SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT

STATISTICAL REPORT 2015/16

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

HSRC
Human Sciences
Research Council

STATS SA
STATISTICS SOUTH AFRICA

Produced by the Centre for Science, Technology and Innovation Indicators on behalf of the Department of Science and Technology.

First published: October 2017

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User feedback

A User Satisfaction Survey (USS) questionnaire is included as Annexure G 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 email to cestiidata@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), Statistics South Africa (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 socio-economic indicators, such as the gross domestic product (GDP), or population or employment numbers, or amendments in response to internal and external data quality and consistency monitoring such as that carried out by the Organisation for Economic Co-operation 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.

FOREWORD

Any modern economy requires adequate levels of investment in research and development (R&D) and innovation. The National Survey of Research and Experimental Development (R&D Survey) is conducted annually to update the series of official statistics on South Africa's performance on key indicators of inputs to R&D – measuring the size, growth and composition of R&D expenditure and the human resources devoted to R&D.

The survey is overseen by the Department of Science and Technology (DST) as a partner within the South African National Statistics System (NSS). R&D statistics are key to informing policy implementation by government and are also of use to the private sector, the international community, media, and researchers.

The Statistics Act (No. 6 of 1999) mandates the Statistician General (SG) to coordinate statistical production in the country, even beyond the confines of Statistics South Africa (Stats SA). Accordingly, each R&D survey is subject to a quality assessment prior to its publication, in terms of the South African Statistical Quality Assessment Framework (SASQAF), to ensure that the survey remains credible and true to its purpose.

The Clearance Committee that conducted the quality assessment noted that the 2015/16 R&D Survey was conducted following good practices, and met most of the set quality requirements. The questionnaire response rate was 73.1%, 1.9 points below the set standard of 75%. The collection rate was 80.8%, which is above the standard of 75%. As in the previous two rounds of the survey, greater focus has been given to expanding the universe of R&D performers, particularly in the business sector and the not-for-profit sector. This led to a higher than targeted out-of-scope rate, i.e. proportion of sampled units that did not perform in-house R&D in the reference year. Intermittent R&D performing units cause this tendency. Also, as in several other economies, R&D in South Africa is concentrated in a few larger R&D performing units across institutional sectors, requiring the survey to purposefully cover such units. Important changes are noted in the higher education sector, with new public institutions established and private higher education institutions growing their research capacity.

The initial phase of incorporating the revisions to the 2015 Frascati Manual (*i.e. Guidelines for Collecting and Reporting Data on Research and Experimental Development*) has started. Minor refinements will be introduced in the 2016/17 round of the R&D Survey questionnaire. Further research and consultations are being undertaken to consider enhancements, both to account for expanded uses of the R&D data in South Africa, and to maintain international comparability.

Given my assessment of the recommendations of the Clearance Committee, I endorse the 2015/16 R&D Survey results and encourage its use by stakeholders.

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STATISTICIAN-GENERAL, REPUBLIC OF SOUTH AFRICA

ACKNOWLEDGEMENTS

The South African National Survey of Research and Experimental Development is conducted annually by the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicator's (HSRC-CeSTII), on behalf of the Department of Science and Technology (DST).

The project team extends its appreciation to Dr Phil Mjwara, Director-General of the DST, Prof. Crain Soudien, CEO of the HSRC, Prof. Leickness Simbayi, Deputy CEO: Research, HSRC, and Dr 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 and Ms Kgomotso Matlapeng of the DST are much appreciated.

Technical inputs and advice by the DST and Statistics South Africa teams, as well as the Clearance Committee for Science, Technology and Innovation Statistical Reports, have helped improve the quality of this publication, and are appreciated. In addition, interactions with the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) have provided invaluable assistance in maintaining the quality and standard of the South African R&D surveys and analysis of the results.

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

The HSRC-CeSTII project team for the 2015/16 South African National Survey of Research and Experimental Development comprised: Lindiwe Binda, Yasser Buchana, Mario Clayford, Zinziswa Hlakula, Firdous Khan, Lwando Kondlo, Glenda Kruss, Loyiso Maciko, Nhlanhla Malaza, Maria Maluleke, Hlamulo Makelane, Jerry Mathekga, Neo Molotja, Gina Mshengu, Precious Mudavanhu, Nazeem Mustapha, Ndiyakholwa Ngqulu, Janine Senekal, Saahier Parker, Thembinkosi Zulu, Theodore Sass, Natasha Saunders, Moses Sithole, Sinovuyo Takatshana, Natalie Vlotman, and Gerard Ralphs.

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
BERD	Business Expenditure on R&D
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
GOVERD	Government Intramural Expenditure on R&D
HEMIS	Higher Education Management Information System
HERD	Expenditure on R&D in the Higher Education Sector
HIV	Human Immunodeficiency Virus
HSRC	Human Sciences Research Council
ICT	Information and Communication Technologies
NESTI	National Experts on Science and Technology Indicators
NPO	Not-for-profit Organisation
NSI	National System of Innovation
NSO	National Statistical Organisation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Experimental Development
RDSMS	Research and Development Survey Management System
SA	South Africa
SASQAF	South African Statistical Quality Assessment Framework
SOE	State Owned Enterprise
SEO	Socio-economic Objective
SMU	Sefako Makgathu Health Sciences University
SIC	Standard Industrial Classification
SNA	System of National Accounts
SPII	Support Programme for Industrial Innovation
Stats SA	Statistics South Africa
SVC	Statistical Value Chain
TB	Tuberculosis
VAT	Value Added Tax

DEFINITIONS AND DESCRIPTIONS

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

Basic research is 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.

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

Capital expenditures are the annual gross expenditures on fixed assets used in the R&D programmes of statistical units. These are reported in full for the period when they took place and are not registered as an element of depreciation. Capital expenditures on R&D consist of buildings, vehicles, plant machinery and equipment.

Civil gross expenditure on research and development (Civil GERD) is the sum of all expenditure by socio-economic objectives, minus expenditure on defence R&D.

Constant 2010 Rands is the value of goods and services of a given year using the prices of a determined base reference year, which is 2010 in this case. These values were obtained by deflating with the GDP deflator using data published in the Statistics South Africa GDP survey P0441, 1st Quarter 2017 (Stats SA, 2017).

Current expenditure is expenditure on items that generally reoccur after a short period. Current expenditure on R&D activities consists of labour costs and other current expenditures.

Experimental development is 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.

Full-time equivalent (FTE) is an estimate of the time spent on R&D activities. It is the proportion of time spent on R&D activities out of all time spent at work.

Gross domestic product (GDP) is the total market value of all final goods and services produced in a country in a given year, equal to total consumer, investment and government spending, plus the value of exports, minus the value of imports. This statistic is obtained from the Statistics South Africa GDP survey P0441, 1st Quarter 2017 (Stats SA, 2017).

Gross expenditure on research and development (GERD) covers all expenditures for R&D performed on national territory in a given year. It thus includes domestically performed R&D which is financed from abroad but excludes R&D funds paid abroad, notably to international agencies.

Headcounts refers to the number of people directly involved in or supporting R&D (i.e. the total number of R&D personnel within a category).

In-house or intramural R&D refers to R&D performed by the unit or entity itself (i.e. by the personnel of the unit or entity). This is R&D performed within the borders of South Africa, even if funded by foreign sources.

Labour costs comprise annual wages and salaries and all associated costs or fringe benefits, such as bonus payments, holiday pay, contributions to pension funds and other social security payments, payroll taxes, etc. The labour costs of persons providing indirect services which are not included in the personnel data (such as security and maintenance personnel or the staff of central libraries, computer departments or head offices) are excluded and included in other current costs.

New materials pertain to the technology and R&D activities of high-tech companies particularly in the aerospace, construction, electronic, biomedical, renewable energy, environmental remediation, food and packaging, manufacturing and motor car industries. New materials include multi-functional materials, advanced materials, nano-materials, nano-composites and nanotechnology.

Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometres, where unique phenomena enable novel applications.

Open-source software is computer software that is available in source code form under an open-source licence. The source code and certain other rights normally reserved for copyright holders are provided under a software licence that permits anyone to study, change, improve and at times also to distribute the software.

Other current expenditure comprise non-capital purchases of materials, supplies and equipment to support R&D performed by the statistical unit in a given year. These include, but are not limited to running costs, overhead expenses, repairs and maintenance, payments to outside organisations for use of specialised testing facilities, payments to outside organisations for specialised services and on-site consultant expenses in support of R&D projects carried out by the R&D performer.

Outsourced R&D refers to R&D done by another entity on behalf of the reporting unit and paid for by the reporting unit.

R&D intensity estimated by GERD as a proportion of GDP is the total intramural expenditures on R&D performed in the country in a given year relative to GDP.

R&D personnel refers to all persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff.

Researchers are R&D personnel engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned.

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.

Socio-economic objective (SEO) classification provides an indication of the R&D activities by main purpose. The SEO classification used in this survey is consistent with the Nomenclature for the Analysis and Comparison of Scientific programs and Budgets (NABS) that was published by Eurostat in 2007.

Statistical unit is an entity for which statistical data are collected or derived.

Standard Industrial Classification (SIC) codes are used by Statistics South Africa for describing the economic activities of industries.

State-owned enterprises (SOEs) are public corporations owned by government units mainly engaged in market production and sale of the kind of goods and services often produced by private enterprises.

Total employment is the total employed labour force in the South African economy. This statistic is obtained from Stats SA Labour Force Survey series P0211 (Stats SA, 2016) where employed persons were defined as those aged 15–64 years who, during the reference week, did any work for at least one hour, or had a job or business but were not at work (temporarily absent).

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A. INTRODUCTION

This Statistical Report presents data tables from the 2015/16 South African National Survey of Research and Experimental Development (R&D survey). The report provides key findings of the survey with commentary and standard summary tables of the overall findings from 2015/16, along with time series data from previous instances of the survey. The Statistical Report is published together with the Main Analysis Report, which provides selected analysis of survey data.

The survey covers the following institutional sectors that perform R&D in South Africa:

- **The business enterprise sector**, comprising all size classes of enterprises, including state-owned enterprises (SOEs).
- **The government sector**, comprising departments in the three spheres of national, provincial and local government with an R&D component, government research institutions and museums.
- **The higher education sector**, comprising all public higher education institutions and private higher education institutions with an R&D component.
- **The not-for-profit sector**, comprising non-governmental and other organisations formally registered as not-for-profit institutions.
- **The science council sector**, comprising the nine science councils established through Acts of Parliament.

This approach is followed in order to maintain consistency with the institutional sector categorisation recommended by the Organisation for Economic Co-operation 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), and to adjust for the South African situation, which demands a split of government into a government sector and a science councils sector.

R&D statistics are presented in tables according to the following categories:
- Gross domestic expenditure on research and development (GERD), and R&D expenditure by R&D-performing sectors
- Local and international sources of funding for R&D sectors
- R&D expenditure by field of research and socio-economic objective, and by industrial sector in the business sector
- R&D expenditure by field of research and socio-economic objective, and by industrial sector for SOEs in the business sector
- R&D expenditure in selected areas of policy interest, namely biotechnology, nanotechnology, environment-related, open-source software, new materials, and tuberculosis (TB), HIV/AIDS and malaria research.
- R&D personnel.

GDP values were obtained from the Stats SA GDP statistical release P0441 (Stats SA, 2017), and the total employment level was taken from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2016).

All financial quantities presented in this report are in current values, unless otherwise indicated. Constant 2010 Rand values were calculated using the GDP deflator.

The headline indicator of GERD/GDP has been recalculated to adjust for ongoing revisions in the Stats SA GDP[1] series.

The classification of main institutional sectors recommended in the System of National Accounts (EC, IMF, OECD, UN and World Bank, 2009) is indicated in terms of those used in the Frascati Manual (OECD, 2002). This is only used indicatively in this report to assist users of data for R&D capitalisation purposes. Full implementation of this procedure will be done once the changes published in the seventh edition of the Frascati Manual have been finalised.

Since the 2014/15 R&D survey, tables have been included to assess the R&D activities of SOEs. This will address new user needs for this type of data.

Section B gives the main findings of the survey, including commentary on key developments. Section C contains a detailed set of tables describing the survey results for 2015/16 and the preceding nine years. The description of the survey methodology is contained in section D, and the higher education sector questionnaire for the 2015/16 survey is reproduced in section F.

[1] The R&D survey has historically used the GDP series calculated according to the production method employed by Statistics South Africa.

B. KEY FINDINGS FOR 2015/16

Gross Domestic Expenditure on R&D (GERD) increases in real terms

South Africa's gross expenditure on research and experimental development (GERD) stood at R32.337 billion[2] at current Rand values in 2015/16.

At constant 2010 prices, GERD amounted to R24.458 billion. The year-on-year change in real GERD was 5.0%.

GERD as a percentage of GDP rose three basis points to 0.80% in 2015/16

As in 2014/15, the increase in GERD was large enough compared to the increase in the level of GDP in current prices to register an increase in R&D intensity[3].

Table B.1: Summary of key statistics and indicators (2013/14 to 2015/16)

KEY INDICATOR	2013/14	2014/15	2015/16
Expenditure on R&D			
Gross domestic expenditure on R&D (GERD) (Rm)	**25,661**	**29,345**	**32,337**
Business enterprise expenditure on R&D (BERD) (Rm)	*11,783*	*13,291*	*13,815*
Not-for-profit (NPO) expenditure on R&D (Rm)	*583*	*779*	*891*
Government expenditure on R&D (GOVERD) (Rm)	*1,697*	*1,893*	*2,013*
Science council (SCI) expenditure on R&D (Rm)	*4,305*	*5,005*	*5,741*
Higher education (HE) expenditure on R&D (HERD) (Rm)	*7,293*	*8,378*	*9,877*
Gross domestic expenditure on R&D in constant 2010 prices (Rm)	21,554	23,304	24,458
Funding sources			
Government-funded* R&D (Rm)	11,007	12,873	14,426
Business-funded R&D (Rm)	10,616	11,982	12,578
Foreign funding of R&D (Rm)	3,315	3,566	4,210
Foreign funding of BERD (Rm)	*1,227*	*1,419*	*1,533*
Foreign funding of NPO R&D (Rm)	*333*	*457*	*501*
Foreign funding of GOVERD (Rm)	*259*	*179*	*500*
Foreign funding of SCI R&D (Rm)	*455*	*431*	*470*
Foreign funding of HERD (Rm)	*1,043*	*1,080*	*1,206*
R&D personnel			
Total R&D personnel (FTE**)	37,956.5	38,465.0	41,054.5
Total researchers# (FTE**)	23,346.0	23,571.9	26,159.4
Total researchers# (headcount)	45,935	48,479	51,877
Female researchers# (headcounts)	20,231	21,471	23,334
Indicators computed from R&D survey			
GERD as a percentage of GDP (%)	0.72	0.77	0.80
Civil GERD as a percentage of GDP (%)	0.69	0.72	0.75
Basic research (R millions)	6,102	7,133	8,210
Total R&D personnel (FTE**) per 1 000 in total employment	2.5	2.5	2.6
Total researchers† (FTE**) per 1 000 in total employment	1.6	1.5	1.7
Female researcher† headcounts as a percentage of total researcher headcounts (%)	44.0	44.3	44.4
Indicators obtained from external data sources			
Gross domestic product (GDP)†† level at current prices (Rm)	3,539,792	3,807,677	4,049,760
GDP†† (%)	2.5	1.7	1.3
SA employment ('000)	15,055	15,459	15,663

*Government-funded R&D includes science council funding and university own funds.

**FTE: Full-time equivalent.

†Researchers include doctoral students and post-doctoral fellows.

††GDP values obtained from Stats SA (2017)

[2] A noteworthy portion of this increase in GERD was due to improved responses in the higher education sector in 2015/16.

[3] This increase of three basis points in R&D intensity should not be overstated, because two of these basis points arise from improved fieldwork practices in the higher education sector.

Notable developments reflected in key indicators

Economic environment

In 2015, GDP dropped a further 0.4 of a percentage point to 1.3%, after having gone down to 1.7% in 2014. Government's Medium-Term Budget Policy Statement (National Treasury, 2015) trimmed spending by R25 billion for 2015/16 and 2016/17, but government spending was still greater than inflation in 2015.

Public sector R&D expenditure grew, while business sector R&D expenditure stagnated

Nominal R&D expenditure increased in all sectors in 2015/16 (see Table C.1), with the higher education sector as the biggest contributor to the increase in R&D expenditure[4], after spending R1.499 billion more than it did in 2014/15. Nominally, the business sector increased[5] R&D expenditure by R524 million. However, in real terms, business expenditure on R&D decreased by 1.0% year-on-year in 2015/16, after two consecutive years of growth. This decreased real expenditure in the business sector was accompanied by a loss of 469.7 FTEs in R&D personnel.

The two largest contributors to BERD (since 2009/10) are the financial intermediation, real estate and business services sector, and the manufacturing sector, as illustrated in Table C.51. On the one hand, the financial intermediation, real estate and business services sector increased its proportional share by 2.5 percentage points to comprise 42.8% of BERD in 2015/16. On the other hand, the manufacturing sector decreased its proportional share by 1.7 percentage points to comprise 32.2% of BERD in 2015/16. The other major industrial sectors each contributed less than 9% to BERD.

Growth in funding of R&D from both Government and Business is slowing down

Government (inclusive of science councils funding and higher education own funds) has increased its funding of R&D (Table C.19) in both nominal and real terms, thereby remaining the largest funder of R&D, funding 44.6% of GERD in 2015/16. However, the growth in government-funded R&D is showing signs of slowing down in 2015/16. The growth in funds from the business sector has been slowing down since at least 2013/14, and now stands at 38.9%. Inasmuch as there appears to be accelerated growth in funding of R&D by foreign sources, the proportion of funding that may be attributed to foreign sources is still at a level that it has been historically, at around 13.0% of GERD, up by 0.8 of a percentage point from 2014/15.

Researcher FTEs increased by 11.0%

R&D personnel (inclusive of doctoral students and postdoctoral fellows at universities) have increased by 2 531 headcounts[6] to 74 931. Growth in R&D personnel (see C.28 for the trends) was mainly driven by the net intake of researchers, which increased by 3 398 headcounts in 2015/16 to 51 877. The larger part of this increase in researcher headcounts came from 2 666 doctoral students and postdoctoral fellows at universities, as has been the case in previous years.

Researcher FTEs (including post-doctoral fellows and doctoral students) increased from 23 571.9 to 26 159.4. The number of FTE researchers per 1 000 in total employment is at 1.7. This indicator has remained within the range of 1.4 to 1.7 for at least ten years.

The proportion of female researchers increased by 0.1 of a percentage point to 44.3% (Table C.29).

R&D performed continued to tend towards applied research

Since 2010/11, applied research has dominated the type of research conducted in South Africa. In 2015/16, applied research comprised 47.5% of GERD, whereas experimental development and basic research only contributed 27.1 and 25.4, respectively, to GERD (Table C.5).

The majority of R&D activity in 2015/16 is now taking place in medical and health sciences (19.8%) and the social sciences (18.7%) (Table C.14). The engineering sciences, at (16.8%) has been superseded by the medical and health sciences and social science research fields in 2015/16, with respect to their levels of contribution to R&D expenditure. Information, computer and communication technologies has been increasing since after 2013/14, and stands at 12.0% in 2015/16.

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[4] Of the increase of R1.499 billion in higher education expenditure on R&D (HERD), R773 million was due to improved responses, coverage and imputation methods. The sources and sizes of these effects in the higher education sector are assessed in Section D.3.

[5] A fifth (or R 110 million, amounting to 0.8% of BERD and 0.3% of GERD) of this increase was due to improved coverage.

[6] Improved fieldwork responses within the higher education sector in 2015/16 have resulted in an adjustment of the ratio between researchers, technicians and other R&D personnel, compared to previous years.

Most of the sharp growth in social science research, since 2012/13, has come from the business sector, which contributed 39.2% of R&D expenditure in this field in 2015/16. The business sector performed the bulk (63.0%) of research in the engineering sciences, with SOEs contributing 18.0 percentage points to this proportion.

R&D in the fields of biotechnology and nanotechnology, open source software, materials, as well as the environment related research maintained growth

In 2015/16, R&D in biotechnology grew 0.3 of a percentage point to 5.7% of GERD, and R&D in nanotechnology decreased by 0.1 of a percentage point to 2.7% of GERD (Table C.10).

The year-on-year growth of R&D expenditure in open source software was 33.3%. R&D expenditure in TB/HIV/AIDS and malaria grew by 9.6% year-on-year, and R&D expenditure in new materials grew by 3.6% year-on-year. Environment and related R&D decreased by 1.9% in real terms from 2014/15 values. (See Table C.11 for the levels of R&D expenditure in current values).

State-owned enterprises

The contribution of SOEs to R&D activity (see Table C.) in the business sector has decreased by 0.9 of a percentage point to 14.3% in 2015/16.

Out of the 6 128 researchers in the business sector, 14.7% were employed in public enterprises (see Table C.75).

C. TABLES

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

C.1. General survey results

C.1.1. Expenditure on research and experimental development

Table C.1: R&D expenditure by sector (2006/07 to 2015/16)

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	16 520 584	1 021 355	2 744 718	3 298 808	9 243 165	212 538
2007/08	18 624 013	1 154 399	2 886 094	3 621 862	10 738 456	223 202
2008/09	21 041 046	1 139 676	3 137 343	4 191 366	12 332 012	240 649
2009/10	20 954 677	1 067 302	3 458 074	5 101 224	11 139 237	188 840
2010/11	20 253 805	1 011 340	3 596 023	5 424 602	10 059 010	162 830
2011/12	22 209 192	1 235 669	3 729 680	6 609 216	10 464 022	170 605
2012/13	23 871 219	1 437 509	4 025 998	7 333 153	10 570 726	503 833
2013/14	25 660 573	1 697 151	4 304 556	7 292 853	11 782 848	583 165
2014/15	29 344 977	1 893 010	5 004 669	8 377 575	13 290 951	778 772
2015/16	32 336 679	2 013 021	5 740 897	9 876 623	13 814 995	891 142

Table C.2: R&D expenditure by sector, constant 2010 Rand values (2006/07 to 2015/16)

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	22 375 580	1 383 329	3 717 463	4 467 926	12 518 999	287 863
2007/08	23 173 765	1 436 413	3 591 152	4 506 664	13 361 806	277 729
2008/09	24 056 670	1 303 016	3 586 990	4 792 077	14 099 448	275 139
2009/10	22 285 524	1 135 087	3 677 699	5 425 206	11 846 698	200 833
2010/11	20 253 805	1 011 340	3 596 023	5 424 602	10 059 010	162 830
2011/12	20 847 398	1 159 902	3 500 988	6 203 961	9 822 403	160 144
2012/13	21 283 165	1 281 658	3 589 510	6 538 112	9 424 676	449 209
2013/14	21 553 925	1 425 544	3 615 667	6 125 725	9 897 153	489 837
2014/15	23 303 998	1 503 314	3 974 404	6 652 961	10 554 866	618 453
2015/16	24 458 370	1 522 581	4 342 220	7 470 343	10 449 195	674 030

GDP values were obtained from the Stats SA GDP statistical release P0441 (Stats SA, 2017).

Table C.3: R&D expenditure composition by sector (2006/07 to 2015/16)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2006/07	6.2	16.6	20.0	55.9	1.3
2007/08	6.2	15.5	19.4	57.7	1.2
2008/09	5.4	14.9	19.9	58.6	1.1
2009/10	5.1	16.5	24.3	53.2	0.9
2010/11	5.0	17.8	26.8	49.7	0.8
2011/12	5.6	16.8	29.8	47.1	0.8
2012/13	6.0	16.9	30.7	44.3	2.1
2013/14	6.6	16.8	28.4	45.9	2.3
2014/15	6.5	17.1	28.5	45.3	2.7
2015/16	6.2	17.8	30.5	42.7	2.8

Table C.4: R&D expenditure as a percentage of GDP by sector (2006/07 to 2015/16)

YEAR	GERD/GDP	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%	%
2006/07	0.90	0.06	0.15	0.18	0.50	0.01
2007/08	0.88	0.05	0.14	0.17	0.51	0.01
2008/09	0.89	0.05	0.13	0.18	0.52	0.01
2009/10	0.84	0.04	0.14	0.20	0.44	0.01
2010/11	0.74	0.04	0.13	0.20	0.37	0.01
2011/12	0.73	0.04	0.12	0.22	0.35	0.01
2012/13	0.73	0.04	0.12	0.23	0.32	0.02
2013/14	0.72	0.05	0.12	0.21	0.33	0.02
2014/15	0.77	0.05	0.13	0.22	0.35	0.02
2015/16	0.80	0.05	0.14	0.24	0.34	0.02

Table C.5: R&D expenditure by type of research (2006/07 to 2015/16)

YEAR	GERD	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	R'000	R'000	R'000	R'000
2006/07	16 520 728	3 075 263	5 794 785	7 650 671
2007/08	18 624 013	3 830 806	6 373 681	8 419 526
2008/09	21 041 046	4 243 156	7 013 082	9 784 808
2009/10	20 954 676	5 553 399	6 578 902	8 822 375
2010/11	20 253 804	4 848 283	8 058 799	7 346 722
2011/12	22 209 192	5 439 561	9 388 273	7 381 358
2012/13	23 871 219	6 030 827	11 064 247	6 776 146
2013/14	25 660 573	6 102 085	12 132 211	7 426 277
2014/15	29 344 977	7 133 213	14 331 016	7 880 748
2015/16	32 336 679	8 209 662	15 349 070	8 777 948

Table C.6: Proportional R&D expenditure by type of research (2006/07 to 2015/16)

YEAR	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	%	%	%
2006/07	18.6	35.1	46.3
2007/08	20.6	34.2	45.2
2008/09	20.2	33.3	46.5
2009/10	26.5	31.4	42.1
2010/11	23.9	39.8	36.3
2011/12	24.5	42.3	33.2
2012/13	25.3	46.3	28.4
2013/14	23.8	47.3	28.9
2014/15	24.3	48.8	26.9
2015/16	25.4	47.5	27.1

Table C.7: R&D expenditure by accounting category (2006/07 to 2015/16)

YEAR		CAPITAL EXPENDITURE ON R&D			CURRENT EXPENDITURE ON R&D			
	GERD	LAND: BUILDINGS AND OTHER STRUCTURES	VEHICLES, PLANT, MACHINERY, EQUIPMENT	SUBTOTAL: CAPITAL EXPENDITURE	LABOUR COSTS	TOTAL COST OF R&D POST-GRADUATE STUDENTS*	OTHER CURRENT EXPENDITURE	SUBTOTAL: CURRENT EXPENDITURE
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	16 520 586	319 868	1 357 234	1 677 102	7 526 757	438 486	6 878 241	14 843 484
2007/08	18 624 013	367 757	1 686 567	2 054 324	8 171 240	495 128	7 903 321	16 569 689
2008/09	21 041 046	326 145	3 091 898	3 418 043	8 661 361	532 883	8 428 759	17 623 003
2009/10	20 954 677	623 089	2 067 728	2 690 817	8 909 301	581 140	8 773 419	18 263 860
2010/11	20 253 805	472 205	1 714 845	2 187 050	8 353 254	756 930	8 956 571	18 066 755
2011/12	22 209 192	454 321	2 215 416	2 669 737	9 534 138	1 074 207	8 931 110	19 539 455
2012/13	23 871 219	495 842	1 747 183	2 243 025	11 922 169	1 186 653	8 519 372	21 628 194
2013/14	25 660 573	529 575	1 857 913	2 387 488	13 304 413	1 224 611	8 744 061	23 273 085
2014/15	29 344 977	805 961	2 311 181	3 117 142	14 443 903	1 579 088	10 204 844	26 227 835
2015/16	32 336 679	711 631	3 008 992	3 720 622	14 781 549	1 926 301	11 908 207	28 616 057

Table C.8: Proportional R&D expenditure by accounting category (2006/07 to 2015/16)

YEAR	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 POST-GRADUATE STUDENTS	OTHER CURRENT EXPENDITURE	SUBTOTAL: CURRENT EXPENDITURE
	%	%	%	%	%	%	%
2006/07	1.9	8.2	10.2	45.6	2.7	41.6	89.8
2007/08	2.0	9.1	11.0	43.9	2.7	42.4	89.0
2008/09	1.6	14.7	16.2	41.2	2.5	40.1	83.8
2009/10	3.0	9.9	12.8	42.5	2.8	41.9	87.2
2010/11	2.3	8.5	10.8	41.2	3.7	44.2	89.2
2011/12	2.0	10.0	12.0	42.9	4.8	40.2	88.0
2012/13	2.1	7.3	9.4	49.9	5.0	35.7	90.6
2013/14	2.1	7.2	9.3	51.8	4.8	34.1	90.7
2014/15	2.7	7.9	10.6	49.2	5.4	34.8	89.4
2015/16	2.2	9.3	11.5	45.7	6.0	36.8	88.5

Table C.9: Expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

YEAR	GERD	BIOTECHNOLOGY	NANOTECHNOLOGY
	R'000	R'000	R'000
2006/07	16 520 584	592 777	310 078
2007/08	18 624 014	648 704	248 521
2008/09	21 041 046	801 640	388 380
2009/10	20 954 677	917 917	423 865
2010/11	20 253 805	1 142 337	414 529
2011/12	22 209 192	1 065 286	596 072
2012/13	23 871 219	1 179 478	662 634
2013/14	25 660 573	1 266 325	664 139
2014/15	29 344 977	1 576 727	818 919
2015/16	32 336 679	1 843 363	871 426

Table C.10: Proportional expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

YEAR	BIOTECHNOLOGY	NANOTECHNOLOGY
	%	%
2006/07	3.6	1.9
2007/08	3.5	1.3
2008/09	3.8	1.8
2009/10	4.4	2.0
2010/11	5.6	2.0
2011/12	4.8	2.7
2012/13	4.9	2.8
2013/14	4.9	2.6
2014/15	5.4	2.8
2015/16	5.7	2.7

Table C.11: R&D expenditure on selected areas of interest (2006/07 to 2015/16)

YEAR	GERD	OPEN SOURCE SOFTWARE	TUBERCULOSIS (TB), HIV/AIDS, MALARIA	ENVIRONMENT / ENVIRONMENT RELATED	NEW MATERIALS
	R'000	R'000	R'000	R'000	R'000
2006/07	16 520 584	192 786	934 760	N/A	336 970
2007/08	18 624 013	254 808	1 120 028	N/A	298 746
2008/09	21 041 046	218 289	1 616 410	N/A	514 242
2009/10	20 954 677	172 712	1 816 901	N/A	559 021
2010/11	20 253 805	157 790	2 052 521	N/A	722 167
2011/12	22 209 192	181 320	2 006 625	1 215 855	783 232
2012/13	23 871 219	211 264	2 478 422	1 051 035	1 327 832
2013/14	25 660 573	339 065	2 867 954	1 088 094	794 016
2014/15	29 344 977	818 735	3 008 176	1 996 195	1 053 783
2015/16	32 336 679	1 145 590	3 462 704	2 056 659	1 146 470

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.12: Proportional R&D expenditure on selected areas of interest (2006/07 to 2015/16)

YEAR	OPEN SOURCE SOFTWARE	TUBERCULOSIS (TB), HIV/AIDS, MALARIA	ENVIRONMENT / ENVIRONMENT RELATED	NEW MATERIALS
	%	%	%	%
2006/07	1.2	5.7	N/A	2.0
2007/08	1.4	6.0	N/A	1.6
2008/09	1.0	7.7	N/A	2.4
2009/10	0.8	8.7	N/A	2.7
2010/11	0.8	10.1	N/A	3.6
2011/12	0.8	9.0	5.5	3.5
2012/13	0.9	10.4	4.4	5.6
2013/14	1.3	11.2	4.2	3.1
2014/15	2.8	10.3	6.8	3.6
2015/16	3.5	10.7	6.4	3.5

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.13: R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural sciences, technology and engineering	**14 568 971**	**16 306 332**	**18 419 289**	**18 236 046**	**17 274 483**	**18 924 485**	**19 384 947**	**20 587 093**	**23 687 304**	**25 562 694**
Mathematical sciences	315 773	341 624	397 512	414 234	530 693	636 153	634 658	627 017	636 084	646 870
Physical sciences	655 378	793 006	952 441	648 657	305 701	338 098	370 616	379 813	582 267	769 739
Chemical sciences	595 579	784 145	1 056 848	860 745	865 345	1 273 588	1 460 180	1 305 139	1 299 969	1 491 410
Earth sciences	426 950	524 133	563 619	402 949	403 848	409 212	499 210	498 427	690 040	635 291
Information, computer and communication technologies	2 314 243	2 598 218	2 763 320	3 272 679	2 808 681	2 852 251	2 000 453	1 994 502	2 946 625	3 877 852
Applied sciences and technologies	1 812 402	1 832 546	1 905 397	1 740 755	2 151 557	2 114 322	2 252 175	2 164 025	1 555 897	1 525 646
Engineering sciences	3 457 912	4 189 408	5 135 032	4 580 166	3 600 159	3 775 247	3 903 931	4 315 051	5 485 812	5 444 740
Biological sciences	798 835	723 280	744 144	800 435	1 326 076	1 350 716	1 555 035	1 578 516	1 398 611	1 452 763
Agricultural sciences	1 138 873	1 264 628	1 147 706	1 445 847	1 307 191	1 710 860	1 810 114	2 196 122	2 656 038	2 573 509
Medical and health sciences	2 489 242	2 616 439	3 139 245	3 506 472	3 461 304	3 819 180	4 107 641	4 668 417	5 459 721	6 389 455
Environmental sciences	216 710	222 514	248 625	229 186	352 139	439 719	587 113	611 007	533 065	375 455
Material sciences	284 530	365 813	306 828	254 092	109 551	166 411	155 379	192 199	368 315	299 069
Marine sciences	62 544	50 579	58 573	79 830	52 238	38 726	48 442	56 857	74 858	80 897
Division 2: Social sciences and humanities	**1 951 613**	**2 317 681**	**2 621 757**	**2 718 631**	**2 979 322**	**3 284 707**	**4 486 272**	**5 073 480**	**5 657 674**	**6 773 985**
Social sciences	1 559 043	1 809 308	2 024 801	2 233 521	2 512 714	2 790 339	3 999 853	4 489 054	5 000 339	6 043 806
Humanities	392 570	508 373	596 956	485 110	466 608	494 368	486 420	584 426	657 335	730 179
Total	**16 520 584**	**18 624 013**	**21 041 046**	**20 954 677**	**20 253 805**	**22 209 192**	**23 871 219**	**25 660 573**	**29 344 977**	**32 336 672**

Table C.14: Proportional R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural sciences, technology and engineering	**88.2**	**87.6**	**87.5**	**87.0**	**85.3**	**85.2**	**81.2**	**80.2**	**80.7**	**79.1**
Mathematical sciences	1.9	1.8	1.9	2.0	2.6	2.9	2.7	2.4	2.2	2.0
Physical sciences	4.0	4.3	4.5	3.1	1.5	1.5	1.6	1.5	2.0	2.4
Chemical sciences	3.6	4.2	5.0	4.1	4.3	5.7	6.1	5.1	4.4	4.6
Earth sciences	2.6	2.8	2.7	1.9	2.0	1.8	2.1	1.9	2.4	2.0
Information, computer and communication technologies	14.0	14.0	13.1	15.6	13.9	12.8	8.4	7.8	10.0	12.0
Applied sciences and technologies	11.0	9.8	9.1	8.3	10.6	9.5	9.4	8.4	5.3	4.7
Engineering sciences	20.9	22.5	24.4	21.9	17.8	17.0	16.4	16.8	18.7	16.8
Biological sciences	4.8	3.9	3.5	3.8	6.5	6.1	6.5	6.2	4.8	4.5
Agricultural sciences	6.9	6.8	5.5	6.9	6.5	7.7	7.6	8.6	9.1	8.0
Medical and health sciences	15.1	14.0	14.9	16.7	17.1	17.2	17.2	18.2	18.6	19.8
Environmental sciences	1.3	1.2	1.2	1.1	1.7	2.0	2.5	2.4	1.8	1.2
Material sciences	1.7	2.0	1.5	1.2	0.5	0.7	0.7	0.7	1.3	0.9
Marine sciences	0.4	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.3	0.3
Division 2: Social sciences and humanities	**11.8**	**12.4**	**12.5**	**13.0**	**14.7**	**14.8**	**18.8**	**19.8**	**19.3**	**20.9**
Social sciences	9.4	9.7	9.6	10.7	12.4	12.6	16.8	17.5	17.0	18.7
Humanities	2.4	2.7	2.8	2.3	2.3	2.2	2.0	2.3	2.2	2.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.15: R&D expenditure by socio-economic objectives (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVES	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	**1 091 516**	**1 135 278**	**1 196 200**	**1 276 269**	**1 341 460**	**1 069 289**	**1 351 337**	**1 386 428**	**1 826 784**	**1 814 789**
Defence	1 091 516	1 135 278	1 196 200	1 276 269	1 341 460	1 069 289	1 351 337	1 386 428	1 826 784	1 814 789
Division 2: Economic development	**10 017 805**	**11 724 590**	**13 312 043**	**12 341 036**	**11 231 879**	**12 174 897**	**12 223 017**	**14 166 615**	**15 359 534**	**16 644 668**
Economic development unclassified	150 668	171 520	209 400	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	792 487	931 733	853 243	1 055 316	1 045 114	1 137 706	1 218 852	1 739 038	1 364 018	1 426 609

SOCIO-ECONOMIC OBJECTIVES	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Animal production and animal primary products	337 029	279 914	289 909	354 639	293 873	565 729	598 602	803 403	694 423	655 059
Mineral resources (excluding energy)	931 909	1 075 821	995 552	1 212 226	1 123 063	1 065 384	1 143 762	1 351 239	1 779 068	1 759 268
Energy resources	574 570	709 891	1 185 455	407 091	274 220	273 390	294 820	288 314	197 072	178 434
Energy supply	347 632	364 876	515 216	540 463	623 953	676 490	509 128	590 980	778 805	636 596
Manufacturing	2 187 583	2 676 911	2 998 301	2 602 319	2 374 657	2 489 799	2 394 239	2 608 207	2 619 974	2 665 871
Construction	937 406	1 150 733	1 461 157	521 289	311 897	392 439	426 960	450 907	270 226	229 284
Transport	515 262	595 065	704 404	924 183	905 571	984 225	992 504	1 115 027	998 136	1 115 349
Information and communication services	1 035 459	1 240 972	1 274 761	1 381 989	1 104 273	1 271 591	1 159 823	1 124 614	1 661 660	2 347 021
Commercial services	1 380 085	1 457 410	1 499 495	2 045 919	1 849 534	1 866 449	1 895 734	2 443 529	2 701 523	2 789 611
Economic framework	349 517	548 517	604 404	598 312	600 662	611 868	715 759	689 386	1 331 844	1 797 751
Natural resources	478 198	521 228	720 746	697 290	725 062	839 825	872 835	961 971	962 787	1 043 816
Division 3: Society	**2 731 152**	**2 827 775**	**3 225 179**	**3 276 198**	**3 247 428**	**3 861 888**	**4 473 657**	**4 585 825**	**5 885 267**	**6 815 987**
Society unclassified	150 668	171 520	209 400	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	1 725 977	1 790 225	2 013 993	2 247 629	2 089 570	2 301 764	2 942 262	2 859 623	3 638 036	4 154 557
Education and training	418 971	389 138	465 475	458 060	442 181	554 462	672 473	882 976	1 346 974	1 603 117
Social development and community services	435 536	476 892	536 312	570 508	715 677	1 005 662	858 922	843 226	900 257	1 058 313
Division 4: Environment	**711 134**	**854 997**	**1 006 106**	**992 840**	**735 909**	**905 570**	**979 981**	**861 976**	**1 414 524**	**1 475 053**
Environment unclassified	50 223	57 173	69 800	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	348 158	375 069	488 204	463 786	310 888	398 977	443 987	388 688	828 768	853 071
Environmental aspects of development	130 144	195 300	176 503	181 907	189 344	216 406	258 144	226 299	288 823	304 008
Environmental and other aspects	182 609	227 455	271 599	347 147	235 677	290 186	277 849	246 989	296 934	317 975
Division 5: Advancement of knowledge	**1 968 977**	**2 081 375**	**2 301 517**	**3 068 334**	**3 697 128**	**4 197 547**	**4 843 227**	**4 659 729**	**4 858 868**	**5 586 182**
Advancement of knowledge unclassified	150 668	171 520	209 400	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	1 372 203	1 456 357	1 604 035	2 036 622	2 672 224	3 025 841	3 497 129	3 407 325	3 445 842	3 891 834
Social sciences and humanities	446 107	453 498	488 082	1 031 712	1 024 904	1 171 706	1 346 098	1 252 404	1 413 026	1 694 348
Total	**16 520 584**	**18 624 015**	**21 041 046**	**20 954 677**	**20 253 805**	**22 209 192**	**23 871 219**	**25 660 573**	**29 344 977**	**32 336 679**

Table C.16: Proportional R&D expenditure by socio-economic objectives (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVES	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**6.6**	**6.1**	**5.7**	**6.1**	**6.6**	**4.8**	**5.7**	**5.4**	**6.2**	**5.6**
Defence	6.6	6.1	5.7	6.1	6.6	4.8	5.7	5.4	6.2	5.6
Division 2: Economic development	**60.6**	**63.0**	**63.3**	**58.9**	**55.5**	**54.8**	**51.2**	**55.2**	**52.3**	**51.5**
Economic development unclassified	0.9	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	4.8	5.0	4.1	5.0	5.2	5.1	5.1	6.8	4.6	4.4
Animal production and animal primary products	2.0	1.5	1.4	1.7	1.5	2.5	2.5	3.1	2.4	2.0
Mineral resources (excluding energy)	5.6	5.8	4.7	5.8	5.5	4.8	4.8	5.3	6.1	5.4
Energy resources	3.5	3.8	5.6	1.9	1.4	1.2	1.2	1.1	0.7	0.6
Energy supply	2.1	2.0	2.4	2.6	3.1	3.0	2.1	2.3	2.7	2.0
Manufacturing	13.2	14.4	14.2	12.4	11.7	11.2	10.0	10.2	8.9	8.2
Construction	5.7	6.2	6.9	2.5	1.5	1.8	1.8	1.8	0.9	0.7
Transport	3.1	3.2	3.3	4.4	4.5	4.4	4.2	4.3	3.4	3.4
Information and communication services	6.3	6.7	6.1	6.6	5.5	5.7	4.9	4.4	5.7	7.3
Commercial services	8.4	7.8	7.1	9.8	9.1	8.4	7.9	9.5	9.2	8.6
Economic framework	2.1	2.9	2.9	2.9	3.0	2.8	3.0	2.7	4.5	5.6
Natural resources	2.9	2.8	3.4	3.3	3.6	3.8	3.7	3.7	3.3	3.2
Division 3: Society	**16.5**	**15.2**	**15.3**	**15.6**	**16.0**	**17.4**	**18.7**	**17.9**	**20.1**	**21.1**
Society unclassified	0.9	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	10.4	9.6	9.6	10.7	10.3	10.4	12.3	11.1	12.4	12.8
Education and training	2.5	2.1	2.2	2.2	2.2	2.5	2.8	3.4	4.6	5.0
Social development and community services	2.6	2.6	2.5	2.7	3.5	4.5	3.6	3.3	3.1	3.3
Division 4: Environment	**4.3**	**4.6**	**4.8**	**4.7**	**3.6**	**4.1**	**4.1**	**3.4**	**4.8**	**4.6**
Environment unclassified	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	2.1	2.0	2.3	2.2	1.5	1.8	1.9	1.5	2.8	2.6
Environmental aspects of development	0.8	1.0	0.8	0.9	0.9	1.0	1.1	0.9	1.0	0.9

SOCIO-ECONOMIC OBJECTIVES	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	1.1	1.2	1.3	1.7	1.2	1.3	1.2	1.0	1.0	1.0
Division 5: Advancement of knowledge	**11.9**	**11.2**	**10.9**	**14.6**	**18.3**	**18.9**	**20.3**	**18.2**	**16.6**	**17.3**
Advancement of knowledge unclassified	0.9	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	8.3	7.8	7.6	9.7	13.2	13.6	14.6	13.3	11.7	12.0
Social sciences and humanities	2.7	2.4	2.3	4.9	5.1	5.3	5.6	4.9	4.8	5.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.17: R&D expenditure by province (2006/07 to 2015/16)

YEAR	GERD	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMA-LANGA	NORTHERN CAPE	NORTH-WEST	WESTERN CAPE
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	16 520 584	752 303	944 829	8 447 470	1 809 013	197 054	340 773	138 426	323 838	3 052 483
2007/08	18 624 014	826 925	1 098 210	9 620 752	2 081 166	240 952	369 535	180 923	402 461	3 373 098
2008/09	21 041 046	889 081	1 562 720	10 981 587	2 210 336	263 784	452 950	169 937	453 574	3 656 717
2009/10	20 954 677	1 121 484	1 370 779	10 377 381	2 167 048	286 157	379 123	174 453	487 376	4 070 214
2010/11	20 253 805	1 048 959	1 332 224	9 772 806	2 290 711	340 379	393 822	217 774	540 951	4 425 059
2011/12	22 209 192	1 278 870	1 718 602	10 391 272	2 515 736	395 042	397 878	250 320	532 456	4 233 409
2012/13	23 871 219	1 463 589	1 714 473	10 602 434	3 013 372	583 857	522 963	341 136	732 363	4 124 394
2013/14	25 660 573	1 478 850	1 943 131	11 975 916	2 752 543	619 437	612 031	400 974	890 364	4 554 545
2014/15	29 344 977	1 734 411	1 456 461	13 686 734	3 187 481	444 015	615 773	473 722	1 027 448	4 949 174
2015/16	32 336 679	2 142 919	1 778 469	14 666 111	3 335 141	628 607	859 201	575 584	1 402 742	5 813 758

Table C.18: Proportional R&D expenditure by province (2006/07 to 2015/16)

YEAR	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMA-LANGA	NORTHERN CAPE	NORTH-WEST	WESTERN CAPE
	%	%	%	%	%	%	%	%	%
2006/07	4.6	5.7	51.1	11.0	1.5	2.2	1.1	2.4	20.4
2007/08	4.4	5.9	51.7	11.2	1.4	2.4	0.9	2.4	19.6
2008/09	4.2	7.4	52.2	10.5	1.4	1.8	0.8	2.3	19.3
2009/10	5.4	6.5	49.5	10.3	1.6	1.9	1.0	2.6	21.1
2010/11	5.2	6.6	48.3	11.3	2.0	2.0	1.2	2.6	20.9
2011/12	5.8	7.7	46.8	11.3	2.6	2.4	1.5	3.3	18.6
2012/13	6.1	7.2	44.4	12.6	2.6	2.6	1.7	3.7	19.1
2013/14	5.8	7.6	46.7	10.7	1.7	2.4	1.8	4.0	19.3
2014/15	5.9	5.0	46.6	10.9	2.1	2.9	2.0	4.8	19.8
2015/16	6.6	5.5	45.4	10.3	1.9	2.4	2.0	3.7	22.0

C.1.2. Source of R&D funds

Table C.19: Funding for R&D by source (2006/07 to 2015/16)

YEAR	TOTAL FUNDS	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	R'000	R'000	R'000	R'000	R'000
2006/07	16 520 570	6 672 138	7 399 660	701 907	1 746 865
2007/08	18 624 059	8 510 101	7 945 949	180 927	1 987 082
2008/09	21 041 046	9 497 510	8 973 490	175 219	2 394 827
2009/10	20 954 676	9 313 028	8 907 527	195 682	2 538 439
2010/11	20 253 805	9 018 874	8 128 246	661 676	2 445 009
2011/12	22 209 192	9 561 917	8 663 105	653 674	3 330 496
2012/13	23 871 219	10 831 893	9 152 042	770 300	3 116 984
2013/14	25 660 573	11 007 083	10 615 902	722 361	3 315 227
2014/15	29 344 977	12 873 458	11 981 974	923 530	3 566 015
2015/16	32 336 679	14 425 992	12 578 499	1 122 328	4 209 861

*Includes science council and university own funds.

**Includes funds from higher education institutions, not-for-profit organisations and individual donations disbursed to all sectors.

Table C.20: Proportional funding for R&D by source (2006/07 to 2015/16)

YEAR	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	%	%	%	%
2006/07	40.4	44.8	4.2	10.6
2007/08	45.7	42.7	1.0	10.7
2008/09	45.1	42.6	0.8	11.4
2009/10	44.4	42.5	0.9	12.1
2010/11	44.5	40.1	3.3	12.1
2011/12	43.1	39.0	2.9	15.0
2012/13	45.4	38.3	3.2	13.1
2013/14	42.9	41.4	2.8	12.9
2014/15	43.9	40.8	3.1	12.2
2015/16	44.6	38.9	3.5	13.0

*Includes science council and university own funds.

**Includes funds from higher education institutions, not-for-profit organisations and individual donations disbursed to all sectors.

Table C.21: Sources of R&D funding by sector, amount and as a percentage of total funds (2015/16)

SOURCE OF FUNDS	TOTAL		GOVERNMENT		SCIENCE COUNCILS		HIGHER EDUCATION		BUSINESS		NOT-FOR-PROFIT	
	R'000	%	R'000	%	R'000	%	R'000	%	R'000	%	R'000	%
Own funds	**17 719 467**	**54.8**	**995 252**	**49.4**	**250 446**	**4.4**	**5 209 112**	**52.7**	**11 122 965**	**80.5**	**141 692**	**15.9**
Internal sources	17 719 467	54.8	995 252	49.4	250 446	4.4	5 209 112	52.7	11 122 965	80.5	141 692	15.9
Government	**7 971 181**	**24.7**	**430 346**	**21.4**	**4 671 777**	**81.4**	**2 184 745**	**22.1**	**522 631**	**3.8**	**161 682**	**18.1**
Grants	3 564 802	11.0	395 117	19.6	2 982 722	52.0	N/A	N/A	134 005	1.0	52 959	5.9
Contracts	2 221 634	6.9	35 230	1.8	1 689 055	29.4	N/A	N/A	388 627	2.8	108 723	12.2
All other	2 184 745	6.8	N/A	N/A	N/A	N/A	2 184 745	22.1	N/A	N/A	N/A	N/A
Business	**1 455 534**	**4.5**	**41109**	**2.0**	**326 648**	**5.7**	**770 448**	**7.8**	**261 745**	**1.9**	**55 585**	**6.2**
Local business	1 455 534	4.5	41109	2.0	326 648	5.7	770 448	7.8	261 745	1.9	55 585	6.2
Other SA sources	**980 636**	**3.0**	**46 348**	**2.3**	**22 520**	**0.4**	**506 126**	**5.1**	**374 888**	**2.7**	**30 754**	**3.5**
Higher education	46 521	0.1	10	0.0	3 313	0.1	31 128	0.3	1.0	0.0	12 070	1.4
Not-for-profit	560 747	1.7	46 322	2.3	19 207	0.3	107 226	1.1	372 776	2.7	15 216	1.7
Individual donations	373 368	1.2	16	0.0	0.0	0.0	367 772	3.7	2 111	0.0	3469	0.4
Foreign	**4 209 861**	**13.0**	**499 966**	**24.8**	**469 507**	**8.2**	**1 206 192**	**12.2**	**1 532 766**	**11.1**	**501 430**	**56.3**
All sources	4 209 861	13.0	499 966	24.8	469 507	8.2	1 206 192	12.2	1 532 766	11.1	501 430	56.3
Total	**32 336 679**	**100.0**	**2 013 021**	**100.0**	**5 740 897**	**100.0**	**9 876 623**	**100.0**	**13 814 995**	**100.0**	**891 142**	**100.0**

Note: N/A indicates that data were not collected.

Table C.22: Government-funded R&D by sector (2006/07 to 2015/16)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	7 193 363	937 005	2 134 960	2 327 134	1 764 448	29 816
2007/08	8 510 055	1 091 049	2 297 322	2 761 557	2 326 728	33 399
2008/09	9 497 510	1 068 527	2 602 458	3 226 674	2 567 140	32 711
2009/10	9 313 028	1 008 475	2 917 683	3 918 620	1 429 766	38 484
2010/11	9 018 874	990 290	2 932 489	4 222 092	832 173	41 830
2011/12	9 561 917	1 112 307	3 310 894	4 598 426	499 298	40 992
2012/13	10 831 893	1 269 337	3 368 555	5 395 871	683 669	114 461
2013/14	11 007 083	1 436 141	3 412 790	5 369 334	685 670	103 148
2014/15	12 873 458	1 711 809	4 319 393	6 020 572	690 396	131 288
2015/16	14 425 992	1 425 598	4 922 223	7 393 857	522 631	161 682

Note: Includes science council and university own funds.

Table C.23: Proportional government-funded R&D by sector (2006/07 to 2015/16)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2006/07	13.0	29.7	32.4	24.5	0.4
2007/08	12.8	27.0	32.5	27.3	0.4
2008/09	11.3	27.4	34.0	27.0	0.3
2009/10	10.8	31.3	42.1	15.4	0.4
2010/11	11.0	32.5	46.8	9.2	0.5
2011/12	11.6	34.6	48.1	5.2	0.4
2012/13	11.7	31.1	49.8	6.3	1.1
2013/14	13.0	31.0	48.8	6.2	0.9
2014/15	13.3	33.6	46.8	5.4	1.0
2015/16	9.9	34.1	51.3	3.6	1.1

Note: Includes science council and university own funds.

Table C.24: Business-funded R&D by sector (2006/07 to 2015/16)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	7 399 659	13 067	265 441	682 493	6 414 319	24 339
2007/08	7 945 949	5 343	263 098	519 804	7 133 913	23 791
2008/09	8 973 490	15 980	137 356	454 184	8 339 379	26 591
2009/10	8 907 527	2 326	120 528	609 250	8 142 996	32 427
2010/11	8 128 246	2 406	198 206	367 340	7 528 667	31 627
2011/12	8 663 105	1 355	67 614	505 510	8 056 545	32 081
2012/13	9 152 042	11 552	135 729	577 527	8 402 340	24 894
2013/14	10 615 902	1 759	419 469	588 598	9 552 717	53 359
2014/15	11 981 974	290	222 892	885 280	10 810 428	63 084
2015/16	12 578 499	41 109	326 648	770 448	11 384 710	55 585

Table C.25: Proportional business-funded R&D by sector (2006/07 to 2015/16)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2006/07	0.2	3.6	9.2	86.7	0.3
2007/08	0.1	3.3	6.5	89.8	0.3
2008/09	0.2	1.5	5.1	92.9	0.3
2009/10	0.0	1.4	6.8	91.4	0.4
2010/11	0.0	2.4	4.5	92.6	0.4
2011/12	0.0	0.8	5.8	93.0	0.4
2012/13	0.1	1.5	6.3	91.8	0.3
2013/14	0.0	4.0	5.5	90.0	0.5
2014/15	0.0	1.9	7.4	90.2	0.5
2015/16	0.3	2.6	6.1	90.5	0.4

Table C.26: Foreign-funded R&D by sector (2006/07 to 2015/16)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2006/07	1 746 996	51 660	320 868	278 708	977 087	118 673
2007/08	1 987 082	56 172	298 906	320 286	1 180 193	131 525
2008/09	2 394 827	53 348	392 008	410 038	1 396 033	143 400
2009/10	2 538 439	54 129	416 571	443 109	1 538 917	85 713
2010/11	2 445 009	16 236	460 580	473 145	1 442 334	52 714
2011/12	3 330 496	118 127	321 257	1 272 173	1 562 277	56 662
2012/13	3 116 984	143 994	510 846	1 010 244	1 189 865	262 035
2013/14	3 315 227	258 531	454 527	1 042 627	1 226 966	332 576
2014/15	3 566 015	179 473	431 215	1 079 732	1 418 823	456 772
2015/16	4 209 861	499 966	469 507	1 206 192	1 532 766	501 430

Table C.27: Proportional foreign-funded R&D by sector (2006/07 to 2015/16)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2006/07	3.0	18.4	16.0	55.9	6.8
2007/08	2.8	15.0	16.1	59.4	6.6
2008/09	2.2	16.4	17.1	58.3	6.0
2009/10	2.1	16.4	17.5	60.6	3.4
2010/11	0.7	18.8	19.4	59.0	2.2
2011/12	3.5	9.6	38.2	46.9	1.7
2012/13	4.6	16.4	32.4	38.2	8.4
2013/14	7.8	13.7	31.4	37.0	10.0
2014/15	5.0	12.1	30.3	39.8	12.8
2015/16	11.9	11.2	28.7	36.4	11.9

C.1.3. R&D personnel

Table C.28: R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	R&D PERSONNEL			RESEARCHERS			TECHNICIANS		OTHER R&D PERSONNEL	
	(HEAD-COUNTS*)	(FTEs)	(FTEs) PER 1000 IN TOTAL EM-PLOYMENT	(HEAD-COUNTS)	(FTEs)	(FTEs) PER 1000 IN TOTAL EM-PLOYMENT	(HEAD-COUNTS)	(FTEs)	(HEAD-COUNTS)	(FTEs)
2006/07	58 706	30 984.4	2.5	39 591	18573.5	1.5	9 761	6 331.8	9 354	6 080.0
2007/08	59 334	31 354.4	2.4	40 084	19320.3	1.5	9 476	6 060.5	9 784	5 973.7
2008/09	58 895	30 801.6	2.2	39 955	19384.3	1.4	9 761	6 022.4	9 179	5 394.8
2009/10	59 494	30 891.3	2.3	40 797	19793.1	1.5	9 443	5 792.2	9 254	5 306.0
2010/11	55 531	29 486.4	2.2	37 901	18719.6	1.4	8 559	5 409.6	9 071	5 357.3
2011/12	59 487	30 978.4	2.3	40 653	20115.1	1.5	9 260	5 566.9	9 574	5 296.5
2012/13	64 917	35 050.3	2.4	42 828	21382.4	1.5	10 790	6 582.3	11 299	7 085.5
2013/14	68 838	37 956.5	2.5	45 935	23346.0	1.6	10 800	6 905.5	12 103	7 705.0
2014/15	72 400	38 465.0	2.5	48 479	23571.9	1.5	12 183	7 731.3	11 738	7 161.9
2015/16	74 931	41 054.5	2.6	51 877	26 159.4	1.7	11 518	7 688.3	11 536	7 206.9

Table C.29: R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	45 935	25 704	20 231	23 346.0	13 180.8	10 165.2	50.8
Technicians directly supporting R&D	10 800	6 900	3 900	6 905.5	4 340.3	2 565.2	63.9
Other personnel directly supporting R&D	12 103	6 003	6 100	7 705.0	3 947.7	3 757.3	63.7
Total	**68 838**	**38 607**	**30 231**	**37 956.5**	**21 468.7**	**16 487.8**	**55.1**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	48 479	27 008	21 471	23 571.9	13 184.7	10 387.2	48.6
Technicians directly supporting R&D	12 183	7 688	4 495	7 731.3	4 867.9	2 863.4	63.5
Other personnel directly supporting R&D	11 738	5 915	5 823	7 161.9	3 833.0	3 328.9	61.0
Total	**72 400**	**40 611**	**31 789**	**38 465.0**	**21 885.6**	**16 579.5**	**53.1**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	51 877	28 543	23 334	26 159.4	14 623.2	11 536.1	50.4
Technicians directly supporting R&D	11 518	7 319	4 199	7 688.3	4 844.6	2 843.8	66.8
Other personnel directly supporting R&D	11 536	5 774	5 762	7 206.9	36 63.7	3 543.2	62.5
Total	**74 931**	**41 636**	**33 295**	**41 054.5**	**23 131.4**	**17 923.1**	**54.8**

*Including doctoral students and post-doctoral fellows.

Table C.30: R&D personnel in headcounts by sector (2006/07 to 2015/16)

YEAR	TOTAL R&D PERSONNEL (HEADCOUNTS)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2006/07	58 706	2 924	5 798	32 033	17 467	484
2007/08	59 344	2 794	5 988	32 109	17 951	502
2008/09	58 895	2 963	5 609	31 226	18 595	502
2009/10	59 494	2 580	5 926	32 392	18 216	380
2010/11	55 531	2 704	4 923	32 571	14 933	400
2011/12	59 487	3 143	4 494	36 157	15 288	405
2012/13	64 917	3 252	5 399	38 205	17 155	906
2013/14	68 838	2 874	5 884	41 464	17 599	1 017
2014/15	72 400	2 893	4 836	44 457	18 743	1 471
2015/16	74 931	2 997	5 162	48 034	17 245	1 493

Note: Includes doctoral students and post-doctoral fellows at higher education institutes.

Table C.31: R&D personnel full-time equivalents by sector (2006/07 to 2015/16)

YEAR	TOTAL R&D PERSONNEL (FTEs)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2006/07	30 984.4	2 068.3	4 956.1	11 002.0	12 595.3	362.7
2007/08	31 354.4	1 950.0	5 058.8	11 505.3	12 461.3	379.1
2008/09	30 801.6	2 073.9	4 699.9	11 169.0	12 492.5	366.4
2009/10	30 891.3	1 903.9	4 782.7	11 870.4	12 024.6	309.7
2010/11	29 486.4	2 178.6	4 312.4	12 477.3	10 205.1	313.1
2011/12	30 978.4	2 404.5	3 803.5	14 563.4	9 894.9	312.1
2012/13	35 050.3	2 597.0	4 748.5	15 614.4	11 322.3	768.0
2013/14	37 956.5	2 245.5	5 164.5	17 777.7	11 877.4	891.4
2014/15	38 465.0	2 181.5	4 180.4	17 944.4	12 927.5	1 231.2
2015/16	41 054.5	2 056.2	4 361.2	20 812.0	12 457.8	1 367.3

Note: Includes doctoral students and post-doctoral fellows at higher education institutes.

Table C.32: Researcher headcounts by sector (2006/07 to 2015/16)

YEAR	TOTAL RESEARCHERS (HEADCOUNTS)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2006/07	39 591	1 111	2 255	27 746	8 227	252
2007/08	40 084	1 138	2 594	27 752	8 336	264
2008/09	39 955	1 169	2 648	27 316	8 560	262
2009/10	40 797	986	2 669	28 552	8 366	224
2010/11	37 901	1 184	1 941	28 154	6 372	250
2011/12	40 653	1 411	1 803	30 993	6 192	254
2012/13	42 828	1 409	1 879	32 955	6 191	394
2013/14	45 935	1 229	1 956	36 133	6 182	435
2014/15	48 479	1 343	1 988	38 381	6 261	506
2015/16	51 877	1 573	2 072	41 639	6 128	465

Note: Includes doctoral students and post-doctoral fellows at higher education institutes.

Table C.33: Researcher headcounts by gender (2006/07 to 2015/16)

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	MALE	FEMALE
2006/07	29 303	6 058	1 396
2007/08	29 327	6 566	1 398
2008/09	28 952	6 595	1 505
2009/10	29 255	7 210	1 573
2010/11	25 300	6 756	1 316
2011/12	25 954	7 201	1 438
2012/13	27 314	8 101	1 591
2013/14	28 014	8 024	1 685
2014/15	28 723	8 468	1 815
2015/16	29 454	9 548	1 881

* Excludes doctoral students and post-doctoral fellows.

Table C.34: Researcher headcounts by race (2006/07 to 2015/16)

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	AFRICAN	COLOURED	INDIAN	WHITE
2006/07	29 303	6 058	1 396	2 402	19 447
2007/08	29 327	6 566	1 398	2 434	18 929
2008/09	28 952	6 595	1 505	2 588	18 265
2009/10	29 255	7 210	1 573	2 448	18 024
2010/11	25 300	6 756	1 316	2 438	14 789
2011/12	25 954	7 201	1 438	2 202	15 113
2012/13	27 314	8 101	1 591	2 514	15 108
2013/14	28 014	8 024	1 685	2 530	15 775
2014/15	28 723	8 468	1 815	2 522	15 919
2015/16	29 454	9 548	1 881	2 629	15 396

Note: Non-SA student data are not collected by population group.

*Excludes doctoral students and post-doctoral fellows.

Table C.35: R&D personnel in headcounts (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL R&D PERSONNEL (HEADCOUNTS)	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**43 008**	**22 642**	**20 366**	**8 367**	**6 499**	**1 351**	**1 575**	**1 805**	**2 124**	**11 119**	**10 168**
*Doctoral degree or equivalent	23 814	12 575	11 239	4 684	3 231	799	878	914	1 189	6 178	5 941
Masters, honours, bachelor or equivalent	16 644	8 667	7 977	3 180	2 804	483	601	789	836	4 215	3 736
Diplomas	2 550	1 400	1 150	503	464	69	96	102	99	726	491
Technicians directly supporting R&D	**11 517**	**7 317**	**4 200**	**2 543**	**1 997**	**703**	**349**	**733**	**418**	**3 338**	**1 436**
Doctoral degree or equivalent	339	209	130	32	12	5	4	6	7	166	107
Masters, honours, bachelor or equivalent	4 280	2 499	1 781	866	751	150	147	283	230	1 200	653
Diplomas	6 898	4 609	2 289	1 645	1 234	548	198	444	181	1 972	676
Other personnel directly supporting R&D	**11 538**	**5 775**	**5 763**	**2 643**	**2 360**	**560**	**787**	**805**	**456**	**1 767**	**2 160**
Doctoral degree or equivalent	380	210	170	61	54	10	10	18	16	121	90
Masters, honours, bachelor or equivalent	3 685	1 667	2 018	592	662	118	182	149	169	808	1005
Diplomas	7 473	3 898	3 575	1 990	1 644	432	595	638	271	838	1 065
Total	**66 063**	**35 734**	**30 329**	**13 553**	**10 856**	**2 614**	**2 711**	**3 343**	**2 998**	**16 224**	**13 764**

Note: Non-SA student data are not collected by population group.

*Doctoral degree or equivalent includes South African doctoral students and post-doctoral fellows (excludes non-SA students).

C.2. Sector tables

C.2.1. Business sector

Table C.36: Business sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Basic research	800 085	929 134	1 073 117	1 267 759	1 025 389	922 888	802 753	968 504	845 527	906 730
Applied research	2 550 483	3 077 341	3 426 651	3 301 773	3 949 410	4 461 770	5 569 024	6 087 791	7 541 596	7 492 229
Experimental research	5 892 597	6 731 981	7 832 244	6 569 705	5 084 210	5 079 364	4 198 949	4 726 553	4 903 827	5 416 037
Total	**9 243 165**	**10 738 456**	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**

Table C.37: Proportional business sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Basic research	8.7	8.7	8.7	11.4	10.2	8.8	7.6	8.2	6.4	6.6
Applied research	27.6	28.7	27.8	29.6	39.3	42.6	52.7	51.7	56.7	54.2
Experimental research	63.8	62.7	63.5	59.0	50.5	48.5	39.7	40.1	36.9	39.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.38: Business sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Capital expenditure	1 120 589	1 445 305	2 658 738	1 638 994	1 306 444	1 650 541	1 072 556	1 132 520	1 397 243	1 289 228
Land: buildings & other structures	154 129	262 994	207 473	285 285	202 835	217 126	140 053	159 162	117 656	186 396
Vehicles, plant, machinery, equipment	966 460	1 182 311	2 451 265	1 353 709	1 103 609	1 433 415	932 503	973 358	1 279 587	1 102 833
Current expenditure	8 122 576	9 293 151	9 673 274	9 500 243	8 752 566	8 813 481	9 498 170	10 650 328	11 893 708	12 525 767
Labour costs	4 461 218	4 881 074	5 279 507	5 207 695	4 467 214	4 723 488	5 821 884	6 768 527	7 659 365	7 821 865
Other current expenditure	3 661 358	4 412 077	4 393 767	4 292 548	4 285 352	4 089 993	3 676 286	3 881 801	4 234 343	4 703 901
Total	**9 243 165**	**10 738 456**	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**

Table C.39: Proportional business sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Capital expenditure	12.1	13.5	21.6	14.7	13.0	15.8	10.1	9.6	10.5	9.3
Land: buildings & other structures	1.7	2.4	1.7	2.6	2.0	2.1	1.3	1.4	0.9	1.3
Vehicles, plant, machinery, equipment	10.5	11.0	19.9	12.2	11.0	13.7	8.8	8.3	9.6	8.0
Current expenditure	87.9	86.5	78.4	85.3	87.0	84.2	89.9	90.4	89.5	90.7
Labour costs	48.3	45.5	42.8	46.8	44.4	45.1	55.1	57.4	57.6	56.6
Other current expenditure	39.6	41.1	35.6	38.5	42.6	39.1	34.8	32.9	31.9	34.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.40: Business sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biotechnology	132 641	169 410	268 923	330 232	341 695	422 121	499 589	556 275	578 747	729 299
Nanotechnology	155 049	30 314	56 881	150 474	102 670	171 808	225 557	170 479	217 216	134 063
Total	**287 690**	**199 724**	**325 804**	**480 706**	**444 366**	**593 929**	**725 145**	**726 754**	**795 963**	**863 362**
Business expenditure on R&D	9 243 165	10 738 456	12 332 012	11 139 237	10 059 010	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995

Table C.41: Proportional business sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Biotechnology	1.4	1.6	2.2	3.0	3.4	4.0	4.7	4.7	4.4	5.3
Nanotechnology	1.7	0.3	0.5	1.4	1.0	1.6	2.1	1.4	1.6	1.0
Total	**3.1**	**1.9**	**2.6**	**4.3**	**4.4**	**5.7**	**6.9**	**6.2**	**6.0**	**6.2**

Table C.42: Business sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environment related	N/A	N/A	N/A	N/A	N/A	31 349	183 921	228 905	176 463	173 356
Open source software	118 858	114 195	96 266	91 818	68 105	85 787	87 200	233 576	241 710	326 856
New materials	115 339	72 992	154 140	173 308	227 682	277 152	225 897	151 890	245 752	224 433
Tuberculosis (TB), HIV/AIDS, malaria	294 689	302 122	466 161	460 233	631 996	812 580	929 121	992 538	1 082 646	1 176 149
Total	**528 886**	**489 309**	**716 567**	**725 359**	**927 783**	**1 206 869**	**1 426 139**	**1 606 909**	**1 746 571**	**1 900 794**
Business expenditure on R&D	9 243 165	10 738 456	12 332 012	11 139 237	10 059 010	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.43: Proportional business sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environment related	N/A	N/A	N/A	N/A	N/A	0.3	1.7	1.9	1.3	1.3
Open source software	1.3	1.1	0.8	0.8	0.7	0.8	0.8	2.0	1.8	2.4
New materials	1.2	0.7	1.2	1.6	2.3	2.6	2.1	1.3	1.8	1.6
Tuberculosis (TB), HIV/AIDS, malaria	3.2	2.8	3.8	4.1	6.3	7.8	8.8	8.4	8.1	8.5
Total	**5.7**	**4.6**	**5.8**	**6.5**	**9.2**	**11.5**	**13.5**	**13.6**	**13.1**	**13.8**

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.44: Business sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural Sciences, Technology and Engineering	**8 881 904**	**10 357 433**	**11 902 551**	**10 743 523**	**9 612 221**	**9 992 916**	**9 127 446**	**9 765 859**	**10 977 250**	**11 447 693**
Mathematical sciences	159 496	176 077	183 255	183 426	110 543	204 594	149 220	209 344	211 324	119 900
Physical sciences	382 551	507 646	655 898	190 292	32 669	28 489	47 672	50 708	56 997	35 616
Chemical sciences	438 969	580 146	859 041	627 729	687 843	934 005	980 021	979 760	847 321	972 398
Earth sciences	66 244	93 014	95 034	90 098	106 759	92 439	102 892	109 665	118 539	93 302
Information, computer and communication technologies	1 980 630	2 182 253	2 412 430	2 855 355	2 502 454	2 481 028	1 576 163	1 610 718	1 908 985	2 572 364
Applied sciences and technologies	1 551 885	1 581 438	1 671 375	1 271 414	1 132 538	902 425	872 014	808 899	955 119	903 958
Engineering sciences	2 439 092	3 237 265	3 908 347	3 311 902	2 768 035	2 751 145	2 827 677	3 093 088	3 548 019	3 429 786

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biological sciences	160 584	161 058	162 776	194 671	207 456	212 632	210 627	213 124	248 838	254 071
Agricultural sciences	277 889	311 287	293 357	323 603	371 310	471 529	444 593	593 315	665 703	671 194
Medical and health sciences	1 225 114	1 268 551	1 509 109	1 567 493	1 622 215	1 843 005	1 812 411	1 974 213	2 170 317	2 300 587
Environmental sciences	42 315	62 355	57 764	47 692	5 818	2 206	44 563	50 909	85 932	21 920
Material sciences	146 588	184 625	82 192	70 949	59 723	65 092	53 855	64 090	154 500	71 967
Marine sciences	10 547	11 719	11 975	8 899	4 859	4 324	5 738	8 026	5 655	630
Division 2: Social Sciences and Humanities	**361 261**	**381 023**	**429 461**	**395 714**	**446 789**	**471 106**	**1 443 280**	**2 016 989**	**2 313 701**	**2 367 302**
Social sciences	360 856	380 554	428 969	395 115	446 789	471 106	1 443 280	2 016 989	2 313 701	2 367 302
Humanities	405	469	491	599	0	0	0	0	0	0
Total	**9 243 165**	**10 738 456**	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**

Table C.45: Proportional business sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural Sciences, Technology and Engineering	**96.1**	**96.5**	**96.5**	**96.4**	**95.6**	**95.5**	**86.3**	**82.9**	**82.6**	**82.9**
Mathematical sciences	1.7	1.6	1.5	1.6	1.1	2.0	1.4	1.8	1.6	0.9
Physical sciences	4.1	4.7	5.3	1.7	0.3	0.3	0.5	0.4	0.4	0.3
Chemical sciences	4.7	5.4	7.0	5.6	6.8	8.9	9.3	8.3	6.4	7.0
Earth sciences	0.7	0.9	0.8	0.8	1.1	0.9	1.0	0.9	0.9	0.7
Information, computer and communication technologies	21.4	20.3	19.6	25.6	24.9	23.7	14.9	13.7	14.4	18.6
Applied sciences and technologies	16.8	14.7	13.6	11.4	11.3	8.6	8.2	6.9	7.2	6.5
Engineering sciences	26.4	30.1	31.7	29.7	27.5	26.3	26.8	26.3	26.7	24.8
Biological sciences	1.7	1.5	1.3	1.7	2.1	2.0	2.0	1.8	1.9	1.8
Agricultural sciences	3.0	2.9	2.4	2.9	3.7	4.5	4.2	5.0	5.0	4.9
Medical and health sciences	13.3	11.8	12.2	14.1	16.1	17.6	17.1	16.8	16.3	16.7
Environmental sciences	0.5	0.6	0.5	0.4	0.1	0.0	0.4	0.4	0.6	0.2
Material sciences	1.6	1.7	0.7	0.6	0.6	0.6	0.5	0.5	1.2	0.5
Marine sciences	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0
Division 2: Social Sciences and Humanities	**3.9**	**3.5**	**3.5**	**3.6**	**4.4**	**4.5**	**13.7**	**17.1**	**17.4**	**17.1**
Social sciences	3.9	3.5	3.5	3.5	4.4	4.5	13.7	17.1	17.4	17.1
Humanities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.46: Business sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	**777 139**	**900 909**	**908 781**	**959 761**	**1 103 510**	**813 259**	**1 040 025**	**1 096 986**	**1 034 893**	**937 964**
Defence	777 139	900 909	908 781	959 761	1 103 510	813 259	1 040 025	1 096 986	1 034 893	937 964
Division 2: Economic Development	**7 233 003**	**8 399 187**	**9 737 338**	**8 258 491**	**7 012 272**	**7 381 289**	**7 234 533**	**8 308 177**	**9 663 402**	**10 362 668**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	279 937	279 437	266 259	309 370	288 323	315 806	374 327	454 990	593 610	622 367
Animal production and animal primary products	67 619	78 657	74 302	110 295	46 709	46 316	38 484	69 916	74 045	74 267
Mineral resources (excluding Energy)	779 765	937 628	839 558	741 401	728 130	733 280	853 544	977 365	1 405 074	1 348 618
Energy resources	470 735	585 453	732 188	290 662	93 532	90 377	90 975	95 375	100 061	79 210
Energy supply	239 018	252 064	393 798	426 407	470 030	490 490	321 456	349 710	503 222	362 656
Manufacturing	1 846 199	2 117 823	2 562 745	2 037 129	1 747 369	1 863 289	1 639 077	1 869 926	2 096 271	2 106 255
Construction	756 166	1 017 969	1 295 717	367 510	16 284	46 158	96 071	125 059	138 237	55 625
Transport	446 162	523 022	621 479	843 301	872 149	920 081	951 435	1 080 427	935 483	1 046 235
Information and communication services	895 714	1 087 198	1 151 637	1 189 650	851 392	978 187	908 640	842 341	1 097 649	1 685 124
Commercial services	1 329 972	1 347 470	1 422 123	1 747 450	1 773 253	1 739 933	1 755 506	2 255 642	2 555 783	2 643 503
Economic framework	16 243	41 756	160 562	106 693	70 795	57 474	103 240	91 464	79 065	273 497
Natural resources	105 475	130 711	216 971	88 624	54 306	99 898	101 778	95 962	84 901	65 312
Division 3: Society	**839 908**	**915 567**	**1 019 848**	**1 224 481**	**1 041 616**	**1 232 867**	**1 242 066**	**1 303 321**	**1 435 870**	**1 433 935**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	799 201	857 364	930 645	1 103 816	880 549	1 054 182	1 045 048	1 097 446	1 212 844	1 216 127
Education and training	12 913	12 204	27 232	26 444	32 486	32 767	29 566	33 913	35 728	33 707
Social development and community services	27 794	45 999	61 971	94 220	128 581	145 918	167 452	171 962	187 298	184 102
Division 4: Environment	**113 821**	**164 552**	**221 747**	**211 208**	**211 025**	**220 698**	**173 535**	**171 747**	**219 212**	**196 802**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	39 233	62 551	91 953	53 022	51 845	58 565	46 213	43 935	55 885	62 471
Environmental aspects of development	28 327	33 901	31 493	22 456	55 577	42 226	17 957	14 344	38 437	18 915

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environmental and other aspects	46 261	68 100	98 301	135 730	103 602	119 907	109 365	113 468	124 889	115 415
Division 5: Advancement of Knowledge	**279 295**	**358 242**	**444 298**	**485 296**	**690 587**	**815 909**	**880 567**	**902 617**	**937 575**	**883 626**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	275 446	353 694	439 330	479 999	682 401	813 150	877 557	899 840	932 030	880 474
Social sciences and humanities	3 848	4 548	4 968	5 298	8 186	2 758	3 010	2 776	5 545	3 152
Total	**9 243 165**	**10 738 457**	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**

Table C.47: Proportional business sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**8.4**	**8.4**	**7.4**	**8.6**	**11.0**	**7.8**	**9.8**	**9.3**	**7.8**	**6.8**
Defence	8.4	8.4	7.4	8.6	11.0	7.8	9.8	9.3	7.8	6.8
Division 2: Economic Development	**78.3**	**78.2**	**79.0**	**74.1**	**69.7**	**70.5**	**68.4**	**70.5**	**72.7**	**75.0**
Economic Development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	3.0	2.6	2.2	2.8	2.9	3.0	3.5	3.9	4.5	4.5
Animal production and animal primary products	0.7	0.7	0.6	1.0	0.5	0.4	0.4	0.6	0.6	0.5
Mineral resources (excluding Energy)	8.4	8.7	6.8	6.7	7.2	7.0	8.1	8.3	10.6	9.8
Energy resources	5.1	5.5	5.9	2.6	0.9	0.9	0.9	0.8	0.8	0.6
Energy supply	2.6	2.3	3.2	3.8	4.7	4.7	3.0	3.0	3.8	2.6
Manufacturing	20.0	19.7	20.8	18.3	17.4	17.8	15.5	15.9	15.8	15.2
Construction	8.2	9.5	10.5	3.3	0.2	0.4	0.9	1.1	1.0	0.4
Transport	4.8	4.9	5.0	7.6	8.7	8.8	9.0	9.2	7.0	7.6
Information and communication services	9.7	10.1	9.3	10.7	8.5	9.3	8.6	7.1	8.3	12.2
Commercial services	14.4	12.5	11.5	15.7	17.6	16.6	16.6	19.1	19.2	19.1
Economic framework	0.2	0.4	1.3	1.0	0.7	0.5	1.0	0.8	0.6	2.0
Natural resources	1.1	1.2	1.8	0.8	0.5	1.0	1.0	0.8	0.6	0.5

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 3: Society	**9.1**	**8.5**	**8.3**	**11.0**	**10.4**	**11.8**	**11.8**	**11.1**	**10.8**	**10.4**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	8.6	8.0	7.5	9.9	8.8	10.1	9.9	9.3	9.1	8.8
Education and training	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2
Social development and community services	0.3	0.4	0.5	0.8	1.3	1.4	1.6	1.5	1.4	1.3
Division 4: Environment	**1.2**	**1.5**	**1.8**	**1.9**	**2.1**	**2.1**	**1.6**	**1.5**	**1.6**	**1.4**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.4	0.6	0.7	0.5	0.5	0.6	0.4	0.4	0.4	0.5
Environmental aspects of development	0.3	0.3	0.3	0.2	0.6	0.4	0.2	0.1	0.3	0.1
Environmental and other aspects	0.5	0.6	0.8	1.2	1.0	1.1	1.0	1.0	0.9	0.8
Division 5: Advancement of Knowledge	**3.0**	**3.3**	**3.6**	**4.4**	**6.9**	**7.8**	**8.3**	**7.7**	**7.1**	**6.4**
Advancement of Knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	3.0	3.3	3.6	4.3	6.8	7.8	8.3	7.6	7.0	6.4
Social sciences and humanities	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.48: Business sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Eastern Cape	247 295	283 488	316 089	320 955	217 880	354 553	468 197	646 497	608 398	651 533
Free State	665 443	786 225	1 213 808	999 554	943 508	1 308 833	1 265 285	1 374 960	831 575	1 124 042
Gauteng	5 263 546	6 142 233	7 131 411	6 120 062	5 439 718	5 558 409	5 356 550	5 813 673	7 160 280	7 183 557
KwaZulu-Natal	962 308	1 302 260	1 255 509	1 183 636	1 280 014	1 160 507	1 237 563	1 434 084	1 501 659	1 436 737
Limpopo	72 813	71 687	75 675	49 375	41 850	62 728	127 451	140 026	161 331	145 736
Mpumalanga	172 948	196 368	201 550	161 154	139 771	157 158	222 974	301 831	435 770	339 985
North-West	197 383	193 339	222 630	267 528	256 428	302 164	380 144	435 849	681 634	451 891
Northern Cape	15 834	7 450	7 319	7 988	17 017	45 267	78 471	124 150	226 303	206 786
Western Cape	1 645 595	1 755 404	1 908 020	2 028 984	1 722 823	1 514 404	1 434 090	1 511 778	1 684 001	2 274 728
Total	**9 243 165**	**10 738 456**	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**

Table C.49: Proportional business sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.7	2.6	2.6	2.9	2.2	3.4	4.4	5.5	4.6	4.7
Free State	7.2	7.3	9.8	9.0	9.4	12.5	12.0	11.7	6.3	8.1
Gauteng	56.9	57.2	57.8	54.9	54.1	53.1	50.7	49.3	53.9	52.0
KwaZulu-Natal	10.4	12.1	10.2	10.6	12.7	11.1	11.7	12.2	11.3	10.4
Limpopo	0.8	0.7	0.6	0.4	0.4	0.6	1.2	1.2	1.2	1.1
Mpumalanga	1.9	1.8	1.6	1.4	1.4	1.5	2.1	2.6	3.3	2.5
North-West	2.1	1.8	1.8	2.4	2.5	2.9	3.6	3.7	5.1	3.3
Northern Cape	0.2	0.1	0.1	0.1	0.2	0.4	0.7	1.1	1.7	1.5
Western Cape	17.8	16.3	15.5	18.2	17.1	14.5	13.6	12.8	12.7	16.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.50: Business sector R&D expenditure by Standard Industrial Classification Code (SIC) (2006/07 to 2015/16)

STANDARD INDUSTRIAL CLASSIFICATION	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agriculture, Hunting, Forestry and Fishing	199 959	213 808	220 757	208 447	157 916	211 132	286 832	364 424	460 464	484 384
Mining and Quarrying	518 262	559 332	578 825	499 286	1 055 963	1 352 877	1 554 284	1 675 153	1 340 103	1 220 985
Manufacturing	**3 537 433**	**4 222 127**	**4 787 581**	**4 321 327**	**3 592 204**	**3 551 234**	**3 476 647**	**3 793 066**	**4 501 146**	**4 442 466**
Manufacture of Food Products, Beverages and Tobacco Products	183 391	196 238	215 876	162 851	221 370	283 262	319 143	340 427	364 178	376 884
Manufacture of Textiles, Clothing and Leather Goods	21 899	17 888	13 755	16 946	2 437	0	2 073	32 091	34 609	9 335
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	110 631	118 535	118 016	111 255	106 448	80 255	50 531	60 437	72 870	95 555
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	1 301 947	1 579 382	2 267 063	1 758 353	1 197 179	1 381 001	1 139 617	1 256 313	1 835 837	1 800 420
Manufacture of Non-Metallic Mineral Products	127 714	183 758	134 638	120 508	87 037	72 039	49 974	52 263	51 097	28 095
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	386 605	500 715	315 295	330 137	240 408	392 800	585 635	620 923	607 574	660 205
Manufacture of Electrical Machinery and Apparatus	189 554	187 612	166 498	146 169	207 954	310 599	312 102	254 042	302 575	381 971

STANDARD INDUSTRIAL CLASSIFICATION	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	425 585	506 497	511 356	591 774	590 174	639 217	656 639	742 033	706 308	569 127
Manufacture of Transport Equipment	784 209	924 053	984 235	1 022 589	881 958	310 145	267 788	334 276	408 448	402 772
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	5 898	7 449	60 849	60 743	57 240	81 914	93 145	100 261	117 649	118 102
Electricity, Gas & Water Supply	1 292 925	1 737 511	2 306 297	955 690	536 050	494 745	385 770	355 720	548 015	439 157
Construction	4 559	6 043	6 105	3 490	3 213	6 495	9 051	8 037	6 637	5 613
Wholesale and Retail	324 666	317 780	334 131	434 522	620 541	547 194	179 383	100 176	85 491	42 977
Transport, Storage and Communication	453 715	490 138	425 235	415 243	354 311	484 222	467 411	451 336	632 243	897 359
Financial Intermediation, Real Estate and Business Services	2 477 423	2 759 550	3 377 896	3 777 124	3 326 985	3 645 625	3 914 543	4 724 439	5 357 151	5 910 332
Community, Social and Personal Services	434 223	432 167	295 185	524 108	411 826	170 499	296 805	310 498	359 701	371 723
Total	**9 243 165**	**10 738 456**	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**

Table C.51: Proportional business sector R&D expenditure by Standard Industrial Classification Code (SIC) (2006/07 to 2015/16)

STANDARD INDUSTRIAL CLASSIFICATION	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Agriculture, Hunting, Forestry and Fishing	2.2	2.	1.8	1.9	1.6	2.0	2.7	3.1	3.5	3.5
Mining and Quarrying	5.6	5.2	4.7	4.5	10.5	12.9	14.7	14.2	10.1	8.8
Manufacturing	**38.3**	**39.3**	**38.8**	**38.8**	**35.7**	**33.9**	**32.9**	**32.2**	**33.9**	**32.2**
Manufacture of Food Products, Beverages and Tobacco Products	2.00	1.8	1.8	1.5	2.2	2.7	3.0	2.9	2.7	2.7
Manufacture of Textiles, Clothing and Leather Goods	0.2	0.2	0.1	0.2	0.0	0.0	0.0	0.3	0.3	0.1
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	1.2	1.1	1.0	1.0	1.1	0.8	0.5	0.5	0.5	0.7
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	14.1	14.7	18.4	15.8	11.9	13.2	10.8	10.7	13.8	13.0
Manufacture of Non-Metallic Mineral Products	1.4	1.7	1.1	1.1	0.9	0.7	0.5	0.4	0.4	0.2
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	4.2	4.7	2.6	3.0	2.4	3.8	5.5	5.3	4.6	4.8

STANDARD INDUSTRIAL CLASSIFICATION	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Manufacture of Electrical Machinery and Apparatus	2.1	1.7	1.4	1.3	2.1	3.0	3.0	2.2	2.3	2.8
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	4.6	4.7	4.1	5.3	5.9	6.1	6.2	6.3	5.3	4.1
Manufacture of Transport Equipment	8.5	8.6	8.0	9.2	8.8	3.0	2.5	2.8	3.1	2.9
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0.1	0.1	0.5	0.5	0.6	0.8	0.9	0.9	0.9	0.9
Electricity, Gas & Water Supply	14	16.2	18.7	8.6	5.3	4.7	3.6	3.0	4.1	3.2
Construction	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Wholesale and Retail	3.5	3.0	2.7	3.9	6.2	5.2	1.7	0.9	0.6	0.3
Transport, Storage and Communication	4.9	4.6	3.4	3.7	3.5	4.6	4.4	3.8	4.8	6.5
Financial Intermediation, Real Estate and Business Services	26.8	25.7	27.4	33.9	33.1	34.8	37	40.1	40.3	42.8
Community, Social and Personal Services	4.7	4.0	2.4	4.7	4.1	1.6	2.8	2.6	2.7	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.52: Business sector R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2006/07	17 467	8 227	5 113	4 127	12 595.3	6 110.9	3 735.0	2 749.4
2007/08	17 951	8 336	5 303	4 312	12 461.3	6 047.5	3 796.4	2 617.4
2008/09	18 595	8 560	5 584	4 451	12 492.5	6 172.0	3 809.9	2 510.6
2009/10	18 216	8 366	5 362	4 488	12 024.6	6 059.5	3 612.6	2 352.6
2010/11	14 933	6 372	4 630	3 931	10 205.1	4 804.0	3 318.7	2 082.3
2011/12	15 288	6 192	5 095	4 001	9 894.9	4 451.9	3 343.5	2 099.5
2012/13	17 155	6 191	6 394	4 570	11 322.3	4 555.9	4 065.5	2 700.9
2013/14	17 599	6 182	6 397	5 020	11 877.4	4 530.1	4 253.1	3 094.2
2014/15	18 743	6 261	6 912	5 570	12 927.5	4 636.2	4 494.4	3 796.9
2015/16	17 245	6 128	6 090	5 027	12 457.8	4 626.8	4 227.4	3 603.6

Table C.53: Business sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	6 182	3 895	2 287	4 530	2 749	1 781	73.3
Technicians directly supporting R&D	6 397	4 418	1 979	4 253	2 876	1 377	66.5
Other personnel directly supporting R&D	5 020	2 879	2 141	3 094	1 817	1 277	61.6
Total	**17 599**	**11 192**	**6 407**	**11 877**	**7 443**	**4 435**	**67.5**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	6 261	3 945	2 316	4 636	2 799	1 837	74.0
Technicians directly supporting R&D	6 912	4 816	2 096	4 494	3 088	1 406	65.0
Other personnel directly supporting R&D	5 570	3 328	2 242	3 797	2 352	1 444	68.2
Total	**18 743**	**12 089**	**6 654**	**12 928**	**8 240**	**4 688**	**69.0**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	6 128	3 945	2 183	4 626.8	2 835.0	1 791.8	75.5
Technicians directly supporting R&D	6 090	4 314	1 776	4 227.4	2 928.0	1 299.4	69.4
Other personnel directly supporting R&D	5 027	3 148	1 879	3 603.6	2 194.1	1 409.5	71.7
Total	**17 245**	**11 407**	**5 838**	**12 457.8**	**7 957.1**	**4 500.7**	**72.2**

Table C.54: Business sector R&D personnel in headcounts by occupation, qualification, population group and gender (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**6 128**	**3 945**	**2 183**	**676**	**567**	**166**	**144**	**390**	**239**	**2 713**	**1 234**
Doctoral degree or equivalent	618	444	174	91	24	16	17	26	20	311	113
Masters, honours, bachelor or equivalent	4 323	2 780	1 543	439	377	110	78	307	174	1 924	914
Diplomas	1 187	721	465	146	166	41	49	57	44	477	206
Technicians directly supporting R&D	**6 090**	**4 314**	**1 776**	**1 104**	**706**	**327**	**148**	**564**	**209**	**2 319**	**713**
Doctoral degree or equivalent	30	20	10	3	1	0	1	1	0	16	7
Masters, honours, bachelor or equivalent	2 152	1 416	736	314	264	79	51	205	117	817	305
Diplomas	3 908	2 878	1 030	787	441	247	96	358	92	1 485	402
Other personnel directly supporting R&D	**5 027**	**3 148**	**1 879**	**1 069**	**613**	**220**	**174**	**695**	**280**	**1 164**	**812**
Doctoral degree or equivalent	77	54	23	17	7	0	0	3	4	35	12
Masters, honours, bachelor or equivalent	1 518	879	639	200	148	54	27	93	71	532	393
Diplomas	3 433	2 215	1 218	852	459	166	148	600	205	597	406
Total	**17 245**	**11 407**	**5 838**	**2 849**	**1 886**	**713**	**466**	**1 650**	**728**	**6 196**	**2 758**

Table C.55: Number of foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2013/14, 2014/15 and 2015/16)

COLLABORATION PARTNERS	2013/14		2014/15		2015/16	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	22	8	14	10	17	8
Higher education institutions	69	16	66	19	64	18
Members of own company	28	11	25	8	25	14
Not-for-profit organisations	6	0	6	3	7	1
Other companies	48	26	56	30	66	32
Science councils	43	6	44	9	41	10
Total number of R&D collaborations	216	67	211	79	220	83
No collaboration	N/A	N/A	20	21	8	11
R&D EXPENDITURE*	**R'000**	**R'000**	**R'000**	**R'000**	**R'000**	**R'000**
Total in-house plus outsourced R&D collaboration expenditure (excl. VAT)	3 445 916	670 854	2 653 929	1 357 157	2 193 307	306 449

*R&D Expenditure includes both internal and outsourced R&D.

Note: Collaborative R&D entails partnerships, alliances and collaborations.

Business sector: State-owned enterprises

The list of SOEs was revised in the 2015/16 reference year. Estimates have been revised based on this expanded list. The list of SOEs will be updated in future as the need arises.

Table C.56: Business sector: SOEs - Number, R&D expenditure, and R&D expenditure as a proportion of BERD (2006/07 to 2015/16)

YEAR	NUMBER OF R&D PERFORMERS	R&D EXPENDITURE	PROPORTION OF BERD
		R'000	%
2006/07	19	2 195 052	23.7
2007/08	19	2 765 729	25.8
2008/09	21	3 438 543	27.9
2009/10	21	2 158 238	19.4
2010/11	19	1 685 520	16.8
2011/12	18	1 318 492	12.6
2012/13	19	1 512 021	14.3
2013/14	19	1 609 771	13.7
2014/15	19	2 019 919	15.2
2015/16	18	1 973 416	14.3

* The average number of state-owned enterprises active within a reference period in the survey from 2006/07 to 2015/16 was 19.

Table C.57: Business sector: SOEs - R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	166 643	206 464	260 468	131 212	68 838	55 107	59 187	263 523	65 489	65 556
Applied research	677 998	913 054	1 130 064	866 097	835 262	832 505	805 106	641 358	1 216 953	860 904
Experimental research	1 350 411	1 646 211	2 048 011	1 160 929	781 421	430 880	647 728	704 890	737 477	1 046 956
Total	**2 195 052**	**2 765 729**	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**

Table C.58: Business sector: SOEs - Proportional R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Basic research	7.6	7.5	7.6	6.1	4.1	4.2	3.9	16.4	3.2	3.3
Applied research	30.9	33.0	32.9	40.1	49.6	63.1	53.2	39.8	60.2	43.6
Experimental research	61.5	59.5	59.6	53.8	46.4	32.7	42.8	43.8	36.5	53.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.59: Business sector: SOEs - R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Capital expenditure	137 020	480 108	1 422 478	401 776	408 927	333 325	179 959	245 077	355 725	122 272
Land: buildings & other structures	12 318	107 001	37 655	60 525	47 672	14 032	11 195	12 920	16 307	31 884
Vehicles, plant, machinery, equipment	124 702	373 107	1 384 823	341 251	361 255	319 293	168 764	232 157	339 418	90 388
Current expenditure	2 058 035	2 285 621	2 016 066	1 756 460	1 276 593	985 167	1 332 062	1 364 694	1 664 194	1 851 145
Labour costs	1 083 291	1 147 839	1 262 273	1 033 378	692 407	658 509	795 414	849 371	922 321	976 713
Other current expenditure	974 744	1 137 782	753 793	723 082	584 186	326 658	536 648	515 323	741 873	874 432
Total	2 195 055	2 765 729	3 438 544	2 158 236	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 417

Table C.60: Business sector: SOEs – Proportional R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Capital expenditure	6.2	17.4	41.4	18.6	24.3	25.3	11.9	15.2	17.6	6.2
Land: buildings & other structures	0.6	3.9	1.1	2.8	2.8	1.1	0.7	0.8	0.8	1.6
Vehicles, plant, machinery, equipment	5.7	13.5	40.3	15.8	21.4	24.2	11.2	14.4	16.8	4.6
Current expenditure	93.8	82.6	58.6	81.4	75.7	74.7	88.1	84.8	82.4	93.8
Labour costs	49.4	41.5	36.7	47.9	41.1	49.9	52.6	52.8	45.7	49.5
Other current expenditure	44.4	41.1	21.9	33.5	34.7	24.8	35.5	32.0	36.7	44.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.61: Business sector: SOEs - Expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biotechnology	7 853	11 729	11 236	6 834	15 100	14 615	23 479	21 845	16 591	12 278
Nanotechnology	5 565	1 993	1 045	2 553	2 995	7 103	3 768	654.135	699.57945	144
Total	**13 417**	**13 722**	**12 281**	**9 386**	**18 095**	**21 717**	**27 247**	**22 499**	**17 290**	**12 422**
Business expenditure on R&D	2 195 052	2 765 729	3 438 543	2 158 238	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416

Table C.62: Business sector: SOEs - Proportional expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Biotechnology	0.4	0.4	0.3	0.3	0.9	1.1	1.6	1.4	0.8	0.6
Nanotechnology	0.3	0.1	0.0	0.1	0.2	0.5	0.2	0.0	0.0	0.0
Total	**0.6**	**0.5**	**0.4**	**0.4**	**1.1**	**1.6**	**1.8**	**1.4**	**0.9**	**0.6**

Table C.63: Business sector: SOEs - R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environment related	N/A	N/A	N/A	N/A	N/A	10 029	15 284	22 448	51 522	30 864
Open source software	3 104	2 566	3 190	5 597	9 087	8 736	7 599	4 124	0	50 589
New materials	4 835	2 919	6 673	17 054	14 598	14 872	12 082	12 233	11 111	64 021
Tuberculosis (TB), HIV/AIDS, malaria	0	0	0	0	0	0	0	0	0	0
Total	**7 939**	**5 484**	**9 863**	**22 652**	**23 684**	**33 636**	**34 965**	**38 806**	**62 633**	**145 474**
Business expenditure on R&D	2 195 052	2 765 729	3 438 543	2 158 238	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416

N/A: Environment related data was collected from the 2011/12 R&D survey onward.

Table C.64: Business sector: SOEs - Proportional R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environment related	N/A	N/A	N/A	N/A	N/A	0.8	1.0	1.4	2.6	1.6
Open source software	0.1	0.1	0.1	0.3	0.5	0.7	0.5	0.3	0.0	2.6
New materials	0.2	0.1	0.2	0.8	0.9	1.1	0.8	0.8	0.6	3.2
Tuberculosis (TB), HIV/AIDS, malaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.4**	**0.2**	**0.3**	**1.0**	**1.4**	**2.6**	**2.3**	**2.4**	**3.1**	**7.4**

N/A: Environment related data was collected from the 2011/12 R&D survey onward.

Table C.65: Business sector: SOEs - R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural Sciences, Technology and Engineering	**2 184 790**	**2 753 974**	**3 426 021**	**2 145 037**	**1 670 869**	**1 318 492**	**1 512 021**	**1 609 771**	**1 963 779**	**1 963 821**
Mathematical sciences	25 561	29 281	31 148	34 896	38 311	142 930	86 576	93 820	137 076	87 387
Physical sciences	375 678	499 480	649 338	174 483	21 123	14 992	40 742	44 460	46 559	32 100
Chemical sciences	63 739	71 947	58 062	57 109	66 503	80 556	133 867	132 399	86 408	64 230
Earth sciences	19 500	22 338	28 149	25 151	27 912	0	44 006	48 671	24 356	12 254
Information, computer and communication technologies	55 969	62 425	98 303	88 484	64 163	126 456	155 601	168 174	304 806	541 009
Applied sciences and technologies	920 326	899 041	1 033 245	616 089	493 368	151 475	176 600	176 391	165 214	133 687
Engineering sciences	672 753	1 112 617	1 473 247	1 091 019	926 729	769 357	781 073	824 057	1 034 900	981 683
Biological sciences	2 484	4 020	2 889	2 727	0	0	13 496	30 701	29 183	33 874
Agricultural sciences	3 526	3 194	863.1	718.8	6 816	8 137	5 343	11 711	12 507	12 665
Medical and health sciences	3 526	0	0	0	15 614	17 491	18 012	18 316	49 357	36 548
Environmental sciences	33 019	37 822	39 093	41 092	3 052	0	42 440	45 772	59 270	16 310
Material sciences	4 591	7 092	6 967	8 296	7 279	7 780	8 605	9 198	9 849	12 073
Marine sciences	4 118	4 716	4 716	4 972	0	0	5659	6103	4294	0
Division 2: Social Sciences and Humanities	**10 262**	**11 755**	**12 522**	**13 201**	**14 651**	**0**	**0**	**0**	**56 140**	**9 595**
Social sciences	10 262	11 755	12 522	13 201	14 651	0	0	0	56 140	9 595
Humanities	0	0	0	0	0	0	0	0	0	0
Total	**2 195 052**	**2 765 729**	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**

Table C.66: Business sector: SOEs - Proportional R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural Sciences, Technology and Engineering	**99.5**	**99.6**	**99.6**	**99.4**	**99.1**	**100.0**	**100.0**	**100.0**	**97.2**	**99.5**
Mathematical sciences	1.2	1.1	0.9	1.6	2.3	10.8	5.7	5.8	6.8	4.4
Physical sciences	17.1	18.1	18.9	8.1	1.3	1.1	2.7	2.8	2.3	1.6
Chemical sciences	2.9	2.6	1.7	2.6	3.9	6.1	8.9	8.2	4.3	3.3
Earth sciences	0.9	0.8	0.8	1.2	1.7	0.0	2.9	3.0	1.2	0.6

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Information, computer and communication technologies	2.5	2.3	2.9	4.1	3.8	9.6	10.3	10.4	15.1	27.4
Applied sciences and technologies	41.9	32.5	30.0	28.5	29.3	11.5	11.7	11.0	8.2	6.8
Engineering sciences	30.6	40.2	42.8	50.6	55.0	58.4	51.7	51.2	51.2	49.7
Biological sciences	0.1	0.1	0.1	0.1	0.0	0.0	0.9	1.9	1.4	1.7
Agricultural sciences	0.2	0.1	0.0	0.0	0.4	0.6	0.4	0.7	0.6	0.6
Medical and health sciences	0.2	0.0	0.0	0.0	0.9	1.3	1.2	1.1	2.4	1.9
Environmental sciences	1.5	1.4	1.1	1.9	0.2	0.0	2.8	2.8	2.9	0.8
Material sciences	0.2	0.3	0.2	0.4	0.4	0.6	0.6	0.6	0.5	0.6
Marine sciences	0.2	0.2	0.1	0.2	0.0	0.0	0.4	0.4	0.2	0.0
Division 2: Social Sciences and Humanities	**0.5**	**0.4**	**0.4**	**0.6**	**0.9**	**0.0**	**0.0**	**0.0**	**2.8**	**0.5**
Social sciences	0.5	0.4	0.4	0.6	0.9	0.0	0.0	0.0	2.8	0.5
Humanities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.67: Business sector: SOEs - R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	**560 704**	**642 320**	**730 541**	**696 861**	**718 698**	**356 627**	**485 487**	**512 440**	**563 927**	**399 183**
Defence	560 704	642 320	730 541	696 861	718 698	356 627	485 487	512 440	563 927	399 183
Division 2: Economic Development	**1 576 946**	**1 983 888**	**2 535 114**	**1 271 859**	**765 929**	**770 791**	**831 597**	**887 024**	**1187718.471**	**1360119.532**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	0	0	0	0	0	0	9030	9380	10075.639	10203.2
Animal production and animal primary products	8 814	6 388	2 877	2 396	1 704	4 069	0	0	0	0
Mineral resources (excluding Energy)	2 334	2 674	0	0	5 576	6 247	6 433	6 541	6 996	7 743
Energy resources	374 502	505 453	650 325	185 159	20 372	22 488	23 158	23 549	25 185	27 874
Energy supply	203 000	213 649	334 360	355 509	405 120	367 866	249 963	253 757	419 084	316 868
Manufacturing	36 108	22 089	21 896	43 790	26 828	57 794	77 574	105 372	178 376	103 757
Construction	743 252	997 680	1 272 653	342 212	603	26 433	70 899	99 484	81 944	0
Transport	143 562	164 445	180 028	266 227	250 553	60 839	125 965	122 633	126 069	253 742

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Information and communication services	44 654	47 776	44 360	46 766	35 131	179 318	193 815	191 811	270 175	609 251
Commercial services	12 485	14 301	19 183	19 856	19 290	1 504	9 893	10 644	11 434	16 235
Economic framework	8 235	9 433	9 433	9 944	0	17 049	36 408	40 833	37 065	14 447
Natural resources	0		0	0	751.8	27 185	28 459	23 019	21 316	0
Division 3: Society	**9 603**	**37 707**	**50 665**	**55 826**	**61 017**	**57 479**	**46 872**	**59 171**	**67371.1975**	**54783.8642**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	0	13 353	20 898	24 288	25 320	22 992	19 743	29 360	26 193	19 804
Education and training	2 138	2 449	2 609	2 750	3 052	11 496	10 862	13 281	14 266	14 447
Social development and community services	7 465	21 905	27 159	28 788	32 645	22 992	16 268	16 530	26 912	20 533
Division 4: Environment	**1 497**	**28 420**	**43 621**	**46 300**	**55 984**	**47 487**	**31 245**	**31 720**	**68425.459**	**56760.157**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	0	13 353	20 898	22 188	25 696	23 368	15 623	15 860	26 193	33 494
Environmental aspects of development	1 497	1 714	1 826	1 925	3 841	0	0	0	16 040	2 741
Environmental and other aspects	0	13 353	20 898	22 188	26 448	24 119	15 623	15 860	26 193	20 525
Division 5: Advancement of Knowledge	**46 302**	**73 394**	**78 602**	**87 391**	**83 891**	**86 108**	**116 819**	**119 417**	**132476.301**	**102570.014**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	42 454	68 986	73 906	82 441	75 716	83 349	113 836	116 668	129 393	99 448
Social sciences and humanities	3 848	4 408	4 696	4 951	8 176	2 758	2 983	2 750	3 083	3 122
Total	**2 195 052**	**2 765 729**	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**

Table C.68: Business sector: SOEs - Proportional R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**25.5**	**49.1**	**21.2**	**32.3**	**42.6**	**27.0**	**32.1**	**31.8**	**27.9**	**20.2**
Defence	25.5	49.1	21.2	32.3	42.6	27.0	32.1	31.8	27.9	20.2
Division 2: Economic Development	**71.8**	**40.2**	**73.7**	**58.9**	**45.4**	**58.5**	**55.0**	**55.1**	**58.8**	**68.9**
Economic Development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.6	0.5	0.5
Animal production and animal primary products	0.4	0.5	0.1	0.1	0.1	0.3	0.0	0.0	0.0	0.0
Mineral resources (excluding Energy)	0.1	0.2	0.0	0.0	0.3	0.5	0.4	0.4	0.3	0.4
Energy resources	17.1	0.7	18.9	8.6	1.2	1.7	1.5	1.5	1.2	1.4
Energy supply	9.2	16.3	9.7	16.5	24.0	27.9	16.5	15.8	20.7	16.1
Manufacturing	1.6	1.7	0.6	2.0	1.6	4.4	5.1	6.5	8.8	5.3
Construction	33.9	2.7	37.0	15.9	0.0	2.0	4.7	6.2	4.1	0.0
Transport	6.5	12.6	5.2	12.3	14.9	4.6	8.3	7.6	6.2	12.9
Information and communication services	2.0	3.7	1.3	2.2	2.1	13.6	12.8	11.9	13.4	30.9
Commercial services	0.6	1.1	0.6	0.9	1.1	0.1	0.7	0.7	0.6	0.8
Economic framework	0.4	0.7	0.3	0.5	0.0	1.3	2.4	2.5	1.8	0.7
Natural resources	0.0	0.0	0.0	0.0	0.0	2.1	1.9	1.4	1.1	0.0
Division 3: Society	**0.4**	**2.9**	**1.5**	**2.6**	**3.6**	**4.4**	**3.1**	**3.7**	**3.3**	**2.8**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	0.0	1.0	0.6	1.1	1.5	1.7	1.3	1.8	1.3	1.0
Education and training	0.1	0.2	0.1	0.1	0.2	0.9	0.7	0.8	0.7	0.7
Social development and community services	0.3	1.7	0.8	1.3	1.9	1.7	1.1	1.0	1.3	1.0
Division 4: Environment	**0.1**	**2.2**	**1.3**	**2.1**	**3.3**	**3.6**	**2.1**	**2.0**	**3.4**	**2.9**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.0	1.0	0.6	1.0	1.5	1.8	1.0	1.0	1.3	1.7
Environmental aspects of development	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.8	0.1

SOCIO-ECONOMIC OBJECTIVE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.0	1.0	0.6	1.0	1.6	1.8	1.0	1.0	1.3	1.0
Division 5: Advancement of Knowledge	**2.1**	**5.6**	**2.3**	**4.0**	**5.0**	**6.5**	**7.7**	**7.4**	**6.6**	**5.2**
Advancement of Knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	1.9	5.3	2.1	3.8	4.5	6.3	7.5	7.2	6.4	5.0
Social sciences and humanities	0.2	0.3	0.1	0.2	0.5	0.2	0.2	0.2	0.2	0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.69: Business sector: SOEs - R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	8 235	12 103	16 648	17 582	12 562	21 897	33 436	38 634	37 244	10 854
Free State	7 956	9 242	3 938	17 432	24 865	31 842	28 367	26 428	25 193	10 854
Gauteng	1 931 375	2 439 748	3 015 137	1 603 650	1 169 019	915 824	1 014 194	1 012 556	1 448 092	1 558 538
KwaZulu-Natal	12 689	27 888	45 057	66 955	54 716	61 139	66 477	91 406	45 588	86 565
Limpopo	0	127.76	0	0	7 157	15 917	19 724	19 596	18 612	3 019
Mpumalanga	0	0	0	0	7 157	15 917	27 038	28 976	33 927	13 222
North-West	79 895	93 832	109 981	138 305	118 682	140 853	151 514	160 739	289 990	170 118
Northern Cape	0	0	0	0	7 157	17 446	18 630	52 104	17 998	2 397
Western Cape	154 902	182 788	247 782	314 314	284 206	97 655	152 641	179 332	103 275	117 850
Total	**2 195 052**	**2 765 729**	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**

Table C.70: Business sector: SOEs - Proportional R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	0.4	0.4	0.5	0.8	0.7	1.7	2.2	2.4	1.8	0.5
Free State	0.4	0.3	0.1	0.8	1.5	2.4	1.9	1.6	1.2	0.5
Gauteng	88.0	88.2	87.7	74.3	69.4	69.5	67.1	62.9	71.7	79.0
KwaZulu-Natal	0.6	1.0	1.3	3.1	3.2	4.6	4.4	5.7	2.3	4.4
Limpopo	0.0	0.0	0.0	0.0	0.4	1.2	1.3	1.2	0.9	0.2
Mpumalanga	0.0	0.0	0.0	0.0	0.4	1.2	1.8	1.8	1.7	0.7
North-West	3.6	3.4	3.2	6.4	7.0	10.7	10.0	10.0	14.4	8.6
Northern Cape	0.0	0.0	0.0	0.0	0.4	1.3	1.2	3.2	0.9	0.1
Western Cape	7.1	6.6	7.2	14.6	16.9	7.4	10.1	11.1	5.1	6.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.71: Business sector: SOEs - R&D expenditure by Standard Industrial Classification code (2006/07 to 2015/16)

STANDARD INDUSTRIAL CLASSIFICATION	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Agriculture, Hunting, Forestry and Fishing	0	1 278	575	479	0	0	12 592	17 187	18 413	18 646
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0
Manufacturing	**442 852**	**493 453**	**552 419**	**547 593**	**530 635**	**248 309**	**444 185**	**475 294**	**480 601**	**370 407**
Manufacture of Food Products, Beverages and Tobacco Products	0	0	0	0	0	0	0	0	0	0
Manufacture of Textiles, Clothing and Leather Goods	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	1 290	1 340	1 439	1 458
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	57 344	57 797	74 080	99 411	61 654	58 362	69 607	72 216	77 350	8 616
Manufacture of Non-Metallic Mineral Products	7 523	2 651	0	0	6 692	7 496	7 719	7 850	8 395	0
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	28 011	32 089	20 798	21 252	0	84 285	224 661	272 253	293 575	297 289
Manufacture of Electrical Machinery and Apparatus	45 200	51 780	54 943	0	0	88 159	76 590	63 824	52 760	20 430
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	0	0	0	0	0	0	0	0	0	0
Manufacture of Transport Equipment	304 774	349 136	402 599	426 930	462 290	10 007	64 318	57 812	47 081	42 614
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0	0	0	0	0	0	0	0	0	0
Electricity, Gas & Water Supply	1 291 610	1 735 709	2 303 869	936 310	521 665	463 592	325 822	340 670	534 569	424 561
Construction	0	0	0	0	0	0	0	0	0	0
Wholesale and Retail	2 138	2 449	2 609	2 750	3 052	0	0	0	0	0
Transport, Storage and Communication	193 367	218 121	176 362	179 602	164 337	304 346	371 495	397 326	565 363	826 532
Financial Intermediation, Real Estate and Business Services	111 098	138 320	222 490	259 855	204 455	302 245	137 898	158 060	150 347	196 661
Community, Social and Personal Services	153 987	176 401	180 218	231 648	261 375	0	220 029	221 233	270 626	136 609
Total	**2 195 052**	**2 765 729**	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**

Table C.72: Business sector: SOEs - Proportional R&D expenditure by Standard Industrial Classification code (2006/07 to 2015/16)

STANDARD INDUSTRIAL CLASSIFICATION	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Agriculture, Hunting, Forestry and Fishing	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.1	0.9	0.9
Mining and Quarrying	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacturing	**20.2**	**17.8**	**16.1**	**25.4**	**31.5**	**18.8**	**29.4**	**29.5**	**23.8**	**18.8**
Manufacture of Food Products, Beverages and Tobacco Products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of Textiles, Clothing and Leather Goods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	2.6	2.1	2.2	4.6	3.7	4.4	4.6	4.5	3.8	0.4
Manufacture of Non-Metallic Mineral Products	0.3	0.1	0.0	0.0	0.4	0.6	0.5	0.5	0.4	0.0
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	1.3	1.2	0.6	1.0	0.0	6.4	14.9	16.9	14.5	15.1
Manufacture of Electrical Machinery and Apparatus	2.1	1.9	1.6	0.0	0.0	6.7	5.1	4.0	2.6	1.0
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of Transport Equipment	13.9	12.6	11.7	19.8	27.4	0.8	4.3	3.6	2.3	2.2
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity, Gas & Water Supply	58.8	62.8	67.0	43.4	30.9	35.2	21.5	21.2	26.5	21.5
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wholesale and Retail	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0
Transport, Storage and Communication	8.8	7.9	5.1	8.3	9.7	23.1	24.6	24.7	28.0	41.9
Financial Intermediation, Real Estate and Business Services	5.1	5.0	6.5	12.0	12.1	22.9	9.1	9.8	7.4	10.0
Community, Social and Personal Services	7.0	6.4	5.2	10.7	15.5	0.0	14.6	13.7	13.4	6.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.73: Business sector: SOEs - R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2006/07	2 568	1130	735	703	2 304.9	1 031.5	649.7	623.7
2007/08	2 822	1217	777	828	2 242.4	1 006.5	642.2	593.7
2008/09	2 955	1301	863	791	2 348.1	1 075.5	703.3	569.3
2009/10	2 550	1115	752	683	1 981.2	915.8	593.3	472.2
2010/11	1 878	773	681	424	1 366.3	598.0	493.0	275.3
2011/12	2 336	841	1 018	477	1 068.6	458.2	431.0	179.4
2012/13	2 699	890	1 351	458	1 307.1	548.4	563.8	194.9
2013/14	2 674	892	1 334	448	1 301.1	541.8	573.0	186.3
2014/15	2 760	918	1479	363	1 335.3	541.5	593.2	200.7
2015/16	2 476	959	1163	354	1 150.1	477.7	587.9	84.5

Table C.74: Business sector: SOEs - R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	892	732	160	541.8	442.1	99.7	60.7
Technicians directly supporting R&D	1 334	1 042	292	573.0	472.0	101.0	43.0
Other personnel directly supporting R&D	448	205	243	186.3	82.4	103.9	41.6
Total	**2 674**	**1 979**	**695**	**1301.1**	**996.5**	**304.6**	**48.7**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	918	751	167	541.5	433.7	107.8	59.0
Technicians directly supporting R&D	1 479	1 113	366	593.2	483.2	110.0	40.1
Other personnel directly supporting R&D	363	179	184	200.7	86.2	114.5	55.3
Total	**2 760**	**2 043**	**717**	**1 335.3**	**1 003.1**	**332.3**	**48.4**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	959	764	195	477.7	375.8	101.9	49.8
Technicians directly supporting R&D	1 163	863	300	587.9	425.7	162.2	50.5
Other personnel directly supporting R&D	354	191	163	84.5	40.2	44.3	23.9
Total	**2 476**	**1 818**	**658**	**1 150.1**	**841.7**	**308.4**	**46.4**

Table C.75: Business sector: SOEs - R&D personnel in headcounts by occupation, qualification, population group and gender (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**903**	**720**	**184**	**237**	**86**	**38**	**12**	**91**	**25**	**354**	**61**
Doctoral degree or equivalent	109	101	8	22	5	6	0	8	0	65	3
Masters, honours, bachelor or equivalent	692	532	161	200	76	32	12	71	22	229	51
Diplomas	102	87	15	16	5	0	0	12	3	59	7
Technicians directly supporting R&D	**1 096**	**813**	**283**	**234**	**132**	**22**	**7**	**18**	**11**	**539**	**133**
Doctoral degree or equivalent	3	3	0	0	0	0	0	0	0	3	0
Masters, honours, bachelor or equivalent	200	135	65	68	49	3	2	8	6	57	7
Diplomas	893	675	218	166	82	19	5	10	5	480	126
Other personnel directly supporting R&D	**477**	**267**	**210**	**185**	**143**	**14**	**10**	**9**	**3**	**59**	**53**
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0
Masters, honours, bachelor or equivalent	85	54	31	28	20	2	2	5	3	19	5
Diplomas	392	213	179	157	123	12	9	3	0	40	48
Total	**2 476**	**1 800**	**676**	**656**	**361**	**74**	**29**	**118**	**39**	**952**	**247**

Table C.76: Business sector: SOEs - Number of foreign and local business sector partners engaged in collaborative R&D*, and total R&D collaboration expenditure (2015/16)

COLLABORATION PARTNERS	2015/16	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	2	2
Higher education institutions	7	1
Members of own company	2	0
Not-for-profit organisations	2	1
Other companies	3	1
Science councils	5	1
Total number of R&D collaborations	21	6
No collaboration	0	1
R&D EXPENDITURE	**R'000**	**R'000**
Total in-house plus outsourced R&D collaboration expenditure (excl. VAT)	164 075	60 861

*R&D Expenditure includes both internal and outsourced R&D.

Note: Collaborative R&D entails partnerships, alliances and collaborations.

C.2.2. Not-for-profit sector

The NPO sector in 2014/15 improved coverage by R185 million contributing 23.8% of NPO R&D expenditure. Care is advised when making inferences on trends in the NPO sector.

Table C.77: Not-for-profit sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Basic research	54 915	65 337	70 725	111 377	59 302	62 134	114 755	132 478	181 492	200 040
Applied research	110 698	119 982	131 259	53 530	87 435	79 105	346 179	322 295	426 132	508 738
Experimental research	46 925	37 883	38 665	23 933	16 092	29 366	42 898	128 391	171 149	182 365
Total	**212 538**	**223 202**	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**

Table C.78: Proportional not-for-profit sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Basic research	25.8	29.3	29.4	59.0	36.4	36.4	22.8	22.7	23.3	22.4
Applied research	52.1	53.8	54.5	28.3	53.7	46.4	68.7	55.3	54.7	57.1
Experimental research	22.1	17.0	16.1	12.7	9.9	17.2	8.5	22.0	22.0	20.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.79: Not-for-profit sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Capital expenditure	6 974	7 025	7 249	8 564	8 820	18 702	37 564	39 983	49 647	53 800
Land: buildings & other structures	2 624	2 959	3 137	3 486	4 447	6 905	11 152	19 047	18 794	18 391
Vehicles, plant, machinery, equipment	4 350	4 066	4 112	5 078	4 373	11 797	26 412	20 936	30 853	35 409
Current expenditure	205 564	216 177	233 400	180 276	154 010	151 903	466 269	543 182	729 125	837 342
Labour costs	98 631	109 147	114 292	94 673	92 098	100 176	243 871	303 644	420 462	468 883
Other current expenditure	106 933	107 030	119 108	85 603	61 912	51 727	222 398	239 538	308 663	368 459
Total	**212 538**	**223 202**	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**

Table C.80: Not-for-profit sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Capital expenditure	3.3	3.1	3.0	4.5	5.4	11.0	7.5	6.9	6.4	6.0
Land: buildings & other structures	1.2	1.3	1.3	1.8	2.7	4.0	2.2	3.3	2.4	2.1
Vehicles, plant, machinery, equipment	2.0	1.8	1.7	2.7	2.7	6.9	5.2	3.6	4.0	4.0
Current expenditure	96.7	96.9	97.0	95.5	94.6	89.0	92.5	93.1	93.6	94.0
Labour costs	46.4	48.9	47.5	50.1	56.6	58.7	48.4	52.1	54.0	52.6
Other current expenditure	50.3	48.0	49.5	45.3	38.0	30.3	44.1	41.1	39.6	41.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.81: Not-for-profit sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biotechnology	429	491	255	4 446	5 666	8 667	29 062	62 082	128 964	159 045
Nanotechnology	0	0	0	0	1 475	0	10 187	4 915	70 348	81 103
Total	**429**	**491**	**255**	**4 446**	**7 141**	**8 667**	**39 249**	**66 997**	**199 312**	**240 148**
NPO expenditure on R&D	212 538	223 202	240 649	188 840	162 830	170 605	503 833	583 165	778 772	891 142

Table C.82: Proportional not-for-profit sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Biotechnology	0.2	0.2	0.1	2.4	3.5	5.1	5.8	10.6	16.6	17.8
Nanotechnology	0.0	0.0	0.0	0.0	0.9	0.0	2.0	0.8	9.0	9.1
Total	**0.2**	**0.2**	**0.1**	**2.4**	**4.4**	**5.1**	**7.8**	**11.5**	**25.6**	**26.9**

Table C.83: Not-for-profit sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environment related	N/A	N/A	N/A	N/A	N/A	15 133	18 022	27 142	50 364	52 156
Open source software	4 973	0	0	0	0	20	419	481	69 509	756
New materials	1 783	0	0	542	830	395	178	191	634	79 322
Tuberculosis (TB), HIV/AIDS, malaria	4 215	0	8 763	7 419	13 979	5 034	246 760	301 086	374 460	482 298
Total	**10 971**	**0**	**8 763**	**7 962**	**14 809**	**20 581**	**265 379**	**328 901**	**494 966**	**614 532**
NPO expenditure on R&D	212 538	223 202	240 649	188 840	162 830	170 605	503 833	583 165	778 772	891 142

Table C.84: Proportional not-for-profit sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environment related	N/A	N/A	N/A	N/A	N/A	8.9	3.6	4.7	6.5	5.9
Open source software	2.3	0.0	0.0	0.0	0.0	0.0	0.1	0.1	8.9	0.1
New materials	0.8	0.0	0.0	0.3	0.5	0.2	0.0	0.0	0.1	8.9
Tuberculosis (TB), HIV/AIDS, malaria	2.0	0.0	3.6	3.9	8.6	3.0	49.0	51.6	48.1	54.1
Total	**5.2**	**0.0**	**3.6**	**4.2**	**9.1**	**12.1**	**52.7**	**56.4**	**63.6**	**69**

Table C.85: Not-for-profit sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural Sciences, Technology and Engineering	**53 937**	**61 494**	**72 018**	**53 112**	**54 776**	**64 042**	**346 961**	**427 237**	**647 068**	**766 355**
Mathematical sciences	0	0	1 041	0	0	0	8 223	9 674	14 613	14 293
Physical sciences	0	0	0	6 422	0	0	765	802	989	1191.043
Chemical sciences	0	0	0	0	0	0	0	1 309	0	0
Earth sciences	185	459	1 012	452	2 585	2 407	2 598	5 907	8 371	8 356
Information, computer and communication technologies	925	1 446	1 555	2 207	0	595	2 919	39	197	528.4
Applied sciences and technologies	1 407	0	0	0	0	1 487	4 317	4 666	19 123	30 565
Engineering sciences	0	0	0	0	0	0	4 075	4 915	4 638	4 005
Biological sciences	1 874	2 005	2 126	904	1 473	7 978	15 475	23 435	23 338	11 400

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Agricultural sciences	17 234	18 324	19 426	20 404	25 679	25 819	33 105	34 165	53 777	60 727
Medical and health sciences	25 237	29 603	36 032	13 999	15 920	17 423	265 031	329 293	497 588	614 889
Environmental sciences	3 097	7 363	8 396	6 014	3 433	7 553	10 122	12 238	23 548	19 552
Material sciences	0	0	0	0	0	0	0	0	0	0
Marine sciences	3 978	2 294	2 431	2 711	5 687	781	331	794	886	847.56
Division 2: Social Sciences and Humanities	**158 601**	**161 708**	**168 631**	**135 728**	**108 054**	**106 563**	**156 872**	**155 928**	**131 705**	**124 787**
Social sciences	156 574	159 155	165 924	133 340	104 306	104 842	142 525	147 029	122 105	117 549
Humanities	2 027	2 553	2 707	2 388	3 749	1 720	14 348	8 898	9 599	7 238
Total	**212 538**	**223 202**	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**

Table C.86: Proportional not-for-profit sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural Sciences, Technology and Engineering	**25.4**	**27.6**	**29.9**	**28.1**	**33.6**	**37.5**	**68.9**	**73.3**	**83.1**	**86**
Mathematical sciences	0.0	0.0	0.4	0.0	0.0	0.0	1.6	1.7	1.9	1.6
Physical sciences	0.0	0.0	0.0	3.4	0.0	0.0	0.2	0.1	0.1	0.1
Chemical sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Earth sciences	0.1	0.2	0.4	0.2	1.6	1.4	0.5	1.0	1.1	0.9
Information, computer and communication technologies	0.4	0.6	0.6	1.2	0.0	0.3	0.6	0.0	0.0	0.1
Applied sciences and technologies	0.7	0.0	0.0	0.0	0.0	0.9	0.9	0.8	2.5	3.4
Engineering sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.6	0.4
Biological sciences	0.9	0.9	0.9	0.5	0.9	4.7	3.1	4.0	3.0	1.3
Agricultural sciences	8.1	8.2	8.1	10.8	15.8	15.1	6.6	5.9	6.9	6.8
Medical and health sciences	11.9	13.3	15.0	7.4	9.8	10.2	52.6	56.5	63.9	69.0
Environmental sciences	1.5	3.3	3.5	3.2	2.1	4.4	2.0	2.1	3.0	2.2
Material sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marine sciences	1.9	1.0	1.0	1.4	3.5	0.5	0.1	0.1	0.1	0.1
Division 2: Social Sciences and Humanities	**74.6**	**72.4**	**70.1**	**71.9**	**66.4**	**62.5**	**31.1**	**26.7**	**16.9**	**14**
Social sciences	73.7	71.3	68.9	70.6	64.1	61.5	28.3	25.2	15.7	13.2
Humanities	1.0	1.1	1.1	1.3	2.3	1.0	2.8	1.5	1.2	0.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.87: Not-for-profit sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	**1 312**	**1 438**	**2 050**	**1 600**	**0**	**0**	**0**	**0**	**690**	**0**
Defence	1 312	1 438	2 050	1 600	0	0	0	0	690	0
Division 2: Economic Development	**61 743**	**63 450**	**69 810**	**71 939**	**65 777**	**60 758**	**110 866**	**113 991**	**152 573**	**157 608**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	13 996	16 030	17 520	18 873	25 441	24 850	36 127	35 511	28 974	32 936
Animal production and animal primary products	1 850	918	972	1 632	1 389	828	2 538	3 083	4 000	7 628
Mineral resources (excluding Energy)	0	0	0	0	763	0	8 150	9 831	9 242	7 955
Energy resources	656	1 000	1 760	2 604	1 653	969	2 538	3 083	3 993	4 008
Energy supply	1 312	1 438	2 575	3 774	3 307	3 430	4 363	8 690	7 663	6 242
Manufacturing	0	0	0	0	0	2 197	3 896	2 955	26 291	31 646
Construction	0	0	0	0	0	0	0	0	0	0
Transport	0	70	74	208	0	137	465	424	0	0
Information and communication services	1 388	0	0	0	0	1 480	2 031	1 823	316	2411.45
Commercial services	622	782	827	970	0	0	0	0	0	1134.7
Economic framework	37 516	36 588	39 059	39 463	27 068	22 228	45 252	42 423	54 435	53 406
Natural resources	4 403	6 624	7 022	4 414	6 157	4 640	5 507	6 167	17 659	10 242
Division 3: Society	**127 170**	**129 159**	**141 189**	**93 947**	**82 481**	**75 597**	**360 333**	**415 093**	**555 151**	**632 030**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	28 057	33 549	37 461	16 554	15 050	13 496	260 712	303 535	449 619	527 783
Education and training	38 907	32 161	32 308	19 986	22 303	23 762	58 894	63 833	61 150	59 917
Social development and community services	60 206	63 449	71 420	57 407	45 128	38 339	40 726	47 725	44 382	44 330
Division 4: Environment	4 493	5 885	6 937	7 052	10 051	13 356	12 841	15 044	16 135	17 503
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	1 090	2 553	3 406	3 577	6 139	7 233	4 716	7 845	8 697	9 949
Environmental aspects of development	209	559	593	683	504	3 746	5 771	4 545	4 569	4 494

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environmental and other aspects	3 194	2 773	2 938	2 792	3 408	2 377	2 355	2 654	2 869	3 060
Division 5: Advancement of Knowledge	**17 819**	**23 271**	**20 663**	**14 303**	**4 521**	**20 895**	**19 793**	**39 036**	**54 223**	**84 002**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	925	459	486	452	632	13 166	7 754	31 450	42 017	69 845
Social sciences and humanities	16 894	22 812	20 177	13 851	3 889	7 729	12 039	7 586	12 206	14 157
Total	**212 537**	**223 203**	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**

Table C.88: Proportional not-for-profit sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**0.6**	**0.6**	**0.9**	**0.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**
Defence	0.6	0.6	0.9	0.8	0.0	0.0	0.0	0.0	0.1	0.0
Division 2: Economic Development	**29.1**	**28.4**	**29.0**	**38.1**	**40.4**	**35.6**	**22.0**	**19.5**	**19.6**	**17.7**
Economic Development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	6.6	7.2	7.3	10	15.6	14.6	7.2	6.1	3.7	3.7
Animal production and animal primary products	0.9	0.4	0.4	0.9	0.9	0.5	0.5	0.5	0.5	0.9
Mineral resources (excluding Energy)	0.0	0.0	0.0	0.0	0.5	0.0	1.6	1.7	1.2	0.9
Energy resources	0.3	0.4	0.7	1.4	1.0	0.6	0.5	0.5	0.5	0.4
Energy supply	0.6	0.6	1.1	2.0	2.0	2.0	0.9	1.5	1.0	0.7
Manufacturing	0.0	0.0	0.0	0.0	0.0	1.3	0.8	0.5	3.4	3.6
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0
Information and communication services	0.7	0.0	0.0	0.0	0.0	0.9	0.4	0.3	0.0	0.3
Commercial services	0.3	0.4	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Economic framework	17.7	16.4	16.2	20.9	16.6	13.0	9.0	7.3	7.0	6.0
Natural resources	2.1	3.0	2.9	2.3	3.8	2.7	1.1	1.1	2.3	1.1

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 3: Society	**59.8**	**57.9**	**58.7**	**49.7**	**50.7**	**44.3**	**71.5**	**71.2**	**71.3**	**70.9**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	13.2	15.0	15.6	8.8	9.2	7.9	51.7	52.0	57.7	59.2
Education and training	18.3	14.4	13.4	10.6	13.7	13.9	11.7	10.9	7.9	6.7
Social development and community services	28.3	28.4	29.7	30.4	27.7	22.5	8.1	8.2	5.7	5.0
Division 4: Environment	**2.1**	**2.6**	**2.9**	**3.7**	**6.2**	**7.8**	**2.5**	**2.6**	**2.1**	**2.0**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.5	1.1	1.4	1.9	3.8	4.2	0.9	1.3	1.1	1.1
Environmental aspects of development	0.1	0.3	0.2	0.4	0.3	2.2	1.1	0.8	0.6	0.5
Environmental and other aspects	1.5	1.2	1.2	1.5	2.1	1.4	0.5	0.5	0.4	0.3
Division 5: Advancement of Knowledge	**8.4**	**10.4**	**8.6**	**7.6**	**2.8**	**12.2**	**3.9**	**6.7**	**7.0**	**9.4**
Advancement of Knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	0.4	0.2	0.2	0.2	0.4	7.7	1.5	5.4	5.4	7.8
Social sciences and humanities	7.9	10.2	8.4	7.3	2.4	4.5	2.4	1.3	1.6	1.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.89: Not-for-profit sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Eastern Cape	4 850	6 164	6 790	8 136	9 790	9 493	25 610	25 478	27 219	21 026
Free State	1 974	1 255	4 763	4 418	6 385	5 096	15 297	15 953	14 214	8 890
Gauteng	102 141	115 499	126 136	104 420	61 496	69 321	162 866	175 651	287 783	345 937
KwaZulu-Natal	42 902	42 141	40 492	30 548	35 765	33 740	163 221	166 603	181 052	232 636
Limpopo	3 979	4 602	5 138	4 524	4 541	7 449	11 779	13 719	49 971	56 143
Mpumalanga	9 131	9 930	10 332	8 311	13 206	16 027	23 195	26 979	30 594	25 944
North-West	1 974	2 207	2 339	2 382	5 612	6 353	42 960	72 446	105 904	97 918
Northern Cape	1 736	2 038	2 159	4 493	2 030	1 889	3 867	3 583	1 546	2 200
Western Cape	43 852	39 367	42 500	21 609	24 003	21 236	55 038	82 753	80 489	100 448
Total	**212 538**	**223 203**	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**

Table C.90: Proportional not-for-profit sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.3	2.8	2.8	4.3	6.0	5.6	5.1	4.4	3.5	2.4
Free State	0.9	0.6	2.0	2.3	3.9	3.0	3.0	2.7	1.8	1.0
Gauteng	48.1	51.7	52.4	55.3	37.8	40.6	32.3	30.1	37	38.8
KwaZulu-Natal	20.2	18.9	16.8	16.2	22	19.8	32.4	28.6	23.2	26.1
Limpopo	1.9	2.1	2.1	2.4	2.8	4.4	2.3	2.4	6.4	6.3
Mpumalanga	4.3	4.4	4.3	4.4	8.1	9.4	4.6	4.6	3.9	2.9
North-West	0.8	1.0	0.9	2.4	3.4	1.1	8.5	12.4	13.6	11.0
Northern Cape	0.9	0.9	1.0	1.3	1.2	3.7	0.8	0.6	0.2	0.2
Western Cape	20.6	17.6	17.7	11.4	14.7	12.4	10.9	14.2	10.3	11.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.91: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2006/07	484	252	77	155	362.7	203.6	55.3	103.9
2007/08	502	264	77	161	379.1	215.6	56.5	107
2008/09	502	262	77	163	366.4	207.6	56.5	102.3
2009/10	380	224	76	80	309.7	187.5	63.7	58.6
2010/11	400	250	49	101	313.1	196.2	47.6	69.3
2011/12	405	254	56	95	312.1	190.8	47.2	74.1
2012/13	906	394	132	380	768	294.5	114.2	359.4
2013/14	1017	435	205	377	891.4	338.4	195.1	357.9
2014/15	1471	506	368	597	1231.2	396	355.5	479.8
2015/16	1493	465	436	592	1367.3	384.81	411.23	571.23

Table C.92: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	435	202	233	338.4	155.6	182.9	77.8
Technicians directly supporting R&D	205	74	131	195.1	68.0	127.1	95.2
Other personnel directly supporting R&D	377	81	296	357.9	77.9	280.0	94.9
Total	1017	357	660	891.4	301.4	590.0	87.6
2014/15	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	506	234	272	396.0	177.1	218.9	78.3
Technicians directly supporting R&D	368	116	252	355.5	110.0	245.5	96.6
Other personnel directly supporting R&D	597	167	430	479.8	123.4	356.3	80.4
Total	1471	517	954	1231.2	410.5	820.7	83.7
2015/16	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	465	206	259	384.8	158.6	226.2	82.8
Technicians directly supporting R&D	436	136	300	411.2	124.2	287.0	94.3
Other personnel directly supporting R&D	592	157	435	571.2	153.9	417.3	96.5
Total	1493	499	994	1 367.3	436.7	930.5	91.6

Table C.93: Not-for-profit sector R&D personnel in headcounts by occupation, qualification, population group and gender (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**465**	**206**	**259**	**89**	**96**	**9**	**25**	**10**	**34**	**98**	**104**
Doctoral degree or equivalent	123	73	50	23	12	1	6	3	7	46	25
Masters, honours, bachelor or equivalent	291	117	174	54	64	7	13	6	22	50	75
Diplomas	51	16	35	12	20	1	6	1	5	2	4
Technicians directly supporting R&D	**436**	**136**	**300**	**99**	**210**	**3**	**14**	**13**	**44**	**21**	**32**
Doctoral degree or equivalent	7	0	7	0	3	0	0	0	0	0	4
Masters, honours, bachelor or equivalent	120	39	81	16	33	1	7	10	26	12	15
Diplomas	309	97	212	83	174	2	7	3	18	9	13
Other personnel directly supporting R&D	**592**	**157**	**435**	**118**	**304**	**5**	**24**	**16**	**45**	**18**	**62**
Doctoral degree or equivalent	6	0	6	0	3	0	0	0	1	0	2
Masters, honours, bachelor or equivalent	146	34	112	17	43	1	7	6	30	10	32
Diplomas	440	123	317	101	258	4	17	10	14	8	28
Total	**1 493**	**499**	**994**	**306**	**610**	**17**	**63**	**39**	**123**	**137**	**198**

C.2.3. Government sector

Table C.94: Government sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Basic research	224 774	322 270	357 786	257 806	257 235	263 380	331 587	245 167	338 250	358 666
Applied research	521 845	599 162	601 688	621 762	600 205	812 067	873 469	1 194 866	1 292 421	1 390 221
Experimental research	274 736	232 967	180 202	187 734	153 900	160 223	232 453	257 118	262 339	264 134
Total	**1 021 355**	**1 154 399**	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**

Table C.95: Proportional government sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Basic research	22.0	27.9	31.4	24.2	25.4	21.3	23.1	14.4	17.9	17.8
Applied research	51.1	51.9	52.8	58.3	59.3	65.7	60.8	70.4	68.3	69.1
Experimental research	26.9	20.2	15.8	17.6	15.2	13.0	16.2	15.1	13.9	13.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.96: Government sector R&D expenditure by spheres and institutes of government and accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Municipalities	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**14 959**	**65 541**	**59 418**	**62 485**	**61 703**
Capital expenditure	N/A	N/A	N/A	N/A	N/A	144	18 605	23 033	12 921	13 059
Land: buildings and other structures	N/A	N/A	N/A	N/A	N/A	0	5 400	10 000	6 537	6 598
Vehicles, plant, machinery, equipment	N/A	N/A	N/A	N/A	N/A	144	13 205	13 033	6 384	6 461
Current expenditure	N/A	N/A	N/A	N/A	N/A	14 815	46 936	36 385	49 564	48 644
Labour costs	N/A	N/A	N/A	N/A	N/A	12 715	30 131	27 513	39 314	38 687
Other current expenditure	N/A	N/A	N/A	N/A	N/A	2 100	16 805	8 872	10 250	9 957
Provincial departments	**174 860**	**253 418**	**232 062**	**245 031**	**284 539**	**335 607**	**372 231**	**249 705**	**421 126**	**376 232**
Capital expenditure	12 706	37 336	24 249	39 748	30 475	42 895	45 895	17 540	39 325	57 905
Land: buildings and other structures	4 495	8 681	2 515	11 238	13 022	10 674	7 255	2 122	5 500	18 037
Vehicles, plant, machinery, equipment	8 211	28 655	21 734	28 510	17 453	32 221	38 640	15 418	33 825	39 868
Current expenditure	162 154	216 082	207 813	205 283	254 064	292 712	326 336	232 165	381 801	318 327
Labour costs	100 676	135 695	129 187	138 397	182 175	206 583	236 367	198 440	248 823	189 465
Other current expenditure	61 478	80 387	78 626	66 886	71 889	86 129	89 969	33 725	132 978	128 862
National departments	**489 971**	**499 085**	**287 333**	**240 412**	**211 176**	**280 005**	**321 632**	**390 301**	**248 041**	**381 855**
Capital expenditure	48 920	22 507	9 340	2 022	38 629	31 879	32 669	45 930	4 406	43 918
Land: buildings and other structures	3 701	0	1 107	500	3 657	11 820	12 783	6 348	811	7900
Vehicles, plant, machinery, equipment	45 219	22 507	8 233	1 522	34 972	20 059	19 886	39 582	3 595	36 018
Current expenditure	441 051	476 578	277 993	238 390	172 547	248 126	288 963	344 371	243 635	337 937
Labour costs	158 890	120 257	98 791	81 619	144 779	140 146	158 808	233 321	150 921	208 005
Other current expenditure	282 161	356 321	179 202	156 771	27 768	107 980	130 155	111 050	92 714	129 932
Government research institutes	**327 065**	**365 468**	**579 395**	**553 651**	**483 999**	**573 698**	**644 360**	**973 807**	**1 134 875**	**1 165 161**
Capital expenditure	57 343	38 837	49 345	168 544	113 395	35 071	157 221	98 010	233 386	202 878
Land: buildings and other structures	31 602	10 225	9 955	115 101	43 360	2 487	58 280	4 542	93 477	112 710
Vehicles, plant, machinery, equipment	25 741	28 612	39 390	53 443	70 035	32 584	98 941	93 468	139 909	90 168
Current expenditure	269 722	326 631	530 050	385 107	370 604	538 627	487 139	875 797	901 489	962 283
Labour costs	148 117	183 167	224 691	245 767	269 965	316 835	355 503	316 256	375 939	311 876
Other current expenditure	121 605	143 464	305 359	139 340	100 639	221 792	131 636	559 541	525 550	650 407
Museums	**29 459**	**36 428**	**40 886**	**28 208**	**31 626**	**31 400**	**33 745**	**23 920**	**26 484**	**28 070**
Capital expenditure	1 908	1 644	4 002	4 087	3 699	3 256	649	946	1 996	2 005
Land: buildings and other structures	481	460	2 331	2 491	2 141	2 337	30	638	687	663
Vehicles, plant, machinery, equipment	1 427	1 184	1 671	1 596	1 558	919	619	308	1 309	1 342
Current expenditure	27 551	34 784	36 884	24 121	27 927	28 144	33 096	22 974	24 488	26 065
Labour costs	20 197	25 041	27 141	17 839	20 814	21 413	25 471	20 769	22 429	23 751
Other current expenditure	7 354	9 743	9 743	6 282	7 113	6 731	7 625	2 205	2 059	2 314
Government sector	**1 021 355**	**1 154 399**	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**
Capital expenditure	120 877	100 324	86 936	214 401	186 198	113 245	255 039	185 459	292 034	319 765
Land: buildings and other structures	40 279	19 366	15 908	129 330	62 180	27 318	83 748	23 650	107 012	145 908
Vehicles, plant, machinery, equipment	80 598	80 958	71 028	85 071	124 018	85 927	171 291	161 809	185 022	173 857
Current expenditure	900 478	1 054 075	1 052 740	852 901	825 142	1 122 424	1 182 470	1 511 692	1 600 976	1 693 256
Labour costs	427 880	464 160	479 810	483 622	617 733	697 692	806 280	796 299	837 425	771 784
Other current expenditure	472 598	589 915	572 930	369 279	207 409	424 732	376 190	715 393	763 551	921 472

N/A: Municipal data were collected from the 2011/12 R&D survey onwards.

Table C.97: Proportional government sector R&D expenditure by spheres and institutes of government and accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Municipalities	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Capital expenditure	N/A	N/A	N/A	N/A	N/A	1.0	28.4	38.8	20.7	21.2
Land: buildings and other structures	N/A	N/A	N/A	N/A	N/A	0.0	8.2	16.8	10.5	10.7
Vehicles, plant, machinery, equipment	N/A	N/A	N/A	N/A	N/A	1.0	20.1	21.9	10.2	10.5
Current expenditure	N/A	N/A	N/A	N/A	N/A	99.0	71.6	61.2	79.3	78.8
Labour costs	N/A	N/A	N/A	N/A	N/A	85.0	46.0	46.3	62.9	62.7
Other current expenditure	N/A	N/A	N/A	N/A	N/A	14.0	25.6	14.9	16.4	16.1
Provincial departments	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Capital expenditure	7.3	14.7	10.4	16.2	10.7	12.8	12.3	7.0	9.3	15.4
Land: buildings and other structures	2.6	3.4	1.1	4.6	4.6	3.2	1.9	0.8	1.3	4.8
Vehicles, plant, machinery, equipment	4.7	11.3	9.4	11.6	6.1	9.6	10.4	6.2	8.0	10.6
Current expenditure	92.7	85.3	89.6	83.8	89.3	87.2	87.7	93.0	90.7	84.6
Labour costs	57.6	53.5	55.7	56.5	64.0	61.6	63.5	79.5	59.1	50.4
Other current expenditure	35.2	31.7	33.9	27.3	25.3	25.7	24.2	13.5	31.6	34.3
National departments	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Capital expenditure	10.0	4.5	3.3	0.8	18.3	11.4	10.2	11.8	1.8	11.5
Land: buildings and other structures	0.8	0.0	0.4	0.2	1.7	4.2	4.0	1.6	0.3	2.1
Vehicles, plant, machinery, equipment	9.2	4.5	2.9	0.6	16.6	7.2	6.2	10.1	1.4	9.4
Current expenditure	90.0	95.5	96.7	99.2	81.7	88.6	89.8	88.2	98.2	88.5
Labour costs	32.4	24.1	34.4	33.9	68.6	50.1	49.4	59.8	60.8	54.5
Other current expenditure	57.6	71.4	62.4	65.2	13.1	38.6	40.5	28.5	37.4	34.0
Government research institutes	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Capital expenditure	17.5	10.6	8.5	30.4	23.4	6.1	24.4	10.1	20.6	17.4
Land: buildings and other structures	9.7	2.8	1.7	20.8	9.0	0.4	9.0	0.5	8.2	9.7
Vehicles, plant, machinery, equipment	7.9	7.8	6.8	9.7	14.5	5.7	15.4	9.6	12.3	7.7
Current expenditure	82.5	89.4	91.5	69.6	76.6	93.9	75.6	89.9	79.4	82.6
Labour costs	45.3	50.1	38.8	44.4	55.8	55.2	55.2	32.5	33.1	26.8
Other current expenditure	37.2	39.3	52.7	25.2	20.8	38.7	20.4	57.5	46.3	55.8
Museums	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Capital expenditure	6.5	4.5	9.8	14.5	11.7	10.4	1.9	4.0	7.5	7.1
Land: buildings and other structures	1.6	1.3	5.7	8.8	6.8	7.4	0.1	2.7	2.6	2.4
Vehicles, plant, machinery, equipment	4.8	3.3	4.1	5.7	4.9	2.9	1.8	1.3	4.9	4.8
Current expenditure	93.5	95.5	90.2	85.5	88.3	89.6	98.1	96.0	92.5	92.9
Labour costs	68.6	68.7	66.4	63.2	65.8	68.2	75.5	86.8	84.7	84.6
Other current expenditure	25.0	26.7	23.8	22.3	22.5	21.4	22.6	9.2	7.8	8.2
Government sector	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Capital expenditure	11.8	8.7	7.6	20.1	18.4	9.2	17.7	10.9	15.4	15.9
Land: buildings and other structures	3.9	1.7	1.4	12.1	6.1	2.2	5.8	1.4	5.7	7.2
Vehicles, plant, machinery, equipment	7.9	7.0	6.2	8.0	12.3	7.0	11.9	9.5	9.8	8.6
Current expenditure	88.2	91.3	92.4	79.9	81.6	90.8	82.3	89.1	84.6	84.1
Labour costs	41.9	40.2	42.1	45.3	61.1	56.5	56.1	46.9	44.2	38.3
Other current expenditure	46.3	51.1	50.3	34.6	20.5	34.4	26.2	42.2	40.3	45.8

N/A: Municipal data were collected from the 2011/12 R&D survey onwards.

Table C.98: Government sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biotechnology	21 911	8 639	21 729	32 496	213 817	81 993	124 429	97 816	85 385	81 409
Nanotechnology	0	0	4 652	0	4 196	4 609	15 035	16 929	13 112	11 774
Total	**21 911**	**8 639**	**26 381**	**32 496**	**218 013**	**86 602**	**139 464**	**114 745**	**98 497**	**93 183**
Government expenditure on R&D	1 021 355	1 154 399	1 139 676	1 067 302	1 011 340	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021

Table C.99: Proportional government sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Biotechnology	2.1	0.7	1.9	3.0	21.1	6.6	8.7	5.8	4.5	4.0
Nanotechnology	0.0	0.0	0.4	0.0	0.4	0.4	1.0	1.0	0.7	0.6
Total	**2.1**	**0.7**	**2.3**	**3.0**	**21.6**	**7.0**	**9.7**	**6.8**	**5.2**	**4.6**

Table C.100: Government sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environment related	N/A	N/A	N/A	N/A	N/A	109 774	170 304	194 564	232 090	192 774
Open source software	4	21 494	4 658	7 238	7 261	1 345	1 501	0	0	0
New materials	1 054	630	726	7 156	26 166	4 107	28 708	30 945	12 062	5 291
Tuberculosis (TB), HIV/AIDS, malaria	64 750	263	240	199 977	174 382	167 522	132 264	380 640	359 074	389 279
Total	**65 808**	**22 387**	**5 624**	**214 371**	**207 809**	**282 748**	**332 777**	**411 585**	**371 135**	**587 343**
Government expenditure on R&D	1 021 355	1 154 399	1 139 676	1 067 302	1 011 340	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.101: Proportional government sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environment related	N/A	N/A	N/A	N/A	N/A	8.9	11.8	11.5	12.3	9.6
Open source software	0.0	1.9	0.4	0.7	0.7	0.1	0.1	0.0	0.0	0.0
New materials	0.1	0.1	0.1	0.7	2.6	0.3	2.0	1.8	0.6	0.3
Tuberculosis (TB), HIV/AIDS, malaria	6.3	0.0	0.0	18.7	17.2	13.6	9.2	22.4	19.0	19.3
Total	**6.4**	**1.9**	**0.5**	**20.1**	**20.5**	**22.9**	**23.1**	**24.3**	**19.6**	**29.2**

Table C.102: Government sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural Sciences, Technology and Engineering	**808 404**	**874 425**	**824 394**	**806 995**	**634 237**	**863 949**	**1 045 006**	**1 359 179**	**1 558 094**	**1 520 894**
Mathematical sciences	24 823	20 643	20 704	24 441	22 811	2 349	1 076	1 525	28 302	397
Physical sciences	24 726	45 052	45 804	12 093	0	0	5 064	0	30 154	26 455
Chemical sciences	16 622	22 672	17 009	21 698	10 653	1 223	21 823	19 394	61 881	61 688
Earth sciences	109 959	161 815	163 156	47 624	42 081	39 303	90 571	65 501	139 388	79 942
Information, computer and communication technologies	56 323	82 123	22 191	28 176	31 960	15 642	7 760	8 431	12 141	4 662
Applied sciences and technologies	31 603	15 286	15 852	9 315	4 154	10 183	32 467	23 216	29 723	22 531
Engineering sciences	26 008	14 164	11 487	14 996	4 165	4 515	10 430	11 853	13 176	12 129
Biological sciences	99 841	113 409	125 152	54 893	85 990	94 662	111 871	138 000	152 735	196 053
Agricultural sciences	170 347	208 662	200 598	274 781	225 441	362 241	460 921	397 687	506 445	471 798
Medical and health sciences	187 741	173 929	180 260	288 488	168 400	270 312	211 840	594 684	553 534	608 530
Environmental sciences	40 851	8 589	11 675	10 722	9 147	34 231	54 394	55 245	14 353	14 478
Material sciences	158	637	640	0	0	4 107	9 771	10 537	0	0
Marine sciences	19 402	7 445	9 866	19 768	29 434	25 182	27 019	33 106	16 262	22 232
Division 2: Social Sciences and Humanities	**212 951**	**279 974**	**315 282**	**260 308**	**377 103**	**371 720**	**392 503**	**337 972**	**334 916**	**492 127**
Social sciences	189 155	235 299	268 058	249 155	363 055	358 892	383 172	326 603	328 522	479 316
Humanities	23 796	44 676	47 225	11 152	14 048	12 828	9 331	11 369	6 394	12 811
Total	**1 021 355**	**1 154 399**	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**

Table C.103: Proportional government sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural Sciences, Technology and Engineering	**79.2**	**75.7**	**72.3**	**75.6**	**62.7**	**69.9**	**72.7**	**80.1**	**82.3**	**75.6**
Mathematical sciences	2.4	1.8	1.8	2.3	2.3	0.2	0.1	0.1	1.5	0.0
Physical sciences	2.4	3.9	4.0	1.1	0.0	0.0	0.4	0.0	1.6	1.3
Chemical sciences	1.6	2.0	1.5	2.0	1.1	0.1	1.5	1.1	3.3	3.1
Earth sciences	10.8	14.0	14.3	4.5	4.2	3.2	6.3	3.9	7.4	4.0

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Information, computer and communication technologies	5.5	7.1	1.9	2.6	3.2	1.3	0.5	0.5	0.6	0.2
Applied sciences and technologies	3.1	1.3	1.4	0.9	0.4	0.8	2.3	1.4	1.6	1.1
Engineering sciences	2.5	1.2	1.0	1.4	0.4	0.4	0.7	0.7	0.7	0.6
Biological sciences	9.8	9.8	11.0	5.1	8.5	7.7	7.8	8.1	8.1	9.7
Agricultural sciences	16.7	18.1	17.6	25.7	22.3	29.3	32.1	23.4	26.8	23.4
Medical and health sciences	18.4	15.1	15.8	27.0	16.7	21.9	14.7	35.0	29.2	30.2
Environmental sciences	4.0	0.7	1.0	1.0	0.9	2.8	3.8	3.3	0.8	0.7
Material sciences	0.0	0.1	0.1	0.0	0.0	0.3	0.7	0.6	0.0	0.0
Marine sciences	1.9	0.6	0.9	1.9	2.9	2.0	1.9	2.0	0.9	1.1
Division 2: Social Sciences and Humanities	**20.8**	**24.3**	**27.7**	**24.4**	**37.3**	**30.1**	**27.3**	**19.9**	**17.7**	**24.4**
Social sciences	18.5	20.4	23.5	23.3	35.9	29.0	26.7	19.2	17.4	23.8
Humanities	2.3	3.9	4.1	1.0	1.4	1.0	0.6	0.7	0.3	0.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.104: Government sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	**50 000**	**0**	**0**	**0**	**2 303**	**2 736**	**19 314**	**21 118**	**21 472**	**42 233**
Defence	50 000	0	0	0	2 303	2 736	19 314	21 118	21 472	42 233
Division 2: Economic Development	**350 497**	**429 646**	**373 251**	**438 114**	**500 343**	**469 129**	**480 373**	**510 688**	**763 932**	**745 129**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	45 951	79 290	66 503	63 570	64 400	70 754	100 956	89 446	107 672	92 506
Animal production and animal primary products	66 655	79 997	78 619	84 842	91 877	86 710	93 504	137 279	156 437	125 737
Mineral resources (excluding Energy)	0	0	0	0	0	0	0	311	5 403	6 548
Energy resources	0	0	0	0	37	0	0	1 023	12 062	5 291
Energy supply	8 905	14 290	12 387	2 522	6 154	10 552	7 193	8 482	34 845	29 705
Manufacturing	79	318	320	5 444	15 870	1 005	1 557	1 544	79 583	1 318
Construction	3 911	3 219	2 484	0	148	9 545	543	741	4 312	1 394
Transport	21 710	15 386	12 073	4 369	9 377	10 964	8 774	1 672	24 105	21 537

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Information and communication services	32 858	69 318	11 965	13 244	44 257	20 590	5 678	5 515	14 397	7 977
Commercial services	4 908	6 897	2 405	9 957	7 471	4 708	3 587	12 162	15 532	13 531
Economic framework	76 965	98 537	105 080	161 326	187 931	157 364	161 541	116 604	167 690	262 289
Natural resources	88 558	62 394	81 415	92 838	72 820	96 938	97 042	135 909	141 895	177 298
Division 3: Society	**341 911**	**265 948**	**285 961**	**326 691**	**341 387**	**538 749**	**592 285**	**872 096**	**912 216**	**952 108**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	150 704	69 493	74 784	77 845	106 522	221 435	171 741	487 130	475 983	482 472
Education and training	112 042	111 407	127 907	158 579	42 234	69 185	116 788	165 906	174 540	209 544
Social development and community services	79 165	85 048	83 270	90 268	192 630	248 129	303 756	219 061	261 693	260 092
Division 4: Environment	**105 792**	**103 372**	**99 985**	**72 614**	**85 347**	**130 742**	**199 677**	**172 006**	**127 394**	**191 334**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	74 710	71 734	83 429	45 360	40 610	83 089	137 679	124 445	91 677	107 265
Environmental aspects of development	8 112	20 797	12 424	18 153	27 635	38 467	51 795	38 877	27 206	53 541
Environmental and other aspects	22 970	10 841	4 132	9 101	17 102	9 186	10 204	8 684	8 511	30 528
Division 5: Advancement of Knowledge	**173 155**	**355 434**	**380 480**	**229 883**	**81 960**	**94 314**	**145 860**	**121 243**	**67 996**	**82 217**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	149 847	324 409	333 561	205 995	50 968	61 357	120 173	96 381	43 170	58 401
Social sciences and humanities	23 309	31 025	46 919	23 888	30 992	32 956	25 687	24 862	24 825	23 816
Total	**1 021 355**	**1 154 400**	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**

Table C.105: Proportional government sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**4.9**	**0.0**	**0.0**	**0.0**	**0.2**	**0.2**	**1.3**	**1.2**	**1.1**	**2.1**
Defence	4.9	0.0	0.0	0.0	0.2	0.2	1.3	1.2	1.1	2.1
Division 2: Economic Development	**34.3**	**37.2**	**32.8**	**41.0**	**49.5**	**38.0**	**33.4**	**30.1**	**40.4**	**37.0**
Economic Development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	4.5	6.9	5.8	6.0	6.4	5.7	7.0	5.3	5.7	4.6
Animal production and animal primary products	6.5	6.9	6.9	7.9	9.1	7.0	6.5	8.1	8.3	6.2
Mineral resources (excluding Energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3
Energy resources	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.3
Energy supply	0.9	1.2	1.1	0.2	0.6	0.9	0.5	0.5	1.8	1.5
Manufacturing	0.0	0.0	0.0	0.5	1.6	0.1	0.1	0.1	4.2	0.1
Construction	0.4	0.3	0.2	0.0	0.0	0.8	0.0	0.0	0.2	0.1
Transport	2.1	1.3	1.1	0.4	0.9	0.9	0.6	0.1	1.3	1.1
Information and communication services	3.2	6.0	1.0	1.2	4.4	1.7	0.4	0.3	0.8	0.4
Commercial services	0.5	0.6	0.2	0.9	0.7	0.4	0.2	0.7	0.8	0.7
Economic framework	7.5	8.5	9.2	15.1	18.6	12.7	11.2	6.9	8.9	13.0
Natural resources	8.7	5.4	7.1	8.7	7.2	7.8	6.8	8.0	7.5	8.8
Division 3: Society	**33.5**	**23.0**	**25.1**	**30.6**	**33.8**	**43.6**	**41.2**	**51.4**	**48.2**	**47.3**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	14.8	6.0	6.6	7.3	10.5	17.9	11.9	28.7	25.1	24.0
Education and training	11.0	9.7	11.2	14.9	4.2	5.6	8.1	9.8	9.2	10.4
Social development and community services	7.8	7.4	7.3	8.5	19.0	20.1	21.1	12.9	13.8	12.9
Division 4: Environment	**10.4**	**9.0**	**8.8**	**6.8**	**8.4**	**10.6**	**13.9**	**10.1**	**6.7**	**9.5**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	7.3	6.2	7.3	4.2	4.0	6.7	9.6	7.3	4.8	5.3
Environmental aspects of development	0.8	1.8	1.1	1.7	2.7	3.1	3.6	2.3	1.4	2.7

SOCIO-ECONOMIC OBJECTIVE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	2.2	0.9	0.4	0.9	1.7	0.7	0.7	0.5	0.4	1.5
Division 5: Advancement of Knowledge	**17.0**	**30.8**	**33.4**	**21.5**	**8.1**	**7.6**	**10.1**	**7.1**	**3.6**	**4.1**
Advancement of Knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	14.7	28.1	29.3	19.3	5.0	5.0	8.4	5.7	2.3	2.9
Social sciences and humanities	2.3	2.7	4.1	2.2	3.1	2.7	1.8	1.5	1.3	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.106: Government sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	109 779	122 191	107 929	100 100	114 127	127 415	194 258	133 657	227 427	225 603
Free State	69 314	62 116	58 697	46 155	39 998	44 200	38 659	55 095	60 860	61 802
Gauteng	321 176	292 757	264 273	396 124	343 096	447 635	427 173	689 915	760 199	832 397
KwaZulu-Natal	84 192	76 458	115 302	54 914	48 056	126 857	168 029	161 962	177 517	187 088
Limpopo	31 118	40 217	55 252	60 421	57 797	65 017	74 621	95 668	83 683	84 232
Mpumalanga	50 568	74 690	39 103	68 796	69 980	78 335	80 201	77 479	93 566	112 173
North-West	32 889	42 500	70 741	29 176	43 048	44 618	45 573	73 576	56 719	61 815
Northern Cape	64 733	66 921	52 907	77 978	58 918	63 556	75 440	61 932	52 579	69 174
Western Cape	257 586	376 550	375 473	233 639	236 320	238 035	333 555	347 869	380 461	378 737
Total	**1 021 355**	**1 154 399**	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**

Table C.107: Proportional government sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	10.7	10.6	9.5	9.4	11.3	10.3	13.5	7.9	12.0	11.2
Free State	6.8	5.4	5.2	4.3	4.0	3.6	2.7	3.2	3.2	3.1
Gauteng	31.4	25.4	23.2	37.1	33.9	36.2	29.7	40.7	40.2	41.4
KwaZulu-Natal	8.2	6.6	10.1	5.1	4.8	10.3	11.7	9.5	9.4	9.3
Limpopo	3.0	3.5	4.8	5.7	5.7	5.3	5.2	5.6	4.4	4.2
Mpumalanga	5.0	6.5	3.4	6.4	6.9	6.3	5.6	4.6	4.9	5.6
North-West	3.2	3.7	6.2	2.7	4.3	3.6	3.2	4.3	3.0	3.1
Northern Cape	6.3	5.8	4.6	7.3	5.8	5.1	5.2	3.6	2.8	3.4
Western Cape	25.2	32.6	32.9	21.9	23.4	19.3	23.2	20.5	20.1	18.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.108: Government sector R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2006/07	2924	1111	831	982	2068.3	784.6	555.7	728.0
2007/08	2794	1138	739	917	1950.0	757.6	495.6	696.9
2008/09	2963	1169	744	1050	2073.9	805.0	495.2	773.7
2009/10	2580	986	509	1085	1903.9	680.4	356.8	866.7
2010/11	2704	1184	421	1099	2178.6	874.2	352.9	951.6
2011/12	3143	1411	432	1300	2404.5	1009.8	330.4	1 064.3
2012/13	3252	1409	517	1326	2597.0	1091.4	385.8	1 119.9
2013/14	2874	1229	518	1127	2245.5	923.7	366.3	955.4
2014/15	2893	1343	550	1000	2181.5	970.0	337.9	873.5
2015/16	2997	1573	537	887	2056.2	953.9	365.7	736.7

Table C.109: Government sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	1 229	586	643	923.7	456.8	466.9	75.2
Technicians directly supporting R&D	518	280	238	366.3	206.0	160.3	70.7
Other personnel directly supporting R&D	1 127	746	381	955.4	650.8	304.7	84.8
Total	**2 874**	**1 612**	**1 262**	**2 245.5**	**1 313.6**	**931.9**	**78.1**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	1 343	615	728	970.0	460.1	509.9	72.2
Technicians directly supporting R&D	550	298	252	337.9	200.1	137.8	61.4
Other personnel directly supporting R&D	1 000	680	320	873.5	617.6	255.9	87.3
Total	**2 893**	**1 593**	**1 300**	**2 181.5**	**1 277.8**	**903.6**	**75.4**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	1 573	727	846	953.9	462.6	491.3	60.6
Technicians directly supporting R&D	537	290	247	365.7	204.3	161.5	68.1
Other personnel directly supporting R&D	887	576	311	736.7	502.7	234.0	83.0
Total	**2 997**	**1 593**	**1 404**	**2 056.2**	**1 169.5**	**886.7**	**68.6**

Table C.110: Government sector R&D personnel in headcounts by occupation, qualification, population group and gender (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**1 573**	**727**	**846**	**392**	**434**	**47**	**62**	**35**	**75**	**253**	**275**
Doctoral degree or equivalent	291	155	136	44	24	9	4	11	15	91	93
Masters, honours, bachelor or equivalent	1 179	527	652	322	367	34	54	21	55	150	176
Diplomas	103	45	58	26	43	4	4	3	5	12	6
Technicians directly supporting R&D	**537**	**290**	**247**	**178**	**146**	**38**	**29**	**7**	**12**	**67**	**60**
Doctoral degree or equivalent	4	2	2	1	0	0	0	0	0	1	2
Masters, honours, bachelor or equivalent	301	160	141	114	86	9	14	6	8	31	33
Diplomas	232	128	104	63	60	29	15	1	4	35	25
Other personnel directly supporting R&D	**887**	**576**	**311**	**409**	**195**	**135**	**51**	**1**	**8**	**31**	**57**
Doctoral degree or equivalent	1	0	1	0	0	0	0	0	0	0	1
Masters, honours, bachelor or equivalent	44	16	28	8	11	2	5	0	2	6	10
Diplomas	842	560	282	401	184	133	46	1	6	25	46
Total	**2 997**	**1 593**	**1 404**	**979**	**775**	**220**	**142**	**43**	**95**	**351**	**392**

C.2.4. Science councils sector

Table C.111: Science councils sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	647 191	804 731	776 406	776 505	871 635	900 830	937 826	970 785	1 166 491	1 348 533
Applied research	1 328 996	1 314 770	1 384 860	1 552 560	1 531 563	1 756 157	1 885 484	2 114 943	2 421 309	2 781 198
Experimental research	768 531	766 593	976 077	1 129 009	1 192 825	1 072 693	1 202 689	1 218 827	1 416 869	1 611 166
Total	**2 744 718**	**2 886 094**	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**

Table C.112: Proportional science councils sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Basic research	23.6	27.9	24.7	22.5	24.2	24.2	23.3	22.6	23.3	23.5
Applied research	48.4	45.6	44.1	44.9	42.6	47.1	46.8	49.1	48.4	48.4
Experimental research	28.0	26.6	31.1	32.6	33.2	28.8	29.9	28.3	28.3	28.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.113: Science councils sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Capital expenditure	212 625	205 857	383 927	452 801	291 830	323 070	275 750	323 190	598 429	916 480
Land: buildings & other structures	53 713	30 704	61 063	107 455	56 141	65 442	68 565	71 602	362 246	162 904
Vehicles, plant, machinery, equipment	158 912	175 153	322 864	345 346	235 689	257 628	207 185	251 588	236 183	753 576
Current expenditure	2 532 093	2 680 237	2 753 416	3 005 273	3 304 193	3 406 610	3 750 248	3 981 366	4 406 240	4 824 418
Labour costs	1 162 633	1 250 480	1 283 210	1 413 128	1 293 033	1 531 460	2 053 204	2 187 401	1 986 918	2 142 875
Other current expenditure	1 369 460	1 429 757	1 470 206	1 592 145	2 011 160	1 875 150	1 697 044	1 793 965	2 419 322	2 681 543
Total	**2 744 718**	**2 886 094**	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**

Table C.114: Proportional science councils sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Capital expenditure	7.7	7.1	12.2	13.1	8.1	8.7	6.8	7.5	12.0	16.0
Land: buildings & other structures	2.0	1.1	1.9	3.1	1.6	1.8	1.7	1.7	7.2	2.8
Vehicles, plant, machinery, equipment	5.8	6.1	10.3	10.0	6.6	6.9	5.1	5.8	4.7	13.1
Current expenditure	92.3	92.9	87.8	86.9	91.9	91.3	93.2	92.5	88.0	84.0
Labour costs	42.4	43.3	40.9	40.9	36.0	41.1	51.0	50.8	39.7	37.3
Other current expenditure	49.9	49.5	46.9	46.0	55.9	50.3	42.2	41.7	48.3	46.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.115: Science councils sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biotechnology	222 190	216 292	207 250	183 844	199 934	208 466	145 671	143 868	312 793	320 048
Nanotechnology	14 031	47 802	173 834	117 215	101 386	102 007	118 555	114 990	125 107	139 107
Total	**236 221**	**264 094**	**381 084**	**301 058**	**301 320**	**310 473**	**264 226**	**258 857**	**437 900**	**459 154**
Science councils expenditure on R&D	2 744 718	2 886 094	3 137 343	3 458 074	3 596 023	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897

Table C.116: Science councils sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Biotechnology	8.1	7.5	6.6	5.3	5.6	5.6	3.6	3.3	6.3	5.6
Nanotechnology	0.5	1.7	5.5	3.4	2.8	2.7	2.9	2.7	2.5	2.4
Total	**8.6**	**9.2**	**12.1**	**8.7**	**8.4**	**8.3**	**6.6**	**6.0**	**8.7**	**8.0**

Table C.117: Science councils sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environment related	N/A	N/A	N/A	N/A	N/A	770 339	378 782	297 097	1 037 320	1 054 651
Open source software	27 510	77 885	67 833	15 013	7 228	15 982	36 636	0	389 871	692 096
New materials	82 990	64 131	157 134	94 304	201 071	197 430	751 305	229 854	358 361	374 463
Tuberculosis (TB), HIV/AIDS, malaria	180 104	233 917	490 982	333 841	386 948	399 070	455 311	398 880	346 751	470 488
Total	**290 604**	**375 933**	**715 949**	**443 158**	**595 247**	**1 382 821**	**1 622 034**	**925 831**	**2 132 304**	**2 591 697**
Science councils expenditure on R&D	2 744 718	2 886 094	3 137 343	3 458 074	3 596 023	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.118: Proportional science councils sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF INTEREST	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environment related	N/A	N/A	N/A	N/A	N/A	20.7	9.4	6.9	20.7	18.4
Open source software	1.0	2.7	2.2	0.4	0.2	0.4	0.9	0.0	7.8	12.1
New materials	3.0	2.2	5.0	2.7	5.6	5.3	18.7	5.3	7.2	6.5
Tuberculosis (TB), HIV/AIDS, malaria	6.6	8.1	15.6	9.7	10.8	10.7	11.3	9.3	6.9	8.2
Total	**10.6**	**13.0**	**22.8**	**12.8**	**16.6**	**37.1**	**40.3**	**21.5**	**42.6**	**45.1**

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.119: Science councils sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural Sciences, Technology and Engineering	**2 530 246**	**2 623 455**	**2 916 350**	**3 258 392**	**3 414 985**	**3 517 520**	**3 819 642**	**4 109 105**	**4 800 742**	**5 486 847**
Mathematical sciences	27 129	35 551	40 632	37 678	113 396	117 637	134 046	128 291	48 258	54 212
Physical sciences	126 542	93 583	115 737	87 221	97 922	120 267	123 267	129 568	263 302	418 648
Chemical sciences	33 774	37 430	44 271	49 462	8 074	20 972	14 078	18 166	63 775	71 024
Earth sciences	130 879	147 427	167 463	179 999	94 642	100 921	112 406	110 092	162 880	181 876

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Information, computer and communication technologies	133 328	212 796	201 731	265 191	161 282	168 115	181 521	182 402	780 044	977 891
Applied sciences and technologies	126 107	138 849	139 267	153 830	924 104	954 616	1 092 098	1 046 934	277 649	296 162
Engineering sciences	642 923	643 349	863 084	947 315	365 980	278 125	292 940	349 666	1 001 486	1 107 289
Biological sciences	306 056	175 592	171 810	200 625	437 938	425 036	485 673	482 728	148 268	144 341
Agricultural sciences	521 454	566 561	442 060	647 750	479 449	582 438	594 638	859 600	1 075 165	1 043 494
Medical and health sciences	340 764	358 726	447 479	440 895	428 642	443 156	426 520	430 472	596 600	775 858
Environmental sciences	72 191	85 414	101 920	112 327	273 283	284 116	330 667	326 122	228 909	240 075
Material sciences	51 020	108 068	155 529	106 411	23 199	15 462	22 905	35 093	113 457	133 231
Marine sciences	18 078	20 108	25 368	29 689	7 073	6 656	8 885	9 970	40 949	42 747
Division 2: Social Sciences and Humanities	**214 472**	**262 639**	**220 993**	**199 682**	**181 038**	**212 160**	**206 356**	**195 452**	**203 927**	**254 050**
Social sciences	194 040	238 019	194 646	182 431	164 954	190 845	186 132	173 407	179 456	223 966
Humanities	20 432	24 620	26 347	17 250	16 084	21 315	20 224	22 044	24 471	30 084
Total	**2 744 718**	**2 886 094**	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**

Table C.120: Proportional science councils sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural Sciences, Technology and Engineering	**92.2**	**90.9**	**93.0**	**94.2**	**95.0**	**94.3**	**94.9**	**95.5**	**95.9**	**95.6**
Mathematical sciences	1.0	1.2	1.3	1.1	3.2	3.2	3.3	3.0	1.0	0.9
Physical sciences	4.6	3.2	3.7	2.5	2.7	3.2	3.1	3.0	5.3	7.3
Chemical sciences	1.2	1.3	1.4	1.4	0.2	0.6	0.3	0.4	1.3	1.2
Earth sciences	4.8	5.1	5.3	5.2	2.6	2.7	2.8	2.6	3.3	3.2
Information, computer and communication technologies	4.9	7.4	6.4	7.7	4.5	4.5	4.5	4.2	15.6	17.0
Applied sciences and technologies	4.6	4.8	4.4	4.4	25.7	25.6	27.1	24.3	5.5	5.2
Engineering sciences	23.4	22.3	27.5	27.4	10.2	7.5	7.3	8.1	20.0	19.3
Biological sciences	11.2	6.1	5.5	5.8	12.2	11.4	12.1	11.2	3.0	2.5
Agricultural sciences	19.0	19.6	14.1	18.7	13.3	15.6	14.8	20.0	21.5	18.2
Medical and health sciences	12.4	12.4	14.3	12.7	11.9	11.9	10.6	10.0	11.9	13.5

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environmental sciences	2.6	3.0	3.2	3.2	7.6	7.6	8.2	7.6	4.6	4.2
Material sciences	1.9	3.7	5.0	3.1	0.6	0.4	0.6	0.8	2.3	2.3
Marine sciences	0.7	0.7	0.8	0.9	0.2	0.2	0.2	0.2	0.8	0.7
Division 2: Social Sciences and Humanities	**7.8**	**9.1**	**7.0**	**5.8**	**5.0**	**5.7**	**5.1**	**4.5**	**4.1**	**4.4**
Social sciences	7.1	8.2	6.2	5.3	4.6	5.1	4.6	4.0	3.6	3.9
Humanities	0.7	0.9	0.8	0.5	0.4	0.6	0.5	0.5	0.5	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.121: Science councils sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	**260 354**	**228 603**	**280 219**	**311 288**	**228 376**	**243 083**	**279 989**	**262 203**	**762 464**	**826 261**
Defence	260 354	228 603	280 219	311 288	228 376	243 083	279 989	262 203	762 464	826 261
Division 2: Economic Development	**1 172 607**	**1 560 688**	**1 592 110**	**1 834 253**	**2 111 033**	**2 191 098**	**2 400 747**	**2 686 504**	**2 306 795**	**2 529 244**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	332 655	433 850	349 907	485 470	478 437	448 531	473 133	624 675	413 737	396 612
Animal production and animal primary products	115 649	25 124	18 760	27 043	25 193	280 542	287 431	419 259	269 519	247 883
Mineral resources (excluding Energy)	62 585	63 469	67 418	387 531	294 203	202 919	213 007	234 273	232 114	265 006
Energy resources	51 257	38 979	379 859	32 136	90 342	94 385	108 360	106 823	5 590	5 063
Energy supply	8 033	874	0	0	0	14 715	13 237	2 937	0	0
Manufacturing	130 396	385 822	225 227	262 443	366 380	351 021	400 864	393 152	88 746	146 395
Construction	149 809	101 232	116 781	129 922	222 124	220 595	256 024	245 333	31 034	60 828
Transport	30 943	33 817	41 260	45 848	0	0	0	0	0	0
Information and communication services	25 177	17 429	24 146	68 506	115 342	127 021	141 495	135 629	396 310	419 252
Commercial services	3 546	8 975	19 536	5 465	14 152	15 522	25 053	19 724	5 236	5 671
Economic framework	85 194	206 878	106 105	84 205	97 367	72 109	70 509	75 411	537 499	664 440
Natural resources	177 363	244 239	243 111	305 685	407 492	363 738	411 634	429 288	327 009	318 094
Division 3: Society	**359 982**	**368 010**	**418 385**	**453 428**	**388 244**	**430 876**	**413 060**	**425 943**	**801 370**	**977 159**
Society unclassified	0	0	0	0	0	0	0	0	0	0

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Health	240 248	272 905	326 340	348 407	310 760	326 500	314 412	316 987	424 639	552 314
Education and training	56 054	37 449	50 525	65 761	50 676	68 852	64 941	72 216	335 946	374 704
Social development and community services	63 680	57 656	41 520	39 260	26 807	35 525	33 707	36 741	40 785	50 141
Division 4: Environment	**225 563**	**263 325**	**338 290**	**355 484**	**52 334**	**31 241**	**39 169**	**46 559**	**422 650**	**455 404**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	120 806	130 041	173 945	190 926	24 043	19 956	22 939	28 295	402 820	426 582
Environmental aspects of development	50 877	46 190	59 943	48 262	19 333	8 623	13 665	14 071	15 824	14 179
Environmental and other aspects	53 880	87 094	104 402	116 296	8 958	2 662	2 565	4 194	4 006	14 644
Division 5: Advancement of Knowledge	**726 212**	**465 468**	**508 339**	**503 621**	**816 035**	**833 382**	**893 033**	**883 346**	**711 390**	**952 830**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	616 487	361 714	407 189	381 098	674 421	694 254	760 107	746 397	422 429	620 283
Social sciences and humanities	109 725	103 754	101 150	122 523	141 614	139 127	132 926	136 949	288 961	332 547
Total	**2 744 718**	**2 886 094**	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**

Table C.122: Proportional science councils sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**9.5**	**7.9**	**8.9**	**9.0**	**6.4**	**6.5**	**7.0**	**6.1**	**15.2**	**14.4**
Defence	9.5	7.9	8.9	9.0	6.4	6.5	7.0	6.1	15.2	14.4
Division 2: Economic Development	**42.7**	**54.1**	**50.7**	**53.0**	**58.7**	**58.7**	**59.6**	**62.4**	**46.1**	**44.1**
Economic Development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	12.1	15.0	11.2	14.0	13.3	12.0	11.8	14.5	8.3	6.9
Animal production and animal primary products	4.2	0.9	0.6	0.8	0.7	7.5	7.1	9.7	5.4	4.3

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Mineral resources (excluding Energy)	2.3	2.2	2.1	11.2	8.2	5.4	5.3	5.4	4.6	4.6
Energy resources	1.9	1.4	12.1	0.9	2.5	2.5	2.7	2.5	0.1	0.1
Energy supply	0.3	0.0	0.0	0.0	0.0	0.4	0.3	0.1	0.0	0.0
Manufacturing	4.8	13.4	7.2	7.6	10.2	9.4	10.0	9.1	1.8	2.6
Construction	5.5	3.5	3.7	3.8	6.2	5.9	6.4	5.7	0.6	1.1
Transport	1.1	1.2	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Information and communication services	0.9	0.6	0.8	2.0	3.2	3.4	3.5	3.2	7.9	7.3
Commercial services	0.1	0.3	0.6	0.2	0.4	0.4	0.6	0.5	0.1	0.1
Economic framework	3.1	7.2	3.4	2.4	2.7	1.9	1.8	1.8	10.7	11.6
Natural resources	6.5	8.5	7.7	8.8	11.3	9.8	10.2	10.0	6.5	5.5
Division 3: Society	**13.1**	**12.8**	**13.3**	**13.1**	**10.8**	**11.6**	**10.3**	**9.9**	**16.0**	**17.0**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	8.8	9.5	10.4	10.1	8.6	8.8	7.8	7.4	8.5	9.6
Education and training	2.0	1.3	1.6	1.9	1.4	1.8	1.6	1.7	6.7	6.5
Social development and community services	2.3	2.0	1.3	1.1	0.7	1.0	0.8	0.9	0.8	0.9
Division 4: Environment	**8.2**	**9.1**	**10.8**	**10.3**	**1.5**	**0.8**	**1.0**	**1.1**	**8.4**	**7.9**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	4.4	4.5	5.5	5.5	0.7	0.5	0.6	0.7	8.0	7.4
Environmental aspects of development	1.9	1.6	1.9	1.4	0.5	0.2	0.3	0.3	0.3	0.2
Environmental and other aspects	2.0	3.0	3.3	3.4	0.2	0.1	0.1	0.1	0.1	0.3
Division 5: Advancement of Knowledge	**26.5**	**16.1**	**16.2**	**14.6**	**22.7**	**22.3**	**22.2**	**20.5**	**14.2**	**16.6**
Advancement of Knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	22.5	12.5	13.0	11.0	18.8	18.6	18.9	17.3	8.4	10.8
Social sciences and humanities	4.0	3.6	3.2	3.5	3.9	3.7	3.3	3.2	5.8	5.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.123: Science councils sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	131 126	138 342	171 669	155 501	150 665	178 594	182 664	115 925	259 128	269 658
Free State	52 773	67 901	58 561	74 355	60 443	37 138	39 054	47 271	58 608	59 953
Gauteng	1 546 032	1 809 272	1 991 853	2 219 609	2 327 712	2 287 762	2 537 028	3 062 983	2 745 142	2 998 643
KwaZulu-Natal	267 620	201 009	231 033	235 432	249 137	292 246	307 302	239 387	484 142	575 016
Limpopo	69 808	67 562	63 455	78 662	66 250	99 104	105 150	7 286	117 270	111 649
Mpumalanga	69 859	66 333	55 547	66 881	55 690	100 476	103 468	62 349	124 613	122 432
North-West	72 968	49 390	41 541	51 295	42 854	104 139	110 361	39 615	153 911	153 676
Northern Cape	55 676	45 250	43 624	35 253	64 774	81 998	78 714	122 454	148 387	218 317
Western Cape	478 856	441 036	480 059	541 086	578 497	548 223	562 256	607 285	913 468	1 231 555
Total	**2 744 718**	**2 886 094**	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**

Table C.124: Proportional science councils sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	4.8	4.8	5.5	4.5	4.2	4.8	4.5	2.7	5.2	4.7
Free State	1.9	2.4	1.9	2.2	1.7	1.0	1.0	1.1	1.2	1.0
Gauteng	56.3	62.7	63.5	64.2	64.7	61.3	63.0	71.2	54.9	52.2
KwaZulu-Natal	9.8	7.0	7.4	6.8	6.9	7.8	7.6	5.6	9.7	10.0
Limpopo	2.5	2.3	2.0	2.3	1.8	2.7	2.6	0.2	2.3	1.9
Mpumalanga	2.5	2.3	1.8	1.9	1.5	2.7	2.6	1.4	2.5	2.1
North-West	2.7	1.7	1.3	1.5	1.2	2.8	2.7	0.9	3.1	2.7
Northern Cape	2.0	1.6	1.4	1.0	1.8	2.2	2.0	2.8	3.0	3.8
Western Cape	17.4	15.3	15.3	15.6	16.1	14.7	14.0	14.1	18.3	21.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.125: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2006/07	5 798	2 255	1 570	1 973	4 956.1	1 982.7	1 342.1	1 631.3
2007/08	5 988	2 594	1 351	2 043	5 058.8	2 300.2	1 099.2	1 659.4
2008/09	5 609	2 648	1 302	1 659	4 699.9	2 246.7	1 119.1	1 334.0
2009/10	5 926	2 669	1 381	1 876	4 782.7	2 251.5	1 179.4	1 351.8
2010/11	4 923	1 941	1 336	1 646	4 312.4	1 777.3	1 155.5	1 379.6
2011/12	4 494	1 803	1 333	1 358	3 803.5	1 634.9	1 172.4	996.1
2012/13	5 399	1 879	1 403	2 117	4 748.5	1 697.1	1 279.6	1 771.8
2013/14	5 884	1 956	1 396	2 532	5 164.5	1 781.3	1 247.3	2 136
2014/15	4 836	1 988	1 857	991	4 180.4	1 765.4	1 686.2	728.9
2015/16	5 162	2 072	1 839	1251	4361.2	1827.1	1683.7	850.3

Table C.126: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	1 956	1 101	855	1781.3	993.8	787.5	91.1
Technicians directly supporting R&D	1 396	814	582	1247.3	724.9	522.4	89.3
Other personnel directly supporting R&D	2 532	1 308	1 224	2136.0	1034.2	1101.8	84.4
Total	**5 884**	**3 223**	**2 661**	**5164.5**	**2752.8**	**2411.7**	**87.8**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	1 988	1 154	834	1765.4	1016.5	748.9	88.8
Technicians directly supporting R&D	1 857	1 077	780	1686.2	959.9	726.3	90.8
Other personnel directly supporting R&D	991	564	427	728.9	364.7	364.2	73.6
Total	**4 836**	**2 795**	**2 041**	**4180.4**	**2341.1**	**1839.4**	**86.4**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	2 072	1 174	898	1827.2	1036.4	790.8	88.2
Technicians directly supporting R&D	1 839	1 088	751	1683.7	973.3	710.4	91.6
Other personnel directly supporting R&D	1 251	671	580	850.4	409.4	441.0	68.0
Total	**5 162**	**2 933**	**2 229**	**4361.2**	**2419.1**	**1942.2**	**84.5**

Table C.127: Science councils sector R&D personnel in headcounts by occupation, qualification, population group and gender (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**2 072**	**1 174**	**898**	**540**	**391**	**60**	**69**	**83**	**95**	**491**	**343**
Doctoral degree or equivalent	858	532	326	222	96	29	28	31	34	250	168
Masters, honours, bachelor or equivalent	1 168	610	558	310	286	27	41	51	58	222	173
Diplomas	46	32	14	8	9	4	0	1	3	19	2
Technicians directly supporting R&D	**1 839**	**1 088**	**751**	**589**	**437**	**88**	**36**	**55**	**72**	**356**	**206**
Doctoral degree or equivalent	51	44	7	8	2	0	0	3	3	33	2
Masters, honours, bachelor or equivalent	982	524	458	269	250	25	21	42	55	188	132
Diplomas	806	520	286	312	185	63	15	10	14	135	72
Other personnel directly supporting R&D	**1 251**	**671**	**580**	**490**	**378**	**50**	**74**	**37**	**40**	**94**	**88**
Doctoral degree or equivalent	32	24	8	11	5	3	0	1	1	9	2
Masters, honours, bachelor or equivalent	557	265	292	158	182	16	17	28	31	63	62
Diplomas	662	382	280	321	191	31	57	8	8	22	24
Total	**5 162**	**2 933**	**2 229**	**1 619**	**1 206**	**198**	**179**	**175**	**207**	**941**	**637**

Table C.128: Science councils sector overview (2014/15 and 2015/16)

SCIENCE COUNCILS	2014/15				2015/16			
	R&D EXPENDITURE	RESEARCHERS	BASIC RESEARCH	CAPITAL EXPENDITURE	R&D EXPENDITURE	RESEARCHERS	BASIC RESEARCH	CAPITAL EXPENDITURE
	R'000	FTEs	R'000	R'000	R'000	FTEs	R'000	R'000
Agricultural Research Council	1 034 342	472.0	206 868	111 103	991 531	542.0	198 306	54 231
Council for Scientific and Industrial Research	2 198 138	622.0	219 814	209 682	2 342 179	631.0	234 218	308 043
Council for Geoscience	130 903	81.0	26 181	31 113	141 787	94.9	28 357	40 002
Human Science Research Council	271 903	98.4	54 381	4 416	334 271	143.2	66 854	15 342
Medical Research Council	544 480	208.0	326 688	7 783	719 738	1710	431 843	42 751
Mintek	288 189	136.2	89 338	23 556	338 956	105.6	67 791	38 730
National Research Foundation	536 714	147.8	243 221	210 776	872 436	139.4	321 163	417 381
Total	**5 004 669**	**1 765.40**	**1 166 491**	**598 429**	**5 740 897**	**1827.2**	**1 348 533**	**916 480**

C.2.5. Higher education sector

The HE sector in 2015/16 obtained improved responses amounting to an additional R772 558 000 to previous estimates of HERD in 2014/15, contributing 7.8% of HERD in 2015/16. This needs to be borne in mind when making inferences on trends in the HE sector.

Table C.129: Higher education sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	1 348 299	1 709 334	1 965 121	2 459 733	2 634 722	3 290 328	3 843 906	3 785 149	4 601 453	5 395 693
Applied research	1 282 627	1 262 425	1 468 624	1 729 496	1 890 185	2 279 175	2 390 090	2 412 316	2 649 558	3 176 685
Experimental research	667 882	650 102	757 621	911 994	899 695	1 039 712	1 099 157	1 095 388	1 126 565	1 304 245
Total	**3 298 808**	**3 621 861**	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**

Table C.130: Proportional higher education sector R&D expenditure by type of research (2006/07 to 2015/16)

TYPE OF RESEARCH	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Basic research	40.9	47.2	46.9	48.2	48.6	49.8	52.4	51.9	54.9	54.6
Applied research	38.9	34.9	35.0	33.9	34.8	34.5	32.6	33.1	31.6	32.2
Experimental research	20.2	17.9	18.1	17.9	16.6	15.7	15.0	15.0	13.4	13.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.131: Higher education sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Capital expenditure	216 037	295 813	281 193	376 057	393 758	564 179	602 116	706 336	779 789	1 141 349
Land: buildings & other structures	69 123	51 734	38 564	97 533	146 602	137 530	192 324	256 114	200 253	198 032
Vehicles, plant, machinery, equipment	146 914	244 079	242 629	278 524	247 156	426 649	409 792	450 222	579 536	943 317
Current expenditure	3 082 771	3 326 049	3 910 173	4 725 167	5 030 844	6 045 037	6 731 037	6 586 517	7 597 786	8 735 274
Labour costs	1 376 395	1 466 379	1 504 542	1 710 183	1 883 176	2 481 322	2 996 929.0	3 248 542.0	3 539 733.2	3 576 140
Total cost of R&D postgraduate students	438 486	495 128	532 883	581 140	756 930	1 074 207	1 186 653.0	1 224 611	1 579 088	1 926 301
Other current expenditure	1 267 890	1 364 542	1 872 748	2 433 844	2 390 738	2 489 508	2 547 455	2 113 364	2 478 965	3 232 833
Total	**3 298 808**	**3 621 862**	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**

Table C.132: Proportional higher education sector R&D expenditure by accounting category (2006/07 to 2015/16)

TYPE OF EXPENDITURE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Capital expenditure	6.5	8.2	6.7	7.4	7.3	8.5	8.2	9.7	9.3	11.6
Land: buildings & other structures	2.1	1.4	0.9	1.9	2.7	2.1	2.6	3.5	2.4	2.0
Vehicles, plant, machinery, equipment	4.5	6.7	5.8	5.5	4.6	6.5	5.6	6.2	6.9	9.6
Current expenditure	93.5	91.8	93.3	92.6	92.7	91.5	91.8	90.3	90.7	88.4
Labour costs	41.7	40.5	35.9	33.5	34.7	37.5	40.9	44.5	42.3	36.2
Total cost of R&D postgraduate students	13.3	13.7	12.7	11.4	14.0	16.3	16.2	16.8	18.8	19.5
Other current expenditure	38.4	37.7	44.7	47.7	44.1	37.7	34.7	29.0	29.6	32.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.133: Higher education sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Biotechnology	215 606	253 872	303 483	366 900	381 225	344 039	380 727	406 285	470 837	553 562
Nanotechnology	140 998	170 405	153 013	156 176	204 802	317 649	293 300	356 826	393 137	505 380
Total	**356 604**	**424 277**	**456 496**	**523 076**	**586 027**	**661 688**	**674 028**	**763 111**	**863 974**	**1 058 942**
Higher Education expenditure on R&D	3 298 808	3 621 862	4 191 366	5 101 224	5 424 602	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623

Table C.134: Proportional higher education sector expenditure on multidisciplinary areas of R&D (2006/07 to 2015/16)

MULTI-DISCIPLINARY AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Biotechnology	6.5	7.0	7.2	7.2	7.0	5.2	5.2	5.6	5.6	5.6
Nanotechnology	4.3	4.7	3.7	3.1	3.8	4.8	4.0	4.9	4.7	5.1
Total	**10.8**	**11.7**	**10.9**	**10.3**	**10.8**	**10.0**	**9.2**	**10.5**	**10.3**	**10.7**

Table C.135: Higher education sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF R&D	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Environment related	N/A	N/A	N/A	N/A	N/A	770 339	300 006	340 386	499 958	583 723
Open source software	41 441	41 234	49 532	58 643	75 195	15 982	85 508	105 008	117 646	125 883
New materials	135 803	160 993	202 242	283 711	266 419	197 430	321 744	381 136	436 975	462 962
Tuberculosis (TB), HIV/AIDS, malaria	391 002	583 726	650 502	815 431	845 216	399 070	714 966	794 810	845 245	944 490
Total	**568 246**	**785 953**	**902 276**	**1 157 785**	**1 186 830**	**1 382 821**	**1 422 224**	**1 621 339**	**1 899 823**	**2 117 058**
Higher Education expenditure on R&D	3 298 808	3 621 862	4 191 366	5 101 224	5 424 602	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.136: Proportional higher education sector R&D expenditure on selected areas of interest (2006/07 to 2015/16)

AREA OF R&D	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environment related	N/A	N/A	N/A	N/A	N/A	11.7	4.1	4.7	6.0	5.9
Open source software	1.3	1.1	1.2	1.1	1.4	0.2	1.2	1.4	1.4	1.3
New materials	4.1	4.4	4.8	5.6	4.9	3.0	4.4	5.2	5.2	4.7
Tuberculosis (TB), HIV/AIDS, malaria	11.9	16.1	15.5	16.0	15.6	6.0	9.7	10.9	10.1	9.6
Total	**17.2**	**21.7**	**21.5**	**22.7**	**21.9**	**20.9**	**19.4**	**22.2**	**22.7**	**21.4**

N/A: Environment-related data were collected from the 2011/12 R&D survey onwards.

Table C.137: Higher education sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Natural Sciences, Technology and Engineering	**2 294 479**	**2 389 525**	**2 703 975**	**3 374 024**	**3 558 265**	**4 486 057**	**5 045 892**	**4 925 713**	**5 704 150**	**6 340 906**
Mathematical sciences	104 323	109 354	151 880	168 689	283 942	311 572	342 093	278 183	333 587	458 068
Physical sciences	121 559	146 726	135 002	352 628	175 110	189 341	193 849	198 735	230 826	287 830
Chemical sciences	106 214	143 897	136 528	161 856	158 775	317 389	444 258	286 511	326 992	386 300
Earth sciences	119 682	121 419	136 955	84 777	157 781	174 141	190 744	207 261	260 862	271 814

MAIN RESEARCH FIELD	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Information, computer and communication technologies	143 037	119 600	125 413	121 750	112 985	186 870	232 090	192 911	245 257	322 406
Applied sciences and technologies	101 400	96 972	78 904	306 195	90 761	245 611	251 278	280 310	274 283	272 429
Engineering sciences	349 889	294 630	352 114	305 953	461 980	741 462	768 810	855 529	918 494	891 532
Biological sciences	230 480	271 216	282 280	349 343	593 219	610 408	731 389	721 229	825 432	846 897
Agricultural sciences	151 950	159 793	192 265	179 309	205 311	268 834	276 857	311 355	354 949	326 296
Medical and health sciences	710 386	785 630	966 365	1 195 597	1 226 127	1 245 284	1 391 838	1 339 755	1 641 683	2 089 591
Environmental sciences	58 256	58 793	68 869	52 431	60 458	111 612	147 367	166 493	180 324	79 430
Material sciences	86 764	72 484	68 467	76 732	26 629	81 749	68 849	82 479	100 358	93 871
Marine sciences	10 539	9 013	8 933	18 764	5 186	1 783	6 469	4 961	11 105	14 442
Division 2: Social Sciences and Humanities	**1 004 329**	**1 232 337**	**1 487 391**	**1 727 200**	**1 866 337**	**2 123 159**	**2 287 261**	**2 367 140**	**2 673 425**	**3 535 718**
Social sciences	658 419	796 281	967 204	1 273 479	1 433 610	1 664 653	1 844 744	1 825 026	2 056 555	2 855 673
Humanities	345 910	436 056	520 187	453 721	432 727	458 505	442 517	542 114	616 870	680 046
Total	**3 298 808**	**3 621 862**	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 615**

Table C.138: Proportional higher education sector R&D expenditure by research field (2006/07 to 2015/16)

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Natural Sciences, Technology and Engineering	**69.6**	**66.0**	**64.5**	**66.1**	**65.6**	**67.9**	**68.8**	**67.5**	**68.1**	**64.2**
Mathematical sciences	3.2	3.0	3.6	3.3	5.2	4.7	4.7	3.8	4.0	4.6
Physical sciences	3.7	4.1	3.2	6.9	3.2	2.9	2.6	2.7	2.8	2.9
Chemical sciences	3.2	4.0	3.3	3.2	2.9	4.8	6.1	3.9	3.9	3.9
Earth sciences	3.6	3.4	3.3	1.7	2.9	2.6	2.6	2.8	3.1	2.8
Information, computer and communication technologies	4.3	3.3	3.0	2.4	2.1	2.8	3.2	2.6	2.9	3.3
Applied sciences and technologies	3.1	2.7	1.9	6.0	1.7	3.7	3.4	3.8	3.3	2.8
Engineering sciences	10.6	8.1	8.4	6.0	8.5	11.2	10.5	11.7	11.0	9.0
Biological sciences	7.0	7.5	6.7	6.8	10.9	9.2	10.0	9.9	9.9	8.6
Agricultural sciences	4.6	4.4	4.6	3.5	3.8	4.1	3.8	4.3	4.2	3.3
Medical and health sciences	21.5	21.7	23.1	23.4	22.6	18.8	19.0	18.4	19.6	21.2

MAIN RESEARCH FIELD	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Environmental sciences	1.8	1.6	1.6	1.0	1.1	1.7	2.0	2.3	2.2	0.8
Material sciences	2.6	2.0	1.6	1.5	0.5	1.2	0.9	1.1	1.2	1.0
Marine sciences	0.3	0.2	0.2	0.4	0.1	0.0	0.1	0.1	0.1	0.1
Division 2: Social Sciences and Humanities	**30.4**	**34.0**	**35.5**	**33.9**	**34.4**	**32.1**	**31.2**	**32.5**	**31.9**	**35.8**
Social sciences	20.0	22.0	23.1	25.0	26.4	25.2	25.2	25.0	24.5	28.9
Humanities	10.5	12.0	12.4	8.9	8.0	6.9	6.0	7.4	7.4	6.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.139: Higher education sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Division 1: Defence	2 711	4 328	5 150	3 620	7 271	10 211	12 009	6 121	7 266	8 330
Defence	2 711	4 328	5 150	3 620	7 271	10 211	12 009	6 121	7 266	8 330
Division 2: Economic Development	**1 199 956**	**1 271 620**	**1 539 534**	**1 738 239**	**1 542 453**	**2 072 624**	**1 996 497**	**2 547 254**	**2 472 831**	**2 850 018**
Economic Development unclassified	150 668	171 520	209 400	0	0	0	0	0	0	0
Plant production and plant primary products	119 949	123 126	153 054	178 033	188 513	277 764	234 309	534 417	220 024	282 188
Animal production and animal primary products	85 256	95 219	117 255	130 828	128 705	151 334	176 645	173 865	190 421	199 545
Mineral resources (excluding Energy)	89 559	74 725	88 576	83 294	99 966	129 185	69 062	129 459	127 236	131 141
Energy resources	51 923	84 459	71 648	81 689	88 657	87 659	92 947	82 011	75 367	84 862
Energy supply	90 365	96 209	106 457	107 759	144 462	157 304	162 879	221 160	233 075	237 993
Manufacturing	210 910	172 947	210 009	297 303	245 037	272 287	348 845	340 630	329 083	380 258
Construction	27 521	28 313	46 175	23 858	73 340	116 141	74 322	79 775	96 642	111 437
Transport	16 447	22 770	29 517	30 456	24 045	53 043	31 830	32 503	38 549	47 577
Information and communication services	80 322	67 026	87 013	110 589	93 281	144 313	101 980	139 305	152 987	232 257
Commercial services	41 037	93 285	54 604	282 078	54 659	106 287	111 587	156 001	124 971	125 771
Economic framework	133 600	164 759	193 599	206 625	217 501	302 693	335 217	363 483	493 154	544 118
Natural resources	102 399	77 260	172 228	205 728	184 287	274 612	256 874	294 645	391 322	472 871
Division 3: Society	**1 062 182**	**1 149 091**	**1 359 797**	**1 177 651**	**1 393 700**	**1 583 800**	**1 865 914**	**1 569 371**	**2 180 662**	**2 820 755**
Society unclassified	150 668	171 520	209 400	0	0	0	0	0	0	0

SOCIO-ECONOMIC OBJECTIVE	2006/07 R'000	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000
Health	507 767	556 914	644 763	701 007	776 688	686 152	1 150 349	654 525	1 074 951	1 375 861
Education and training	199 056	195 917	227 502	187 291	294 482	359 897	402 285	547 108	739 611	925 245
Social development and community services	204 691	224 740	278 132	289 353	322 530	537 752	313 280	367 738	366 099	519 649
Division 4: Environment	**261 464**	**317 863**	**339 148**	**346 483**	**377 151**	**509 533**	**554 758**	**456 619**	**629 133**	**614 011**
Environment unclassified	50 223	57 173	69 800	0	0	0	0	0	0	0
Environmental knowledge	112 319	108 189	135 472	170 901	188 250	230 135	232 440	184 169	269 688	246 804
Environmental aspects of development	42 619	93 853	72 050	92 353	86 295	123 344	168 956	154 462	202 787	212 879
Environmental and other aspects	56 303	58 648	61 826	83 229	102 606	156 054	153 362	117 989	156 658	154 328
Division 5: Advancement of Knowledge	**772 495**	**878 959**	**947 737**	**1 835 231**	**2 104 026**	**2 433 048**	**2 903 975**	**2 713 487**	**3 087 684**	**3 583 508**
Advancement of Knowledge unclassified	150 668	171 520	209 400	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	329 497	416 081	423 469	969 079	1 263 802	1 443 913	1 731 540	1 633 257	2 006 195	2 262 831
Social sciences and humanities	292 330	291 359	314 868	866 152	840 223	989 135	1 172 435	1 080 231	1 081 488	1 320 677
Total	**3 298 808**	**3 621 862**	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**

Table C.140: Proportional higher education sector R&D expenditure by socio-economic objective (2006/07 to 2015/16)

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Division 1: Defence	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.2**	**0.2**	**0.1**	**0.1**	**0.1**
Defence	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1
Division 2: Economic Development	**36.4**	**35.1**	**36.7**	**34.1**	**28.4**	**31.4**	**27.2**	**34.9**	**29.5**	**28.9**
Economic Development unclassified	4.6	4.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	3.6	3.4	3.7	3.5	3.5	4.2	3.2	7.3	2.6	2.9
Animal production and animal primary products	2.6	2.6	2.8	2.6	2.4	2.3	2.4	2.4	2.3	2.0

SOCIO-ECONOMIC OBJECTIVE	2006/07 %	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %
Mineral resources (excluding Energy)	2.7	2.1	2.1	1.6	1.8	2.0	0.9	1.8	1.5	1.3
Energy resources	1.6	2.3	1.7	1.6	1.6	1.3	1.3	1.1	0.9	0.9
Energy supply	2.7	2.7	2.5	2.1	2.7	2.4	2.2	3.0	2.8	2.4
Manufacturing	6.4	4.8	5.0	5.8	4.5	4.1	4.8	4.7	3.9	3.9
Construction	0.8	0.8	1.1	0.5	1.4	1.8	1.0	1.1	1.2	1.1
Transport	0.5	0.6	0.7	0.6	0.4	0.8	0.4	0.4	0.5	0.5
Information and communication services	2.4	1.9	2.1	2.2	1.7	2.2	1.4	1.9	1.8	2.4
Commercial services	1.2	2.6	1.3	5.5	1.0	1.6	1.5	2.1	1.5	1.3
Economic framework	4.0	4.5	4.6	4.1	4.0	4.6	4.6	5.0	5.9	5.5
Natural resources	3.1	2.1	4.1	4.0	3.4	4.2	3.5	4.0	4.7	4.8
Division 3: Society	**32.2**	**31.7**	**32.4**	**23.1**	**25.7**	**24.0**	**25.4**	**21.5**	**26.0**	**28.6**
Society unclassified	4.6	4.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	15.4	15.4	15.4	13.7	14.3	10.4	15.7	9.0	12.8	13.9
Education and training	6.0	5.4	5.4	3.7	5.4	5.4	5.5	7.5	8.8	9.4
Social development and community services	6.2	6.2	6.6	5.7	5.9	8.1	4.3	5.0	4.4	5.3
Division 4: Environment	7.9	8.8	8.1	6.8	7.0	7.7	7.6	6.3	7.5	6.2
Environment unclassified	1.5	1.6	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	3.4	3.0	3.2	3.4	3.5	3.5	3.2	2.5	3.2	2.5
Environmental aspects of development	1.3	2.6	1.7	1.8	1.6	1.9	2.3	2.1	2.4	2.2
Environmental and other aspects	1.7	1.6	1.5	1.6	1.9	2.4	2.1	1.6	1.9	1.6
Division 5: Advancement of Knowledge	**23.4**	**24.3**	**22.6**	**36.0**	**38.8**	**36.8**	**39.6**	**37.2**	**36.9**	**36.3**
Advancement of Knowledge unclassified	4.6	4.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	10.0	11.5	10.1	19.0	23.3	21.8	23.6	22.4	23.9	22.9
Social sciences and humanities	8.9	8.0	7.5	17.0	15.5	15.0	16.0	14.8	12.9	13.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.141: Higher education sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	259 254	276 740	286 605	536 792	556 496	608 815	592 861	557 292	612 239	975 099
Free State	155 326	180 713	226 892	246 298	281 889	323 335	356 177	449 852	491 203	523 782
Gauteng	1 214 575	1 260 991	1 467 914	1 537 166	1 600 783	2 028 145	2 118 817	2 233 696	2 733 330	3 305 576
KwaZulu-Natal	451 992	459 299	567 999	662 518	677 740	902 386	1 137 258	750 507	843 111	903 664
Limpopo	63 233	79 716	86 635	147 397	224 603	349 559	300 435	187 317	216 352	229 364
Mpumalanga	67 029	105 629	72 590	88 680	119 231	170 966	182 192	147 134	174 657	190 716
North-West	97 246	166 137	150 125	190 570	184 514	275 088	311 325	405 963	404 575	444 135
Northern Cape	42 944	48 277	68 443	92 062	107 581	148 425	164 483	161 603	146 769	164 487
Western Cape	947 209	1 044 360	1 264 162	1 599 741	1 671 766	1 802 496	2 169 606	2 399 489	2 755 339	3 139 800
Total	**3 298 808**	**3 621 862**	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**

Table C.142: Proportional higher education sector R&D expenditure by province (2006/07 to 2015/16)

PROVINCE	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	7.9	7.6	6.8	10.5	10.3	9.2	8.1	7.6	7.3	9.9
Free State	4.7	5.0	5.4	4.8	5.2	4.9	4.9	6.2	5.9	5.3
Gauteng	36.8	34.8	35.0	30.1	29.5	30.7	28.9	30.6	32.6	33.5
KwaZulu-Natal	13.7	12.7	13.6	13.0	12.5	13.7	15.5	10.3	10.1	9.1
Limpopo	1.9	2.2	2.1	2.9	4.1	5.3	4.1	2.6	2.6	2.3
Mpumalanga	2.0	2.9	1.7	1.7	2.2	2.6	2.5	2.0	2.1	1.9
North-West	2.9	4.6	3.6	3.7	3.4	4.2	4.2	5.6	4.8	4.5
Northern Cape	1.3	1.3	1.6	1.8	2.0	2.2	2.2	2.2	1.8	1.7
Western Cape	28.7	28.8	30.2	31.4	30.8	27.3	29.6	32.9	32.9	31.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table C.143: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation (2006/07 to 2015/16)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS			
	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL
2006/07	21 746	17 459	2 170	2 117	5168.9	3657.8	643.8	867.3
2007/08	21 365	17 008	2 006	2 351	5178.1	3672.3	612.8	893.0
2008/09	20 223	16 313	2 054	1 856	4859.3	3643.5	541.7	674.2
2009/10	20 850	17 010	2 115	1 725	5018.0	3761.8	579.8	676.4
2010/11	19 970	15 553	2 123	2 294	5023.0	3613.7	534.9	874.5
2011/12	21 458	16 294	2 344	2 820	6091.2	4355.3	673.4	1062.5
2012/13	22 691	17 441	2 344	2 906	6571.5	4700.6	737.3	1133.5
2013/14	23 543	18 212	2 284	3 047	7005.7	5000.5	843.7	1161.5
2014/15	24 701	18 625	2 496	3 580	7237.8	5097.7	857.3	1282.8
2015/16	25 612	19 217	2 616	3 779	7147.1	4701.9	1000.3	1445.0

*Excluding post-graduates.

Table C.144: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2013/14, 2014/15 and 2015/16)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2013/14	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	36 133	19 920	16 213	15 772.5	8 825.3	6 947.2	43.7
Technicians directly supporting R&D	2 284	1 314	970	843.7	465.1	378.6	36.9
Other personnel directly supporting R&D	3 047	989	2 058	1 161.5	367.8	793.7	38.1
Total	**41 464**	**22 223**	**19 241**	**17 777.7**	**9 658.2**	**8 119.5**	**42.9**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	38 381	21 060	17 321	15 804.3	8 731.8	7 072.5	41.2
Technicians directly supporting R&D	2 496	1 381	1 115	857.3	509.5	347.8	34.3
Other personnel directly supporting R&D	3 580	1 176	2 404	1 282.8	374.8	908.0	35.8
Total	**44 457**	**23 617**	**20 840**	**17 944.4**	**9 616.2**	**8 328.3**	**40.4**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	41 639	22 491	19 148	18 366.8	10 130.6	8 236.2	44.1
Technicians directly supporting R&D	2 616	1 491	1 125	1 000.3	614.8	385.4	38.2
Other personnel directly supporting R&D	3 779	1 222	2 557	1 445.0	403.6	1 041.4	38.2
Total	**48 034**	**25 204**	**22 830**	**20 812.0**	**11 149.0**	**9 663.0**	**43.3**

*Includes doctoral students and post-doctoral fellows.

Table C.145: Higher education sector R&D personnel in headcounts by occupation and gender, and full-time equivalents by occupation (2013/14, 2014/15 and 2015/16)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
2013/14	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Researchers*	18 212	9 736	8 476	5 000.5	27.5
Technicians directly supporting R&D	2 284	1 314	970	843.7	36.9
Other personnel directly supporting R&D	3 047	989	2 058	1 161.5	38.1
Total	**23 543**	**12 039**	**11 504**	**7 005.7**	**29.8**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Researchers*	18 625	9 876	8 749	5 097.7	27.4
Technicians directly supporting R&D	2 496	1 381	1 115	857.3	34.3
Other personnel directly supporting R&D	3 580	1 176	2 404	1 282.8	35.8
Total	**24 701**	**12 433**	**12 268**	**7 237.8**	**29.3**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Researchers*	19 217	10 098	9 119	4 701.9	24.5
Technicians directly supporting R&D	2 616	1 491	1 125	1 000.3	38.2
Other personnel directly supporting R&D	3 779	1 222	2 557	1 445.0	38.2
Total	**25 612**	**12 811**	**12 801**	**7 147.1**	**27.9**

*Excludes doctoral students and post-doctoral fellows.

Table C.146: Higher education sector R&D postgraduates in headcounts by qualification and gender, and full-time equivalents by qualification (2013/14, 2014/15 and 2015/16)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
2013/14	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
Post-doctoral fellows	1 801	1 101	700	1 706.9	94.8
Doctoral students	16 120	9 083	7 037	9 065.2	56.2
Masters students	36 274	17 932	18 342	18 933.6	52.2
Total	**54 195**	**28 116**	**26 079**	**29 705.6**	**54.8**
2014/15	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Post-doctoral fellows	1 983	1 183	800	1 876.8	94.6
Doctoral students	17 773	10 001	7 772	8 829.8	49.7
Masters students	35 746	17 241	18 505	16 796.7	47.0
Total	**55 502**	**28 425**	**27 077**	**27 503.3**	**49.6**
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Post-doctoral fellows	2 268	1 338	930	2 167.2	95.6
Doctoral students	20 154	11 055	9 099	11 497.7	57.0
Masters students	38 501	18 258	20 243	17 780.9	46.2
Total	**60 923**	**30 651**	**30 272**	**31 445.8**	**51.6**

Table C.147: Higher education sector R&D personnel in headcounts by occupation, qualification, population group and gender (2015/16)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN		WHITE	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers*	**19 217**	**10 098**	**9 119**	**3 691**	**2 672**	**624**	**674**	**819**	**850**	**4 964**	**4 923**
Doctoral degree or equivalent	8 370	4 879	3 491	1 325	736	300	222	375	281	2 879	2 252
Masters, honours, bachelor or equivalent	9 683	4 633	5 050	2 055	1 710	305	415	404	527	1 869	2 398
Diplomas	1 164	586	578	311	226	19	37	40	42	216	273
Technicians directly supporting R&D	**2 616**	**1 491**	**1 125**	**573**	**498**	**248**	**122**	**94**	**81**	**576**	**424**
Doctoral degree or equivalent	248	143	105	20	6	5	3	2	4	116	92
Masters, honours, bachelor or equivalent	725	361	364	153	118	36	54	20	24	152	168
Diplomas	1 643	987	656	400	374	207	65	72	53	308	164
Other personnel directly supporting R&D	**3 779**	**1 222**	**2 557**	**557**	**869**	**150**	**463**	**55**	**83**	**460**	**1 142**
Doctoral degree or equivalent	263	131	132	33	39	7	10	14	10	77	73
Masters, honours, bachelor or equivalent	1 420	473	947	209	278	45	126	22	35	197	508
Diplomas	2 096	618	1 478	315	552	98	327	19	38	186	561
Total	**25 612**	**12 811**	**12 801**	**4 821**	**4 039**	**1 022**	**1 259**	**968**	**1 014**	**6 000**	**6 489**

*Excludes doctoral students and post-doctoral fellows.

Table C.148 Higher education sector overview (2015/16)

	R&D EXPENDITURE	RESEARCHER HEADCOUNT	RESEARCHER FTE	POSTGRAD HEADCOUNT*	POSTGRAD FTE*
	R' 000				
Private Universities	108 441	415	205.1	288	151.7
Universities	8 913 707	15 739	4 020.8	20 644	12 481.7
Nelson Mandela Metropolitan University	285 928	537	104.2	629	313.4
North West University	603 524	1 616	414.3	1 619	852.0
Rhodes University	239 032	495	155.6	631	631.0
Sefako Makgatho Health Sciences University (SMU)†	167 449	504	106.8	68	47.6
University of Cape Town	1 473 043	1 310	527.3	2 066	1 319.6
University of Fort Hare	307 607	466	93.2	652	652.0
University of Johannesburg	443 016	916	234.5	1 062	587.3
University of KwaZulu Natal	652 217	1 417	389.5	3 118	1 485.0
University of Limpopo	96 886	360	66.2	220	192.1
University of Pretoria	933 182	1 652	380.8	2 479	1 160.7
University of South Africa	491 305	1703	394.9	2 203	1 363.0
University of Stellenbosch	1 125 733	1 163	398.1	1 783	988.8
University of the Free State	362 643	566	164.4	827	397.6
University of the Western Cape	419 521	946	281.6	1 016	880.5
University of the Witwatersrand	1 233 285	1 793	269.0	2 013	1 449.9
University of Zululand	79 338	295	40.5	258	161.2
Universities of (Science) and Technology	854 476	3 063	476.0	1 490	1 031.5
Cape Peninsula University of Technology	180 175	524	95.4	235	235.0
Walter Sisulu University of Technology and Science	237 522	703	105.5	63	46.8
Central University of Technology	68 316	282	68.5	114	49.1
Durban Institute of Technology	85 990	350	44.7	271	157.8
Mangosuthu Technikon	17 668	160	20.3	8	8.0
Tshwane University of Technology	160 364	289	47.7	498	344.3
University of Venda for Science and Technology	43 522	388	38.8	241	145.2
Vaal University of Technology	60 920	367	55.1	60	45.3
Total	**9 876 623**	**19 217**	**4701.9**	**22 422**	**13 664.9**

*Postdoctoral and doctoral students.

† SMU (previously Medunsa) split from University of Limpopo.

Collected personnel data may differ from Higher Education Management Information System (HEMIS) data in some cases due to definitional differences in personnel categories.

D. METHODOLOGY

D.1. Survey design and planning

The South African National Survey of Research and Experimental Development (R&D survey) forms part of the tools for monitoring and evaluating the performance of the National System of Innovation (NSI).

The R&D survey may be thought of as three survey instruments covering the four main institutional sectors described in the Frascati Manual: business enterprise, government, private not-for-profit and higher education sectors. In South Africa, the science councils are extracted from the government sector and are reported separately, thus comprising a fifth South African sector.

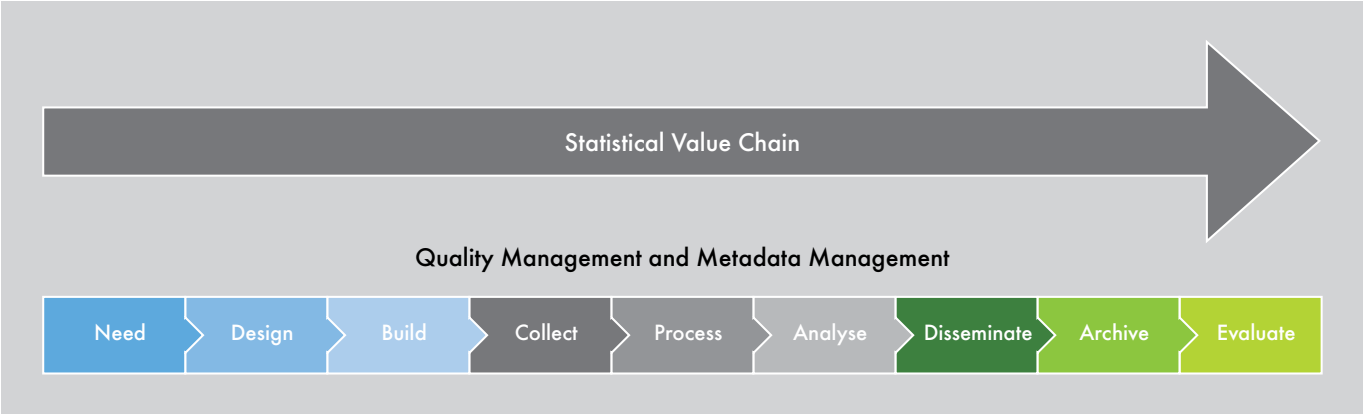
The scope of the survey includes all units performing R&D, either continuously or occasionally. Output tables are agreed in advance of the survey between CeSTII and the DST as a standard.

The survey collects data in accordance with the guidelines recommended by the OECD in the Frascati Manual (OECD, 2002). This helps to maintain coherence and international comparability. The System of National Accounts (EC, IMF, OECD, UN and World Bank, 2009) and the National System of Innovation differ on the identification of target units and definitions.

In the interests of coherence of its data with other South African economic survey data, the South African R&D survey takes care to use standards and methods applied or recommended by Stats SA. Concepts and definitions are aligned as far as possible with those in use by the National Statistical Organisation (NSO) (Stats SA, 2010a). Indicators that use external data are sourced from Stats SA surveys: gross domestic product values are the values for the 2015 annual reference period taken from the quarterly Stats SA GDP statistical release P0441 (Stats SA, 2017a), and employment level is the value for the first quarter of 2015 obtained from the Stats SA Quarterly Labour Force Survey statistical release P02111 (Stats SA, 2016). The survey also uses the Standard Industrial Classification (Stats SA, 2004) codes for business sector industrial classifications employed by Stats SA.

Overall, CeSTII performs quality management in line with practices recommended by Stats SA in the South African Statistical Quality Assessment Framework (SASQAF) (Stats SA, 2010b). The survey was conducted according to a project plan aligned with the phases of the Statistical Value Chain (SVC) illustrated in Figure D.1, which is modelled on practice at Stats SA.

Figure D.1 Statistical Value Chain used in quality and metadata management



D.2. Frame, sample selection and fieldwork

Three questionnaires were used in the survey for the business sector, the higher education sector, and government departments, research institutes, museums, science councils and not-for-profit organisations.

R&D performers in sectors were taken to be any units that had R&D expenditure, or were likely to have had R&D expenditure, in 2015/16. Table D.1 describes each of the sectors, the fieldwork periods by sector, and also their respective reference periods.

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

SECTOR	DESCRIPTION	REFERENCE PERIOD	METHOD OF SURVEYING	FIELDWORK AND FOLLOW-UP PERIOD
Business	Business enterprises, including state-owned enterprises.	Financial year 2015-2016 (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 of likely R&D performers developed and maintained by CeSTII since 2001. All known and likely R&D performers were targeted.	October 2016 - June 2017
Not-for-profit	Non-governmental and not-for-profit entities (i.e. those registered as Section 21 Companies).	Financial year 1 April 2015 to 31 March 2016 (or nearest complete financial year).	All known and likely R&D performers were surveyed following an investigative process using a list of registered non-governmental and not-for-profit organisations including those that were on the current frame.	26 September 2016 - 7 April 2017
Government	National and provincial departments, local government, museums, research institutes and other research units with an R&D components.	Financial year 1 April 2015 to 31 March 2016 (or nearest complete financial year).	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.	25 October 2016 - 31 May 2017
Science councils	The nine science councils established through Acts of Parliament.	Financial year 1 April 2015 to 31 March 2016 (or nearest complete financial year).	Seven statutory science councils were surveyed, using a census approach.	25 October 2016 - 31 May 2017
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.	Calendar year (ending 31 December 2015).	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.	25 October 2016 - 31 May 2017

D.3. Fieldwork

The R&D data were collected by means of questionnaires that were sent to the units in each sector by surface and/or electronic mail.

A unit was considered as a response if it completed and returned a questionnaire with non-zero in-house R&D expenditure; if the unit's in-house R&D expenditure, headcounts, and sources of fund data were reported by the respondent without a completed questionnaire; or if data were confirmed by the respondent after being imputed based on secondary data sources. The data sources used for imputation included previous R&D survey responses as well as other private and public data sources such as the Higher Education Management Information System (HEMIS) and Support Programme for Industrial Innovation (SPII).

For each sector, a list of R&D-performing units was identified from existing lists and intelligence-gathering operations. These units were verified as R&D performers to determine the units to be surveyed before collection began.

Business sector

CeSTII has developed a register of potential R&D performers in the business sector from several information sources, including the following lists: JSE Limited Top 100 Companies, Technology Top 100, Support Programme for Industrial Innovation and Technology and Human Resources for Industry Programme). The business sector register benefited further from inclusions from the DST R&D Tax Incentive programme surveyed in 2014/15. The business register contained 874 units in the 2015/16 survey period.

In 2015/16, the business sector used 251 units obtained from the 2013 Business Innovation Survey sample to improve coverage. The identified 251 units were classified as potential new R&D performers, as they were yet to undergo a register cleaning and contact verification procedure. Following contact searches, of the 251 units identified as potential new R&D performers, 247 units had available contact details with which to ensure effective contact verification. Out of the 156 units with identified reporting units, 136 returned questionnaires and 26 recorded R&D activity. The additional coverage from the remaining 26 that the process yielded was estimated in Table D.2.

Table D.2: Assessment of improved coverage in the business sector

	AMOUNT	PROPORTIONAL CONTRIBUTION TO BERD	NUMBER OF UNITS
	RAND MILLION	%	
BERD	13,814.995		
Improved coverage in business sector	109.854	0.8	26
Total additional coverage contribution to BERD	**109.854**	**0.8**	

As a proportion of GERD, the additional coverage due to all three of these effects in 2015/16 was 0.3%. Viewed as a proportion of overall BERD, the additional coverage was relatively small at 0.8%.

It was estimated that the contribution of the improved coverage to the R&D intensity was 0.003 percentage points of the value of 0.80%.

Science councils sector

Seven R&D-active science councils responded to the survey questionnaire. One of these science councils was surveyed at the level of its constituent units, resulting in a total of 13 reporting units surveyed in the science councils sector.

Not-for-profit sector

There is an ongoing process of improvement in coverage of the not-for-profit sector by investigating a comprehensive list of 2 203 NPOs. No new sources were added to the register. A total of 141 units on the source list were investigated for the 2015/16 survey, of which 12 were confirmed with reporting units. The NPO frame for the 2015/16 survey comprised a total of 82 units that were identified as likely R&D performers, consisting of 12 new units and 70 that were previously surveyed.

Government sector

The government sector investigated a list of 164 units consisting of national and provincial departments, municipalities, research centres and museums, of which 100 units were selected for surveying.

Higher education sector

In the 2015/16 R&D survey, the survey frame for the higher education sector was 33, which consisted of 9 private universities and 24 public universities. The 2015/16 R&D survey included responses from three institutions that were previously imputed on more than one occasion, and also included the Sefako Makgatho Health Sciences University (SMU) for the first time. The effect of these improved responses and improved coverage in the private higher education sector is assessed in Table D.3. SMU, previously part of the Medunsa Campus at the University of Limpopo was established in May 2016 through the Higher Education Act 1997 (Act 101 of 1997). The two other newly formed universities, the Sol Plaatje University and University of Mpumalanga, will be included in the higher education sector frame as they become fully operational and established in their research activities.

The use of annual reports in producing estimates for missing other current expenditure was put to greater use in 2015/16. The additional R&D expenditure covered from such increased usage is estimated in Table D.3.

The funding of research chairs, while not explicitly delineated between respondents and collectors, were included in these estimates, as it has been in previous years.

Table D.3: Assessment of effects of improved fieldwork responses in the higher education sector

	AMOUNT	PROPORTIONAL CONTRIBUTION TO BERD	NUMBER OF UNITS
	RAND MILLION	%	
HERD	9,876.623		
Additional R&D expenditure from annual reports	57.023	0.6	7
Additional R&D expenditure from improved responses in public universities	658.825	6.6	4
Additional R&D expenditure from improved fieldwork responses in private universities	56.711	0.6	3
Total additional contribution to HERD	**772.558**	**7.8**	

As a proportion of GERD, the additional coverage due to all three of these effects in 2015/16 was 2.4%. Viewed as a proportion of overall HERD, it is relatively large. The additional coverage was estimated at 7.8% of HERD expenditure, and this needs to be taken into consideration when making inferences on trends in the HE sector.

It was estimated that the contribution of these effects to the R&D intensity was 0.02 percentage points of the value of 0.80%.

D.4. Quality indicators of survey coverage, fieldwork and analysis

A summary set of quality indicators for the collection and imputation phases of the survey processes in Table D.4 records an overall questionnaire response rate of 73.1% for the 2015/16 R&D survey, which is an improvement of 5.2 percentage points on the response rate of 67.9% that was achieved in 2014/15. At the same time, the survey systematically increased coverage that was realised in the business sector by 26 units (that contributed an additional R 110 million worth of R&D expenditure) from the addition of a new source to existing sources. Also, in the higher education sector coverage was increased by three units (contributing an additional R57 million), and in the NPO sector by 1 unit (adding half a million Rand to R&D expenditure in the sector), using existing sources of coverage.

The R&D expenditure weighted response rate of 87.2% gives an estimate of the size of national R&D expenditure captured from responses alone; that is, excluding the proportion contributed by imputed units. This indicator decreased by 6.8 percentage points from 94.0% in 2014/15 due mainly to an increase in the number and size of unit imputations in the business sector.

Part of the relatively high number of out-of-scopes in the business, not-for-profit and government sectors may be attributed to the nature of the scope of R&D surveys conducted according to Frascati standards, where the units selected for surveying include *likely* R&D performers in addition to known R&D performers. The nature of R&D performance is such that there may be a very small number of projects active in the R&D-performing business unit of a firm. These projects typically last for around three years, according to reports from the field. Upon termination of the project, the R&D expenditure of a firm would thus be nought for a particular reference period, which with the existing CeSTII operational procedures would classify it as an out-of-scope unit, even though it might very well perform R&D again in the future. For this reason the R&D survey uses collection rates as well as questionnaire response rates as key quality indicators of the collect phase of the SVC.

Non-response[7] was defined as failure to obtain a measurement on one or more variables for one or more units selected for the survey. These include out-of-scope units. *Out-of-scope units* are defined as units that should not be included in the survey frame because they did not belong to the target population in the reference period. Entities that returned a questionnaire stating nil in-house R&D expenditure for the survey reference period were counted as out-of-scope for the 2015/16 R&D survey.

[7] Adapted from Sarndal, Swensson, & Wretman, 1992.

Questionnaire responses were defined as those units that were not classified as non-responses within the set of all questionnaires sent out. The questionnaire response rate was calculated using the following formula:

$$\text{Questionnaire response rate} = \frac{\textit{Responses}}{\textit{(Responses+Non-response)–(Out-of-scope)}}$$

Collection rate was defined as the proportion of completed questionnaires received for the survey compared to the total number of actively reporting sample units on the sample registry.

$$\text{Collection rate} = \frac{\textit{Responses+Out of scope+Refusals}}{\textit{active reporting units}}$$

The *weighted response rate* is a measure of the fraction of R&D expenditure collected from responses. It was calculated as:

$$\text{Weighted response rate} = \frac{\textit{R\&D expenditure obtained from responses}}{\textit{(R\&D expenditure from responses + unit imputations)}}$$

The *survey unit imputation rate* was defined as the number of eligible non-responding units that had all data imputed as a fraction of eligible units. It was calculated using the following formula:

$$\text{Survey unit imputation rate} = \frac{\textit{Unit imputations}}{\textit{(Response+Non-response)–(Out-of-scope)}}$$

Table D.4: Quality indicators of survey coverage by sector

SECTOR	NUMBER OF UNITS INVESTI-GATED	NUMBER OF UNITS SELECTED TO COMPILE STATISTICS	NON-RESPONSE	OUT-OF-SCOPE	RESPONSES	QUESTION-NAIRE RESPONSE RATE	COLLECTION RATE	UNIT IMPUTATION RATE	R&D EXPENDITURE WEIGHTED RESPONSE RATE
Business	874	624	210	76	414	75.5%	81.1%	9.3%	72.4%
Not-for-profit	141	82	36	14	46	67.6%	75.6%	2.9%	99.1%
Government	164	100	48	5	52	54.7%	79.0%	5.3%	98.1%
Science councils	13	13	0	0	13	100.0%	100.0%	0.0%	100.0%
Higher education	33	33	5	0	28	84.8%	84.8%	10.0%	97.2%
Total	**1,225**	**852**	**299**	**95**	**553**	**73.1%**	**80.8%**	**8.1%**	**87.2%**

D.5. Imputation

Imputation is a procedure for entering a value for a specific data item where the response is missing or unusable. The R&D survey strives to keep the rate of imputation as low as possible, while striving to include all likely sources of R&D activity in the final estimates. Since 2012/13, the rates of imputation employed have been reported, along with the age of the data used to impute (Table D.5). Prior to 2007, the size of imputations were relatively high, and inferences obtained from this period need to take this into account.

A unit is selected for imputation only if sector leaders are convinced that those units do indeed perform R&D. Where it was not possible to obtain company confirmation, individual fieldworkers provide evidence of on-going R&D activity to qualify units for imputation. The survey employed varying degrees of imputation, ranging from using a total R&D expenditure figure reported by the respondent (by email or telephone), followed by imputing the remaining data items from available sector R&D profiles, to generating an R&D profile for a unit based on its known historical R&D profile adjusted by a GDP inflationary factor, or using publicly available data on a unit's R&D. The imputation models were unchanged from those used in the 2013/14 survey. Financial data on R&D were adjusted by a GDP inflation factor of 1.265 in 2015/16.

Table D.5: Number of units and age of data used in the imputation models by sector

AGE OF DATA	BUSINESS	NPO	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION
Imputed (data from current reference period)	0	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)	47	2	5	0	2
Commuted (data more than one year old)	4	0	0	0	1
Total	51	2	5	0	3

Personnel data for non-responding higher education institutions were imputed from personnel data obtained from the Higher Education Management Information System. R&D expenditure for these units was imputed from a mathematical model or left unchanged from previous estimates.

Details of the imputation methods are available from CeSTII on request.

D.6. Data processing and analysis

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 R&D Survey Management System. Summary data was drawn from the system, and anomalies were identified by cross-checking results and returned to sector leaders for verification and correction, when necessary.

Data tables were drawn from the data in the form of outputs agreed upon by CeSTII and the DST at the start of the survey project process. These included time series data that were added from previous surveys for the purpose of multi-year comparison. Final data quality checks were performed using the time series data, by looking for consistency with expectations, checking other sources of data, and also taking into account the economic environment.

Tables on the SOEs were produced by selecting known SOEs from the enterprises in the business sector. The list of SOEs was developed by CeSTII over several years as part of the register-building process in the business sector and was checked against the treasury list (National Treasury, 2015), and augmented with additional units in the fieldwork collection period for the 2015/16 survey, where these were confirmed by fieldwork.

D.7. Dissemination

The 2015/16 R&D survey reports will be disseminated to all respondents as well as to other users of the R&D statistics.

This report is available on request from CeSTII and the DST. The report can be downloaded from the HSRC-CeSTII website (http://www.hsrc.ac.za/en/departments/CeSTii/reports-cestii) or the DST website (http://www.dst.gov.za/index.php/resource-center/rad-reports). Care is taken to ensure the confidentiality of respondent information, and the data presented in the report are therefore anonymised as far as possible.

D.8. Storage and archiving

The data from the R&D survey series have been archived according to established CeSTII procedures. Hard copies of the data from the two most recent surveys are kept in safe storage at CeSTII, while the data from older surveys are kept in safe storage off site. All data are stored electronically on secure servers, and daily backups of databases are generated.

E. REFERENCES

EC, IMF, OECD, UN and World Bank. 2009. *System of National Accounts 2008*. New York: Commission for the European Communities, the International Monetary Fund, the Organisation for Economic Co-operation and Development, the United Nations and the World Bank.

National Treasury. 2015. *Estimates of National Expenditure 2015*. Pretoria: The National Treasury, Republic of South Africa. Retrieved from http://www.treasury.gov.za/documents/national%20budget/2015/ene/FullENE.pdf

National Treasury. 2015. Public Institutions Listed in PFMA Schedule 1, 2, 3A, 3B, 3C AND 3D as at 30 April 2015. Pretoria: The National Treasury, Republic of South Africa. Retrieved from http://www.treasury.gov.za/legislation/pfma/public%20entities/2015-04-30%20Public%20institutions%20Sch%201-3D.pdf

OECD. 2002. *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*. Paris: Organisation for Economic Co-operation and Development.

Sarndal, C.E., Swensson, B., & Wretman, J. 1992. *Model Assisted Survey Sampling*. New York: Springer-Verlag.

Stats SA. 2004. *Standard Industrial Classification*. Retrieved from http://www.statssa.gov.za/additional_services/sic/sic.htm

Stats SA. 2010a. *Concepts and Definitions for South Africa 2010 v.3*. Pretoria: Statistics South Africa.

Stats SA. 2010b. *South African Statistical Quality Assessment Framework (SASQAF), Second Edition*. Pretoria: Statistics South Africa.

Stats SA. 2016. *Quarterly Labour Force Survey: Quarter 1 2016*. Pretoria: Statistics South Africa.

Stats SA. 2017. *Gross domestic product: P0441, First quarter 2017*. Pretoria: Statistics South Africa.

F. R&D SURVEY QUESTIONNAIRE (HIGHER EDUCATION SECTOR)

STRICTLY CONFIDENTIAL

NATIONAL SURVEY OF RESEARCH & EXPERIMENTAL DEVELOPMENT INPUTS TO HIGHER EDUCATION [PUBLIC]
2015 ACADEMIC YEAR

UNIT	Please modify address label if necessary

AUTHORITY

The Centre for Science, Technology and Innovation Indicators (CeSTII), within the Human Sciences Research Council (HSRC), conducts the Survey of Inputs into Research and Experimental Development (R&D) for the Department of Science and Technology (DST). **The Survey is conducted in terms of the Statistics Act No. 6 of 1999.** Organisations are therefore legally required to respond to this request for data and is required to provide accurate information about R&D performance. All data gathered for this survey is confidential. The HSRC and DST will not disseminate any information identifiable with an organisation without their consent.

PURPOSE AND SCOPE OF SURVEY

The R&D survey collects data on the inputs into R&D activities performed **IN-HOUSE** in South Africa by all organisations (including Business, Government, Science Councils, Not-for Profit and Higher Education). The data is used for planning and monitoring purposes and to support decisions about strengthening South Africa's competitiveness. Previous survey results may be viewed at http://www.hsrc.ac.za/en/departments/cestii/sa-national-survey-of-research-and-experimental-development. This survey covers the **Academic Year 1 January to 31 December 2015.**

DUE DATE

Kindly complete and return this form as soon as possible, but no later than **1 DECEMBER 2016.**

Return address: R&D Survey, Private Bag X2, Vlaeberg, 8018 **OR:** E-mail to addresses listed below.

PLEASE KEEP A COPY OF THIS QUESTIONNAIRE FOR YOUR RECORDS

ASSISTANCE

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

Name	Contact Number	E-mail
Ms Natalie Vlotman	021 466 7826	nvlotman@hsrc.ac.za

Dr. Neo Molotja
Senior Research Specialist
nmolotja@hsrc.ac.za
Tel: 021 466 7818

Details of person completing this questionnaire (Please print)

Name (With title)		**Tel**		
Designation		**Fax**		
Date		**Cell**		
Signature		**E-mail**		

Details of person who has verified the data provided in this survey form, and is authorised to sign off on behalf of the institution (e.g. Dean/Director/DVC of Research)

Name (With title)		**Tel**		
Designation		**Fax**		
Date		**Cell**		
Signature		**E-mail**		

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

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

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

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

Scope of survey
The survey requests data performed IN-HOUSE by your organisation on the national territory of South Africa. Part five asks some questions on "out-sourced R&D".

R&D in Higher Education Institutions
Any activity classified as R&D is characterised by originality; it should have investigation as a primary objective and should have the potential to produce results that are sufficiently general for humanity's stock of knowledge (theoretical and/or practical) to be recognisably increased.

Most research work in higher education institutions would qualify as R&D.

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

- The provision of professional, technical, administrative or clerical support and/or assistance to personnel directly engaged in R&D
- The management of personnel who are either directly engaged in R&D or are providing professional, technical or clerical support or assistance to those R&D activities of students undertaking postgraduate research courses

R&D Excludes:
The following specific activities are excluded, except where they are used primarily for the support of, or as part of, R&D activities performed in this reporting unit:

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

The Classification of Borderline Institutions
Research institutes (such as specialised healthcare clinics or "attached" research institutions) that are not directly concerned with third level teaching, but whose activities, R&D or otherwise, are all the same closely associated with the Higher Education sector should be carefully considered:

- Entities initiated by a Higher Education Institution (HEI) but subsequently becoming a not-for-profit or business entity should be classified as such and surveyed by Not-for Profit or Business sectors, even if there are close links with a Higher Education Institution.
- Staff and R&D expenditure should be reported where it was incurred
- Staff members on the payroll of the HEI Institution (e.g. department heads) should be reported by the HEI concerned.
- Staff that appears on the payroll of the "borderline" institution' should be reported by the institution concerned and not the HEI.
- The same applies to equipment and running costs.

It would be appreciated if we were informed of all such institutions to ensure that they are surveyed by the appropriate sectors and to minimise double counting.

Provincial/Academic Hospitals
Higher Education Institutions are requested to report on all academic and technical staff performing R&D, with joint appointments between provincial/academic hospitals and the HEI. This includes headcount, FTE's, labour costs, equipment and running costs.

• Supervision and monitoring of postgraduate research courses, including students • Software development where the aim of the project is the systematic resolution of a scientific uncertainty • Research work in the biological, medical, engineering, physical and social sciences and the humanities • Social science research, including economic, cultural, educational, psychological and sociological research • R&D carried out as a participant in any unincorporated joint venture • R&D projects performed on contract for other legal entities, such as businesses • "Feedback R&D" directed at solving problems occurring beyond the original R&D phase, for example technical problems arising during initial production runs	It is understood that some of these costs may not be reflected in the HEI's HEMIS data or financial statements, but we request that a best estimate be included where necessary.

PART 1: GENERAL INFORMATION

1. **Name of Higher Education Institution**

2. **Name of reporting unit e.g. Faculty**

3. **Did the reporting unit perform any IN-HOUSE R&D during the 2015 academic year?**

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

(Please tick)

Y ☐ **Continue to Part 2: Question 4**

N ☐ **Proceed to Part 5: Q 16 & 17 on Outsourced R&D if applicable**

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

PART 2: R&D PERSONNEL AND STUDENTS

R&D PERSONNEL
Report against the categories listed below for all personnel employed directly in R&D or providing direct R&D services/support for at least 5% of their time. Do not count any staff NOT supporting research. Please include permanent, temporary, full-time, part-time and contract staff, as well as joint appointments for provincial hospital staff.

1. Researchers

INCLUDE:

- Academic staff engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the direct management of the projects concerned.
- Managers and administrators engaged in the planning and management of the scientific and technical aspects of a researcher's work. Their rank is usually equal or superior to that of persons directly employed as researchers and they are often former or part-time researchers.
- Academic staff involved in research and also studying towards a Masters or Doctoral degree should be included as research staff (not students).

EXCLUDE:

- Managers and directors concerned primarily with budgets and human resources, rather than project management or content (include in Other personnel directly supporting R&D).
- Masters and doctoral students and post-doctoral fellows .

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

3. Other personnel directly supporting R&D

3.1 Executive and managerial level
Executives and directors concerned primarily with budgets and human resources in support of research, rather than project management.

3.2 Administrative and support staff
Skilled and unskilled crafts workers supporting research.
Secretarial, administrative and clerical personnel supporting/working on, or directly associated with, R&D activity.

EXCLUDE:
Persons providing *indirect* services such as security and maintenance personnel, staff of central libraries, IT departments or head offices, should be excluded here but the relevant proportion of their labour costs should be included under "Other Current Costs" in Question 8D.

R&D STUDENTS

- All Post-doctoral fellows in whichever capacity they are appointed by the institution
- Doctoral students
- Students undertaking a Masters degree with at least a 40% research component in 2015

4. HEADCOUNTS OF R&D PERSONNEL

Provide the Headcounts of all R&D personnel in this reporting unit according to the categories below
(Consult NOTE A on page 6 on how to extract the researcher headcount from HEMIS)
(Consult NOTE B on page 6 on how to calculate the Headcount and FTE data for Technicians and Other Support Staff)

Personnel Categories and Highest Qualification	African		Coloured		Indian		White		Sub-total		TOTAL
	M	F	M	F	M	F	M	F	M	F	
Researchers											
Doctorates									-	-	-
Masters/Hons/Bachelors or equivalent									-	-	-
Diplomas and other qualifications									-	-	-
Researcher total											
Technicians/Technologists											
Doctorates									-	-	-
Masters/Hons/Bachelors or equivalent									-	-	-
Diplomas and other qualifications									-	-	-
Technician total											
Other personnel directly supporting R&D											
Doctorates									-	-	-
Masters/Hons/Bachelors or equivalent									-	-	-
Diplomas and other									-	-	-
Other direct support total											

Carry sub-totals over to Q5

5. RESEARCH FULL-TIME EQUIVALENTS (FTE's) AND COST-TO-COMPANY

Using the Male and Female Headcounts of all R&D personnel reported for in Question 4, provide the Research Full-Time Equivalents (time devoted to Research and Development). Then calculate the total labour costs of R&D using the average annual full cost-to-company for full-time staff (including annual wages and salaries and all associated costs or fringe benefits such as bonus payments, contributions to pension and medical aid funds, payroll tax, UIF and all other statutory payments) per category below.

(Consult the appendix provided on how to calculate Research FTE's for researchers using HEMIS data)
(Consult NOTE B on page 6 on how to calculate Research FTE's for technicians and support staff)

Personnel Categories	Headcounts (From Q 4)			Research Full Time Equivalents (FTE's)			Average annual labour cost per full-time person R'000 Excluding VAT (B)	Calculated labour cost of R&D R'000 (A x B)
	M	F	Total	M	F	Total (A)		
Researchers *	-	-	-			-		R -
Technicians directly supporting R&D	-	-	-			-		R -
Other personnel directly supporting R&D	-	-	-			-		R -
TOTAL LABOUR COST OF R&D								-

** Use the median annual labour cost (cost-to-company as explained above) of FULL-TIME senior lecturers*

Carry over total calculated labour cost of R&D personnel to Question 8C

NOTE A: CALCULATION OF RESEARCHER HEADCOUNTS AND FTE'S USING HEMIS DATA

HEMIS data for the 2015 academic year should be used to calculate researcher headcounts and FTE's. To extract this data from HEMIS use the SFTE final table structure and the Staff Programme Classification (element number/name: 044/staff programme) Classification Code 020 (Research) as the primary filter. We suggest that the data be opened in Microsoft Access or Excel. Create a table with the following variables present:

- *Gender* — *Element 012*
- *Race* — *Element 013*
- *Personnel Category* — *Element 039*
- *FTE Value* — *Element 043*
- *Qualification Type* — *Element 046*

- Only report on data pertaining to instruction/research professionals (Classification Code: 01).
- Please capture all staff, namely: permanent/temporary status, part-time/full –time and joint appointments. The number of records present should provide the headcount, while the total of the FTE values will provide the FTE value for Research that is required.
- Should you wish to extract this information at Faculty level, extract the data using CESM categories as a filter, and then divide these CESM's according to Faculty.

NOTE B: CALCULATION OF TECHNICIAN AND OTHER SUPPORT STAFF HEADCOUNT AND FTE'S

Unfortunately HEMIS data only reports on technicians and other staff DOING research and not SUPPORTING research. Technicians and other staff DOING research should be included under the Researcher category. HEMIS data as such could therefore not be used to calculate the headcount and Research FTE's of technicians and other staff supporting research. This information should rather be obtained from Management Information, Faculty Officers and/or Faculty Deans.

Please note: Total FTE's should only include such staff members that support research for at least 5% of their time, NOT ALL Technicians, Executive/Managerial or Administrative staff.

CALCULATING RESEARCH FULL-TIME EQUIVALENTS:

For the purpose of this survey, a person can work a maximum of 1 FTE in a year. This is why the Research FTE is not defined by specifying the maximum number of working hours in a month or year. The following equation can be used to calculate person years of effort on R&D:

(Full time equivalent) x (Portion of the year the person spent on R&D) x (Portion of their job spent on R&D) = Person years of effort on R&D

For example:

-a full time employee who devotes 100% of their time to R&D

1 x 1 x 1 = 1 person years on R&D

-a full time employee spending 40% of his/her time on R&D during half of the survey year:

1 x 0.4 persons x 0.5 years = 0.2 person years of R&D effort

-a part-time employee working 40% of a full time year doing only R&D

0.4 x 1x 1= 0.4 FTE to the R&D effort.

-20 full-time male researchers spending 40% of their time on R&D during the survey year:

20 x 0.4 x 1= 8

NOTE: please calculate FTEs for all R&D personnel

Indirect Services:

The labour costs of persons providing indirect services such as security and maintenance personnel, staff of central libraries, IT departments or head offices, should be **excluded** here but the relevant contribution included under "Other Current Costs in Question 8D.

6. HEADCOUNT OF POSTGRADUATE STUDENTS

Provide the Headcount of all R&D post-doctoral fellows and postgraduate students (full-time and part-time students) in this reporting unit according to the categories below.

Postgraduate student categories	South African								Non-South African		Sub-total		TOTAL
	African		Coloured		Indian		White		All Races		M	F	
	M	F	M	F	M	F	M	F	M	F			
Post-doctoral fellows											-	-	-
Doctoral Students											-	-	-
Masters Students (only those with at least a 40% research component in their Master's degree)											-	-	-
TOTAL											-	-	0

Carry sub-totals over to Q7

7. PERCENTAGE TIME ON RESEARCH AND TOTAL COSTS

Using the headcounts of all R&D post-doctoral fellows and postgraduate students reported in Q6, provide the Research Full Time Equivalents (time spent on Research and Development) according to the categories below. Then provide the total value of salaries, stipends and all bursaries (both internal and external) from all available records.

Postgraduate Student Categories	Headcount (From Q6)		Full-Time Equivalents (FTE's)		Total value of salaries, stipends & bursaries R'000 Excluding VAT
	M	F	M	F	
Post-doctoral fellows	-	-			
Doctoral students	-	-			
Masters Students (only those with at least a 40% research component in their Master's degree)	-	-			
TOTAL COST OF STUDENTS					R -

Carry over total value of salaries, stipends and bursaries to Question 8C

PART 3: IN-HOUSE R&D EXPENDITURE

8. IN-HOUSE R&D EXPENDITURE

Compile expenditure on IN-HOUSE R&D during the academic year 2015. Include expenditure funded from all sources: internal and external (contracts and grants) and undertaken by the reporting unit on its own behalf or for other parties.

***PLEASE NOTE:* Outsourced R&D should be reported under Part 5.**

CAPITAL EXPENDITURE ON R&D

(See NOTE C on page 8 regarding the definition of capital expenditure and how to calculate capital expenditure on R&D)

Purchase of equipment can, in theory, be classified as either capital or current expenditure. A distinction can therefore be made between "major" and "minor" equipment (to be included in "capital" and "current" expenditures respectively) by establishing some kind of monetary limitation. Please provide us with this limitation as used by your institution:

R

		R'000 Excluding VAT
Vehicles, plant, machinery and equipment	**A**	
Land, buildings and other structures	**B**	

LABOUR COSTS OF R&D		**R'000 Excluding VAT**
Total cost of R&D personnel (carried over from Question 5)		-
Total cost of R&D postgraduate students (carried over from Question 7)		-
TOTAL	**C**	-

OTHER CURRENT EXPENDITURE ON R&D

(See NOTE D on page 8 regarding the definition of current expenditure and how to calculate current expenditure devoted to R&D)

		R'000 Excluding VAT
Other Current Expenditure	**D**	

		R'000 Excluding VAT
TOTAL R&D EXPENDITURE (A + B + C + D = E)	**E**	-

Carry over Total R&D Expenditure (E) to Question 9

THE DEFINITION AND CALCULATION OF IN-HOUSE R&D EXPENDITURE

NOTE C: CAPITAL EXPENDITURE

- The full cost of capital expenses must be reported in the year of purchase (Do not depreciate)

Including – but not limited to:

- Expenditure on fixed assets used in the R&D projects of this reporting unit
- Acquisition of software, including license fees, expected to be used for more than one year
- Purchase of databases expected to be used for more than one year
- Major repairs, improvements and modifications on land and buildings

Excluding:

- Other repairs and maintenance expenses
- Depreciation provisions
- Proceeds from the sale of R&D assets

- Where a capital item is used solely for R&D, allocate the full cost of the item
- If the capital item is used for more than one activity, include only an estimate of the portion used for R&D
- Only where such an estimate of the portion used for R&D is not available, apply the percentage time that Researchers in the reporting unit spent on R&D, to the cost of the item.

NOTE D: CURRENT EXPENDITURE

Including - but not limited to:

- Direct project costs, project consumables and running costs linked to research such as materials, fuels and other inputs, including telephone and printing
- Subsistence and travel expenses
- Repair and maintenance expenses
- Payments to outside organisations for use of specialised testing facilities, analytical work, engineering or other specialised services in support of R&D projects carried out by this reporting unit
- Commission/consultant expenses for research projects carried out by this reporting unit
- The relevant % of indirect and institutional costs and utility costs such as rent, space charge, leasing and hiring expenses, furniture, water, electricity any other overhead costs
- The relevant % of labour costs of persons providing indirect services such as the Head Office, HR, Finances, security and maintenance personnel, staff of central libraries, IT departments

Excluding:

- Contract R&D expenses where the research project is carried out elsewhere by others on behalf of this reporting unit
- Payments for purchases of technical know-how (goodwill)
- Licence fees
- Depreciation provisions

- Where current expenses such as direct project costs and consumables are used solely for R&D, allocate the full cost of the items
- If these current expenses are used for more than one activity, include only an estimate of the portion used for R&D
- Only where such an estimate of the portion used for R&D is not available, such as indirect and utility costs, and labour costs of staff providing indirect services, it is advised that respondents apply the percentage time that researchers in the reporting unit spent on R&D to the total of these current expenditures.
- So if a Faculty income and expenditure statement shows that the current expenditure for indirect and utility costs and labour costs of staff providing indirect services for the year was say R1,700,000 and that researchers on average spent 22% of their time to R&D, then this component of R&D current expenditure may be estimated as 0.22 x R1,700,000 = R374,000.

9. SOURCES OF IN-HOUSE R&D EXPENDITURE (as reported in Question 8)

Provide a breakdown of the total R&D expenditure according to the sources of funds listed below
(NOTE: Only the proportion of the money actually SPENT is required, not the total income per source.)

EXTERNAL SOURCES SPENT ON R&D		**R'000 Excluding VAT**
National, Provincial and Local Government excluding the HE Vote		
Government Research Institutes e.g. Water Research Commission, KwaZulu Natal Wildlife, Natal Sharks Board, National Health Laboratories Service, Nuclear Energy Corporation of South Africa (NECSA), SA National Botanical Institute etc.		
Agency Funding e.g. all funding administered by NRF and its National Facilities (HartRAO, SAIAB, iThemba Labs, SAAO, HMO, Zoological Gardens); THRIP funds from DTI; Innovation Fund; MRC Agency funding Note: Report only the component of funding spent by **your** institution		
Science Council Funding i.e. CSIR, HSRC, MRC (Non-agency), ARC, Geosciences, SABS, Mintek, Africa Institute of SA		
Domestic Business including industry funds for THRIP projects		
Other South African Sources		
• Other Higher Education Institutions		
• Not for Profit Organisations		
• Donations and bequests from Individuals		
Foreign Sources		
SUB-TOTAL EXTERNAL SOURCES	**F**	-

NOTE F: THE CALCULATION OF GENERAL UNIVERSITY FUNDS

- To calculate General University Funds please subtract the subtotal of all external sources listed above (F) from the total in-house R&D expenditure reported in Q8. General University Funds will therefore comprise components of the Higher Education Vote and the HEI's own funds (e.g. income from endowments, shareholdings, property, student fees, and subscriptions to journals).
- In order to enable us to classify the source of these funds more accurately, please provide your best estimate of the split of these General University Funds that can be attributed to the Higher Education Vote and the University's Own Funds. You may use a percentage distribution to calculate the split.

Total R&D EXPENDITURE (carried over from Q8)	**E**	-
SUB-TOTAL (EXTERNAL SOURCES) **(carried over from F above)**	**F**	-
GENERAL UNIVERSITY FUNDS (See NOTE F above) **(Including the Higher Education Vote and the HEI's Own Funds)**	**E - F**	-
Higher Education Vote	%	
Own Funds	%	

10. FOREIGN SOURCES OF FUNDS (in R000's) FOR IN-HOUSE R&D

Provide a breakdown of the foreign funding expenditure (as reported in Q9) according to the categories listed below.

10a. If your organisation received no R&D funding from foreign sources kindly tick N/A here and move to question 11:

NA

		SUB TOTAL (R000's) made up of :							
Category	**Category (Sub-Total)**	**Africa (outside SA)**	**Middle East**	**Europe**	**USA / Canada**	**Central & South America**	**China**	**Rest of Asia**	**Other**
Business	**0**								
Not-for-Profit Organisations / Individuals**	**0**								
Foundations	**0**								
Government	**0**								
Higher Education	**0**								
TOTAL	**0**								

* ***Including affiliated company, trade associations*** *(Affiliated denotes parent or subsidiary organisation)*
** *NPO's serving households only. Funding from non-profit organisations primarily serving by Business, Higher Education or Government should be allocated to these sectors.*

11. PROVINCIAL EXPENDITURE ON R&D

State the locations where the reporting unit carries out R&D activities and the percentage of the total R&D expenditure.

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

Eastern Cape		Mpumalanga	
Free State		Northern Cape	
Gauteng		North-West	
KwaZulu-Natal		Western Cape	
Limpopo		**TOTAL**	**0%**

PART 4: CATEGORIES OF R&D EXPENDITURE

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

Specify the percentage of IN-HOUSE R&D LABOUR COST AND OTHER CURRENT EXPENDITURE by type of R&D.

Basic Research

Work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without a specific application in view.

The analyses of properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws.

Research providing the broad base of knowledge necessary for the solution of recognised practical problems.

The results of basic research are usually published in scientific journals.

%

Applied Research

Original investigation to acquire new knowledge with a specific application in view

To determine the possible uses for the findings of basic research.

To determine new methods or ways of achieving specific and pre-determined objectives

The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods, or systems.

Applied research develops ideas into operational form.

The knowledge or information derived from it is often patented but may also be kept secret.

%

Experimental Development

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

%

TOTAL **0%**

13a. RESEARCH FIELDS (RF)

Classify R&D according to Research Fields (see Codes book) and provide the associated % of the Total R&D Expenditure per research field

- The RF Codes are based on recognised academic disciplines and emerging areas of study.
- RF Codes per institution may exceed the number of rows provided for in the questionnaire - please feel free to provide an expanded list of RF Codes on a seperate sheet if applicable.

	RF Codes	Percentage		RF Codes	Percentage
RF			RF		
RF			RF		
TOTAL					0%

13b. Multi-Disciplinary R&D

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

DEFINITIONS

- **Biotechnology** is application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.
- **Nanotechnology** is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering and technology, nanotechnology involves imaging, measuring, modelling, and manipulating matter at this length scale.

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

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

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

13c. Specific Areas of R&D

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

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

Specific Areas of Interest	% of R&D expenditure
Open source software	
New materials	
Tuberculosis (TB), HIV/AIDS, Malaria	
Environment/ Environmental issues	
No R&D in these areas	

TICK if no such R&D is done

14. SOCIO-ECONOMIC OBJECTIVES (SEO)

Classify R&D according to Socio-Economic Objectives (see Code book) and provide the associated % Expenditure

- The SEO classification provides an indication of the sector of the national economy which will be the main beneficiary of the R&D you are practicing.
- SEO Codes per institution may exceed the number of rows provided for in the questionnaire - please feel free to provide an expanded list of SEO Codes on a separate sheet if applicable.

	SEO Codes	Percentage		SEO Codes	Percentage
S			S		
S			S		
S			S		
S			S		
S			S		
TOTAL					**0%**

15. COLLABORATIVE R&D

15a Does your institution collaborate on R&D with persons / organisation outside your own institution?

YES ☐ **Continue with Question 15.b** **NO** ☐ **Go to Question 16**

15b. With whom is R&D conducted in partnerships, alliances or collaboration?

NOTE: In the table below a single collaborative R&D project with several partners may be ticked in several places. Collaborative R&D may be in-house or out-sourced. R&D collaboration can occur without expenditure – please note zero expenditure in such cases.

			Foreign consisting of . . . (tick as appropriate)							
	South Africa	Foreign	Africa (outside SA)	Middle East	Europe	USA / Canada	Central & South America	China	Rest of Asia	Other
Higher Education Institutions										
Science Councils (e.g. CSIR, Mintek, MRC, ARC etc)										
Government Research Institutes										
Members of own organisation / Affiliated* organisations										
Business enterprises (specialist consultants and trade associations)										
Not-for-profit organisations**										
NO COLLABORATION										
	R 000s Excl VAT	**R 000s Excl VAT**								
TOTAL (in-house & outsourced) R&D collaboration expenditure										

** Affiliated denotes parent or subsidiary organisation*
*** NPO's serving households only. Funding from non-profit organisations primarily serving by Business, Higher Education or Government should be allocated to these sectors*

PART 5: R&D OUTSOURCED / CONTRACTED OUT

Outsourced R&D refers to:

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

If your organisation does not outsource any R&D kindly tick N/A.

N/A

16. State the value of R&D outsourced <u>INSIDE</u> South Africa

R'000 Excluding VAT

17. State the value of R&D outsourced <u>OUTSIDE</u> South Africa

R'000 Excluding VAT

THANK YOU FOR YOUR TIME AND EFFORT!

F. USER SATISFACTION SURVEY

SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT: STATISTICAL REPORT 2015/16

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 by email to RnDSurvey@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
- ☐ Private enterprise
- ☐ Public enterprise
- ☐ Academic or research institution
- ☐ International organisation
- ☐ Media
- ☐ Not-for-profit organisation
- ☐ 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.

Thank you for completing the survey.

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