structures	2 959	1.3	2 624	1.2	2 336	1.0
Vehicles, plant, machinery, equipment	4 066	1.8	4 350	2.0	7 756	3.4
Current expenditure	216 177	96.9	205 564	96.7	216 422	95.5
Labour costs	109 147	48.9	98 631	46.4	85 511	37.8
Other current expenditure	107 030	48.0	106 933	50.3	130 911	57.8
Total	223 202	100.	212 538	100	226 514	100.

Current expenditure totalled R216 million and comprised labour costs and other operational expenses, as indicated in Table N4. Current expenditure accounted for the greater proportion (96.9%) of the total NPO expenditure on R&D. The cost of infrastructure, equipment, buildings and maintenance of physical plants accounted for the remaining 3.1%. The trend in the percentage breakdown of capital and current expenditure remained similar for the last three R&D Surveys.

Table N5: NPO R&D expenditure by type of research (2007/08, 2006/07 and 2005/06)

Type of Research	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Basic research	65 337	29.3	54 915	25.8	57 877	25.6
Applied research	119 982	53.8	110 698	52.1	123 609	54.6
Experimental research	37 883	17.0	46 925	22.1	45 026	19.9
Total	223 202	100	212 538	100	226 512	100

Table N5 shows that more than half (53.8%) of the total R&D expenditure in the NPO sector was used to support applied research, followed by basic research (29.3%) and experimental development research (17.0%). The amount spent on applied research in the NPO sector exceeded expenditure on the other types of research in each of the last three R&D Surveys.

Table N6: NPO R&D expenditure by source of funds (2007/08, 2006/07 and 2005/06)

Source of funds	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Organisation	6 325	2.8	14 974	7.0	46 934	20.7
Own funds	6 325	2.8	14 974	7.0	46 934	20.7
Government	33 399	15.0	29 816	14.0	28 470	12.6
Grants	18 301	8.2	17 352	8.2	16 295	7.2
Contracts	15 098	6.8	12 464	5.9	12 175	5.4
Business	23 791	10.7	24 339	11.5	27 416	12.1
Business (domestic only)	23 791	10.7	24 339	11.5	27 416	12.1
Other South African sources	28 162	12.6	24 736	11.6	21 354	9.4
Higher education	3 134	1.4	2 722	1.3	2 304	1.0
Not-for-profit organisations	18 758	8.4	19 100	9.0	16 379	7.2
Individual donations	6 270	2.8	2 914	1.4	2 671	1.2
Foreign	131 525	58.9	118 673	55.8	102 340	45.2
All sources	131 525	58.9	118 673	55.8	102 340	45.2
Total	223 202	100.	212 538	100	226 514	100

It is characteristic of the NPO sector that the largest source of funding is derived from international development agencies, as indicated in Table N6. The percentage of funding from foreign sources has been increasing steadily each year, from 45.2% in 2005/06, to 55.8% in 2006/07 and 58.9% in 2007/08. Funding from government increased marginally, but steadily, from 2005/06.

Figure N1: Provincial distribution of NPO R&D activity (2007/08 and 2006/07)

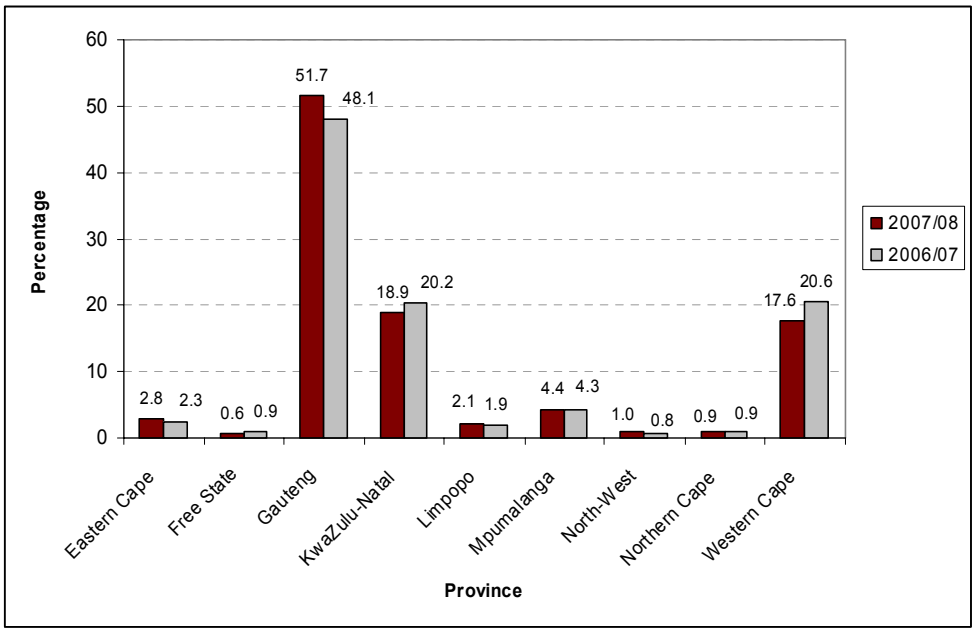


Figure N1 shows that R&D expenditure by the NPO sector is concentrated mainly in Gauteng (51.7%), followed by KwaZulu-Natal (18.9%) and the Western Cape (17.6%).

5.4.2 R&D orientation

Table N7: NPO R&D expenditure by research field (2007/08, 2006/07 and 2005/06)

Main research field	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Natural sciences, technology and engineering	**61 494**	**27.6**	**53 937**	**25.4**	**54 740**	**24.2**
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	459	0.2	185	0.1	158	0.1
Information, computer and communication technologies	1 446	0.6	925	0.4	789	0.3
Applied sciences and technologies	0	0.0	1 407	0.7	5 775	2.5
Engineering sciences	0	0.0	0	0.0	0	0.0
Biological sciences	2 005	0.9	1 874	0.9	1 630	0.7
Agricultural sciences	18 324	8.2	17 234	8.1	16 507	7.3
Medical and health sciences	29 603	13.3	25 237	11.9	23 748	10.5
Environmental sciences	7 363	3.3	3 097	1.5	3 531	1.6
Material sciences	0	0.0	0	0.0	0	0.0
Marine sciences	2 294	1.0	3 978	1.9	2 602	1.1
Division 2: Social sciences and humanities	**161 708**	**72.4**	**158 601**	**74.6**	**171 774**	**75.8**
Social sciences	159 155	71.3	156 574	73.7	170 126	75.1
Humanities	2 553	1.1	2 027	1.0	1 648	0.7
Total	223 202	100	212 538	100	226 514	100

Table N7 shows NPO R&D expenditure by research field. The findings of the 2001/02 and 2003/04 surveys indicated an equal split between R&D expenditure in the social sciences and humanities, and in the natural sciences, technology and engineering. Data from 2004/05 until 2007/08 show a different trend in that there is stronger emphasis on the social sciences, reaching 72.4% of expenditure in 2007/08; the remaining 27.6% was spent on R&D in the natural sciences. This trend may be expected to continue, as most NPOs indicated that they specialise in the social sciences.

Table N8: NPO R&D expenditure by socio-economic objective (2007/08, 2006/07 and 2005/06)

Socio-economic objective	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Defence	1 438	0.6	1 312	0.6	1 161	0.5
Defence	1 438	0.6	1 312	0.6	1 161	0.5
Division 2: Economic development	63 450	28.4	61 743	29.1	58 984	26.0
Economic development unclassified	0	0.0	0	0.0	0	0.0
Plant production and plant primary products	16 030	7.2	13 996	6.6	13 747	6.1
Animal production and animal primary products	918	0.4	1 850	0.9	1 577	0.7
Mineral resources (excluding energy)	0	0.0	0	0.0	0	0.0
Energy resources	1 000	0.4	656	0.3	581	0.3
Energy supply	1 438	0.6	1 312	0.6	1 161	0.5
Manufacturing	0	0.0	0	0.0	0	0.0
Construction	0	0.0	0	0.0	0	0.0
Transport	70	0.0	0	0.0	0	0.0
Information and communication services	0	0.0	1 388	0.7	1 183	0.5
Commercial services	782	0.4	622	0.3	2 396	1.1
Economic framework	36 588	16.4	37 516	17.7	34 253	15.1
Natural resources	6 624	3.0	4 403	2.1	4 086	1.8
Division 3: Society	129 159	57.9	127 170	59.8	147 288	65.0
Society unclassified	0	0.0	0	0.0	0	0.0
Health	33 549	15.0	28 057	13.2	26 824	11.8
Education and training	32 161	14.4	38 907	18.3	72 160	31.9
Social development and community services	63 449	28.4	60 206	28.3	48 304	21.3
Division 4: Environment	5 885	2.6	4 493	2.1	3 870	1.7
Environment unclassified	0	0.0	0	0.0	0	0.0
Environmental knowledge	2 553	1.1	1 090	0.5	949	0.4
Environmental aspects of development	559	0.3	209	0.1	185	0.1
Environmental and other aspects	2 773	1.2	3 194	1.5	2 736	1.2
Division 5: Advancement of knowledge	23 271	10.4	17 819	8.4	15 211	6.7
Advancement of knowledge unclassified	0	0.0	0	0.0	0	0.0
Natural sciences, technologies and engineering	459	0.2	925	0.4	789	0.3
Social sciences and humanities	22 812	10.2	16 894	7.9	14 422	6.4
Total	223 203	100	212 537	100	226 514	100

Expenditure by socio-economic objective in the NPO sector was the highest in division 3 (society) at 57.9%, followed by division 2 (economic development) at 28.4%, as indicated in Table N8. This pattern has persisted throughout all six R&D Surveys. In 2007/08, the main thrusts observed in division 3 (society) was social development and community services (at 28.4% of NPO R&D expenditure), followed by health (15.0%), and education and training (14.4%).

5.4.3 R&D personnel

Table N9: NPO R&D personnel: headcount and full-time equivalent (2007/08, 2006/07 and 2005/06)

Occupation	Headcount			Full-time equivalents	
2007/8	Male	Female	Total	FTE	FTE as % of headcount
Researchers	134	130	264	215.6	81.6
Technicians	44	33	77	56.5	73.4
Other personnel directly supporting R&D	41	120	161	107.0	66.5
Total	219	283	502	379.1	75.5
2006/07	Male	Female	Total	FTE	FTE as % of headcount
Researchers	127	125	252	203.6	80.8
Technicians	43	34	77	55.3	71.8
Other personnel	38	117	155	103.9	67.1
Total	208	276	484	362.7	74.9
2005/06	Male	Female	Total	FTE	FTE as % of headcount
Researchers	133	110	243	198.6	81.7
Technicians	48	36	84	59	70.2
Other personnel: Executive and management *	13	28	41	29.0	70.8
Other personnel: Administrative and support staff *	26	91	117	78.3	66.9
Total	220	265	485	364.9	75.2

*'Other personnel' was divided between 'executive and management' and 'administrative and support' staff in the 2005/06 survey.

Table N9 indicates that in 2007/08, the NPO sector accounted for 264 researchers, 77 technicians and 161 other personnel directly supporting R&D. There were 215.6 FTE researchers in the NPO sector, who spent an average of 81.6% of their time on research. This is a slight increase over the 203.6 FTE researchers recorded in 2006/07. The number of FTE technicians increased from 55.3 in 2006/07 to 56.5 in 2007/08; and they reported that they spent approximately 73.4 % of their time on R&D. Support staff accounted for 107.0 FTEs and dedicated 66.5% of their time to R&D.

The 2007/08 survey revealed increased researcher headcount and FTE numbers. Technicians and other personnel directly supporting research categories showed marginal increases in headcount and FTE numbers (Tables N10.1 and 10.2). Women were once again well represented and accounted for 56.3% of the total headcounts of research personnel and 49.2% of researchers. Previous surveys showed similar results, indicating that despite women making up the greater proportion of total R&D personnel, there were still more male researchers.

The 2007/08 R&D Survey showed furthermore that of the total R&D personnel in the NPO sector, Africans made up the largest proportion (45.8%), followed by Whites (36.1%), Coloureds (10.0%) and Indians (8.2%). Just over half the R&D personnel (52.1%) were researchers. Fewer than 10% of the NPO research personnel had a doctorate. Of the researchers, 45.8% were White, 41.3% African, 7.5% Indian and 4.9% Coloured.

Table N10.1: NPO R&D personnel: headcount by race, gender and qualification (2007/08)

Qualification	African		Coloured		Indian		White		Subtotal		Total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
Researchers												
Doctoral degree or equivalent	7	1	3	0	1	0	21	5	32	6	38	7.6
Masters, honours, bachelors or equivalent	48	29	7	3	4	14	39	56	99	102	201	40.0
Diplomas	3	21	0	0	0	1	0	0	3	22	25	4.9
Subtotal	58	51	10	3	5	15	60	61	134	130	264	52.6
Technicians directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0	0.0
Masters, honours, bachelors or equivalent	10	12	3	2	2	4	7	2	22	20	42	8.4
Diplomas	14	5	0	3	2	1	6	4	22	13	35	7.0
Subtotal	24	17	3	5	4	5	13	6	44	33	77	15.3
Other personnel directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	3	3	3	3	6	1.2
Masters, honours, bachelors or equivalent	6	25	0	10	2	3	10	14	18	51	69	13.8
Diplomas	13	36	4	15	2	4	1	10	20	65	85	17.0
Subtotal	19	61	4	25	4	8	14	27	41	120	161	32.1
Total	101	129	17	33	13	28	87	94	219	283	502	100

Table N10.2: NPO R&D personnel: headcount by race, gender and qualification (2006/07)

Qualification	African		Coloured		Indian		White		Subtotal		Grand Total	
	M	F	M	F	M	F	M	F	M	F	Headcount	%
Researchers												
Doctoral degree or equivalent	7	1	3	0	1	0	16	5	27	6	33	6.9
Masters, honours, bachelors or equivalent	47	31	8	5	5	17	39	64	100	118	217	44.9
Diplomas	0	0	0	0	0	1	0	0	0	1	1	0.3
Subtotal	54	32	11	5	6	19	55	69	127	125	252	52.1
Technicians directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0	0.0
Masters, honours, bachelors or equivalent	10	11	3	2	2	4	7	3	22	20	42	8.7
Diplomas	15	6	0	3	2	1	4	4	21	14	35	7.2
Subtotal	25	17	3	5	4	5	11	7	43	34	77	15.9
Other personnel directly supporting R&D												
Doctoral degree or equivalent	0	0	0	0	0	0	2	3	2	3	5	1.1
Masters, honours, bachelors or equivalent	6	24	0	12	2	3	11	17	20	56	75	15.6
Diplomas	11	30	2	12	1	5	2	12	16	58	74	15.4
Subtotal	17	54	2	23	3	8	15	32	38	117	155	32.0
Total	97	103	16	33	13	32	82	108	208	276	484	100

5.4.4 National priority areas

Table N11: NPO expenditure by multidisciplinary R&D area (2007/08 and 2006/07)

Multidisciplinary R&D area	2007/08		2006/07	
	R'000	%	R'000	%
Biotechnology	491	0.2	429	0.2
Nanotechnology	0	0.0	0	0.0
Total	491	0.2	429	0.2
Total R&D expenditure	223 202	100	212 538	100

The data in Table N11 show that the NPO sector did not dedicate any expenditure to nanotechnology-related R&D and that this sector was involved in research in biotechnology-related fields to the very limited extent of devoting only 0.2% of R&D expenditure in the sector to such research.

Table N12: NPO expenditure by national R&D priority area (2007/08 and 2006/07)

National R&D priority area	2007/08		2006/07	
	R'000	%	R'000	%
Open source software	0	0.0	4 973	2.3
New materials	0	0.0	1 783	0.8
Tuberculosis (TB), HIV/AIDS, malaria	0	0.0	4 215	2.0
Total	0	0.0	10 971	5.2
Total R&D expenditure	223 202	100	212 538	100

In 2006/07, the NPO sector dedicated about 5.2% of its R&D expenditure to health-related and new materials research, as well as open source software development (Table N12), but there were no data available for 2007/08 to enable reporting on these categories.

Chapter 6: Science Council Sector

6.1 Introduction

The science councils in South Africa play an important role in research and development. Although there are only nine science councils (see Table S13 for a list of the science councils), they are fairly large institutes with multiple subdivisions. The mandate of the science councils is to perform sector-specific research, the outcomes of which might be critical to the direction that policy development and implementation would assume. The R&D Survey provides important information on the extent to which science councils invest in activities that are in line with the future growth of research and innovation and ultimately economic growth. Furthermore, the volume of resources devoted to R&D is an indicator of the level of commitment to the production and exploitation of new knowledge.

It is therefore important that science councils are not only aware of the survey, but also that the purpose of the survey is well understood at all levels of these organisations. Understanding the purpose and the importance of the survey enables science councils to structure their reporting mechanisms and systems to take into consideration data requested for the R&D Survey. Furthermore, responding to the survey aids in indicating where resources for R&D are most needed. This chapter describes the R&D inputs (personnel and expenditure) within the science council sector.

6.2 Survey methods

The 2007/08 questionnaire followed the same structure that was used in the 2006/07 questionnaire. No new questions were included in the survey instrument, and the minor changes made to the questionnaire were mainly to correct typos, which did not warrant a pilot study. Contact information was verified and updated prior to the survey.

The National Research Foundation (NRF) is now the only organisation providing R&D data at the level of the unit. For the first time in the 2007/08 survey, the Agricultural Research Council (ARC) used the head office as the unit of measure. Previously, 13 questionnaires were sent to ARC, one to each unit. As a result of the ARC's adjustment, it was necessary to dispatch only 14 electronic questionnaires to the science council sector for the 2007/08 survey.

This survey covered expenditure for the year ending 31 March 2008 (which was applicable to science councils and all government departments). Respondents were allowed two to three months to complete and return the questionnaire. On average, it took four to six telephone calls and four to eight e-mails to distribute and receive responses back by the stipulated date.

All 14 questionnaires were returned with the required data. The response rate in 2007/08 was 100%, as in previous years.

Where necessary, follow-up calls were made to confirm the data, especially in cases where the response indicated significant increases or decreases in expenditure or personnel. The questionnaires were checked and verified for accuracy and completeness before being uploaded on to the Survey Management Research System (SMRS).

6.3 Key results

Key results for the science council sector are as follows for the years 2007/08, 2006/07 and 2005/06:

Table S1: In-house R&D expenditure by sector (2007/08, 2006/07 and 2005/06)

Sector	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Business enterprise	10 738 456	57.7	9 243 165	55.9	8 243 776	58.3
Government	1 154 399	6.2	1 021 355	6.2	844 640	6
Higher education	3 621 862	19.4	3 298 808	20.0	2 732 215	19.3
Not-for-profit	223 202	1.2	212 538	1.3	226 514	1.6
Science councils	2 886 094	15.5	2 744 718	16.6	2 102 094	14.9
Grand total	18 624 013	100	16 520 584	100	14 149 239	100

South Africa's total expenditure on R&D during 2007/08 reached R18 624 billion, which was an increase of 12.7% over the previous survey period. Tables S1 and S2 show that the science councils accounted for 15.5% of GERD in 2007/08, and their expenditure on R&D increased by 5%, from R2.74 billion in 2006/07 to R2.88 billion in 2007/08. However, the share of R&D by science councils decreased by 6.6% over the same period, from 16.6% in 2006/07 to 15.5% in 2007/08.

In 2007/08, science councils employed 5 988 R&D personnel by headcount (see Table S3), which comprised 10.0% of the total R&D personnel. The total number of R&D personnel increased by 3.3%, while the number of researchers in the science councils increased by 15.0%. Within the R&D-performing sectors, the higher education sector had the largest concentration of R&D personnel.

Table S2: Main characteristics of R&D in the science council sector (2007/08, 2006/07 and 2005/06)

Main characteristics	2007/08	2006/07	2005/06
Expenditure on R&D (Rand million)	2 886	2 745	2 102
Expenditure on R&D as % of GDP	0.166%	0.178%	0.176%
R&D personnel (FTE)	5 059	4 956	4 103
Researchers (FTE)	2 300	1 983	1 323
% of expenditure financed by local industry	9.1	9.7	10.5
% of expenditure financed by government	64.9	66.7	52.6

Table S3: R&D personnel: headcount by sector (2007/08 and 2006/07)

Sector	Researchers		Technicians directly supporting R&D		Other personnel directly supporting R&D		Grand total		Percentage	
	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07
Business enterprise	8 336	8 227	5 303	5 113	4 312	4 127	17 951	17 467	30.2	29.8
Government	1 138	1 111	739	831	917	982	2 794	2 924	4.7	5.0
Higher education	17 008	17 459	2 006	2 170	2 351	2 117	21 365	21 746	36.0	37.0
Not-for-profit	264	252	77	77	161	155	502	484	0.8	0.8
Science councils	2 594	2 255	1 351	1 570	2 043	1 973	5 988	5 798	10.1	9.9
Grand total	29 340	29 304	9 476	9 761	9 784	9 354	48 600	48 419	81.9	82.5
Higher education doctoral students and postdoctoral fellows	10 744	10 287	-	-	-	-	10 744	10 287	18.1	17.5
Total	40 084	39 591	9 476	9 761	9 784	9 354	59 344	58 706	100	100

In 2007/08, the science council sector spent R2.89 billion on R&D. Although there was an increase in R&D expenditure in this sector in nominal terms, this expenditure failed to keep up with the overall growth in the economy. In 2007/08, R&D intensity (R&D expenditure as a percentage of GDP) was 0.16%, compared with 0.17% in 2006/07.

6.4 Detailed results

This section provides results pertaining to financial data; the R&D orientation; R&D personnel and national R&D priority areas.

6.4.1 Financial data

Table S4: Science council R&D expenditure by accounting category (2007/08, 2006/07 and 2005/06)

Type of expenditure	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Capital expenditure on R&D	205 857	7.1	212 625	7.7	209 013	9.9
Land: Buildings and other structures	30 704	1.1	53 713	2.0	76 528	3.6
Vehicles, plant, machinery, equipment	175 153	6.1	158 912	5.8	132 485	6.3
Current expenditure	2 680 237	92.9	2 532 093	92.3	1 893 081	90.1
Labour costs	1 250 480	43.3	1 162 633	42.4	875 467	41.6
Other current expenditure	1 429 757	49.5	1 369 460	49.9	1 017 614	48.4
Total	2 886 094	100	2 744 718	100	2 102 094	100

Capital expenditure decreased over the years (Table S4). It stood at R205 million in 2007/08, representing 7.1% of total R&D expenditure in the science council sector (down from 7.7% in 2006/07). There was similarly a decline of 2.2% in capital expenditure as a percentage of R&D expenditure in the sector between 2005/06 and 2006/07.

Current expenditure accounted for 92.9% of the total R&D expenditure in the science council sector in 2007/08. Expenditure associated with labour costs totalled R1.3 billion (or 43.3%), while other current costs amounted to R1.4 billion (49.5%).

Table S5: Science council R&D expenditure by type of research (2007/08, 2006/07 and 2005/06)

Type of research	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Basic research	804 731	27.9	647 191	23.6	522 861	24.9
Applied research	1 314 770	45.6	1 328 996	48.4	1 018 979	48.5
Experimental research	766 593	26.6	768 531	28.0	560 254	26.7
Total	2 886 094	100	2 744 718	100	2 102 094	100

Table S5 shows that between 2005/06 and 2007/08, the bulk (45.6%) of the R&D expenditure by science councils was related to applied research. Basic research accounted for 27.9% of R&D in science councils in 2007/08, and expenditure on this type of research increased by 24.3%, from R647 191 million in 2006/07 to R804 731 in 2007/08.

Table S6: Science council R&D expenditure by source of funds (2007/08, 2006/07 and 2005/06)

Source of funds	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Organisation	422 811	14.6	305 577	11.1	485 702	23.1
Own funds	422 811	14.6	305 577	11.1	485 702	23.1
Government	1 874 511	64.9	1 829 383	66.7	1 105 832	52.6
Grants	1 086 663	37.7	1 146 192	41.8	629 237	29.9
Contracts	787 848	27.3	683 191	24.9	476 595	22.7
Business	263 098	9.1	265 441	9.7	220 698	10.5
Business (domestic only)	263 098	9.1	265 441	9.7	220698	10.5
Other South African sources	26 768	0.9	23 449	0.9	35 679	1.7
Higher education	3 353	0.1	583	0.0	4 620	0.2
Not-for-profit organisations	21 608	0.7	22 846	0.8	30 006	1.4
Individual donations	1 807	0.1	20	0.0	1 053	0.1
Foreign	298 906	10.4	320 868	11.7	254 183	12.1
All sources	298 906	10.4	320 868	11.7	254183	12.1
Total	2 886 094	100	2 744 718	100	2 102 094	100

Funding for R&D activities in the science councils comes from a variety of sources, mostly in the form of government grants and contracts, which made up to 65% of the total funding (see Table S6). About 14.6% of the R&D funding came from science councils' own funds, while the financial support from the business sector amounted to 9.1% of the total and the share of funding from abroad to 10.4%.

Figure S1: Provincial distribution of R&D activity in science councils (2007/08 and 2006/07)

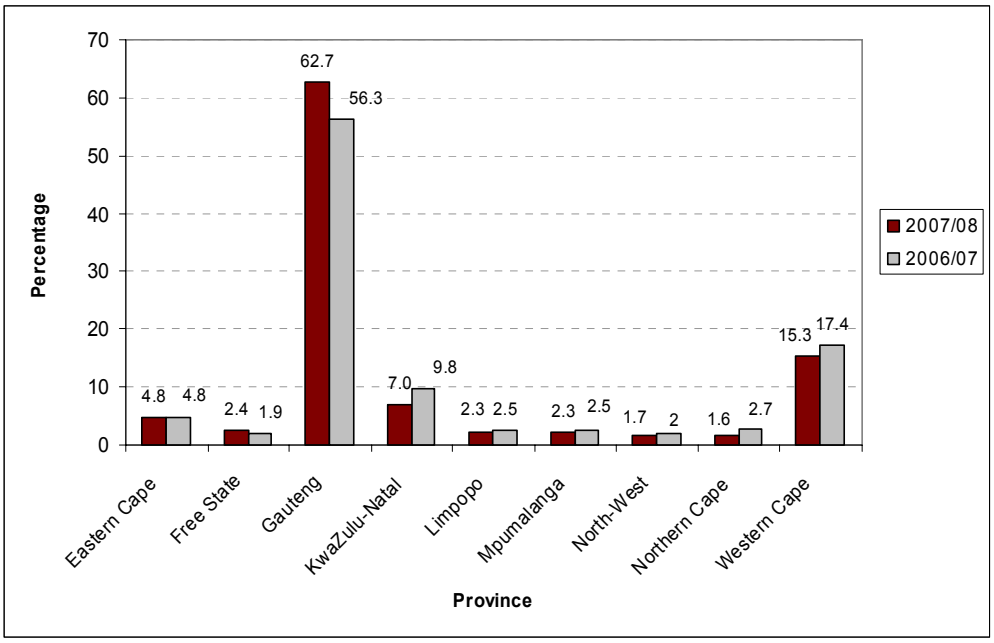


Figure S1 shows the location of R&D activity in science councils, namely, where R&D is actually performed, as opposed to where it is managed or financed. Of the nine South African provinces, only three reported an increase in R&D expenditure in sciences councils in 2007/08. R&D expenditure performed by science councils in Gauteng province amounted to 62.7% of the total performed in the country, having increased by 17.0% between 2006/07 and 2007/08. The Eastern Cape and Free State provinces also reported increases of 5.5% and 28.7% respectively over the previous year. In the Western Cape (the second highest performer of R&D within science councils), the R&D expenditure of science councils decreased by 7.9%. In KwaZulu-Natal, R&D expenditure by science councils decreased by almost 25%.

6.4.2 R&D orientation

In 2007/08, the engineering field accounted for 22.3% of total R&D expenditure, followed by the agricultural sciences at 19.6% and medical and health sciences at 12.4% (Table S7). Research in the social sciences (at 8.2%) also featured significantly within the science councils in comparison with other fields.

Table S7: Science council R&D expenditure by research field (2007/08, 2006/07 and 2005/06)

Main research field	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Natural sciences, technology and engineering	2 623 455	90.9	2 530 246	92.2	1 922 728	91.5
Mathematical sciences	35 551	1.2	27 129	1.0	20 564	1.0
Physical sciences	93 583	3.2	126 542	4.6	114 723	5.5
Chemical sciences	37 430	1.3	33 774	1.2	21 494	1.0
Earth sciences	147 427	5.1	130 879	4.8	96 410	4.6
Information, computer and communication technologies	212 796	7.4	133 328	4.9	82 238	3.9
Applied sciences and technologies	138 849	4.8	126 107	4.6	78 065	3.7
Engineering sciences	643 349	22.3	642 923	23.4	451 924	21.5
Biological sciences	175 592	6.1	306 056	11.2	265 202	12.6
Agricultural sciences	566 561	19.6	521 454	19.0	387 569	18.4
Medical and health sciences	358 726	12.4	340 764	12.4	270 090	12.8
Environmental sciences	85 414	3.0	72 191	2.6	56 259	2.7
Material sciences	108 068	3.7	51 020	1.9	69 742	3.3
Marine sciences	20 108	0.7	18 079	0.7	8 448	0.4
Division 2: Social sciences and humanities	262 639	9.1	214 472	7.8	179 366	8.5
Social sciences	238 019	8.2	194 040	7.1	165 557	7.9
Humanities	24 620	0.9	20 432	0.7	13 809	0.7
Total	2 886 094	100	2 744 718	100	2 102 094	100

Table S8: Science council expenditure by socio-economic objective (2007/08, 2006/07 and 2005/06)

Socio-economic objective	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Division 1: Defence	228 603	7.9	260 354	9.5	155 066	7.4
Defence	228 603	7.9	260 354	9.5	155 066	7.4
Division 2: Economic development	1 560 688	54.1	1 172 607	42.7	1 126 650	53.6
Economic development unclassified	0	0.0	0	0.0	0	0.0
Plant production and plant primary products	433 850	15.0	332 655	12.1	297 626	14.2
Animal production and animal primary products	25 124	0.9	115 649	4.2	72 380	3.4
Mineral resources (excluding energy)	63 469	2.2	62 585	2.3	286 363	13.6
Energy resources	38 979	1.4	51 257	1.9	30 997	1.5
Energy supply	874	0.0	8 033	0.3	595	0.0
Manufacturing	385 822	13.4	130 396	4.8	110 467	5.3
Construction	101 232	3.5	149 809	5.5	90 143	4.3
Transport	33 817	1.2	30 943	1.1	18 401	0.9
Information and communication services	17 429	0.6	25 177	0.9	18 271	0.9
Commercial services	8 975	0.3	3 546	0.1	0	0.0
Economic framework	206 878	7.2	85 194	3.1	66 540	3.2
Natural resources	244 239	8.5	177 363	6.5	134 867	6.4
Division 3: Society	368 010	12.8	359 982	13.1	278 222	13.2
Society unclassified	0	0.0	0	0.0	0	0.0
Health	272 905	9.5	240 248	8.8	218 941	10.4
Education and training	37 449	1.3	56 054	2.0	51 704	2.5
Social development and community services	57 656	2.0	63 680	2.3	7 577	0.4
Division 4: Environment	263 325	9.1	225 563	8.2	168 682	8.0
Environment unclassified	0	0.0	0	0.0	0	0.0

Socio-economic objective	2007/08		2006/07		2005/06	
	R'000	%	R'000	%	R'000	%
Environmental knowledge	130 041	4.5	120 806	4.4	94 519	4.5
Environmental aspects of development	46 190	1.6	50 877	1.9	43 835	2.1
Environmental and other aspects	87 094	3.0	53 880	2.0	30 328	1.4
Division 5: Advancement of knowledge	465 468	16.1	726 212	26.5	373 474	17.8
Advancement of knowledge unclassified	0	0.0	0	0.0	0	0.0
Natural sciences, technologies and engineering	361 714	12.5	616 487	22.5	306 398	14.6
Social sciences and humanities	103 754	3.6	109 725	4.0	67 076	3.2
Total	2 886 094	100	2 744 718	100	2 102 094	100

Table S8 shows that in 2007/08, 54.1% of R&D expenditure in science councils was directed towards economic development and 16.1% towards the advancement of knowledge; research related to society accounted for a further 12.8%, the environment for 9.1% and defence for 7.9%. In division 1, (economic development), science councils funded R&D totalling R443 million (15.0% of total) in relation to plant production and plant primary products. R&D related to manufacturing increased significantly from R130 million in 2006/07 to R386 million in 2007/08. Other significant increases within the economic development objective over the same period included research on the economic framework (in which expenditure increased by 142.8%) and natural resources (with an increase of 37.7%). R&D expenditure related to defence decreased by 12.2%. There was a particularly significant drop of 41.3% in expenditure on the natural sciences, technologies and engineering subdivision of the advancement of knowledge objective between 2006/07 and 2007/08.

6.4.3 R&D personnel

Table S9: Science council R&D personnel: headcount and FTEs (2007/08, 2006/07 and 2005/06)

Occupation	Headcount			Full-time equivalent	
2007/08	Male	Female	Total	FTE	FTE as % of headcount
Researchers	1 602	992	2 594	2 300.2	88.7
Technicians	741	610	1 351	1 099.2	81.4
Other personnel directly supporting R&D	1 205	838	2 043	1 659.4	81.2
Total	3 548	2 440	5 988	5 058.8	84.5
2006/07	Male	Female	Total	FTE	FTE as % of headcount
Researchers	1 409	846	2 255	1 982.8	87.9
Technicians	891	679	1 570	1 342.1	85.5
Other personnel	1 129	844	1 973	1 631.3	82.7
Total	3 429	2 369	5 798	4 956.1	85.5
2005/06	Male	Female	Total	FTE	FTE as % of headcount
Researchers	1 111	679	1 790	1 323.3	73.9
Technicians	1 001	677	1 678	1 250.9	74.5
Other personnel: Executive and management *	268	64	332	223.1	67.2
Other personnel: Administrative and support staff *	928	951	1 879	1 305.9	69.5
Total	3 308	2 371	5 679	4 103.1	72.3

*'Other personnel' were divided between 'executive and management' and 'administrative support staff' in the 2005/06 survey.

According to Table S9, the science council sector employed 5 988 R&D personnel (by headcount) in 2007/08, corresponding to approximately 5 059 full-time equivalents, which represented an increase of 2.1% over 2006/07. Researchers made up the largest group of FTE R&D personnel (45.5%); this number increased by 16.0% between 2006/07 and 2007/08.

Tables S10.1 and S10.2 provide a breakdown of total R&D personnel in the science council sector by race, gender and qualification. The results of the 2007/08 survey show that 2 594 researchers (by headcount) were employed at science councils. Of theses, 26.0% had a doctoral degree, 59.8% held a degree other than a doctorate, and the remainder (14.2%) had a diploma as a qualification. The number of researchers with a doctorate declined by 7.0% compared with 2006/07. Male researchers accounted for 61.8% of all researchers in science councils (and for 70.8% of the researchers with a doctorate). There were 197 women researchers with a doctorate, 32.5% of whom were black (African, Indian and Coloured).

White male researchers dominate the science council sector (35.2%), followed by African males (20.0%), white females (18.5%) and African females (13.8%). Coloured researchers accounted for only 4.6% of the total, and Indian researchers made up 8.0%. The results show that R&D personnel with a doctorate stood at 732, or 12.2% of the total. As in previous surveys, the science council sector continued to be male dominated. The number of women administrators and support staff continued to decline, but this did not translate into a significant increase in women working as researchers or holding a doctorate.

Table S10.1: Science council R&D personnel: headcount by race, gender and qualification (2007/08)

Qualification	African		Coloured		Indian		White		Subtotal		Total
	M	F	M	F	M	F	M	F	M	F	
Researchers											
Doctoral degree or equivalent	111	39	16	7	24	18	326	133	477	197	674
Masters, honours, bachelors or equivalent	298	245	36	34	67	69	486	316	887	664	1 551
Diplomas	109	73	14	12	14	16	101	30	238	131	369
Subtotal	518	357	66	53	105	103	913	479	1 602	992	2 594
Technicians directly supporting R&D											
Doctoral degree or equivalent	8	0	0	0	0	0	12	2	20	2	22
Masters, honours, bachelors or equivalent	85	111	16	12	11	19	87	59	199	201	400
Diplomas	268	240	67	21	9	28	178	118	522	407	929
Subtotal	361	351	83	33	20	47	277	179	741	610	1 351
Other personnel directly supporting R&D											
Doctoral degree or equivalent	7	1	1	0	5	2	14	6	27	9	36
Masters, honours, bachelors or equivalent	68	66	7	16	11	7	55	66	141	155	296
Diplomas	796	312	80	92	24	21	137	249	1 037	674	1 711
Subtotal	871	379	88	108	40	30	206	321	1 205	838	2 043
Total	1 750	1 087	237	194	165	180	1 396	979	3 548	2 440	5 988

Table S10.2: Science council R&D personnel: headcount by race, gender and qualification (2006/07)

Qualification	African		Coloured		Indian		White		Subtotal		Total
	M	F	M	F	M	F	M	F	M	F	
Researchers											
Doctoral degree or equivalent	123	40	12	9	33	23	337	148	505	220	725
Masters, honours, bachelors or equivalent	249	196	36	44	72	58	480	298	837	596	1 433
Diplomas	10	13	3	1	5	2	49	14	67	30	97
Subtotal	382	249	51	54	110	83	866	460	1 409	846	2 255
Technicians directly supporting R&D											
Doctoral degree or equivalent	1	0	1	0	1	0	3	4	6	4	10
Masters, honours, bachelors or equivalent	87	132	18	20	7	25	101	77	213	254	467
Diplomas	310	243	91	28	16	17	255	133	672	421	1 093
Subtotal	398	375	110	48	24	42	359	214	891	679	1 570
Other personnel directly supporting R&D											
Doctoral degree or equivalent	3	0	0	0	0	0	2	2	5	2	7
Masters, honours, bachelors or equivalent	79	54	12	7	12	14	41	69	144	144	288
Diplomas	735	320	79	93	20	24	146	261	980	698	1 678
Subtotal	817	374	91	100	32	38	189	332	1 129	844	1 973
Total	1 597	998	252	202	166	163	1 414	1 006	3 429	2 369	5 798

6.4.4 National priority areas

Table S11: Science council R&D expenditure by multidisciplinary R&D area (2007/8 and 2006/07)

Multidisciplinary R&D area	2007/08		2006/07	
	R'000	%	R'000	%
Biotechnology	216 292	7.5	222 190	8.1
Nanotechnology	47 802	1.7	14 031	0.5
Total	264 094	9.2	236 221	8.6
Total R&D expenditure	2 886 094	100	2 744 718	100

R&D expenditure related to nanotechnology increased steadily over the past two survey periods, as indicated in Table S11. The expenditure amounted to R11.1 million in 2005/06 and increased to R216.3 million in 2007/08. Expenditure related to R&D in biotechnology decreased slightly by almost 3%.

Table S12: Science council R&D expenditure by national priority area (2007/8 and 2006/07)

National R&D priority area	2007/08		2006/07	
	R'000	%	R'000	%
Open source software	77 885	2.7	27 510	1.0
New materials	64 131	2.2	82 990	3.0
Tuberculosis (TB), HIV/AIDS, malaria	233 917	8.1	180 104	6.6
Total	375 933	13.0	290 604	10.6
Total R&D expenditure	2 886 094	100	2 744 718	100

Between 2006/07 and 2007/08, the science councils' expenditure on national R&D priority areas increased by 29.4% (Table S12). The most significant increase in expenditure was related to R&D in diseases such as tuberculosis (TB), HIV/AIDS and malaria.

In conclusion, Table S13 provides a summary of total R&D expenditure, researchers (FTE), expenditure on basic research and capital expenditure per science council.

Table S13: Science council overview 2007/08

Science Councils	Total R&D expenditure	Researchers	Basic research	Capital expenditure
	R'000	(FTE)	R'000	R'000
Africa Institute of South Africa (AISA)	25 285	17	25 285	1 222
Agricultural Research Council (ARC)	694 316	445	104 147	44 136
Council for Scientific and Industrial Research (CSIR)	1 112 648	1 240.0	233 656	84 673
Council for Geoscience (CGS)	89 754	80	67 316	29 012
Human Sciences Research Council (HSRC)	170 342	100.0	34 068	4 191
Medical Research Council (MRC)	324 236	251	194 542	8 215
Council for Mineral Technology (Mintek)	355 526	70.4	71 105	17 000
National Research Foundation (NRF)	109 615	93.8	74 612	17 408
South African Bureau of Standards (SABS)	4 372	3	0	0
Total	2 886 094	2 300	804 731	205 857

Notifications

Revisions

The DST, Stats SA, the HSRC and the project team reserve the right to collaboratively revise data, indicators and analysis, if deemed necessary, to improve the quality of this product. Revisions of data may originate from both internal and external data quality and consistency checks or amendments in response to queries from the OECD, which conducts quality checks through global comparative analysis, time series analysis and other methods. Revisions to this document may also result from changes in outside data (for example, the revision by Stats SA of national data series such as GDP).

Note that any revisions concerning the data presented in this report will be noted and can be accessed on the DST and HSRC websites (see the Dissemination section below for website addresses).

User satisfaction survey

A user satisfaction survey is included in *Annexure II* of this report. The project team invites users to complete this survey and return their responses by fax to +27 (0)21 461 1255.

Input from various participants continues to be included in the feedback process following each survey with a view to ensuring the success of future surveys.

Dissemination

This report is published for wider dissemination by both the HRSC and the DST and is freely downloadable. The report may be downloaded from:

- www.dst.gov.za/publications-policies/r-d-reports
- www.hsrc.ac.za/CCUP-RnD-7.phtml

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Data extractions by CeSTII on behalf of users are governed by the Access Protocol and are generally provided free of charge unless fairly substantial analytical work is required to accede to the request for data.

Annexure I: Example of a R&D Survey Questionnaire

Department of Science and Technology

Statistics South Africa

Human Sciences Research Council

CeSTII SURVEY OF RESEARCH & EXPERIMENTAL DEVELOPMENT (R&D) INPUTS SCIENCE COUNCILS/ GOVERNMENT/ NOT-FOR-PROFIT 2007/08 FINANCIAL YEAR

Organisation	Please modify address label if necessary

AUTHORITY
The Centre for Science, Technology and Innovation Indicators (CeSTII), within the Knowledge Systems Programme of the Human Sciences Research Council (HSRC), conducts the Survey of Inputs into Research and Experimental Development (R&D) for the Department of Science and Technology (DST). The Survey is a component of Official Statistics, as defined in the Statistics Act No. 6 of 1999, and all data gathered for this survey is confidential. The HSRC and DST will not disseminate any information identifiable with an organisation without their consent.

PURPOSE AND SCOPE OF SURVEY
The R&D Survey collects data on the inputs into R&D activities performed **IN-HOUSE** in South Africa by all organisations (Including Business, Government, Science Councils, Not-for Profit and Higher Education). The data is used for planning and monitoring purposes and for measuring international competitiveness. Previous survey results may be viewed at www.hsrc.ac.za/RnDSurvey. This survey covers the Financial Year 1 April 2007 to 31 March 2008 (or your nearest complete financial year).

DUE DATE
Kindly complete and return this questionnaire (by post or e-mail) to: **wblankley@hsrc.ac.za** or **R&D Survey, Private Bag X2, Vlaeberg 8018.**

ASSISTANCE
To assist you with queries kindly contact one of the survey managers:

Sector	Name	Contact Number	E-mail

Details of person completing this questionnaire (Please print)

Name (With title)	
Designation	
Date	
Signature	

Tel	( )
Fax	( )
Cell	( )
E-mail	

THE FOLLOWING DEFINITIONS ARE IMPORTANT IN THE COMPLETION OF THE SURVEY QUESTIONNAIRE: WHAT IS R&D?

Definition
This survey follows the approach of the Organisation for Economic Co-operation and Development (OECD), which defines Research and Experimental Development (R&D) as:

- **Research** is creative work and original investigation undertaken on a systematic basis to gain new knowledge, including knowledge of humanity, culture and society.
- **Development** is the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes.

The basic criterion for distinguishing R&D from related activities is the presence in R&D of an appreciable element of novelty and the resolution of scientific and/or technological uncertainty, i.e. when the solution to a problem is not readily apparent to someone familiar with the basic stock of commonly used knowledge and techniques in the area concerned.

For example investigating electrical conduction in crystals is basic research; application of crystallography to the properties of alloys is applied research. New chip designs involve development. Investigating the limiting factors in chip element placement lies at the border between basic and applied research. Much business R&D involves development.

R&D Includes – but is not limited to:
Activities of personnel who are obviously engaged in R&D. In addition, research activity includes:

- The provision of professional, technical, administrative or clerical support and/or assistance to personnel directly engaged in R&D
- Management of personnel who are either directly engaged in R&D or are providing professional, technical or clerical support to those performing R&D
- Software development where the aim of the project is the systematic resolution of a scientific or technological uncertainty
- Research work in the biological, physical and social sciences, and the humanities
- Social science research includes economic, cultural, educational, psychological and sociological research.
- Research work in engineering and the medical sciences
- R&D projects performed for other parties
- "Feedback R&D" directed at solving problems occurring beyond the original R&D phase, for example technical problems arising during initial production runs.

R&D Excludes:
The following specific ROUTINE activities are excluded, except where they are an essential part of R&D:

- Scientific and technical information services
- Engineering and technical services
- General purpose or routine data collection
- Standardisation and routine testing
- Feasibility studies (except into R&D projects)
- Specialised routine medical care, for example routine pathology services
- The commercial, legal and administrative aspects of patenting, copyrighting or licensing activities
- Routine computer programming, systems work or software maintenance where there are no technological uncertainties to be resolved.

PART 1: GENERAL INFORMATION

1. **Parent organisation/Department**

2. **Name of organisation/ unit**

3. **Total number of employees working for the organisation during financial year**
(include staff on contract for six months or longer)

4. **Did the reporting organisation/unit perform any <u>IN-HOUSE R&D</u> in South Africa during the financial year?**

- In-house R&D refers to R&D performed by the reporting unit on its own behalf or on behalf of the others.
- It excludes R&D projects funded by this organisation but carried out by others using their own facilities.
- In-house R&D must be distinguished from outsourced R&D which should be reported under Part 5.
- Only R&D performed in South Africa should be recorded.

Yes ☐ **Please continue with question 5 to question 15**

No ☐ **Please proceed to Part 5: Question 13, 14 and 15 on <u>Outsourced</u> R&D**

☐ **If your reporting organisation/unit does *not* do any In-House and/or Outsourced R&D, please tick this box and return the questionnaire as a NIL response.**

PART 2: IN-HOUSE R&D PERSONNEL

Report for all R&D personnel, permanent and contract (6 months or longer).

Researchers
Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the planning and management of the projects concerned.

Technicians directly supporting R&D
Persons doing technical tasks in support of R&D, normally under the direction and supervision of a Researcher.

Other personnel directly supporting R&D
Other supporting staff includes skilled and unskilled crafts persons, secretarial and clerical staff participating in R&D projects or directly associated with such Projects.

NOTE: Do not include personnel **indirectly** supporting R&D: Typical examples are transportation, storage, cleaning, repair, maintenance and security activities, as well as administration and clerical activities undertaken not exclusively for R&D (such as the activities of central finance and personnel departments).
Allowance for these should be made under overheads in R&D expenditure (current expenditure – **Question 7D**) but such persons should not be included as R&D personnel.

5. HEADCOUNT OF R&D PERSONNEL

Provide the headcount of all R&D personnel according to categories below

Personnel Categories and Highest Qualification	African		Coloured		Indian		White		Subtotal		TOTAL
	M	F	M	F	M	F	M	F	M	F	
Researchers (incl. Research Executives & Research Managers)											
Doctorates											
Masters/Hons/Bachelors or equivalent											
Diplomas and other											
RESEARCHER TOTAL											
Technicians /Technologists											
Doctorates											
Masters/Hons/Bachelors or equivalent											
Diplomas and other											
TECHNICIAN TOTAL											
Other personnel directly supporting R&D											
Doctorates											
Masters/Hons/Bachelors or equivalent											
Diplomas and other											
OTHER SUPPORT TOTAL											

CARRY SUBTOTALS OVER TO QUESTION 6

6. FULL-TIME EQUIVALENTS (FTEs) AND LABOUR COSTS OF R&D PERSONNEL

Provide an estimate of Person Years of effort on R&D (or Full-Time Equivalents), according to the categories below.

CALCULATING 'FULL TIME EQUIVALENT' (FTE) PERSONS

Note: For the purpose of this survey, an employee can only work one person year each year (even if he/she works several hours of over-time everyday.
For example:
-a **full time** employee who devotes **100%** of their time to R&D
1 x 1 = 1 person years on R&D
-a **full time** employee spending **40%** of his/her time on R&D during **half** of the survey year:
0.4 x 0.5 years = 0.2 person years of R&D effort
-a **part-time** employee working **40%** of a full time year doing only R&D
0.4 x 1= 0.4 FTE to the R&D effort.
-20 **full-time** male researchers spending **40%** of their time on R&D during the survey year:
20 x 0.4 x 1= 8

NOTE: please calculate FTEs for all R&D personnel.

Personnel Categories	Headcounts (From Q 5)			Full Time Equivalents (FTE's)			Average annual labour cost per person R'000 (Excl. VAT) (B)	Calculated labour cost of R&D R'000 (Excl. VAT) (A x B)
	M	F	Total	M	F	Total (A)		
Researchers (incl. Research Executives & Research Managers)								
Technicians directly supporting R&D								
Other personnel directly supporting R&D								
TOTAL LABOUR COST OF R&D								

Carry over total calculated labour cost to question 7C

PART 3: IN-HOUSE R&D EXPENDITURE

7. IN-HOUSE R&D EXPENDITURE:

Allocate in-house R&D expenditure as follows:

CAPITAL EXPENDITURE ON R&D

- The full price of capital expenses must be reported in the year of purchase (do not depreciate)
- If the asset has been/will be used for more than one activity, include only an estimate of the portion used for R&D.

Including - but not limited to:	*Excluding:*
• Expenditure on fixed assets used in the R&D projects of your business. • Acquisition of software, including fees, expected to be used for more than one year. • Purchase of databases expected to be used for more than one year. • Major repairs & improvements on land & buildings	• Other repairs and maintenance expenses. • Depreciation provisions. • Proceeds from the sale of R&D assets.

		R'000 (Excl. VAT)
Vehicles, plant, machinery and equipment	**A**	R
Land; buildings and other structures	**B**	R

LABOUR COSTS OF R&D

		R'000 (Excl. VAT)
Labour Costs of R&D personnel (from Question 6:)	**C**	R

OTHER CURRENT EXPENDITURE ON R&D

Including - but not limited to:	*Excluding:*
• Materials, fuels and other inputs. • Water, electricity and other overheads expenses • Repair and maintenance expenses. • Payments to outside organisations for use of specialised testing facilities. • Payments to outside organisations for analytical work, engineering or other specialised services in support of R&D projects carried out by this department/unit • Commission/consultant expenses for research projects carried out by this department/unit • Other R&D expenses and indirect costs not classified in 7A, 7B or 7C. • The relevant % of labour costs of persons providing indirect services such as Head office, HR, Finance, security, maintenance personnel, staff of central libraries, IT departments	• Contract R&D expenses where the research project is carried out elsewhere by others on behalf of this department/unit. • Payments for purchases of technical know-how. • Payments for patent searches. • Depreciation provisions.

		R'000 (Excl. VAT)
Other Current Expenditure	**D**	R

	R'000 (Excl. VAT)
TOTAL R&D EXPENDITURE (A + B + C + D)	**R**

8. SOURCES OF FUNDS FOR IN-HOUSE R&D

Provide a breakdown of the total R&D expenditure (as reported in question 7) according to sources of funds.

	R'000 (Excl. VAT)
Organisation	
Own funds	R
Government (includes Science Councils e.g. CSIR, Departments and Institutes)	
Grants (including SPII, Innovation Fund etc)	R
Contracts	R
Business	
Business (Domestic only)	R
Other South African	
Higher Education	R
Not-for-profit organisations	R
Individual Donations	R
Foreign	
All sources	R

	R'000 (Excl. VAT)
TOTAL R&D EXPENDITURE (to correspond with Q7)	**R**

9. PROVINCIAL EXPENDITURE ON R&D

Please state the location where your organisations/unit carried out R&D activities and the percentage of the total R&D expenditure.

Specify where R&D is actually performed, rather than where it is managed/financed from.

Eastern Cape		Mpumalanga	
Free State		Northern Cape	
Gauteng		North-West	
KwaZulu-Natal		Western Cape	
Limpopo		**TOTAL**	**100%**

PART 4: CATEGORIES OF IN-HOUSE R&D EXPENDITURE

10. IN-HOUSE R&D CURRENT EXPENDITURE BY TYPE OF R&D

Specify the percentage of total IN-HOUSE LABOUR COST and OTHER CURRENT R&D expenditure by <u>type of R&D.</u>

Basic Research

	Percentage
• Work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without a specific application in view • Analyses of properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws. • The results of basic research are usually published in peer-reviewed scientific journals	%

Applied Research

	Percentage
• Original investigation to acquire new knowledge with a specific application in view. • Activities that determine the possible uses for the findings of basic research. • The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods, or systems. • Applied research develops ideas into operational form. • Information or knowledge derived from applied research may be published in peer-reviewed journals or subjected to other forms of intellectual property protection.	%

Experimental Development

	Percentage
• Systematic work using existing knowledge gained from research and/or practical experience for the purpose of creating new or improved materials, products, processes or services, or improving substantially those already produced or installed.	%

TOTAL	**100 %**

11a. RESEARCH FIELDS (RF)

Classify R&D according to Research Fields (See Appendix B in Code book) and provide the associated % of the Total R&D expenditure per research field.

The RF Codes are based on recognised academic disciplines and emerging areas of study.

RF Codes		Percentage	RF Codes		Percentage
RF			RF		
RF			RF		
RF			RF		
RF			RF		
RF			RF		
				Total	100 %

11b. MULTI-DISCIPLINARY R&D

Please estimate the percentage of R&D expenditure allocated to the following areas:

- Multi-disciplinary R&D combines several research fields or disciplines. If your organisation performs such R&D, as described below, please provide the applicable % of total R&D Expenditure.
- Note that the percentages will most likely not total 100%.

DEFINITIONS

Biotechnology is an application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometres, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering and technology, nanotechnology involves imaging, measuring, modelling, and manipulating matter at this length scale.

Multidisciplinary Area of R&D	% of R&D expenditure
Biotechnology	%
Nanotechnology	%

No Multi-Disciplinary R&D in these areas	☐	← TICK if no such R&D is done

11c. R&D AND NATIONAL PRIORITY AREAS

Please estimate the percentage of R&D expenditure allocated to the following areas:

- National Policy and the National R&D Strategy emphasise the importance of certain areas of R&D.
- Some of these National Priority areas are listed below. If your organisation performs R&D in these areas, please provide the applicable % of total R&D Expenditure.
- Note that the percentages will most likely not total 100%.

National Priority Area of R&D	% of R&D expenditure
Open source software	%
New materials	%
Tuberculosis (TB), HIV/AIDS, malaria	%

No R&D in these areas	☐

← TICK if no such R&D is done

12. SOCIO-ECONOMIC OBJECTIVES (SEO)

Classify R&D according to Socio-Economic Objectives with associated % expenditure.
(See Appendix C in Code book)

The SEO classification provides an indication of the sector of the national economy which will be the main beneficiary of the R&D you are practising

SEO Codes		Percentage	SEO Codes		Percentage
S			S		
S			S		
S			S		
S			S		
S			S		
			Total		**100 %**

PART 5: R&D OUTSOURCED / CONTRACTED OUT

Outsourced R&D refers to:

- Outsourced or extramural expenditures are the amounts an organization paid or committed to pay to another organisation for the performance of R&D during a specific period.
- This includes acquisition of R&D performed by and/or grants given to other organisations for performing R&D

13. State value of R&D outsourced **inside South Africa.**

R'000 (Excl. VAT)
R

14. State value of R&D outsourced **outside South Africa.**

R'000 (Excl. VAT)
R

15. If the amount stated in **question 13 and 14** is in excess of **1 million Rands**, please indicate the name of the organisation that received payment, the approximate payment made for the performance of R&D and the associated expenditure.

State details of R&D outsourced **inside South Africa**

Outsourced to:	**Approximate Value R'000 (excl. VAT)**

State details of R&D outsourced **outside South Africa**

Outsourced to:	**Approximate Value R'000 (excl. VAT)**

THANK YOU FOR YOUR TIME AND EFFORT

Annexure II: User Satisfaction Survey

In order to improve the quality and relevance of the R&D statistics, it would be useful to receive the views of users of this publication (South Africa's *National Survey of Research and Experimental Development, 2007/08*). It would therefore be appreciated if you would complete the following questionnaire and return by fax to +27 (0)21 461 1255 or e-mail to wblankley@hsrc.ac.za.

1. Name and address of respondent:

Name and title	
Designation/ occupation	
Name and address of organisation or enterprise.	

2. Which of the following describes your area of work? Mark with 'X'.

Government		International organisation	
Private enterprise		Media	
Public enterprise		Not-for-profit organisation	
Academic or research institution		Other, specify	

3. In which country do you work?

4. What is your assessment of the content of this publication?

Excellent ☐ Good ☐ Average ☐ Satisfactory ☐ Poor ☐

5. How useful is this publication for your work?

Extremely useful ☐ Very useful ☐ Useful ☐ Partly useful ☐ Not at all useful ☐

6. How accurate is the picture of R&D in your sector or research field/s as presented in this publication?

Very accurate ☐ Fairly accurate ☐ Unsure ☐ Not too accurate ☐ Not at all accurate ☐

7. How easy was it to find specific information that you required in the publication?

Extremely easy ☐ Very easy ☐ Easy ☐ Not very easy ☐ Not at all easy ☐

8. What information (i.e. tables, text or figures) were of most interest to you? Please be as specific as possible (e.g. provide table, page or figure numbers).

9. What did you like best about the publication?

10. Provide any comments or recommendations for the improvement of the publication.

Thank you for completing the questionnaire.