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National Survey of Research and Experimental Development (2010/11 Fiscal Year)

Statistical Report 2010/11

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REPUBLIC OF SOUTH AFRICA

HSRC
Human Sciences
Research Council

REPUBLIC OF SOUTH AFRICA
STATISTICIAN-GENERAL
NSS
National Statistics System

NOTIFICATIONS

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User feedback

A User Satisfaction Survey questionnaire is included as **Annexure** of this report. It would be very much appreciated if users could complete the questionnaire and return it by fax to +27 (0) 21 461 1255 or by e-mail to sparker@hsrc.ac.za or nmustapha@hsrc.ac.za. The feedback is analysed following each survey cycle to ensure the continued improvement of the R&D survey.

Revisions

The Department of Science and Technology (DST), Stats SA and the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicators (HSRC-CeSTII) jointly reserve the right to revise the data, indicators and analysis contained in this report. Such revisions may result from revisions by Stats SA of the national gross domestic product (GDP) data series or amendments in response to internal and external data quality and consistency monitoring such as that carried out by the Organisation for Economic Cooperation and Development (OECD), which conducts quality checks through global comparative analysis, time series analyses and other methods. Explanations of any revisions will be made available and accessible on the DST and HSRC websites.

Project team

The National Survey of Research and Experimental Development is conducted annually by HSRC-CeSTII on behalf of the DST.

The HSRC-CeSTII project team for the 2010/11 R&D survey comprised (in alphabetical order): Thomson Batidzirai, William Blankley, Irma Booyens, Demetre Labadarios, Vaughan Leiberum, Bonelwa Mabovu, Hlamulo Makelane, Nazeem Mustapha, Nolitha Nkobole, Saahier Parker, Madalitso Phiri, Guia Ritacco, Julien Rumbelow, Natasha Saunders, Moses Sithole and Natalie Vlotman.

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The project team extends its appreciation to Dr Phil Mjwara, Director-General of the Department of Science and Technology (DST), to Prof Olive Shisana, Chief Executive Officer (CEO) of the Human Sciences Research Council (HSRC), and to Mr Pali Lehohla, Statistician-General, for their support of the R&D survey. The support and contributions of Mr Imraan Patel, Mr Godfrey Mashamba, Ms Tshidi Mamogobo, Ms Rose Msiza, Mr Hlomo Makgoba, Ms Kgomotso Matlapeng, and Ms Thandokazi Teti of the DST are much appreciated. We further acknowledge the contributions of HSRC-CeSTII administrative staff, Valda West, Sumaya Abdullatief and Benelton Jumath, and also the Information and Communication Technology (ICT) help desk operated by Noor Fakier.

During the finalisation of the report, the technical inputs and advice of the DST and Stats SA teams and the Clearance Committee for Science, Technology and Innovation Statistical Reports helped improve the quality of the publication and is appreciated. Interactions with the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) have provided invaluable assistance in improving the quality and standard of the South African R&D surveys and analysis of the results.

We are also most grateful for and acknowledge the co-operation of the respondents to the questionnaire.

FOREWORD

The Statistics Act (No. 6 of 1999) requires of the Statistician General (SG) to coordinate statistical production beyond the confines of Statistics South Africa (Stats SA). The Department of Science and Technology (DST) has fully supported this intent, producing on an annual basis the National Survey of Research and Experimental Development (R&D Survey). As such, the DST has become a model for the type of functional and activity based relationship required to assist other partners of the National Statistics System (NSS) in contributing to the body of official statistics.

In recognising this role, DST has agreed to subject the R&D Survey to an ongoing statistical quality assessment as gazetted through South Africa Statistical Quality Assessment Framework (SASQAF) to ensure that the survey remains credible in meeting the user needs; in informing planning and decision making; and in monitoring the implementation of government programmes and policies.

Working with the Director General of the DST and supported by the Centre for Science Technology and Innovation Indicators (CeSTII), we adopted a quality Management Plan for this survey and establish a Clearance Committee that reviews each round of the survey and advise whether the quality management principles have been adhered to before the results can be released.

The quality concerns that were noted in the 2009/10 survey were resolved to an extent in the 2010/11 survey as there were noticeable improvements in coverage and documentation of process metadata. However there is still need to improve the coverage further and Stats SA, DST and CeSTII continue to work together in resolving quality concerns.

Given my assessment and the visible commitment demonstrated by the DST in implementing the quality improvement initiatives, I endorse the 2010/11 R&D Survey results and encourage its use by stakeholders.

Pali J Lehohla
Statistician-General
Republic of South Africa

PREFACE

The National Survey of Research and Experimental Development (R&D) is undertaken annually to monitor the country's investments in R&D. The survey provides information on R&D funding and performance in South Africa. The data help to profile the size and shape of the R&D landscape and support the production of statistics for use in system-level planning, monitoring and evaluation.

The 2010/11 R&D survey recorded that South Africa spent R20.25 billion as gross expenditure on research and development (GERD), a nominal decrease of 3.3% from the R20.95 billion recorded for 2009/10. With the GERD as a percentage of Gross Domestic Product (GDP) at 0.76%, the findings indicate a fourth consecutive decline from 0.93% of 2007/08, 0.92% of 2008/09 and 0.87% in 2009/10. These declines are occurring in an environment of modest increases in GDP.

The trends show that the government's funding for R&D has been increasing consistently; and from 2007 its contribution towards funding surpassed that of the business sector. This is an important development because the government has continued to increase funding for R&D despite the pressures on the fiscus during the period from 2008 to 2010. This has resulted in some shifts, where the higher education and science councils sectors have both increased their contribution to overall spending on R&D compared to the situation in the mid-2000s. By investing in these sectors, the government is able to boost the capacity for new knowledge creation and drive strategic research initiatives that have specific outcomes for development. This includes, for example, the advances in health research, particularly on HIV/AIDS vaccines and cancer treatment, the five pilot plants to test feasibility for mineral beneficiation processes and technologies, and the hydrogen and fuel cell technology programmes.

On the other hand, the business sector remains the largest performer of R&D, with 49.7% of GERD. The decline of 9.7% in the R&D expenditure in this sector is, therefore, of concern as it has direct implications for industrial innovation and economic competitiveness.

The current efforts to boost the human resource base for science, engineering and technology, and recapitalise and build the public scientific facilities are important in creating attractive conditions and incentives and encouraging private sector and international R&D investment. The new

amendments to the R&D tax incentives and the recent establishment of the Technology Innovation Agency are some of the specific measures to encourage business sector R&D and innovation.

Globally there has been a slow growth in R&D spending between 2008 and 2010, which is a similar trend observed with South Africa. Recent statistics show that some countries have turned the corner and are starting to increase their R&D spending.

We extend our appreciation to the CeSTII project team for their efforts in conducting this survey each year, and the support of Statistics South Africa in recommending and monitoring of the use of statistically sound methodology to ensure that the survey continuously produces quality statistics.

A special word of thanks goes to all the survey respondents, in the higher education sector, science councils, not-for-profit sector, goverment sector and the business sector, who gave their time so readily to make this survey a success.

Derek Hanekom

Derek Hanekom, MP
Minister of Science and Technology

LIST OF ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
BERD	Business expenditure on R&D
CEO	Chief executive officer
CESM	Classification of Educational Subject Matter
CeSTII	Centre for Science, Technology and Innovation Indicators
DST	Department of Science and Technology
FTE	Full-time equivalent
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
HEMIS	Higher Education Management Information System
HIV	Human immunovirus
HSRC	Human Sciences Research Council
ICT	Information and Communication Technology
JSE	Johannesburg Stock Exchange
JSE 100	Johannesburg Securities Exchange 100
NESTI	National Experts on Science and Technology Indicators
NPO	Not-for-profit sector
NPOs	Not-for-profit organisations
OECD	Organisation for Economic Cooperation and Development
R	Rand (South African currency)
R&D	Research and experimental development
SA	South Africa
SASQAF	South African Statistical Quality Assessment Framework
SIC	Standard industrial classification
SMMEs	Small, medium and micro enterprises
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

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A. INTRODUCTION

This statistical report presents data tables from the 2010/11 South African National Survey of Research and Experimental Development (R&D survey). It is published together with a separate Main Results Report that provides trends and brief analysis of the survey data. The tables are arranged according to the sections below, covering different dimensions on Research and Development (R&D) expenditures and human resources in 2010/11.

- Gross expenditure on research and development (GERD)
- GERD by R&D-performing sectors
- Sources and flows of funding for R&D
- R&D expenditure by economic sector, field of research and socio-economic objectives
- R&D personnel by occupation (researchers, technicians and support staff) and the time devoted to R&D
- R&D involving local and international collaborations.

The survey covered all sectors that perform R&D in South Africa; namely the business, not-for-profit, government, science councils and higher education sectors. The technical description of the survey methodology is contained in the 'Technical notes' section of this report.

Definitions

The South African R&D data are compiled according to international guidelines outlined by the Organisation for Economic Cooperation and Development (OECD) in *"The Measurement of Scientific and Technological Activities: Proposed Standard Practice for Surveys on Research and Experimental Development"*, known as the Frascati Manual (OECD 2002). Therefore, the definitions used in the survey are those of the OECD's Frascati Manual, which defines R&D as follows:

- **Research and experimental development (R&D)** comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

R&D may be categorised according to the following types:

- **Basic research:** Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.
- **Applied research:** Original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.
- **Experimental development:** Systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

B. KEY FINDINGS FOR 2010/11

GERD has declined for the second consecutive year following a decade and a half of increases in real terms.

Gross domestic expenditure on research and development (GERD) for 2010/11 was R20.254 billion, representing a nominal decrease of 3.3% from the R20.955 billion reported in 2009/10. This is the second consecutive decline in GERD, following a decade and a half of real increases.

GERD as a percentage of gross domestic product (GDP) at current prices was 0.76% in 2010/11, which is 11 basis points lower than the 0.87% recorded in 2009/10.

- Between 2009 and 2010, GDP at current prices increased (Stats SA P0441: GDP, 3rd Quarter 2011). A decrease of R701 million in R&D expenditure over the same period resulted in GERD as a proportion of GDP decreasing.

Table B.1 shows the key R&D indicators for the 2009/10 and 2010/11 reference periods.

Table B.1: Key indicators

Key indicator	Value	
	2009/10	2010/11
Gross domestic expenditure on R&D – GERD (Rand millions)	20 955	20 254
Gross domestic product (GDP) at current prices (Rand millions)	2 395 967	2 664 269
GERD as a percentage of GDP (%)	0.87	0.76
Total R&D personnel (FTE*)	30 891.3	29 486.4
Total researchers (FTE*)	19 793.1	18 719.6
Total researchers (FTE*) per 1 000 in total employment	1.5	1.4
Total R&D personnel (FTE*) per 1 000 in total employment	2.3	2.2
Total researchers (headcount)	40 797	37 901
Female researchers (headcounts) as a percentage of total researchers	41	42

** FTE = Full-time equivalent*

Commentary

The business sector remained the largest performer of R&D in South Africa, spending R10.059 billion on R&D in 2010/11. Business expenditure on research and experimental development (BERD) as a percentage of GDP decreased by eight basis points from 0.46% in 2009/10 to 0.38% in 2010/11.

The business sector also registered the largest decrease in R&D expenditure among all the sectors between 2009/10 and 2010/11, amounting to R1.080 billion and representing a decrease of 9.7%. Substantial decreases in R&D expenditure were observed in the following sectors: manufacturing; financial intermediation, real estate and business services; and electricity, gas and water supply. On the other hand, the mining and quarrying sector recorded a significant increase in R&D expenditure.

- R&D expenditure in the electricity, gas and water supply sector decreased by R420 million (a 43.9% year-on-year decrease). R&D expenditure in the financial intermediation, real estate and business services sector decreased by R450 million (a 11.9% year-on-year decrease). R&D expenditure in the manufacturing of refined petroleum and petroleum-based products decreased by R561 million (31.9% year-on-year) between 2009/10 and 2010/11.
- The largest increase in spending occurred in the mining and quarrying sector, where R&D expenditure increased by R557 million (a year-on-year increase of 111.5%).

In terms of research types, the applied research accounted for the largest proportion of GERD in 2010/11, having increased from 31.4% in 2009/10 to 39.8% in 2010/11. The proportion of experimental development decreased from 42.1% to 36.3%, while the proportion of basic research also decreased from 26.5% to 23.9% over the same period.

The largest percentage of GERD in South Africa during 2010/11 was spent in engineering sciences (17.8%); medical and health sciences (17.1%); ICT (13.9%); and social sciences (12.4%). R&D expenditure in the engineering sciences has been declining gradually over the years, and decreased from R4.189 billion in 2007/08 to R3.600 billion in 2010/11, while there have been increases over the same period in the medical and health sciences, social sciences, applied sciences and technologies, as well as the agricultural sciences. These research fields have accounted for the bulk of GERD over the past decade.

The main sources of funding for R&D in South Africa were the government and business sectors.

- The government sector funded 44.5% while the business sector funded 40.1% of all R&D undertaken in 2010/11.
- The proportion of R&D expenditure funded by foreign sources was unchanged from 2009/10 at 12.1%.
- The other contributions to funding R&D activities in South Africa came from not-for-profit organisations (1.7%), individual donations (1.4%) and higher education institutions (0.1%).
- The business sector funded most of its own R&D in 2010/11, while funding from government was distributed mainly between higher education and science councils.
- A large proportion of the funding from abroad was spent in the business sector.

The higher education sector employed the highest number of R&D personnel, followed by the business sector.

- The R&D personnel headcount totalled 55 531 in 2010/11, which was 3 963 fewer than in 2009/10. Full-time equivalent (FTE) R&D personnel totalled 29 486.4, a year-on-year decrease of 4.5% from the 30 891.3 reported in 2009/10.
- There were increases in FTE R&D personnel between 2009/10 and 2010/11 in the higher education sector (5.1%), the government sector (14.4%) and the not-for-profit sector (1.1%), but these increases were not sufficient to offset the decreases in the business and science councils sectors.
- Researchers made up the largest proportion of R&D personnel, accounting for 68.3% (37 901) of total personnel engaged in R&D. The number of FTE researchers per 1 000 in total employment has stagnated between 1.4 and 1.5 over the past six years.
- The number of female researchers decreased by 5.0% year-on-year, from 16 645 in 2009/10 to 15 805 in 2010/11. However, this rate of decrease was lower than the overall rate of decrease of researchers, with the result that the proportion of female researchers increased by 0.9 percentage points from 40.8% in 2009/10 to 41.7% in 2010/11.

C. TABLES

Note: Totals in the tables may not add up to the sum of individual items due to rounding effects.

Expenditure on research and experimental development

Table C.1: In-house R&D expenditure by sector, R'000 (2001/02–2010/11)

Year	GERD (all sectors)	Government	Science councils	Higher education	Business	Not-for-profit
2010/11	**20 253 805**	1 011 340	3 596 023	5 424 602	10 059 010	162 830
2009/10	**20 954 677**	1 067 302	3 458 074	5 101 224	11 139 237	188 840
2008/09	**21 041 046**	1 139 676	3 137 343	4 191 366	12 332 012	240 649
2007/08	**18 624 013**	1 154 399	2 886 094	3 621 862	10 738 456	223 202
2006/07	**16 520 584**	1 021 355	2 744 718	3 298 808	9 243 165	212 538
2005/06	**14 149 239**	844 640	2 102 094	2 732 215	8 243 776	226 514
2004/05	**12 009 981**	515 331	1 996 050	2 533 971	6 766 361	198 268
2003/04	**10 082 559**	465 367	1 745 493	2 071 351	5 591 325	209 023
2001/02	**7 488 074**	203 110	1 294 454	1 896 156	4 023 576	70 778

Table C.2: GERD composition by major R&D-performing sector, percentage (2001/02–2010/11)

Year	Government	Science councils	Higher education	Business	Not-for-profit
2010/11	5.0	17.8	26.8	49.7	0.8
2009/10	5.1	16.5	24.3	53.2	0.9
2008/09	5.4	14.9	19.9	58.6	1.1
2007/08	6.2	15.5	19.4	57.7	1.2
2006/07	6.2	16.6	20.0	55.9	1.3
2005/06	6.0	14.9	19.3	58.3	1.6
2004/05	4.3	16.6	21.1	56.3	1.7
2003/04	4.6	17.3	20.5	55.5	2.1
2001/02	2.7	17.4	25.3	53.7	0.9

Table C.3: GERD by type of research, R'000 (2001/02–2010/11)

Year	GERD	Basic research	Applied research	Experimental development
2010/11	**20 253 804**	4 848 283	8 058 799	7 346 722
2009/10	**20 954 676**	5 553 399	6 578 902	8 822 375
2008/09	**21 041 046**	4 243 156	7 013 082	9 784 808
2007/08	**18 624 013**	3 830 806	6 373 681	8 419 526
2006/07	**16 520 728**	3 075 263	5 794 785	7 650 671
2005/06	**14 149 238**	2 649 755	5 056 379	6 443 104
2004/05	**12 009 979**	2 237 102	4 651 528	5 121 349
2003/04	**10 082 559**	2 435 363	3 865 436	3 781 760
2001/02	**7 488 076**	2 078 456	2 987 540	2 422 078

Table C.4: GERD by accounting category, R'000 (2001/02–2010/11)

Year	GERD	Capital expenditure on R&D			Current expenditure on R&D			
		Land: Buildings and other structures	Vehicles, plant, machinery, equipment	Subtotal: Capital expenditure	Labour costs	Total cost of R&D postgrad-uate students	Other current expenditure	Subtotal: Current expenditure
2010/11	**20 253 805**	472 205	1 714 845	**2 187 050**	8 353 254	756 930	8 956 571	**18 066 755**
2009/10	**20 954 677**	623 089	2 067 728	**2 690 817**	8 909 301	581 140	8 773 419	**18 263 860**
2008/09	**21 041 046**	326 145	3 091 898	**3 418 043**	8 661 361	532 883	8 428 759	**17 623 003**
2007/08	**18 624 013**	367 757	1 686 567	**2 054 324**	8 171 240	495 128	7 903 321	**16 569 689**
2006/07	**16 520 586**	319 868	1 357 234	**1 677 102**	7 526 757	438 486	6 878 241	**14 843 484**
2005/06	**14 149 239**	347 342	1 619 871	**1 967 213**	6 178 386	313 645	5 689 995	**12 182 026**
2004/05	**12 009 981**	205 970	870 022	**1 075 992**	5 721 100	308 454	4 904 435	**10 933 989**
2003/04	**10 082 559**	190 412	944 006	**1 134 418**	4 608 946	190 892	4 148 303	**8 948 141**
2001/02	**7 488 076**	48 783	933 571	**982 354**	3 622 993	*	2 481 797	**6 104 790**
Unspecified amount (2001/02)	**400 930****							

** This was not measured in the first R&D Survey (2001/02) conducted by the HSRC*
*** Certain R&D expenditure was reported in 2001/02 but was not allocated to sub-categories in capital or current expenditure*

Table C.5: Expenditure on multidisciplinary areas of R&D, R'000 (2005/06–2010/11)

Year	GERD	Total expenditure	Biotechnology	Nanotechnology
2010/11	**20 253 805**	**1 556 866**	1 142 337	414 529
2009/10	**20 954 677**	**1 341 782**	917 917	423 865
2008/09	**21 041 046**	**1 190 020**	801 640	388 380
2007/08	**18 624 014**	**897 225**	648 704	248 521
2006/07	**16 520 584**	**902 855**	592 777	310 078
2005/06	**14 149 238**	**690 811**	454 332	236 479

Note: Data on the multidisciplinary areas of R&D were collected for the first time in 2005/06

Table C.6: R&D Expenditure on selected areas of interest, R 000 (2005/06 – 2010/11)

Year	GERD	Total R&D expenditure in national priority areas	Open source software	New materials	Tuberculosis (TB), HIV/AIDS, malaria
2010/11	**20 253 805**	**2 932 478**	157 790	722 167	2 052 521
2009/10	**20 954 677**	**2 548 634**	172 712	559 021	1 816 901
2008/09	**21 041 046**	**2 348 941**	218 289	514 242	1 616 410
2007/08	**18 624 013**	**1 673 582**	254 808	298 746	1 120 028
2006/07	**16 520 584**	**1 464 516**	192 786	336 970	934 760
2005/06	**14 149 239**	**1 144 075**	101 937	308 800	733 338

Note: Data on the selected areas of interest were collected for the first time in 2005/06

Table C.7: R&D expenditure by research field, R'000 (2001/02–2010/11)

Main research field	2010/11	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05	2003/04	2001/02
Division 1: Natural sciences, technology and engineering	**17 274 483**	**18 236 046**	**18 419 289**	**16 306 332**	**14 568 971**	**12 404 829**	**10 516 783**	**8 892 709**	**6 606 536**
Mathematical sciences	530 693	414 234	397 512	341 624	315 773	291 122	205 285	192 441	94 672
Physical sciences	305 701	648 657	952 441	793 006	655 378	551 426	379 230	348 905	96 134
Chemical sciences	865 345	860 745	1 056 848	784 145	595 579	591 258	608 438	533 070	401 077
Earth sciences	403 848	402 949	563 619	524 133	426 950	365 771	266 185	254 879	215 675
Information, computer and communication Technologies	2 808 681	3 272 679	2 763 320	2 598 218	2 314 243	1 866 314	1 534 031	1 060 623	904 067
Applied sciences and technologies	2 151 557	1 740 755	1 905 397	1 832 546	1 812 402	1 541 893	973 201	1 030 020	1 187 736
Engineering sciences	3 600 159	4 580 166	5 135 032	4 189 408	3 457 912	2 950 059	2 868 546	2 500 912	1 725 576
Biological sciences	1 326 076	800 435	744 144	723 280	798 835	705 410	583 545	504 349	308 913
Agricultural sciences	1 307 191	1 445 847	1 147 706	1 264 628	1 138 873	961 166	865 736	741 589	608 665
Medical and health sciences	3 461 304	3 506 472	3 139 245	2 616 439	2 489 242	2 088 399	1 779 259	1 358 092	736 327
Environmental sciences	352 139	229 186	248 625	222 514	216 710	194 867	201 042	146 423	116 968
Material sciences	109 551	254 092	306 828	365 813	284 530	246 125	191 841	165 323	161 630
Marine sciences	52 238	79 830	58 573	50 579	62 544	51 019	60 444	56 083	49 096
Division 2: Social sciences and humanities	**2 979 322**	**2 718 631**	**2 621 757**	**2 317 681**	**1 951 613**	**1 744 411**	**1 493 200**	**1 189 851**	**790 482**
Social sciences	2 512 714	2 233 521	2 024 801	1 809 308	1 559 043	1 393 471	1 159 115	967 790	636 520
Humanities	466 608	485 110	596 956	508 373	392 570	350 940	334 085	222 061	153 962
TOTAL	**20 253 805**	**20 954 677**	**21 041 046**	**18 624 013**	**16 520 584**	**14 149 240**	**12 009 983**	**10 082 560**	**7 488 074***

** The R&D survey of 2001/02 reported an unspecified expenditure of R91.055 million that is included in the total.*

Table C.8: R&D expenditure by socio-economic objectives, R'000 (2001/02–2010/11)

Socio-economic objectives	2010/11	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05	2003/04	2001/02
Division 1: Defence	**1 341 460**	**1 276 269**	**1 196 200**	**1 135 278**	**1 091 516**	**906 174**	**883 101**	**1 006 013**	**683 068**
Defence	1 341 460	1 276 269	1 196 200	1 135 278	1 091 516	906 174	883 101	1 006 013	683 068
Division 2: Economic development	**11 231 879**	**12 341 036**	**13 312 043**	**11 724 590**	**10 017 805**	**8 817 223**	**6 990 226**	**5 765 250**	**4 420 767**
Economic development unclassified	0	0	209 400	171 520	150 668	115 029	102 936	93 498	13 456
Plant production and plant primary products	1 045 114	1 055 316	853 243	931 733	792 487	731 188	526 775	468 345	403 514
Animal production and animal primary products	293 873	354 639	289 909	279 914	337 029	272 077	299 990	272 065	184 489
Mineral resources (excluding energy)	1 123 063	1 212 226	995 552	1 075 821	931 909	1 164 691	979 512	688 042	933 681
Energy resources	274 220	407 091	1 185 455	709 891	574 570	438 889	335 717	312 619	66 782
Energy supply	623 953	540 463	515 216	364 876	347 632	273 823	326 122	317 876	268 321
Manufacturing	2 374 657	2 602 319	2 998 301	2 676 911	2 187 583	1 859 779	1 356 014	1 230 223	1 011 298
Construction	311 897	521 289	1 461 157	1 150 733	937 406	745 634	454 608	442 661	87 372
Transport	905 571	924 183	704 404	595 065	515 262	438 848	422 968	418 458	299 273
Information and communication services	1 104 273	1 381 989	1 274 761	1 240 972	1 035 459	948 734	667 136	393 727	403 407
Commercial services	1 849 534	2 045 919	1 499 495	1 457 410	1 380 085	1 145 775	766 339	527 456	276 224
Economic framework	600 662	598 312	604 404	548 517	349 517	304 864	223 875	193 052	213 148
Natural resources	725 062	697 290	720 746	521 228	478 198	377 891	528 236	407 227	259 803
Division 3: Society	**3 247 428**	**3 276 198**	**3 225 179**	**2 827 775**	**2 731 152**	**2 316 725**	**2 274 312**	**1 583 390**	**891 483**
Society unclassified	0	0	209 400	171 520	150 668	115 029	102 936	93 498	3 364
Health	2 089 570	2 247 629	2 013 993	1 790 225	1 725 977	1 522 650	1 504 741	1 044 744	44 513
Education and training	442 181	458 060	465 475	389 138	418 971	382 105	382 553	200 500	201 100
Social development and community services	715 677	570 508	536 312	476 892	435 536	296 942	284 082	244 648	240 506
Division 4: Environment	**735 909**	**992 840**	**1 006 106**	**854 997**	**711 134**	**604 769**	**575 026**	**555 312**	**410 545**
Environment unclassified	0	0	69 800	57 173	50 223	38 343	34 312	31 166	6 728
Environmental knowledge	310 888	463 786	488 204	375 069	348 158	303 892	257 500	248 177	216 283
Environmental aspects of development	189 344	181 907	176 503	195 300	130 144	118 802	141 631	122 517	97 523
Environmental and other aspects	235 677	347 147	271 599	227 455	182 609	143 732	141 583	153 452	90 010
Division 5: Advancement of knowledge	**3 697 128**	**3 068 334**	**2 301 517**	**2 081 375**	**1 968 977**	**1 504 349**	**1 287 316**	**1 172 594**	**930 870**
Advancement of knowledge unclassified	0	0	209 400	171 520	150 668	115 029	102 936	93 498	10 092
Natural sciences, technologies and engineering	2 672 224	2 036 622	1 604 035	1 456 357	1 372 203	925 287	788 740	755 448	793 052
Social sciences and humanities	1 024 904	1 031 712	488 082	453 498	446 107	464 032	395 640	323 648	127 725
TOTAL	**20 253 805**	**20 954 677**	**21 041 046**	**18 624 015**	**16 520 584**	**14 149 239**	**12 009 981**	**10 082 559**	**7 488 074***

** The R&D survey of 2001/02 reported an unspecified expenditure of R151.343 million that is included in the total.*

Table C.9: GERD by province, R'000 (2001/02–2010/11)

Year	GERD	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	Northern Cape	North-West	Western Cape
2010/11	**20 253 805**	1 048 959	1 332 224	9 772 806	2 290 711	395 042	397 878	532 456	250 320	4 233 409
2009/10	**20 954 677**	1 121 484	1 370 779	10 377 381	2 167 048	340 379	393 822	217 774	540 951	4 425 059
2008/09	**21 041 046**	889 081	1 562 720	10 981 587	2 210 336	286 157	379 123	174 453	487 376	4 070 214
2007/08	**18 624 014**	826 925	1 098 210	9 620 752	2 081 166	263 784	452 950	453 574	169 937	3 656 717
2006/07	**16 520 584**	752 303	944 829	8 447 470	1 809 013	240 952	369 535	180 923	402 461	3 373 098
2005/06	**14 149 238**	672 008	718 908	7 173 590	1 532 158	197 054	340 773	323 838	138 426	3 052 483
2004/05	**12 009 982**	481 979	723 225	6 552 884	1 229 397	151 112	299 681	370 301	100 241	2 101 162
2003/04	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2001/02	**7 488 076**	247 862	654 550	4 100 072	809 405	118 748	145 014	78 566	321 054	1 012 805

Note: N/A indicates that data were not collected

Source of R&D funds

Table C.10: R&D expenditure by sources of funds, R'000 (2010/11)

Source of funds	Total (all sectors)	R&D expenditure by sources of funds				
		Government	Science councils	Higher education	Business	Not-for-profit
Own funds	**11 247 643**	**785 909**	**420 235**	**2 749 111**	**7 269 547**	**22 841**
Internal sources	11 247 643	785 909	420 235	2 749 111	7 269 547	22 841
Government	**5 063 619**	**204 381**	**2 512 254**	**1 472 981**	**832 173**	**41 830**
Grants	2 050 064	197 976	1 480 925	N/A	346 916	24 247
Contracts	1 540 574	6 405	1 031 329	N/A	485 257	17 583
All other	1 472 981	N/A	N/A	1 472 981	N/A	N/A
Business	**858 699**	**2 406**	**198 206**	**367 340**	**259 120**	**31 627**
Local business	858 699	2 406	198 206	367 340	259 120	31 627
Other SA sources	**638 835**	**2 408**	**4 748**	**362 025**	**255 836**	**13 818**
Higher education	10 928	35	1 598	4 798	2 483	2 014
Not-for-profit	341 690	796	2 539	74 508	252 043	11 804
Individual donations	286 217	1 577	611	282 719	1 310	0
Foreign	**2 445 009**	**16 236**	**460 580**	**473 145**	**1 442 334**	**52 714**
Parent company	761 011	N/A	N/A	N/A	761 011	N/A
Foundations	289 447	N/A	N/A	N/A	289 447	N/A
All sources	1 394 551	16 236	460 580	473 145	391 876	52 714
TOTAL	**20 253 805**	**1 011 340**	**3 596 023**	**5 424 602**	**10 059 010**	**162 830**

Note: N/A indicates that data were not collected

Table C.11: Percentage R&D expenditure by sources of funds, (2010/11)

Source of funds	Total (all sectors)	% of R&D expenditure by sources of funds				
		Government	Science councils	Higher education	Business	Not-for-profit
Own funds	**55.5**	**77.7**	**11.7**	**50.7**	**72.3**	**14.0**
Internal sources	55.5	77.7	11.7	50.7	72.3	14.0
Government	**25.0**	**20.2**	**69.9**	**27.2**	**8.3**	**25.7**
Grants	10.1	19.6	41.2	N/A	3.4	14.9
Contracts	7.6	0.6	28.7	N/A	4.8	10.8
All other	7.3	N/A	N/A	27.2	N/A	N/A
Business	**4.2**	**0.2**	**5.5**	**6.8**	**2.6**	**19.4**
Local business	4.2	0.2	5.5	6.8	2.6	19.4
Other SA sources	**3.2**	**0.2**	**0.1**	**6.7**	**2.5**	**8.5**
Higher education	0.1	0	0	0.1	0	1.2
Not-for-profit	1.7	0.1	0.1	1.4	2.5	7.2
Individual donations	1.4	0.2	0	5.2	0	0
Foreign	**12.1**	**1.6**	**12.8**	**8.7**	**14.3**	**32.4**
Parent company	3.8	N/A	N/A	N/A	7.6	N/A
Foundations	1.4	N/A	N/A	N/A	2.9	N/A
All sources	6.9	1.6	12.8	8.7	3.9	32.4
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**

Note: N/A indicates that data were not collected

Table C.12: Sources of funding for R&D by sector (current values), R'000 (2001/02–2010/11)

Year	Government	Business	Other South African (local) sources*	Foreign sources
2010/11	9 018 874	8 128 246	661 676	2 445 009
2009/10	9 313 028	8 907 527	195 682	2 538 439
2008/09	9 497 510	8 973 490	175 219	2 394 827
2007/08	8 510 101	7 945 949	180 927	1 987 082
2006/07	6 672 138	7 399 660	701 907	1 746 865
2005/06	5 403 955	6 206 837	620 849	1 917 598
2004/05	4 276 313	5 838 774	62 342	1 832 551
2003/04	3 433 088	5 521 405	32 337	1 095 741
2001/02	2 633 224	3 990 505	407 204	457 143

**Includes higher education institutions and not-for-profit organisations*

Table C.13: Foreign-funded R&D by sector, R'000 (2001/02–2010/11)

Year	Total (all sectors)	Foreign-funded R&D by sector				
		Government	Science councils	Higher education	Business	Not-for-profit
2010/11	**2 445 009**	16 236	460 580	473 145	1 442 334	52 714
2009/10	**2 538 439**	54 129	416 571	443 109	1 538 917	85 713
2008/09	**2 394 827**	410 038	143 400	392 008	1 396 033	53 348
2007/08	**1 987 082**	56 172	298 906	320 286	1 180 193	131 525
2006/07	**1 746 996**	51 660	320 868	278 708	977 087	118 673
2005/06	**1 917 598**	58 714	254 183	305 590	1 196 771	102 340
2004/05	**1 894 645**	57 765	254 287	303 002	1 208 310	71 281
2003/04	**1 095 741**	45 065	171 076	224 031	534 636	120 933
2001/02	**457 143**	8 890	121 653	173 865	127 775	24 960

R&D personnel

Table C.14: R&D personnel, headcount and full-time equivalents (FTEs) (2001/02–2010/11)

Year	R&D personnel			Researchers			Technicians	Other R&D personnel
	R&D personnel (headcount)	R&D personnel (FTEs)	R&D personnel per 1 000 in total employment	Researchers (headcount)	Researchers (FTEs)	Researchers per 1 000 in total employment	Technicians (headcount)	Other R&D personnel (headcount)
2010/11	55 531	29 486.42	55.5	37 901	18 719.55	37.9	8 559	9 071
2009/10	59 494	30 891.28	59.5	40 797	19 793.06	40.8	9 443	9 254
2008/09	58 895	30 801.55	58.9	39 955	19 384.33	40.0	9 761	9 179
2007/08	59 334	31 354.00	59.1	40 084	19 320.30	40.1	9 476	9 784
2006/07	58 706	30 985.37	58.7	39 591	18 573.53	39.6	9 761	9 354
2005/06	57 275	28 798.00	57.3	39 266	17 303.00	39.3	8 325	9 684
2004/05	56 453	29 696.00	56.5	37 001	17 915.00	37.0	8 641	10 811
2003/04	40 605	21 186.72	40.6	22 760	10 127.49	22.8	8 193	9 651
2001/02	32 501	15 720.46	32.5	19 406	8 706.90	19.4	5 139	7 956

Table C.15: R&D personnel by sector, headcount (2001/02–2010/11)

Year	Total R&D personnel (all sectors)	R&D personnel by sector (headcount)				
		Government	Science councils	Higher education	Business	Not-for-profit
2010/11	**55 531**	2 704	4 923	32 571	14 933	400
2009/10	**59 494**	2 580	5 926	32 392	18 216	380
2008/09	**58 895**	2 963	5 609	31 226	18 595	502
2007/08	**59 334**	2 794	5 988	32 109	17 951	502
2006/07	**58 706**	2 924	5 798	32 033	17 467	484
2005/06	**57 275**	2 001	5 679	32 789	16 321	485
2004/05	**56 453**	2 311	6 170	33 126	14 337	509
2003/04	**40 605**	2 283	6 522	19 377	11 608	815
2001/02	**32 501**	2 138	5 874	15 767	8 284	438

Note: R&D personnel includes doctoral and post-doctoral students

Table C.16: Researchers by sector, headcount (2001/02–2010/11)

Year	Total researchers (all sectors)	Researchers by sector (headcount)				
		Government	Science councils	Higher education	Business	Not-for-profit
2010/11	**37 901**	1 184	1 941	28 154	6 372	250
2009/10	**40 797**	986	2 669	28 552	8 366	224
2008/09	**39 955**	1 169	2 648	27 316	8 560	262
2007/08	**40 084**	1 138	2 594	27 752	8 336	264
2006/07	**39 591**	1 111	2 255	27 746	8 227	252
2005/06	**39 266**	874	1 790	28 879	7 480	243
2004/05	**37 001**	692	1 846	27 603	6 575	285
2003/04	**22 760**	929	2 414	14 054	5 058	305
2001/02	**19 406**	560	2 214	12 626	3 753	253

SECTOR TABLES

Business sector

Table C.17: Business sector R&D expenditure by type of research (2008/09, 2009/10 and 2010/11)

	2008/09		2009/10		2010/11	
Type of research	**R'000**	**%**	**R'000**	**%**	**R'000**	**%**
Basic research	1 073 117	8.7	1 267 759	11.4	1 025 389	10.2
Applied research	3 426 651	27.8	3 301 773	29.6	3 949 410	39.3
Experimental research	7 832 244	63.5	6 569 705	59.0	5 084 210	50.5
Total	**12 332 012**	**100**	**11 139 237**	**100**	**10 059 010**	**100**

Table C.18: Business sector R&D expenditure by provincial distribution of R&D activity (2008/09, 2009/10 and 2010/11)

	2008/09		2009/10		2010/11	
Province	**R'000**	**%**	**R'000**	**%**	**R'000**	**%**
Eastern Cape	316 089	2.6	320 955	2.9	217 880	2.2
Free State	1 213 808	9.8	999 554	9.0	943 508	9.4
Gauteng	7 131 411	57.8	6 120 062	54.9	5 439 718	54.1
KwaZulu-Natal	1 255 509	10.2	1 183 636	10.6	1 280 014	12.7
Limpopo	75 675	0.6	49 375	0.4	41 850	0.4
Mpumalanga	201 550	1.6	161 154	1.4	139 771	1.4
North-West	7 319	0.1	7 988	0.1	256 428	2.5
Northern Cape	222 630	1.8	267 528	2.4	17 017	0.2
Western Cape	1 908 020	15.5	2 028 984	18.2	1 722 823	17.1
Total	**12 332 012**	**100**	**11 139 237**	**100**	**10 059 010**	**100**

Table C.19: Business sector R&D expenditure by research field (2008/09, 2009/10 and 2010/11)

Main research field	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Division 1: Natural Sciences, Technology and Engineering	**11 902 551**	**96.5**	**10 743 523**	**96.4**	**9 612 221**	**95.6**
Mathematical sciences	183 255	1.5	183 426	1.6	110 543	1.1
Physical sciences	655 898	5.3	190 292	1.7	32 669	0.3
Chemical sciences	859 041	7.0	627 729	5.6	687 843	6.8
Earth sciences	95 034	0.8	90 098	0.8	106 759	1.1
Information, computer and communication technologies	2 412 430	19.6	2 855 355	25.6	2 502 454	24.9
Applied sciences and technologies	1 671 375	13.6	1 271 414	11.4	1 132 538	11.3
Engineering sciences	3 908 347	31.7	3 311 902	29.7	2 768 035	27.5
Biological sciences	162 776	1.3	194 671	1.7	207 456	2.1
Agricultural sciences	293 357	2.4	323 603	2.9	371 310	3.7
Medical and health sciences	1 509 109	12.2	1 567 493	14.1	1 622 215	16.1
Environmental sciences	57 764	0.5	47 692	0.4	5 818	0.1
Material sciences	82 192	0.7	70 949	0.6	59 723	0.6
Marine sciences	11 975	0.1	8 899	0.1	4 859	0
Division 2: Social Sciences and Humanities	**429 461**	**3.5**	**395 714**	**3.6**	**446 789**	**4.4**
Social sciences	428 969	3.5	395 115	3.5	446 789	4.4
Humanities	491	0	599	0	0	0
Total	**12 332 012**	**100**	**11 139 237**	**100**	**10 059 010**	**100**

Table C.20: Business sector R&D expenditure by standard industrial classification (SIC) code (2008/09, 2009/10 and 2010/11)

SIC classification	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Agriculture, Hunting, Forestry and Fishing	**220 757**	**1.8**	**208 447**	**1.9**	**157 916**	**1.6**
Mining and Quarrying	**578 825**	**4.7**	**499 286**	**4.5**	**1 055 963**	**10.5**
Manufacturing	**4 787 581**	**38.8**	**4 321 327**	**38.8**	**3 592 204**	**35.7**
Manufacture of Food Products, Beverages and Tobacco Products	215 876	1.8	162 851	1.5	221 370	2.2
Manufacture of Textiles, Clothing and Leather Goods	13 755	0.1	16 946	0.2	2 437	0
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	118 016	1.0	111 255	1.0	106 448	1.1
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	2 267 063	18.4	1 758 353	15.8	1 197 179	11.9
Manufacture of Non-Metallic Mineral Products	134 638	1.1	120 508	1.1	87 037	0.9
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	315 295	2.6	330 137	3.0	240 408	2.4
Manufacture of Electrical Machinery and Apparatus	166 498	1.4	146 169	1.3	207 954	2.1
Manufacture of Radio, Television and communication Equipment &Apparatus Manufacture of Medical, Precision and Optical Instruments, Watches & Clocks	511 356	4.1	591 774	5.3	590 174	5.9
Manufacture of Transport Equipment	984 235	8.0	1 022 589	9.2	881 958	8.8
Manufacture of Furniture, Recycling; Manufacturing not elsewhere classified	60 849	0.5	60 743	0.5	57 240	0.6
Electricity, Gas and Water Supply	**2 306 297**	**18.7**	**955 690**	**8.6**	**536 050**	**5.3**
Construction	**6 105**	**0**	**3 490**	**0**	**3 213**	**0**
Wholesale and Retail	**334 131**	**2.7**	**434 522**	**3.9**	**620 541**	**6.2**
Transport, Storage and Communication	**425 235**	**3.4**	**415 243**	**3.7**	**354 311**	**3.5**
Financial Intermediation, Real Estate and Business Services	**3 377 896**	**27.4**	**3 777 124**	**33.9**	**3 326 985**	**33.1**
Community, Social and Personal Services	**295 185**	**2.4**	**524 108**	**4.7**	**411 826**	**4.1**
Total	**12 332 012**	**100**	**11 139 237**	**100**	**10 059 010**	**100**

Table C.21: Business sector R&D personnel, headcount and full-time equivalents (2008/09, 2009/10 and 2010/11)

Occupation	Headcount			Full-time equivalents	
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	6 033	2 527	8 560	6 172.0	72.1
Technicians directly supporting R&D	3 833	1 751	5 584	3 809.9	68.2
Other personnel directly supporting R&D	2 443	2 008	4 451	2 510.6	56.4
Total	**12 309**	**6 286**	**18 595**	**12 492.5**	**67.2**
2009/10	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	5 830	2 536	8 366	6 059.5	72.4
Technicians directly supporting R&D	3 672	1 690	5 362	3 612.6	67.4
Other personnel directly supporting R&D	2 468	2 020	4 488	2 352.6	52.4
Total	**11 970**	**6 246**	**18 216**	**12 024.6**	**66.0**
2010/11	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	4 370	2 002	6 372	4 804.0	75.4
Technicians directly supporting R&D	3 235	1 395	4 630	3 318.7	71.7
Other personnel directly supporting R&D	2 320	1 611	3 931	2 082.3	53.0
Total	**9 925**	**5 008**	**14 933**	**10 205.1**	**68.3**

Table C.22: Business sector R&D personnel headcount by race, gender, personnel category and qualification (2010/11)

	African		Coloured		Indian		White		Subtotal		Total
Qualification	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	
Researchers											
Doctoral degree or equivalent	102	40	26	5	33	28	466	140	**627**	**212**	**838**
Masters, honours, bachelor or equivalent	421	347	122	61	326	175	1 960	822	**2 829**	**1 404**	**4 233**
Diplomas	151	105	75	35	135	56	554	191	**914**	**386**	**1 301**
Subtotal	**674**	**491**	**222**	**100**	**494**	**258**	**2 980**	**1 152**	**4 370**	**2 002**	**6 372**
Technicians directly supporting R&D											
Doctoral degree or equivalent	3	2	2	0	2	0	13	17	**19**	**19**	**38**
Masters, honours, bachelor or equivalent	202	213	54	35	161	88	609	309	**1 026**	**645**	**1 671**
Diplomas	777	388	118	58	188	84	1 108	201	**2 190**	**731**	**2 921**
Subtotal	**982**	**603**	**173**	**92**	**350**	**173**	**1 730**	**528**	**3 235**	**1 395**	**4 630**
Other personnel directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	19	0	**19**	**0**	**19**
Masters, honours, bachelor or equivalent	63	111	9	6	69	63	163	31	**304**	**210**	**514**
Diplomas	929	747	213	307	247	307	608	40	**1 997**	**1 401**	**3 397**
Subtotal	**992**	**858**	**222**	**313**	**316**	**369**	**790**	**71**	**2 320**	**1 611**	**3 931**
Total	**2 648**	**1 952**	**617**	**505**	**1 160**	**800**	**5 500**	**1 751**	**9 925**	**5 008**	**14 933**

Table C.23: Business sector R&D collaborations* (2008/09, 2009/10 and 2010/11)

	2008/09		2009/10		2010/11	
Partner	**South Africa**	**Foreign**	**South Africa**	**Foreign**	**South Africa**	**Foreign**
Higher education institutions	139	12	85	8	177	5
Science councils	21	1	15	2	27	13
Government research institutes	32	5	5	4	26	0
Members of own company / affiliated companies	79	26	233	38	119	28
Other companies (including specialist consultants)	170	59	94	23	518	24
Not-for-profit organisations	16	6	1	0	8	1
Total	**457**	**107**	**433**	**75**	**875**	**71**
No collaboration	420	419	69	73	130	133

**Number of partnerships, alliances and collaborations*

Not-for-profit sector

Table C.24: Not-for-profit sector R&D expenditure by type of research (2008/09, 2009/10 and 2010/11)

Type of research	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Basic research	70 725	29.4	111 377	59.0	59 302	36.4
Applied research	131 259	54.5	53 530	28.3	87 435	53.7
Experimental research	38 665	16.1	23 933	12.7	16 092	9.9
Total	**240 649**	**100**	**188 840**	**100**	**162 830**	**100**

Table C.25: Not-for-profit sector R&D expenditure by research field (2008/09, 2009/10 and 2010/11)

Main research field	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Division 1: Natural Sciences, Technology and Engineering	**72 018**	**29.9**	**53 112**	**28.1**	**54 776**	**33.6**
Mathematical sciences	1 041	0.4	0	0	0	0
Physical sciences	0	0	6 422	3.4	0	0
Chemical sciences	0	0	0	0	0	0
Earth sciences	1 012	0.4	452	0.2	2585	1.6
Information, computer and communication technologies	1 555	0.6	2 207	1.2	0	0
Applied sciences and technologies	0	0	0	0	0	0
Engineering sciences	0	0	0	0	0	0
Biological sciences	2 126	0.9	904	0.5	1 473	0.9
Agricultural sciences	19 426	8.1	20 404	10.8	25 679	15.8
Medical and health sciences	36 032	15.0	13 999	7.4	15 920	9.8
Environmental sciences	8 396	3.5	6 014	3.2	3 433	2.1
Material sciences	0	0	0	0	0	0
Marine sciences	2 431	1.0	2 711	1.4	5 687	3.5
Division 2: Social Sciences and Humanities	**168 631**	**70.1**	**135 728**	**71.9**	**108 054**	**66.4**
Social sciences	165 924	68.9	133 340	70.6	104 306	64.1
Humanities	2 707	1.1	2 388	1.3	3 749	2.3
Total	**240 649**	**100**	**188 840**	**100**	**162 830**	**100**

Table C.26: Not-for-profit sector R&D personnel, headcount and full-time equivalents (2008/09, 2009/10 and 2010/11)

Occupation	Headcount			Full-time equivalents	
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	140	122	262	207.6	79.2
Technicians directly supporting R&D	44	33	77	56.5	73.4
Other personnel directly supporting R&D	41	122	163	102.3	62.8
Total	**225**	**277**	**502**	**366.4**	**73.0**
2009/10	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	113	111	224	187.5	83.7
Technicians directly supporting R&D	41	35	76	63.7	83.8
Other personnel directly supporting R&D	16	64	80	58.6	73.2
Total	**170**	**210**	**380**	**309.7**	**81.5**
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	103	147	250	196.2	78.5
Technicians directly supporting R&D	39	10	49	47.6	97.0
Other personnel directly supporting R&D	22	79	101	69.3	68.6
Total	**164**	**236**	**400**	**313.1**	**78.3**

Table C.27: Not-for-profit sector R&D personnel by race, gender, personnel category and qualification, headcount (2010/11)

	African		Coloured		Indian		White		Subtotal		
Qualification	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Total**
Researchers											
Doctoral degree or equivalent	7	5	2	3	1	1	17	20	**27**	**29**	**56**
Masters, honours, bachelor or equivalent	28	33	7	5	2	11	33	46	**70**	**95**	**165**
Diplomas	5	17	0	0	1	5	0	1	**6**	**23**	**29**
Subtotal	**40**	**55**	**9**	**8**	**4**	**17**	**50**	**67**	**103**	**147**	**250**
Technicians directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	**0**	**0**	**0**
Masters, honours, bachelor or equivalent	5	0	0	1	0	0	3	0	**8**	**1**	**9**
Diplomas	19	4	1	1	1	2	10	2	**31**	**9**	**40**
Subtotal	**24**	**4**	**1**	**2**	**1**	**2**	**13**	**2**	**39**	**10**	**49**
Other personnel directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	**0**	**0**	**0**
Masters, honours, bachelor or equivalent	2	5	0	6	1	2	5	11	**8**	**24**	**32**
Diplomas	7	28	2	8	3	5	2	14	**14**	**55**	**69**
Subtotal	**9**	**33**	**2**	**14**	**4**	**7**	**7**	**25**	**22**	**79**	**101**
Total	**73**	**92**	**12**	**24**	**9**	**26**	**70**	**94**	**164**	**236**	**400**

Table C.28: Not-for-profit sector R&D expenditure by provincial distribution of R&D activity (2008/09, 2009/10 and 2010/11)

Province	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Eastern Cape	6 790	2.8	8 136	4.3	9 790	6.0
Free State	4 763	2.0	4 418	2.3	6 385	3.9
Gauteng	126 136	52.4	104 420	55.3	61 496	37.8
KwaZulu-Natal	40 492	16.8	30 548	16.2	35 765	22.0
Limpopo	5 138	2.1	4 524	2.4	4 541	2.8
Mpumalanga	10 332	4.3	8 311	4.4	13 206	8.1
North-West	2 159	0.9	4 493	2.4	5 612	3.4
Northern Cape	2 339	1.0	2 382	1.3	2 030	1.2
Western Cape	42 500	17.7	21 609	11.4	24 003	14.7
Total	**240 649**	**100**	**188 840**	**100**	**162 830**	**100**

Government sector

Table C.29: Government sector R&D expenditure by type of research (2008/09, 2009/10 and 2010/11)

	2008/09		2009/10		2010/11	
Type of research	**R'000**	**%**	**R'000**	**%**	**R'000**	**%**
Basic research	357 786	31.4	257 806	24.2	257 235	25.4
Applied research	601 688	52.8	621 762	58.3	600 205	59.3
Experimental research	180 202	15.8	187 734	17.6	153 900	15.2
Total	**1 139 676**	**100**	**1 067 302**	**100**	**1 011 340**	**100**

Table C.30: Government sector R&D expenditure by research field (2008/09, 2009/10 and 2010/11)

	2008/09		2009/10		2010/11	
Main research field	**R'000**	**%**	**R'000**	**%**	**R'000**	**%**
Division 1: Natural Sciences, Technology and Engineering	**824 394**	**72.3**	**806 995**	**75.6**	**634 237**	**62.7**
Mathematical sciences	20 704	1.8	24 441	2.3	22 811	2.3
Physical sciences	45 804	4.0	12 093	1.1	0	0
Chemical sciences	17 009	1.5	21 698	2.0	10 653	1.1
Earth sciences	163 156	14.3	47 624	4.5	42 081	4.2
Information, computer & communication technologies	22 191	1.9	28 176	2.6	31 960	3.2
Applied sciences and technologies	15 852	1.4	9 315	0.9	4 154	0.4
Engineering sciences	11 487	1.0	14 996	1.4	4 165	0.4
Biological sciences	125 152	11.0	54 893	5.1	85 990	8.5
Agricultural sciences	200 598	17.6	274 781	25.7	225 441	22.3
Medical and health sciences	180 260	15.8	288 488	27.0	168 400	16.7
Environmental sciences	11 675	1.0	10 722	1.0	9 147	0.9
Material sciences	640	0.1	0	0	0	0
Marine sciences	9 866	0.9	19 768	1.9	29 434	2.9
Division 2: Social Sciences and Humanities	**315 282**	**27.7**	**260 308**	**24.4**	**377 103**	**37.3**
Social sciences	268 058	23.5	249 155	23.3	363 055	35.9
Humanities	47 225	4.1	11 152	1.0	14 048	1.4
Total	**1 139 676**	**100**	**1 067 302**	**100**	**1 011 340**	**100**

Table C.31: Government sector R&D personnel, headcount and full-time equivalents (2008/09, 2009/10 and 2010/11)

Occupation	Headcount			Full-time equivalents	
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	623	546	1 169	805.0	68.9
Technicians directly supporting R&D	405	339	744	495.2	66.6
Other personnel directly supporting R&D	752	298	1 050	773.7	73.7
Total	**1 780**	**1 183**	**2 963**	**2 073.9**	**70**
2009/10	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	500	486	986	680.4	69.0
Technicians directly supporting R&D	253	256	509	356.8	70.1
Other personnel directly supporting R&D	721	364	1 085	866.7	79.9
Total	**1 474**	**1 106**	**2 580**	**1 903.9**	**73.8**
2010/11	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	610	574	1 184	874.2	73.8
Technicians directly supporting R&D	221	200	421	352.9	83.8
Other personnel directly supporting R&D	782	317	1 099	951.6	86.6
Total	**1 613**	**1 091**	**2 704**	**2 178.6**	**80.6**

Table C.32: Government sector R&D personnel headcount by race, gender, personnel category and qualification (2010/11)

	African		Coloured		Indian		White		Subtotal		
Qualification	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Total**
Researchers											
Doctoral degree or equivalent	21	11	6	5	4	8	94	55	**125**	**79**	**204**
Masters, honours, bachelor or equivalent	254	237	24	38	16	33	158	162	**452**	**470**	**922**
Diplomas	23	16	4	6	1	0	5	3	**33**	**25**	**58**
Subtotal	**298**	**264**	**34**	**49**	**21**	**41**	**257**	**220**	**610**	**574**	**1 184**
Technicians directly supporting R&D											
Doctoral degree or equivalent	4	1	2	1	1	3	2	1	**9**	**6**	**15**
Masters, honours, bachelor or equivalent	46	48	10	6	5	4	32	21	**93**	**79**	**172**
Diplomas	70	64	10	6	2	11	37	34	**119**	**115**	**234**
Subtotal	**120**	**113**	**22**	**13**	**8**	**18**	**71**	**56**	**221**	**200**	**421**
Other personnel directly supporting R&D											
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	**0**	**0**	**0**
Masters, honours, bachelor or equivalent	8	17	3	5	2	1	4	16	**17**	**39**	**56**
Diplomas	505	172	235	43	2	5	23	58	**765**	**278**	**1 043**
Subtotal	**513**	**189**	**238**	**48**	**4**	**6**	**27**	**74**	**782**	**317**	**1 099**
Total	**931**	**566**	**294**	**110**	**33**	**65**	**355**	**350**	**1 613**	**1 091**	**2 704**

Table C.33: Government sector R&D expenditure by provincial distribution of R&D activity (2008/09, 2009/10 and 2010/11)

Province	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Eastern Cape	107 929	9.5	100 100	9.4	114 127	11.3
Free State	58 697	5.2	46 155	4.3	39 998	4.0
Gauteng	264 273	23.2	396 124	37.1	343 096	33.9
KwaZulu-Natal	115 302	10.1	54 914	5.1	48 056	4.8
Limpopo	55 252	4.8	60 421	5.7	57 797	5.7
Mpumalanga	39 103	3.4	68 796	6.4	69 980	6.9
North-West	52 907	4.6	77 978	7.3	43 048	4.3
Northern Cape	70 741	6.2	29 176	2.7	58 918	5.8
Western Cape	375 473	32.9	233 639	21.9	236 320	23.4
Total	**1 139 676**	**100**	**1 067 302**	**100**	**1 011 340**	**100**

Science councils sector

Table C.34: Science councils R&D expenditure by type of research (2008/09, 2009/10 and 2010/11)

Type of research	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Basic research	776 407	24.7	776 505	22.5	871 635	24.2
Applied research	1 384 860	44.1	1 552 560	44.9	1 531 563	42.6
Experimental research	976 077	31.1	1 129 009	32.6	1 192 825	33.2
Total	**3 137 344**	**100**	**3 458 074**	**100**	**3 596 023**	**100**

Table C.35: Science councils R&D expenditure by provincial distribution of R&D activity (2008/09, 2009/10 and 2010/11)

Province	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Eastern Cape	171 669	5.5	155 501	4.5	150 665	4.2
Free State	58 561	1.9	74 355	2.2	60 443	1.7
Gauteng	1 991 853	63.5	2 219 609	64.2	2 327 712	64.7
KwaZulu-Natal	231 033	7.4	235 432	6.8	249 137	6.9
Limpopo	63 455	2.0	78 662	2.3	66 250	1.8
Mpumalanga	55 547	1.8	66 881	1.9	55 690	1.5
North-West	43 624	1.4	35 253	1.0	42 854	1.2
Northern Cape	41 541	1.3	51 295	1.5	64 774	1.8
Western Cape	480 059	15.3	541 086	15.6	578 497	16.1
Total	**3 137 343**	**100**	**3 458 074**	**100**	**3 596 023**	**100**

Table C.36: Science councils R&D expenditure by research field (2008/09, 2009/10 and 2010/11)

Main research field	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Division 1: Natural Sciences, Technology and Engineering	**2 916 350**	**93.0**	**3 258 392**	**94.2**	**3 414 985**	**95.0**
Mathematical sciences	40 632	1.3	37 678	1.1	113 396	3.2
Physical sciences	115 737	3.7	87 221	2.5	97 922	2.7
Chemical sciences	44 271	1.4	49 462	1.4	8 074	0.2
Earth sciences	167 463	5.3	179 999	5.2	94 642	2.6
Information, computer and communication technologies	201 731	6.4	265 191	7.7	161 282	4.5
Applied sciences and technologies	139 267	4.4	153 830	4.4	924 104	25.7
Engineering sciences	863 084	27.5	947 315	27.4	365 980	10.2
Biological sciences	171 810	5.5	200 625	5.8	437 938	12.2
Agricultural sciences	442 060	14.1	647 750	18.7	479 449	13.3
Medical and health sciences	447 479	14.3	440 895	12.7	428 642	11.9
Environmental sciences	101 920	3.2	112 327	3.2	273 283	7.6
Material sciences	155 529	5.0	106 411	3.1	23 199	0.6
Marine sciences	25 368	0.8	29 689	0.9	7 073	0.2
Division 2: Social Sciences and Humanities	**220 993**	**7.0**	**199 682**	**5.8**	**181 038**	**5.0**
Social sciences	194 646	6.2	182 431	5.3	164 954	4.6
Humanities	26 347	0.8	17 250	0.5	16 084	0.4
Total	**3 137 343**	**100**	**3 458 074**	**100**	**3 596 023**	**100**

Table C.37: Science councils sector R&D personnel, headcount and full-time equivalents (2008/09, 2009/10 and 2010/11)

Occupation	Headcount			Full-time equivalents	
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	1 615	1 033	2 648	2 246.74	84.8
Technicians directly supporting R&D	681	621	1 302	1 119.10	86.0
Other personnel directly supporting R&D	829	830	1 659	1 334.03	80.4
Total	**3 125**	**2 484**	**5 609**	**4 699.87**	**83.8**
2009/10	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	1 637	1 032	2 669	2 251.50	84.4
Technicians directly supporting R&D	698	683	1 381	1 179.40	85.4
Other personnel directly supporting R&D	1 029	847	1 876	1 351.80	72.1
Total	**3 364**	**2 562**	**5 926**	**4 782.70**	**80.7**
2010/11	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers	1 110	831	1 941	1 777.27	91.6
Technicians directly supporting R&D	691	645	1 336	1 155.54	86.5
Other personnel directly supporting R&D	836	810	1 646	1 379.59	83.8
Total	**2 637**	**2 286**	**4 923**	**4 312.40**	**87.6**

Table C.38: Science councils sector R&D personnel headcount by race, gender, personnel category and qualification (2010/11)

Qualification	African		Coloured		Indian		White		Subtotal		Total
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Researchers											
Doctoral degree or equivalent	125	71	16	25	35	33	289	146	**465**	**275**	740
Masters, honours, bachelor or equivalent	226	184	25	28	43	81	290	237	**584**	**530**	1 114
Diplomas	19	10	0	1	5	4	37	11	**61**	**26**	87
Subtotal	**370**	**265**	**41**	**54**	**83**	**118**	**616**	**394**	**1 110**	**831**	**1 941**
Technicians directly supporting R&D											
Doctoral degree or equivalent	1	1				3	0	3	**1**	**7**	8
Masters, honours, bachelor or equivalent	117	162	21	18	28	38	63	54	**229**	**272**	501
Diplomas	249	253	56	17	15	17	141	79	**461**	**366**	827
Subtotal	**367**	**416**	**77**	**35**	**43**	**58**	**204**	**136**	**691**	**645**	**1 336**
Other personnel directly supporting R&D											
Doctoral degree or equivalent	20	9	4	3	2	2	63	46	**89**	**60**	149
Masters, honours, bachelor or equivalent	162	137	20	18	14	21	111	146	**307**	**322**	629
Diplomas	320	214	25	91	25	13	70	110	**440**	**428**	868
Subtotal	**502**	**360**	**49**	**112**	**41**	**36**	**244**	**302**	**836**	**810**	**1 646**
Total	**1 239**	**1 041**	**167**	**201**	**167**	**212**	**1 064**	**832**	**2 637**	**2 286**	**4 923**

Table C.39: Science councils sector overview (2010/11)

Science councils	R&D expenditure R'000	Researchers (FTE)	Basic Research R'000	Capital Expenditure R'000
African Institute of South Africa	47 001	14.00	47 001	8 865
Agricultural Research Council	612 872	468.00	91 931	13 093
Council for Scientific and Industrial Research (CSIR)	1 756 738	626.00	175 674	153 893
Council for Geoscience	70 759	100.00	55 192	1 928
Human Science Research Council (HSRC)	178 716	77.00	17 872	2 576
Medical Research Council	399 608	287.00	239 765	11 629
Mintek	337 160	123.00	101 148	59 215
National Research Foundation	193 169	82.27	143 053	40 631
Total	**3 596 023**	**1 777.27**	**871 635**	**291 830**

Higher education sector

Table C.40: Higher education sector R&D expenditure by type of research (2008/09, 2009/10 and 2010/11)

Type of research	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Basic research	1 965 121	46.9	2 459 733	48.2	2 634 722	48.6
Applied research	1 468 624	35.0	1 729 496	33.9	1 890 185	34.8
Experimental research	757 621	18.1	911 994	17.9	899 695	16.6
Total	**4 191 366**	**100**	**5 101 224**	**100**	**5 424 602**	**100**

Table C.41: Higher education sector R&D expenditure by provincial distribution of R&D activity (2008/09, 2009/10 and 2010/11)

Province	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Eastern Cape	286 605	6.8	536 792	10.5	556 496	10.3
Free State	226 892	5.5	246 298	4.8	281 889	5.2
Gauteng	1 467 914	34.9	1 537 166	30.1	1 600 783	29.5
KwaZulu-Natal	567 999	14.7	662 518	13.0	677 740	12.5
Limpopo	86 635	2.5	147 397	2.9	224 603	4.1
Mpumalanga	72 590	1.9	88 680	1.7	119 231	2.2
North-West	68 443	4.9	92 062	1.8	184 514	3.4
Northern Cape	150 125	0.8	190 570	3.7	107 581	2.0
Western Cape	1 264 162	27.4	1 599 741	31.4	1 671 766	30.8
Total	**4 191 366**	**100**	**5 101 224**	**100**	**5 424 602**	**100**

Table C.42: Higher education sector R&D expenditure by research field (2008/09, 2009/10 and 2010/11)

Main research field	2008/09		2009/10		2010/11	
	R'000	%	R'000	%	R'000	%
Division 1: Natural Sciences, Technology and Engineering	**2 703 975**	**64.5**	**3 374 024**	**66.1**	**3 558 265**	**65.59**
Mathematical sciences	151 880	3.6	168 689	3.3	283 942	5.2
Physical sciences	135 002	3.2	352 628	6.9	175 110	3.2
Chemical sciences	136 528	3.3	161 856	3.2	158 775	2.9
Earth sciences	136 955	3.3	84 777	1.7	157 781	2.9
Information, computer and communication technologies	125 413	3.0	121 750	2.4	112 985	2.1
Applied sciences and technologies	78 904	1.9	306 195	6.0	90 761	1.7
Engineering sciences	352 114	8.4	305 953	6.0	461 980	8.5
Biological sciences	282 280	6.7	349 343	6.9	593 219	10.9
Agricultural sciences	192 265	4.6	179 309	3.5	205 311	3.8
Medical and health sciences	966 365	23.1	1 195 597	23.4	1 226 127	22.6
Environmental sciences	68 869	1.6	52 431	1.0	60 458	1.1
Material sciences	68 467	1.6	76 732	1.5	26 629	0.5
Marine sciences	8 933	0.2	18 764	0.4	5 186	0.1
Division 2: Social Sciences and Humanities	**1 487 391**	**35.5**	**1 727 200**	**33.9**	**1 866 337**	**34.4**
Social sciences	967 204	23.1	1 273 479	25.0	1 433 610	26.4
Humanities	520 187	12.4	453 721	8.9	432 727	8.0
Total	**4 191 366**	**100**	**5 101 224**	**100**	**5 424 602**	**100**

Table C.43: Higher education sector R&D personnel, headcount and full-time equivalents (2008/09, 2009/10 and 2010/11)

Occupation	Headcount			Full-time equivalents	
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers*	9 283	7 030	16 313	3 643.5	22.3
Technicians directly supporting R&D	1 214	840	2 054	541.7	26.4
Other personnel directly supporting R&D	692	1 164	1 856	674.2	36.3
Total	**11 189**	**9 034**	**20 223**	**4 859.3**	**24.0**
2009/10	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers*	9 534	7 476	17 010	3 761.8	22.1
Technicians directly supporting R&D	1 243	872	2 115	579.8	27.4
Other personnel directly supporting R&D	626	1 099	1 725	676.4	39.2
Total	**11 403**	**9 447**	**20 850**	**5 018.0**	**24.1**
2010/11	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Researchers*	8 630	6 923	15 553	3 613.7	23.2
Technicians directly supporting R&D	1 233	890	2 123	534.9	25.2
Other personnel directly supporting R&D	760	1 534	2 294	874.5	38.1
Total	**10 623**	**9 347**	**19 970**	**5 023.0**	**25.2**

**Excludes postgraduate students.*

Table C.44: Higher education sector R&D postgraduate students by gender and qualification, headcount and full-time equivalents (2008/09, 2009/10 and 2010/11)

Qualification	Headcount			Full-time equivalents	
2008/09	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Post-doctoral fellows	372	255	627	538.9	85.9
Doctoral students	6 045	4 331	10 376	5 770.8	55.6
Masters students	13 100	12 424	25 524	11 074.1	43.4
Total	**19 517**	**17 010**	**36 527**	**17 383.7**	**47.6**
2009/10	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Post-doctoral fellows	447	334	781	696.7	89.2
Doctoral students	6 108	4 653	10 761	6 155.8	57.2
Masters students	13 614	13 342	26 956	11 105.2	41.2
Total	**20 169**	**18 329**	**38 498**	**17 957.6**	**46.6**
2010/11	**Male**	**Female**	**Total**	**FTEs**	**FTEs as % of headcount**
Post-doctoral fellows	570	391	961	866.6	90.2
Doctoral students	6 714	4 926	11 640	6 587.6	56.6
Masters students	14 165	14 208	28 373	12 505.1	44.1
Total	**21 449**	**19 525**	**40 974**	**19 959.3**	**48.7**

Table C.45: Higher education sector R&D personnel headcount by race, gender, personnel category and qualification (2010/11)

	African		Coloured		Indian		White		Subtotal		Total
Qualification	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	
Researchers											
Doctoral degree or equivalent	811	335	150	109	275	164	2 325	1 448	**3 561**	**2 056**	5 617
Masters, honours, bachelor or equivalent	1 454	938	199	229	320	380	2 094	2 220	**4 067**	**3 767**	7 834
Diplomas	413	348	52	60	127	136	410	556	**1 002**	**1 100**	2 102
Subtotal	**2 678**	**1 621**	**401**	**398**	**722**	**680**	**4 829**	**4 224**	**8 630**	**6 923**	**15 553**
Technicians directly supporting R&D											
Doctoral degree or equivalent	5	2	0	0	1	2	20	22	**26**	**26**	52
Masters, honours, bachelor or equivalent	108	85	17	15	21	10	119	152	**265**	**262**	527
Diplomas	295	160	178	102	103	41	366	299	**942**	**602**	1 544
Subtotal	**408**	**247**	**195**	**117**	**125**	**53**	**505**	**473**	**1 233**	**890**	**2 123**
Other personnel directly supporting R&D											
Doctoral degree or equivalent	24	16	6	6	6	2	49	35	**85**	**59**	144
Masters, honours, bachelor or equivalent	50	54	6	14	5	8	63	136	**124**	**212**	336
Diplomas	189	268	70	132	38	52	254	811	**551**	**1 263**	1 814
Subtotal	**263**	**338**	**82**	**152**	**49**	**62**	**366**	**982**	**760**	**1 534**	**2 294**
Total	**3 349**	**2 206**	**678**	**667**	**896**	**795**	**5 700**	**5 679**	**10 623**	**9 347**	**19 970**

Table C.46: Higher education sector overview (2010/11)

	R&D Expenditure (R'000)	Researcher Headcount	Researcher FTE	Postgrad Headcount	Postgrad FTE
PRIVATE UNIVERSITIES	**9 175**	**8**	**8.0**	**0**	**0.0**
Monash University	9 175	8	8.0		
UNIVERSITIES	**5 071 987**	**13 112**	**3 222.3**	**11 913**	**7 025.7**
Nelson Mandela Metropolitan University	207 291	454	80.8	470	231.6
North West University	243 466	1 060	318.0	934	483.7
Rhodes University	204 381	296	95.0	380	383.0
University of Cape Town	911 811	944	336.6	1 380	896.0
University of Fort Hare	31 961	292	58.4	246	148.8
University of Johannesburg (RAU, Vista and Wits Tech)	221 154	786	187.5	629	629.0
University of KwaZulu Natal (Former Natal University and University Durban-Westville)	631 414	1 708	459.0	1 236	544.0
University of Limpopo	155 509	319	51.9	165	58.7
University of Pretoria	441 977	1 677	326.8	1 551	644.8
University of South Africa (Including Technikon SA and Vista campus)	270 003	1 689	388.5	1 024	638.3
University of Stellenbosch	565 240	1 071	332.6	1 312	765.9
University of the Free State (Including University of the North: Qwa Qwa Campus)	213 791	186	50.2	601	259.2
University of the Western Cape	163 340	509	206.2	525	323.4
University of the Witwatersrand	778 683	1 868	280.2	1 295	919.5
University of Zululand	31 966	253	50.6	165	99.8
UNIVERSITIES OF SCIENCE AND TECHNOLOGY	**343 440**	**2 433**	**383.4**	**688**	**428.6**
2005 Cape Peninsula University of Technology (Cape and Peninsula Tech)	76 015	380	66.0	150	150.0
2005 Walter Sisulu University of Technology and Science (Unitra, Border and Eastern Cape Tech)	40 614	608	85.1	32	19.2
Central University of Technology, Free State (Former Technikon Free State)	39 893	168	69.3	61	52.0
Durban Institute of Technology (DIT) (Former Natal and M.L. Sultan Technikons)	51 296	306	40.5	90	61.7
Mangosuthu Technikon	8 015	50	10.0		
Tshwane University of Technology (TUT) (Former North West, North Gauteng, Pretoria Technikons)	88 074	391	60.7	226	72.0
University of Venda for Science and Technology	12 268	321	19.3	105	63.0
Vaal University of Technology (Former Vaal Triangle Technikon)	27 265	209	32.6	24	10.6
Total	**5 424 602**	**15 553**	**3 613.7**	**12 601**	**7 454.2**

D. TECHNICAL NOTES

Survey planning and design

The South African National Survey of Research and Experimental Development is commissioned by the DST and forms part of the tools for monitoring and evaluating the performance of the national innovation system. The survey collects data in accordance with the guidelines recommended by the OECD in the Frascati Manual. Additional data were collected based on South Africa's specific data needs, for instance data on population groups of R&D personnel and on R&D expenditure towards HIV/AIDS, which fall outside the variables outlined in the OECD guidelines.

The Frascati Manual defines R&D as follows:

"Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications."

The survey produced statistics on expenditure and human resources devoted to R&D in South Africa in the specified annual reference period, 2010/11. These data are used to compile national and international indicators on R&D for South Africa. Standard output tables for the production of indicators are agreed in advance of the survey between the HSRC-CeSTII and DST. No additional data items were identified for inclusion in the 2010/11 survey questionnaire compared with the 2009/10 survey.

HSRC-CeSTII conducted the survey according to a project plan aligned with the phases of the Statistical Value Chain (Figure D.1) described in the South African Statistical Quality Assessment Framework (SASQAF) (Stats SA 2008).

Figure D.1: Statistical Value Chain

Survey build and data collection

The R&D data was collected by means of questionnaires that were sent to R&D-performing entities in each sector by surface or electronic mail. A set of three separate questionnaires was developed for the survey. The first questionnaire was designed for the business sector and the second for the higher education sector, while the third targeted government departments, research institutes, science councils and not-for-profit organisations. All five of the sectors were surveyed between August 2011 and April 2012. Table D1 describes each of the sectors and provides the respective reference period.

Table D.1: Description of sectors, respective reference periods and methods of surveying

Sector	Description	Reference period	Method of surveying
Business	Large, medium and small enterprises; state-owned enterprises.	Financial year ending 28 February 2011 (or the closest complete financial year).	A purposive design was used for the survey of the business sector, and the frame was constructed from the business register developed and maintained by HSRC-CeSTII, since 2002. All known and likely R&D performers were targeted.
Not-for-profit	Non-governmental and other organisations formally registered as NPOs.	Financial year ending 28 February 2011 (or the closest complete financial year).	Non-governmental and other organisations formally registered as NPOs were surveyed through purposive sampling, similar to the approach adopted for the business sector.
Government	National and provincial departments, local government, museums, Research Institutes and other Research Councils with an R&D component.	Financial (fiscal) year ending 31 March 2011.	Government departments were surveyed using a census approach. All national government departments, associated research institutions and museums performing R&D at national, provincial and local levels were included in the government sector.
Science councils	The nine science councils established through Acts of Parliament.	Financial (fiscal) year ending 31 March 2011.	Eight statutory science councils were surveyed, using a census approach. One entity was not eligible for surveying in 2010/11. One science council was surveyed at a unit level. This resulted in a total of 13 entities surveyed in the science councils sector.
Higher education	All public higher education institutions as well as private higher education institutions that performed R&D. Teaching hospitals were also included in this sector.	2010/11 calendar year (ending 31 December 2010).	Higher education institutions, namely universities, universities of science and technology, institutes of education and private higher education institutions were included in the higher education sector frame. All public higher education institutions were surveyed, using a census approach.

Fieldwork

For the 2010/11 survey, the questionnaire response rate was calculated using the following formula:

$$\frac{\text{Response}}{\text{(Response + Non-response) - (Out-of-scope)}}$$

Non-response[1] was defined as failure to obtain a measurement on one or more variables for one or more entities selected for the survey. These included out-of-scope entities.

Out-of-scope entities[1] were defined as entities that should not be included in the sampling frame because they did not belong to the target population in the reference period. If enumerated, they would cause over-coverage. Entities that returned a questionnaire stating zero R&D expenditure were counted as out-of-scope for the 2010/11 R&D survey.

In-scope entities[2] were defined as entities performing in-house R&D or with likely in-house R&D activity; entities that indicated that no R&D had been performed during the 2010/11 period were classified as out-of-scope.

Questionnaire responses[2] were defined as entities that were not counted as non-responsive.

Survey coverage rate[2] was defined as the proportion of R&D-performing entities used to estimate survey variables as a fraction of eligible entities. This was referred to as the 'survey response rate' in the 2009/10 survey report. To avoid confusion with the response rate quality indicator, this was renamed as 'the survey coverage rate' in the 2010/11 report. It was calculated using the following formula:

$$\frac{\text{Response + Imputations}}{\text{(Response + Non-response) - (Out-of-scope)}}$$

1 *Adapted from Sarndal, Swensson and Wretman (1992).*
2 *This is the HSRC -CeSTII operational definition.*

An entity was considered as a response if it completed and returned a questionnaire with non-zero R&D expenditure, or if the entity's in-house R&D expenditure figure was reported by the respondent without a completed questionnaire, or if in-house R&D expenditure was confirmed by the respondent after being imputed based on secondary data. The data sources used for imputation included previous R&D survey responses as well as other private and public data sources such as HEMIS and SPII.

Imputation

The survey employed varying degrees of imputation, ranging from using a total R&D expenditure figure reported by the respondent (by e-mail or telephone), followed by imputing the remaining data items from available sector R&D profiles, to generating an R&D profile for an entity based on its known historical R&D profile adjusted by the GDP inflation factor, or using publicly available data on an entity's R&D. The imputation models ('impute' and 'commute') were unchanged from those used in the 2009/10 survey. Details of the imputation methods are contained in the HSRC-CeSTII R&D Survey Operations Manual, section 2.6.1, and are available on request. Financial data on R&D were adjusted by a GDP inflation factor[3]. Table D2 presents survey response and imputation rates.

Table D.2: Age of data used in the imputation models by sector

Age of data	Business	NPO	Government	Science councils	Higher education
	Number of entities per category				
Imputed (data from current reference period)	17	0	0	0	0
Imputed (data from previous year)	0	0	0	0	0
Imputed (data more than one year old)	0	0	0	0	0
Commuted (data from previous year)	40	1	13	0	0
Commuted (data more than one year old)	81	0	10	0	5
Total	**138**	**1**	**23**	**0**	**5**

Imputation models were applied where required, and where evidence of R&D existed. In order to improve the data quality, more rigorous requirements were put in place for selecting entities to be imputed in the 2010/11 R&D survey; only companies with evidence of on-going R&D activity qualified for imputation. Individual fieldwork lists were interrogated, and non-responders were identified towards the end of the survey period. These were isolated for possible imputation. All commuted data were sent to companies for review, agreement or adjustment where necessary. Where it was not possible to obtain company sign-off, individual fieldworkers were responsible for providing evidence of on-going R&D activity at the selected entity.

Table D.3: Analysis of survey coverage by sector

Sector	Number of entities surveyed	Non-response	Out-of-scope	Responses	Imputations	Questionnaire response rate (%)	Survey coverage rate (%)
Business	599	362	65	237	138	44.4	70.2
Not-for-profit	86	62	18	24	1	35.3	36.8
Government	202	145	32	57	23	33.5	47.1
Science councils	13	0	0	13	0	100	100
Higher education	24	5	0	19	5	79.2	100
Total	**924**	**574**	**115**	**350**	**167**	**43.3**	**63.9**

3 *GDP inflation factor = 2010 nominal GDP / 2009 nominal GDP = 10.97839.*

Data processing and analysis

Completed respondent questionnaires were checked and signed off by the responsible fieldworker. Where necessary, apparent anomalies were clarified by contacting respondents by e-mail or telephone. Similarly, all imputed data items were confirmed and signed off by the responsible fieldworker.

Once the individual responses to the questionnaires, including summation and percentage calculations, had been checked by the relevant fieldworker, the data were manually entered on the Survey Management and Results System (SMRS) by a data capturer. Data entries were then checked against the questionnaire/fieldwork notes used in the original capture of data on the SMRS as a second quality-control measure in the data-capturing process. Following data capture, an extensive series of automated discrepancy-checking algorithms were applied to the data. Where anomalies were found that were not due to computational error, the responsible sector leader(s) of the survey corrected the data to the required standard in consultation with the relevant respondent(s).

Standard data tables were then drawn from the data in the form of outputs agreed upon by HSRC-CeSTII and the DST. Time-series data were added from previous surveys for the purpose of multi-year comparison.

Final data quality-control measures required that the formatted tables be analysed by HSRC-CeSTII staff by cross-checking sectoral data items with corresponding aggregate data items. Where variability in data across the time series was observed, factors contributing to such variability were identified and checked by examining the unit-level data on the database to ensure that no anomalies had been missed in processing. Furthermore, statistical extrapolation was applied to the aggregate tables with respect to missing human resource data on the demographics and qualifications of R&D personnel to ensure the consistency of data across the 2010/11 survey report between more detailed and less detailed tables.

Dissemination of survey results

The 2010/11 R&D survey reports were disseminated to all respondents as well as to users of the R&D statistics.

This report is available on request from HSRC-CeSTII and the DST. The report can be downloaded from the HSRC-CeSTII website (www.hsrc.ac.za/en/research-areas/Research_Areas_PHHSI/CeSTii/sa-national-survey-of-research-and-experimental-development) or the DST website (http://www.dst.gov.za/index.php/resource-center/rad-reports). Extreme care is taken to ensure the confidentiality of respondent information, and the data presented in the report is therefore anonymised as far as possible.

Storage and archiving of survey results

The data have been archived according to established HSRC-CeSTII procedures. Hard copies of the data from the two most recent surveys are kept in safe storage at HSRC-CeSTII, while the data from older surveys are kept in safe storage off site. All data are stored electronically on secure servers, and daily back-ups of databases are generated. In addition, as part of the HSRC's institutional objectives, the HSRC's Data Curation Unit, in consultation with HSRC-CeSTII, has completed the curation of data from the 2001/02, 2003/04 and 2004/05 R&D surveys, and data from the remaining surveys are in the process of being curated.

Summary of the survey methodology used for each sector

Business sector

The 2010/11 survey frame was constructed as follows:

- Using the 2009/10 R&D survey return list as a baseline, the 2010/11 R&D survey frame was drawn from the 663 companies for which a BERD data entry point was listed in the 2009/10 survey year.
- Fifty-four entities were added to the register through interrogation of the JSE Limited Top 100 Companies and Technology Top 100 (TT100), as well as lists from the Support Programme for Industrial Innovation (SPII) and the Technology and Human Resources for Industry Programme (THRIP), which increased the initial sample to 717. Of the 54 entities, 17 were new to the register.

The 717 companies were adopted as the initial sample list and subjected to the verification process for the 2010/11 R&D survey, which involved contacting companies telephonically to ascertain whether they were still performing R&D; and whether their contact details (postal and e-mail addresses) in the database were still correct.

Following the verification process, the initial sample list was finalised, and a questionnaire dispatch list of 603 companies was drawn up. These companies represented the active and known, or likely, R&D performers. This list was later updated and increased to 607 companies by the end of the survey period.

The reasons for excluding 114 entities in the initial sample from the questionnaire dispatch list were as follows:

- Forty-eight companies were found to be 'active'; however, they advised that they had not conducted any R&D during the reference period.
- Twenty-three companies were marked as 'active', but were classified as unlikely R&D performers based on new business intelligence information gathered.
- Thirty-eight companies were marked as 'active'; however, their R&D status could not be verified as they had not responded to the previous four surveys and were thus not contactable to confirm R&D activity.
- Five companies were marked as expired, or were not traceable to confirm their R&D status, or there was sufficient evidence to regard them as non-R&D-performing companies.

In an effort to boost responses to the survey, the survey team undertook visits to selected known R&D-performing business enterprises, including companies that had previously supplied R&D data to the survey, as well as companies that had not responded to requests for information in the previous surveys. The selection of the companies to be visited by the survey team was based on:

- Previous responses to the survey: both responders and non-responders were visited
- Company R&D value: companies with both large and small values of R&D
- Geographic location and willingness to meet with the team.

In the business sector, 16 fieldwork visits were successfully completed across the four major metropolitan areas of South Africa. Throughout the survey period, the survey team engaged in repeated telephone and e-mail communication with respondents and potential respondents to the survey. Where necessary, teleconference and video-conference facilities were used to interact with respondents in an effort to enhance their understanding of the questionnaire, increase compliance with the requirements of the survey and secure the submission of a completed questionnaire. As a long-term quality-improvement strategy, the survey undertook a number of steps to ensure improved data quality:

- Reduction in the number of out-of-scope entities through verification prior to fieldwork rollout
- Rigorous interrogation of many of the leading company listings, such as the JSE Limited Top 100 Companies, Technology Top 100 Awards Programme, SPII, THRIP, Innovation Fund and Who Owns Whom (R&D performers), as well as lists used for the Innovation Survey (R&D performers) as part of the register-building efforts.
- Improved application of imputation models.
- Enhanced investigation of small, medium and micro enterprises (SMMEs) to ensure wider coverage of the SMME sector in South Africa.

Not-for-profit sector

The contact verification methodology used for the not-for-profit (NPO) sector for the 2010/11 R&D survey was as follows:

- Respondents' contact information (including postal details) was verified mainly by telephone and e-mail.
- The contact details were confirmed with respondents by communicating with the director/director of research or the personal assistant to the director of the organisation.

The list of valid responses from the previous R&D survey in 2009/10 was used as the point of departure for the NPO sector in the 2010/11 R&D survey:

- The original register for the in 2009/10 survey consisted of 89 organisations.
- Eighty-six organisations were listed for questionnaire dispatch, as three of the NPOs that had responded to the 2009/10 survey were confirmed to have been de-registered and closed due to lack of funds.
- Questionnaires were dispatched to all 86 entities by post as well as e-mail.
- Twenty-four questionnaires reporting R&D expenditure were returned; an additional 18 questionnaires that were returned were found to be out-of-scope. One commute was created for the NPO sector; six organisations declined to participate; and the rest of the entities were non-responsive.
- Efforts to improve response rates included conducting field visits to selected NPOs as well as teleconferences with respondents to ensure improved data quality. The criteria used to select NPOs for field visits were that a poor response had been received from the entity in previous R&D surveys, as well as uncertainty with respect to the entity's R&D status. One NPO was visited because it had indicated in a public forum that it was involved in R&D activity.

As part of the improved methodology for the R&D survey, steps are being implemented to remove out-of-scope entities from the sample before the start of the survey.

Government sector

The contact verification methodology used for the government sector for the 2010/11 R&D survey was as follows:

- Respondents' contact information (including postal details) was verified mainly by telephone and e-mail.
- The contact details were confirmed with respondents by communicating with the head of department, director, director of research or personal assistant to the director of the organisation.

HSRC-CeSTII conducted an R&D workshop on the R&D survey for the government sector in Gauteng and the Western Cape in 2011, which was attended by representatives of several government departments, research institutes and museums.

The list of valid responses from the 2009/10 R&D survey was used as the point of departure for the government sector in the 2010/11 R&D survey:

- The original register for the 2009/10 survey consisted of 141 entities. Due to a database malfunction, the contact details of respondents might have been altered or lost. In order to improve the veracity of the database, a rigorous contact verification process was undertaken, and the database was expanded to ensure detailed coverage of the government sector.
- For the 2010/11 survey, questionnaires were dispatched to 202 entities by post as well as e-mail. Fifty-seven questionnaires reporting R&D expenditure were returned; an additional 32 questionnaires that were returned were found to be out-of-scope. Twenty-three commutes were created, and the remaining entities were non-responsive.
- Efforts to improve response rates included conducting field visits to selected government departments as well as arranging teleconferences with respondents to ensure improved data quality. National and provincial departments were targeted to determine whether they conduct R&D activities as defined in the Frascati Manual (OECD 2002). Research institutions were visited to delineate their research units so as to gain better understanding of which units to target in the survey. Some museums were visited to enhance their understanding of the survey.

As part of the continual improvement of processes for the R&D survey, steps are being implemented to remove out-of-scope entities from the sample before the start of the survey.

Science councils sector

- The science councils sector survey frame was obtained from the list of valid responses to the previous R&D survey in 2009/10.
- One entity, which indicated that all its R&D functions had been closed down, was thus not included in the survey.

The science councils sector has historically produced a 100% response rate, and thus no additional fieldwork was required, as compliance in this sector is very high. However, constant communication with respondents by e-mail and telephone is still the hallmark of the survey. Continual refinements in survey and fieldwork methodology are employed to increase the efficiency of data collection in this sector.

Higher education sector

The contact verification methodology used for the higher education sector for the 2010/11 R&D survey was as follows:

- Respondents' contact information (including postal details) was verified by telephone and e-mail.
- The contact details were confirmed with respondents by communicating with the dean of research, director, director of research or personal assistant to the relevant head of department or unit.

The list of valid responses from higher education institutions to the 2009/10 R&D survey was used as the basis for the 2010/11 survey sample:

- The higher education sample included all 23 public higher education institutions and one private higher education institution.
- For the 2010/11 survey, all 24 institutions were surveyed electronically only, by means of e-mail.
- Nineteen institutions returned the questionnaire, and five institutions did not.
- Commutes were created for the five non-responding institutions using current data from the Higher Education Management System (HEMIS) to supplement personnel and student information. Data from the HEMIS Classification of Educational Subject Matter (CESM) categories were used to inform the research field data.
- Data from the National Research Foundation were used to supplement student bursary information.

No workshops were held in the higher education sector for the 2010/11 survey, but a special effort was made to visit the non-responding institutions (some of which still did not respond).

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ANNEXURE III
USER SATISFACTION SURVEY: R&D MAIN RESULTS REPORT

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. It would therefore be appreciated if you could complete the following questionnaire and return by fax to +27 (0)21 461 1255 or e-mail to nmustapha@hsrc.ac.za or sparker@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 contents 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 very 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.

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