SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT

STATISTICAL REPORT 2017/18

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

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DISSEMINATION

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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 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 Innovation (DSI), 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 Cooperation and Development (OECD), which conducts quality checks through global comparative analysis, time series analyses and other methods. Explanations of any revisions will be made available and accessible on the DSI and HSRC websites.

FOREWORD

The National Survey of Research and Experimental Development (R&D Survey) is published annually to give an update on South Africa's R&D statistics. These statistics measure the size, growth and composition of R&D expenditure, R&D funding and R&D personnel.

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

The 2017/18 R&D data collection was in line with the Frascati Manual 2002, an international guideline for R&D statistics that is published by the Organization for Economic Cooperation and Development (OECD). A phased approach is being followed to adopt the revisions brought by the Frascati Manual 2015 edition. Starting with the 2016/17 survey, some concepts and definitions were refined and some new sub-categories on R&D personnel data were introduced but without changing the historical data series. Further Frascati Manual 2015 revisions will be introduced in the 2019/20 R&D survey.

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). Therefore, each R&D survey is subjected to a quality assessment process, before the results can be approved for publication. A Clearance Committee oversees this process, in accordance with the South African Statistical Quality Assessment Framework (SASQAF), to ensure that the survey remains at a high standard in terms of producing quality statistics.

In August 2019, new members were appointed to the Clearance Committee in order to boost its capacity by bringing in persons representing the survey respondents and user groups, such as the higher education sector, the business sector, policy researchers and other relevant actors from government institutions.

The quality indicators used in the 2017/18 statistical report indicate that there have been improvements in the way the survey is conducted, since the beginning of the clearance process. The assessment shows that there has been some improvement on the following indicators over time: the adherence to the Statistical Value Chain phases, collection rate, sampling frame duplication rate, range error rate, duplication error rate, proportion of misclassified units, GERD responses, BERD responses, proportion of statistical unit deaths not reflected and proportion of births not reflected.

Based on the improvements done, the R&D survey is ready to undergo the SASQAF self-assessment process. The output of this process will indicate their readiness for the full assessment by the Independent Assessment Unit.

Based on my assessment of the recommendations of the Clearance Committee, I endorse the 2017/18 R&D Survey results, and encourage its use by stakeholders.

Risenga Maluleke
STATISTICIAN-GENERAL, REPUBLIC OF SOUTH AFRICA

ACKNOWLEDGEMENTS

The South African National Survey of Research and Experimental Development (R&D Survey) is conducted annually by HSRC-CeSTII on behalf of the Department of Science and Innovation (DSI).

The project team extends its appreciation to Dr Phil Mjwara, Director-General of the DSI, Risenga Maluleke, Statistician-General, Prof. Crain Soudien, CEO of the HSRC, and Prof. Leickness Simbayi, Deputy CEO: Research of the HSRC, and for their support of the R&D Survey.

The support and contributions of Dr Glenda Kruss, Deputy Executive Director of CeSTII, Imraan Patel, Godfrey Mashamba, Tshidi Mamogobo, Kgomotso Matlapeng and Thabo Manyaka of the DSI are much appreciated.

Technical inputs and advice by the DSI 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. 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.

The HSRC-CeSTII project team for the 2017/18 South African National Survey of Research and Experimental Development comprised: Curtis Bailey, Lindiwe Binda, Mario Clayford, Nozibele Gcora, Firdous Khan, Lwando Kondlo, Nhlanhla Malaza, Jerry Mathekga, Neo Molotja, Precious Mudavanhu, Nazeem Mustapha, Kgabo Hector Ramoroka, Janine Senekal, Theodore Sass, Natasha Saunders, Moses Sithole, Anele Slater, Natalie Vlotman, Sibusiso Ziqubu, Thembinkosi Zulu.

We further acknowledge the contributions and support of Gerard Ralphs, the Programme Manager in CeSTII, and the administrative staff Maria Maluleke, Zinziswa Hlakula, and Vuyiseka Mpikwa.

We are most grateful for and acknowledge the cooperation of the respondents to the questionnaire.

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
BERD	Business Expenditure on R&D
CeSTII	Centre for Science, Technology and Innovation Indicators
DSI	Department of Science and Innovation
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
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 objective (SEO), 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, 4th Quarter 2018 (Stats SA, 2019a).

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, 4th Quarter 2018 (Stats SA, 2019a).

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.

Master's students refer to students doing a full research master's as well as those doing coursework plus thesis with a research component.

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 motorcar 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 (irrespective of nationality) employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff. These include emeritus professors, honorary fellows and research fellows[1].

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

Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge — including knowledge of humankind, culture and society — and to devise new applications of available knowledge.

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, 2019b) 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).

[1] Prior to 2016/17, R&D personnel were comprised of only South African researchers, technicians and other R&D personnel. Also, emeritus professors, honorary fellows and research fellows were not explicitly included in the estimates of R&D personnel.

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A. INTRODUCTION

This Statistical Report presents data tables from the 2017/18 South African National Survey of Research and Experimental Development (R&D Survey). The report provides key findings of the survey with commentary, standard summary tables of the overall findings from 2017/18 along with time series from previous instances of the survey. The Statistical Report is published annually, along with the Main Report, which provides selected analysis of the survey data.

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

- **The business enterprise sector**, comprising large, medium and small enterprises, including state-owned enterprises.
- **The government sector**, comprising national, provincial and local government with an R&D component, government research institutions, and museums.
- **The higher education sector**, comprising all public 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 Cooperation and Development (OECD) in *The Measurement of Scientific and Technological Activities: Proposed Standard Practice for Surveys on Research and Experimental Development*, known as the Frascati Manual (OECD, 2002, 2015)[2]. The split of Government into two sectors - a Government sector and a Science Councils sector - is an adjustment to the South African situation.

This report presents R&D statistics 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 in selected areas of policy interest, namely: biotechnology, nanotechnology, space science, 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, 2019a), and the total employment level was taken from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2019b).

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[3] 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.

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

[2] Concepts and definitions as given in the 2015 Frascati Manual were introduced in the 2016/17 survey cycle. However, data collection still refers to the 2002 Frascati Manual. From the 2019/20 survey cycle onwards, changes reflected in the 2015 Frascati Manual will be gradually introduced.

[3] The R&D Survey has historically used the GDP series calculated according to the production method.

From the 2016/17 survey onwards, the master's students category was split into two types: students doing a research master's degree and students doing a master's degree with coursework and a dissertation component. Furthermore, non-SA R&D staff were included in headcount estimates since 2016/17.

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 2017/18 and the preceding nine years. The description of the survey methodology is contained in section D, and the higher sector questionnaire for the 2017/18 survey is reproduced in section F.

B. KEY FINDINGS FOR 2017/18

Gross Domestic Expenditure on R&D increased in real terms, but is slowing down

At constant 2010 prices, GERD grew by 3.1% year-on-year to reach a level of R25.963 billion. This growth in GERD shows a declining trend since the maximum of 8.3% reached in 2014/15. In current values, GERD amounted to R38.725 billion in 2017/18.

GERD as a percentage of GDP remained relatively unchanged in 2017/18

R&D intensity remained relatively unchanged, rising by only one basis point to 0.83% in 2017/18.

Table B.1: Summary of key statistics and indicators (2015/16 to 2017/18)

KEY INDICATOR	2015/16	2016/17	2017/18
Expenditure on R&D			
Gross domestic expenditure on R&D (GERD) (Rm)	32 337	35 693	38 725
Business enterprise expenditure on R&D (BERD) (Rm)	*13 815*	*14 781*	*15 859*
Not-for-profit (NPO) expenditure on R&D (Rm)	*891*	*1 018*	*1 216*
Government expenditure on R&D (GOVERD) (Rm)	*2 013*	*2 099*	*2 326*
Science council (SCI) expenditure on R&D (Rm)	*5 741*	*6 136*	*6 313*
Higher education (HE) expenditure on R&D (HERD) (Rm)	*9 877*	*11 659*	*13 010*
Gross domestic expenditure on R&D in constant 2010 prices (Rm)	24 467	25 191	25 963
Funding sources			
Government-funded* R&D (Rm)	14 426	16 428	18 082
Business-funded R&D (Rm)	12 578	14 046	16 067
Foreign funding of R&D (Rm)	4 210	4 172	3 937
Foreign funding of BERD (Rm)	*1 533*	*1 339*	*475*
Foreign funding of NPO R&D (Rm)	*501*	*640*	*866*
Foreign funding of GOVERD (Rm)	*500*	*512*	*472*
Foreign funding of SCI R&D (Rm)	*470*	*538*	*618*
Foreign funding of HERD (Rm)	*1 206*	*1 143*	*1 506*
R&D personnel			
Total R&D personnel (FTE**)	41 054.5	42 533.0	44 259.3
Total researchers# (FTE**)	26159.4	27656.2	29515.2
Total researchers# (headcount)	51 877	56 761	61 840
Female researchers# (headcounts)	23 334	25 591	27 774
Indicators computed from R&D survey			
GERD as a percentage of GDP (%)	0.80	0.82	0.83
Civil GERD as a percentage of GDP (%)	0.75	0.78	0.79
BERD as a percentage of GERD (%)	45.9	45.3	41.0
Basic research (R millions)	8 210	9 543	10 224
Total R&D personnel (FTE**) per 1 000 in total employment	2.6	2.6	2.7
Total researchers# (FTE**) per 1 000 in total employment	1.7	1.7	1.8
Female researcher# headcounts as a percentage of total researcher headcounts (%)	44.4	45.1	44.9
Indicators obtained from external data sources			
Gross domestic product (GDP) level at current prices (Rm)	4 049 884	4 359 060	4 653 579
GDP (%)	1.2	0.4	1.4
SA employment ('000)	15 663	16 212	16 378

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

**FTE: Full-time equivalent.

#Researchers include doctoral students, post-doctoral fellows.

#Researchers include specific categories of R&D for 2016/17 and 2017/18.

Note: Headcounts Includes Non-SA R&D staff for 2016/17 and 2017/18.

Notable developments reflected in key indicators

Economic environment

- Although GDP went up to 1.4% in 2017, this was coming from a low base in 2016 (Stats SA, 2019a). There were substantial reductions in the baseline budgets of government departments in 2017/18 (National Treasury, 2017).

Science councils and higher education R&D expenditure growth is declining, while business sector R&D expenditure was driven mainly by growth in the banking sector

- Nominal R&D expenditure increased in all sectors in 2017/18 (see Table C.1). However, the increases in science council and higher education sectors are showing signs of a declining trend.
- Whereas the year-on-year real growth in BERD is positive at 1.9%, the proportion of GERD due to business sector expenditure, which has been below 50% since 2010/11, continued its downward trend and is at 41.0% in 2017/18.
- The largest contributor to BERD (since 2011/12) was the financial intermediation, real estate and business services sector, whose contribution to BERD was 48.8%, up by 4.5 percentage points (Table C.50). This sector was followed by the manufacturing sector, whose contribution to BERD was 28.2% in 2017/18, up by just 0.4 of a basis point.

Government funding is slowing down, and funding from foreign sources dried up further

- Government (inclusive of science councils and higher education own funds) remained the largest funder of R&D at 46.7%, followed by the business sector, which funds 41.5% of R&D in the Republic.
- However, the growth of government funding of R&D has declined in 2017/18, and is currently at a level of R18.082 billion. Funding of R&D by the business sector, which has been slowing down since 2013/14 to reach a level in 2017/18 of R16.067 billion, is starting to show some signs of growth.
- After decreasing in 2016/17, funding of R&D by other sources, both local (R0.639 billion) and foreign (R3.937 billion) in 2017/18, have recorded the largest decreases in ten years.

Researcher FTEs increased by 6.7%

- The number of R&D personnel (inclusive of doctoral students and postdoctoral fellows at universities) have increased by 4 233 to a total of 84 262. Growth in R&D personnel (see Table C.30 for the trends) is mainly driven by the net intake of researchers, which increased by 5 079 headcounts in 2017/18. The latter increase, in turn, was driven by an increase in research staff (excluding post-doctoral fellows and doctoral students). After decreasing by 172 in 2016/17, the number of technicians has decreased in 2017/18 by a further 127 headcounts.
- The time spent by researchers (including post-doctoral fellows and doctoral students) on R&D increased by 1 726.3 FTE from 42 533.0 to 44 259.3. The number of FTE researchers per 1 000 in total employment is at 1.8 similar to what it has been for at least ten years (Table C.28).
- The proportion of female researchers decreased by 0.2 of a percentage point to 44.9% (Table C.29).

The trend towards applied research persists, and experimental research declines proportionately

- Since 2010/11, applied research has dominated the type of research conducted in South Africa. In 2017/18, applied research grew to comprise 53.3% of GERD, whereas experimental development and basic research only contributed 20.3% and 26.4%, respectively, to GERD (Table C.6).
- The research field in which the majority of R&D activity in 2017/18 took place is the social sciences (23.7%), followed by the medical and health sciences at 19.5% of GERD (Table C.13). The other three research areas that received the most attention were engineering, ICT, and agricultural sciences.

R&D expenditure in the fields of communicable diseases and environment related research are consistently higher than in new materials, space science and open-source software

- In 2017/18, R&D in biotechnology decreased proportionately, to make up 4.6% of GERD. Similarly, nanotechnology research decreased to comprise 1.9% of GERD in 2017/18 (Table C.9).
- R&D expenditure in TB/HIV/AIDS and malaria consisted of 11.9% of GERD. Environment and related R&D was at a level of 7.3% of GERD. Space science, open-source software and new materials research were at levels of 0.8%, 3.2% and 2.2% respectively (Table C.11).

R&D levels in State-owned Enterprises (SOEs) are relatively low

- The contribution of SOEs to R&D activity (see Table C.56) in the business sector was at levels of 16.0% of BERD in 2017/18.
- Out of the 7 142 researchers in the business sector, 21.1% are employed in public enterprises (see Table C.75).

Notes:

- Totals in the tables may not add up to the sum of their constituent items due to rounding effects.
- Data from 2001/02 onwards may be downloaded from
  - http://datacuration.hsrc.ac.za/

C.1. General survey results

C.1.1. Expenditure on research and experimental development

Table C.1: R&D expenditure by sector (2008/09 to 2017/18)

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
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
2016/17	**35 692 973**	2 098 646	6 136 183	11 659 258	14 781 270	1 017 616
2017/18	**38 724 590**	2 325 875	6 313 344	13 009 876	15 859 185	1 216 310

Table C.2: R&D expenditure by sector, constant 2010 Rand values (2008/09 to 2017/18)

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2008/09	**24 056 681**	1 303 016	3 586 992	4 792 079	14 099 455	275 139
2009/10	**22 285 515**	1 135 087	3 677 697	5 425 204	11 846 693	200 833
2010/11	**20 253 802**	1 011 340	3 596 022	5 424 601	10 059 009	162 830
2011/12	**20 847 389**	1 159 901	3 500 987	6 203 958	9 822 399	160 144
2012/13	**21 283 167**	1 281 658	3 589 510	6 538 113	9 424 677	449 209
2013/14	**21 551 944**	1 425 413	3 615 334	6 125 162	9 896 243	489 792
2014/15	**23 351 132**	1 506 354	3 982 443	6 666 417	10 576 214	619 704
2015/16	**24 478 150**	1 523 812	4 345 732	7 476 385	10 457 645	674 575
2016/17	**25 304 686**	1 487 844	4 350 273	8 265 881	10 479 245	721 444
2017/18	**25 962 839**	1 559 379	4 232 771	8 722 451	10 632 765	815 473

Table C.3: R&D expenditure composition by sector (2008/09 to 2017/18)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
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
2016/17	5.9	17.2	32.7	41.4	2.9
2017/18	6.0	16.3	33.6	41.0	3.1

Table C.4: R&D expenditure as a percentage of GDP by sector (2008/09 to 2017/18)

YEAR	GERD/GDP	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%	%
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
2016/17	**0.82**	0.05	0.14	0.27	0.34	0.02
2017/18	**0.83**	0.05	0.14	0.28	0.34	0.03

Table C.5: R&D expenditure by type of research (2008/09 to 2017/18)

YEAR	GERD	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	R'000	R'000	R'000	R'000
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
2016/17	**35 692 973**	9 542 644	17 061 167	9 089 162
2017/18	**38 724 590**	10 223 956	20 623 856	7 876 778

Table C.6: Proportional R&D expenditure by type of research (2008/09 to 2017/18)

YEAR	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	%	%	%
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
2016/17	26.7	47.8	25.5
2017/18	26.4	53.3	20.3

Table C.7: R&D expenditure by accounting category (2008/09 to 2017/18)

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
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
2016/17	**35 692 973**	1 274 737	2 822 229	4 096 967	16 505 080	1 928 108	13 162 819	31 596 007
2017/18	**38 724 590**	1 715 060	2 385 032	4 100 092	18 757 628	1 889 065	13 977 805	34 624 498

*Includes specific categories of R&D personnel costs (from 2016/17).

Table C.8: Proportional R&D expenditure by accounting category (2008/09 to 2017/18)

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
	%	%	%	%	%	%	%
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
2016/17	3.6	7.9	11.5	46.2	5.4	36.9	88.5
2017/18	4.4	6.2	10.6	48.4	4.9	36.1	89.4

*Includes specific categories of R&D personnel costs (from 2016/17).

Table C.9: Expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

YEAR	GERD	BIOTECHNOLOGY	NANOTECHNOLOGY
	R'000	R'000	R'000
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
2016/17	**35 692 973**	1 788 728	853 121
2017/18	**38 724 590**	1 797 013	718 527

Table C.10: Proportional expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

YEAR	BIOTECHNOLOGY	NANOTECHNOLOGY
	%	%
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
2016/17	5.0	2.4
2017/18	4.6	1.9

Table C.11: R&D expenditure on selected areas of interest (2008/09 to 2017/18)

YEAR	GERD	OPEN-SOURCE SOFTWARE	TUBERCULOSIS (TB), HIV/AIDS, MALARIA	ENVIRONMENT / ENVIRONMENT RELATED	NEW MATERIALS	SPACE SCIENCE
	R'000	R'000	R'000	R'000	R'000	R'000
2008/09	**21 041 046**	218 289	1 616 410	N/A	514 242	N/A
2009/10	**20 954 677**	172 712	1 816 901	N/A	559 021	N/A
2010/11	**20 253 805**	157 790	2 052 521	N/A	722 167	N/A
2011/12	**22 209 192**	181 320	2 006 625	1 215 855	783 232	N/A
2012/13	**23 871 219**	211 264	2 478 422	1 051 035	1 327 832	N/A
2013/14	**25 660 573**	339 065	2 867 954	1 088 094	794 016	N/A
2014/15	**29 344 977**	818 735	3 008 176	1 996 195	1 053 783	N/A
2015/16	**32 336 679**	1 145 590	3 462 704	2 056 659	1 146 470	N/A
2016/17	**35 692 973**	826 648	3 947 430	2 452 367	1 008 578	633 930
2017/18	**38 724 590**	1 233 636	4 621 859	2 815 269	850 606	300 763

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.12: Proportional R&D expenditure on selected areas of interest (2008/09 to 2017/18)

YEAR	OPEN-SOURCE SOFTWARE	TUBERCULOSIS (TB), HIV/AIDS, MALARIA	ENVIRONMENT / ENVIRONMENT RELATED	NEW MATERIALS	SPACE SCIENCE
	%	%	%	%	%
2008/09	1.0	7.7	N/A	2.4	N/A
2009/10	0.8	8.7	N/A	2.7	N/A
2010/11	0.8	10.1	N/A	3.6	N/A
2011/12	0.8	9.0	5.5	3.5	N/A
2012/13	0.9	10.4	4.4	5.6	N/A
2013/14	1.3	11.2	4.2	3.1	N/A
2014/15	2.8	10.3	6.8	3.6	N/A
2015/16	3.5	10.7	6.4	3.5	N/A
2016/17	2.3	11.1	6.9	2.8	1.8
2017/18	3.2	11.9	7.3	2.2	0.8

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.13: R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural sciences, technology and engineering	**18 419 289**	**18 236 046**	**17 274 483**	**18 924 485**	**19 384 947**	**20 587 093**	**23 687 304**	**25 562 694**	**27 253 955**	**28 666 760**
Mathematical sciences	397 512	414 234	530 693	636 153	634 658	627 017	636 084	646 870	713 360	872 293
Physical sciences	952 441	648 657	305 701	338 098	370 616	379 813	582 267	769 739	876 009	1 096 821
Chemical sciences	1 056 848	860 745	865 345	1 273 588	1 460 180	1 305 139	1 299 969	1 491 410	1 761 693	2 068 309
Earth sciences	563 619	402 949	403 848	409 212	499 210	498 427	690 040	635 291	780 402	756 427
Information, computer and communication technologies	2 763 320	3 272 679	2 808 681	2 852 251	2 000 453	1 994 502	2 946 625	3 877 852	4 494 987	4 009 589
Applied sciences and technologies	1 905 397	1 740 755	2 151 557	2 114 322	2 252 175	2 164 025	1 555 897	1 525 646	1 585 106	1 413 711
Engineering sciences	5 135 032	4 580 166	3 600 159	3 775 247	3 903 931	4 315 051	5 485 812	5 444 740	4 611 038	4 331 807
Biological sciences	744 144	800 435	1 326 076	1 350 716	1 555 035	1 578 516	1 398 611	1 452 763	1 416 454	1 509 122
Agricultural sciences	1 147 706	1 445 847	1 307 191	1 710 860	1 810 114	2 196 122	2 656 038	2 573 509	2 741 962	2 980 343
Medical and health sciences	3 139 245	3 506 472	3 461 304	3 819 180	4 107 641	4 668 417	5 459 721	6 389 455	6 868 131	7 540 190
Environmental sciences	248 625	229 186	352 139	439 719	587 113	611 007	533 065	375 455	992 281	1 195 051
Material sciences	306 828	254 092	109 551	166 411	155 379	192 199	368 315	299 069	287 507	749 476
Marine sciences	58 573	79 830	52 238	38 726	48 442	56 857	74 858	80 897	125 024	143 621
Division 2: Social sciences and humanities	**2 621 757**	**2 718 631**	**2 979 322**	**3 284 707**	**4 486 272**	**5 073 480**	**5 657 674**	**6 773 985**	**8 439 018**	**10 057 830**
Social sciences	2 024 801	2 233 521	2 512 714	2 790 339	3 999 853	4 489 054	5 000 339	6 043 806	7 495 167	9 168 767
Humanities	596 956	485 110	466 608	494 368	486 420	584 426	657 335	730 179	943 851	889 064
Total	21 041 046	20 954 677	20 253 805	22 209 192	23 871 219	25 660 573	29 344 977	32 336 679	35 692 973	38 724 590

Table C.14: Proportional R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural sciences, technology and engineering	**87.5**	**87.0**	**85.3**	**85.2**	**81.2**	**80.2**	**80.7**	**79.1**	**76.4**	**74.0**
Mathematical sciences	1.9	2.0	2.6	2.9	2.7	2.4	2.2	2.0	2.0	2.3
Physical sciences	4.5	3.1	1.5	1.5	1.6	1.5	2.0	2.4	2.5	2.8
Chemical sciences	5.0	4.1	4.3	5.7	6.1	5.1	4.4	4.6	4.9	5.3
Earth sciences	2.7	1.9	2.0	1.8	2.1	1.9	2.4	2.0	2.2	2.0
Information, computer and communication technologies	13.1	15.6	13.9	12.8	8.4	7.8	10.0	12.0	12.6	10.4
Applied sciences and technologies	9.1	8.3	10.6	9.5	9.4	8.4	5.3	4.7	4.4	3.7
Engineering sciences	24.4	21.9	17.8	17.0	16.4	16.8	18.7	16.8	12.9	11.2
Biological sciences	3.5	3.8	6.5	6.1	6.5	6.2	4.8	4.5	4.0	3.9
Agricultural sciences	5.5	6.9	6.5	7.7	7.6	8.6	9.1	8.0	7.7	7.7
Medical and health sciences	14.9	16.7	17.1	17.2	17.2	18.2	18.6	19.8	19.2	19.5
Environmental sciences	1.2	1.1	1.7	2.0	2.5	2.4	1.8	1.2	2.8	3.1
Material sciences	1.5	1.2	0.5	0.7	0.7	0.7	1.3	0.9	0.8	1.9
Marine sciences	0.3	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.4	0.4
Division 2: Social sciences and humanities	**12.5**	**13.0**	**14.7**	**14.8**	**18.8**	**19.8**	**19.3**	**20.9**	**23.6**	**26.0**
Social sciences	9.6	10.7	12.4	12.6	16.8	17.5	17.0	18.7	21.0	23.7
Humanities	2.8	2.3	2.3	2.2	2.0	2.3	2.2	2.3	2.6	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 (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVES	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**1 196 200**	**1 276 269**	**1 341 460**	**1 069 289**	**1 351 337**	**1 386 428**	**1 826 784**	**1 814 789**	**1 629 650**	**2 124 098**
Defence	1 196 200	1 276 269	1 341 460	1 069 289	1 351 337	1 386 428	1 826 784	1 814 789	1 629 650	2 124 098
Division 2: Economic development	**13 312 043**	**12 341 036**	**11 231 879**	**12 174 897**	**12 223 017**	**14 166 615**	**15 359 534**	**16 644 668**	**18 357 187**	**19 528 226**
Economic development unclassified	209 400	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	853 243	1 055 316	1 045 114	1 137 706	1 218 852	1 739 038	1 364 018	1 426 609	1 920 246	1 701 055

SOCIO-ECONOMIC OBJECTIVES	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	2016/17 R'000	2017/18 R'000
Animal production and animal primary products	289 909	354 639	293 873	565 729	598 602	803 403	694 423	655 059	746 579	794 314
Mineral resources (excluding energy)	995 552	1 212 226	1 123 063	1 065 384	1 143 762	1 351 239	1 779 068	1 759 268	1 328 413	1 256 826
Energy resources	1 185 455	407 091	274 220	273 390	294 820	288 314	197 072	178 434	556 147	546 831
Energy supply	515 216	540 463	623 953	676 491	509 128	590 980	778 805	636 596	730 849	853 099
Manufacturing	2 998 301	2 602 319	2 374 657	2 489 799	2 394 239	2 608 207	2 619 974	2 665 871	2 543 694	2 628 725
Construction	1 461 157	521 289	311 897	392 440	426 960	450 907	270 226	229 284	300 582	318 837
Transport	704 404	924 183	905 571	984 225	992 504	1 115 027	998 136	1 115 349	1 195 426	1 247 963
Information and communication services	1 274 761	1 381 989	1 104 273	1 271 591	1 159 823	1 124 614	1 661 660	2 347 021	2 694 355	2 129 740
Commercial services	1 499 495	2 045 919	1 849 534	1 866 449	1 895 734	2 443 529	2 701 523	2 789 611	3 134 235	4 448 419
Economic framework	604 404	598 312	600 662	611 868	715 759	689 386	1 331 844	1 797 751	1 997 933	2 343 788
Natural resources	720 746	697 290	725 062	839 825	872 835	961 971	962 787	1 043 816	1 208 728	1 258 630
Division 3: Society	**3 225 179**	**3 276 198**	**3 247 428**	**3 861 889**	**4 473 657**	**4 585 825**	**5 885 267**	**6 815 987**	**7 558 386**	**8 517 207**
Society unclassified	209 400	0	0	0	0	0	0	0	0	0
Health	2 013 993	2 247 629	2 089 570	2 301 764	2 942 262	2 859 623	3 638 036	4 154 557	4 733 478	5 118 330
Education and training	465 475	458 060	442 181	554 463	672 473	882 976	1 346 974	1 603 117	1 307 791	1 398 846
Social development and community services	536 312	570 508	715 677	1 005 662	858 922	843 226	900 257	1 058 313	1 517 117	2 000 031
Division 4: Environment	**1 006 106**	**992 840**	**735 909**	**905 570**	**979 981**	**861 976**	**1 414 524**	**1 475 053**	**2 015 344**	**2 092 706**
Environment unclassified	69 800	0	0	0	0	0	0	0	0	0
Environmental knowledge	488 204	463 786	310 888	398 977	443 987	388 688	828 768	853 071	969 476	1 016 592
Environmental aspects of development	176 503	181 907	189 344	216 406	258 144	226 299	288 823	304 008	361 391	357 509
Environmental and other aspects	271 599	347 147	235 677	290 187	277 849	246 989	296 934	317 975	684 478	718 604
Division 5: Advancement of knowledge	**2 301 517**	**3 068 334**	**3 697 128**	**4 197 547**	**4 843 227**	**4 659 729**	**4 858 868**	**5 586 182**	**6 132 406**	**6 462 352**
Advancement of knowledge unclassified	209 400	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	1 604 035	2 036 622	2 672 224	3 025 841	3 497 129	3 407 325	3 445 842	3 891 834	4 424 024	4 771 950
Social sciences and humanities	488 082	1 031 712	1 024 904	1 171 706	1 346 098	1 252 404	1 413 026	1 694 348	1 708 382	1 690 403
Total	21 041 046	20 954 677	20 253 805	22 209 192	23 871 219	25 660 573	29 344 977	32 336 679	35 692 973	38 724 590

Table C.16: Proportional R&D expenditure by socio-economic objectives (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVES	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**5.7**	**6.1**	**6.6**	**4.8**	**5.7**	**5.4**	**6.2**	**5.6**	**4.6**	**5.5**
Defence	5.7	6.1	6.6	4.8	5.7	5.4	6.2	5.6	4.6	5.5
Division 2: Economic development	**63.3**	**58.9**	**55.5**	**54.8**	**51.2**	**55.2**	**52.3**	**51.5**	**51.4**	**50.4**
Economic development unclassified	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	4.1	5.0	5.2	5.1	5.1	6.8	4.6	4.4	5.4	4.4
Animal production and animal primary products	1.4	1.7	1.5	2.5	2.5	3.1	2.4	2.0	2.1	2.1
Mineral resources (excluding energy)	4.7	5.8	5.5	4.8	4.8	5.3	6.1	5.4	3.7	3.2
Energy resources	5.6	1.9	1.4	1.2	1.2	1.1	0.7	0.6	1.6	1.4
Energy supply	2.4	2.6	3.1	3.0	2.1	2.3	2.7	2.0	2.0	2.2
Manufacturing	14.2	12.4	11.7	11.2	10.0	10.2	8.9	8.2	7.1	6.8
Construction	6.9	2.5	1.5	1.8	1.8	1.8	0.9	0.7	0.8	0.8
Transport	3.3	4.4	4.5	4.4	4.2	4.3	3.4	3.4	3.3	3.2
Information and communication services	6.1	6.6	5.5	5.7	4.9	4.4	5.7	7.3	7.5	5.5
Commercial services	7.1	9.8	9.1	8.4	7.9	9.5	9.2	8.6	8.8	11.5
Economic framework	2.9	2.9	3.0	2.8	3.0	2.7	4.5	5.6	5.6	6.1
Natural resources	3.4	3.3	3.6	3.8	3.7	3.7	3.3	3.2	3.4	3.3
Division 3: Society	**15.3**	**15.6**	**16.0**	**17.4**	**18.7**	**17.9**	**20.1**	**21.1**	**21.2**	**22.0**
Society unclassified	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	9.6	10.7	10.3	10.4	12.3	11.1	12.4	12.8	13.3	13.2
Education and training	2.2	2.2	2.2	2.5	2.8	3.4	4.6	5.0	3.7	3.6
Social development and community services	2.5	2.7	3.5	4.5	3.6	3.3	3.1	3.3	4.3	5.2
Division 4: Environment	**4.8**	**4.7**	**3.6**	**4.1**	**4.1**	**3.4**	**4.8**	**4.6**	**5.6**	**5.4**
Environment unclassified	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	2.3	2.2	1.5	1.8	1.9	1.5	2.8	2.6	2.7	2.6
Environmental aspects of development	0.8	0.9	0.9	1.0	1.1	0.9	1.0	0.9	1.0	0.9

SOCIO-ECONOMIC OBJECTIVES	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	1.3	1.7	1.2	1.3	1.2	1.0	1.0	1.0	1.9	1.9
Division 5: Advancement of knowledge	**10.9**	**14.6**	**18.3**	**18.9**	**20.3**	**18.2**	**16.6**	**17.3**	**17.2**	**16.7**
Advancement of knowledge unclassified	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	7.6	9.7	13.2	13.6	14.6	13.3	11.7	12.0	12.4	12.3
Social sciences and humanities	2.3	4.9	5.1	5.3	5.6	4.9	4.8	5.2	4.8	4.4
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 (2008/09 to 2017/18)

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
2008/09	**21 041 046**	889 081	1 562 720	10 981 587	2 210 336	286 157	379 123	174 453	487 376	4 070 214
2009/10	**20 954 677**	1 121 484	1 370 779	10 377 381	2 167 048	340 379	393 822	217 774	540 951	4 425 059
2010/11	**20 253 805**	1 048 959	1 332 224	9 772 806	2 290 711	395 042	397 878	250 320	532 456	4 233 409
2011/12	**22 209 192**	1 278 870	1 718 602	10 391 272	2 515 736	583 857	522 963	341 136	732 363	4 124 394
2012/13	**23 871 219**	1 463 589	1 714 473	10 602 434	3 013 372	619 437	612 031	400 974	890 364	4 554 545
2013/14	**25 660 573**	1 478 850	1 943 131	11 975 916	2 752 543	444 015	615 773	473 722	1 027 448	4 949 174
2014/15	**29 344 977**	1 734 411	1 456 461	13 686 734	3 187 481	628 607	859 201	575 584	1 402 742	5 813 758
2015/16	**32 336 679**	2 142 919	1 778 469	14 666 111	3 335 141	627 125	791 248	660 963	1 209 434	7 125 269
2016/17	**35 692 973**	2 206 473	1 834 572	16 421 582	3 639 100	728 874	699 720	532 530	1 298 778	8 331 345
2017/18	**38 724 590**	2 300 631	2 149 267	17 319 635	4 172 713	854 885	715 616	576 963	1 306 478	9 328 402

Table C.18: Proportional R&D expenditure by province (2008/09 to 2017/18)

YEAR	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMA-LANGA	NORTHERN CAPE	NORTH-WEST	WESTERN CAPE
	%	%	%	%	%	%	%	%	%
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
2016/17	6.2	5.1	46.0	10.2	2.0	2.0	1.5	3.6	23.3
2017/18	5.9	5.6	44.7	10.8	2.2	1.8	1.5	3.4	24.1

C.1.2. Source of R&D funds

Table C.19: Funding for R&D by source (2008/09 to 2017/18)

YEAR	TOTAL FUNDS	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	R'000	R'000	R'000	R'000	R'000
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
2016/17	**35 692 973**	16 427 596	14 045 892	1 047 980	4 171 507
2017/18	**38 724 590**	18 082 182	16 066 846	638 858	3 936 705

*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 (2008/09 to 2017/18)

YEAR	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	%	%	%	%
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
2016/17	46.0	39.4	2.9	11.7
2017/18	46.7	41.5	1.6	10.2

*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 (2017/18)

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	**24 230 216**	**62.6**	**1 340 977**	**57.7**	**252 916**	**4.0**	**7 664 786**	**58.9**	**14 868 724**	**93.8**	**102 813**	**8.5**
Internal sources	24 230 216	62.6	1 340 977	57.7	252 916	4.0	7 664 786	58.9	14 868 724	93.8	102 813	8.5
Government	**8 823 503**	**22.8**	**428 953**	**18.4**	**5 058 274**	**80.1**	**2 822 203**	**21.7**	**371 165**	**2.3**	**142 908**	**11.7**
Grants	2 447 211	6.3	416 606	17.9	3 320 124	27.5	N/A	N/A	202 371	1.3	90 084	7.4
Contracts	3 554 089	9.2	12 347	0.5	1 738 150	52.6	N/A	N/A	168 794	1.1	52 824	4.3
All other	2 822 203	7.3	N/A	N/A	N/A	N/A	2 822 203	21.7	N/A	N/A	N/A	N/A
Business	**1 198 122**	**3.1**	**519**	**0.0**	**354 820**	**5.6**	**679 563**	**5.2**	**94 473**	**0.6**	**68 747**	**5.7**
Local business	1 198 122	3.1	519	0.0	354 820	5.6	679 563	5.2	94 473	0.6	68 747	5.7
Other SA sources	**536 044**	**1.4**	**83 641**	**3.6**	**29 496**	**0.5**	**337 247**	**2.6**	**50 060**	**0.3**	**35 600**	**2.9**
Higher education	71 359	0.2	140	0.0	3 580	0.1	59 478	0.5	0	0.0	8 162	0.7
Not-for-profit	239 690	0.6	83 207	3.6	25 916	0.4	60 647	0.5	50 060	0.3	19 860	1.6
Individual donations	224 995	0.6	294	0.0	0	0.0	217 122	1.7	0	0.0	7 579	0.6
Foreign	**3 936 705**	**10.2**	**471 786**	**20.3**	**617 838**	**9.8**	**1 506 077**	**11.6**	**474 762**	**3.0**	**866 241**	**71.2**
All sources	3 936 705	10.2	471 786	20.3	617 838	9.8	1 506 077	11.6	474 762	3.0	866 241	71.2
Total	38 724 590	100.0	2 325 875	100.0	6 313 344	100.0	13 009 876	100.0	15 859 185	100.0	1 216 310	100.0

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

Table C.22: Government-funded* R&D by sector (2008/09 to 2017/18)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
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
2016/17	**16 427 596**	1 530 964	5 076 805	9 222 246	453 958	143 623
2017/18	**18 082 182**	1 769 929	5 311 190	10 486 989	371 165	142 908

*Includes science council and university own funds.

Table C.23: Proportional government-funded* R&D by sector (2008/09 to 2017/18)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
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
2016/17	9.3	30.9	56.1	2.8	0.9
2017/18	9.8	29.4	58.0	2.1	0.8

*Includes science council and university own funds.

Table C.24: Business-funded R&D by sector (2008/09 to 2017/18)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
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
2016/17	**14 045 892**	1 261	483 166	906 651	12 586 109	68 705
2017/18	**16 066 846**	519	354 820	679 563	14 963 198	68 747

Table C.25: Proportional business-funded R&D by sector (2008/09 to 2017/18)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
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
2016/17	0.0	3.4	6.5	89.6	0.5
2017/18	0.0	2.2	4.2	93.1	0.4

Table C.26: Foreign-funded R&D by sector (2008/09 to 2017/18)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
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
2016/17	4 171 507	512 090	537 503	1 143 451	1 338 662	639 801
2017/18	3 936 705	471 786	617 838	1 506 077	474 762	866 241

Table C.27: Proportional foreign-funded R&D by sector (2008/09 to 2017/18)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
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
2016/17	12.3	12.9	27.4	32.1	15.3
2017/18	12.0	15.7	38.3	12.1	22.0

C.1.3. R&D personnel

Table C.28: R&D personnel in headcounts and full-time equivalents by occupation (2008/09 to 2017/18)

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)
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	26159.4	1.7	11 518	7 688.3	11 536	7 206.9
2016/17	**80 029**	**42 533.0**	**2.6**	56 761	27656.2	1.7	11 346	7 563.1	11 922	7 313.6
2017/18	**84 262**	**44 259.3**	**2.7**	61 840	29 515.2	1.8	11 219	7 383.3	11 203	7 360.8

*Includes doctoral students and post-doctoral fellows. Also includes specific categories of R&D personnel (from 2016/17).

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.29: R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
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**	3 663.7	3 543.2	62.5
Total	74 931	41 636	33 295	41 054.5	23 131.4	17 923.1	54.8
2016/17	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**56 761**	31 170	25 591	**27 656.2**	15 312.5	12 343.8	48.7
Technicians directly supporting R&D	**11 346**	7 028	4 318	**7 563.1**	4 570.8	2 992.4	66.7
Other personnel directly supporting R&D	**11 922**	5 722	6 200	**7 313.6**	3 755.9	3 557.8	61.3
Total	80 029	43 920	36 109	42 533.0	23 639.1	18 893.9	53.1
2017/18	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**61 840**	34 066	27 774	**29 515.2**	16 404.3	13 111.0	47.7
Technicians directly supporting R&D	**11 219**	6 673	4 546	**7 383.3**	4 289.6	3 093.7	65.8
Other personnel directly supporting R&D	**11 203**	5 580	5 623	**7 360.8**	3 870.4	3 490.5	65.7
Total	84 262	46 319	37 943	44 259.3	24 564.2	19 695.1	52.5

*Includes doctoral students and post-doctoral fellows. Also includes specific categories of R&D personnel (from 2016/17).

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.30: R&D personnel in headcounts by sector (2008/09 to 2017/18)

YEAR	TOTAL R&D PERSONNEL (HEADCOUNTS*)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
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
2016/17	**80 029**	3 076	4 955	52 384	17 998	1 616
2017/18	**84 262**	3 027	4 866	57 074	17 554	1 741

*Includes doctoral students and post-doctoral fellows. Also includes specific categories of R&D personnel (from 2016/17).

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.31: R&D personnel full-time equivalents by sector (2008/09 to 2017/18)

YEAR	TOTAL R&D PERSONNEL* (FTEs)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
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
2016/17	**42 533.0**	2 031.6	4 421.4	22 061.4	12 549.2	1 469.5
2017/18	**44 259.3**	2 000.4	4 294.9	23 415.1	12 952.9	1 596.0

*Includes doctoral students and post-doctoral fellows. Also includes specific categories of R&D personnel (2016/17 only).

Note: Headcounts include non-SA R&D personnel (2016/17 only). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.32: Researcher headcounts by sector (2008/09 to 2017/18)

YEAR	TOTAL RESEARCHERS (HEADCOUNTS*)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
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
2016/17	**56 761**	1 677	2 189	46 028	6 463	404
2017/18	**61 840**	1 671	2 053	50 549	7 142	425

*Includes doctoral students and post-doctoral fellows. Also includes specific categories of R&D personnel (from 2016/17).

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.33: Researcher headcounts by gender (2008/09 to 2017/18)

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	MALE	FEMALE
2008/09	**28 952**	17 694	11 258
2009/10	**29 255**	17 614	11 641
2010/11	**25 300**	14 823	10 477
2011/12	**25 954**	15 065	10 889
2012/13	**27 314**	15 378	11 936
2013/14	**28 014**	15 520	12 494
2014/15	**28 723**	15 824	12 899
2015/16	**29 455**	16 150	13 305
2016/17	**33 035**	17 957	15 078
2017/18	**36 233**	19 800	16 433

*Excludes doctoral students and post-doctoral fellows. Researchers includes specific categories of R&D personnel (from 2016/17).

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.34: Researcher headcounts by race (2008/09 to 2017/18)

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	AFRICAN	COLOURED	INDIAN/ASIAN	WHITE	NON-SA
2008/09	**28 952**	6 595	1 505	2 588	18 265	N/A
2009/10	**29 255**	7 210	1 573	2 448	18 024	N/A
2010/11	**25 300**	6 756	1 316	2 438	14 789	N/A
2011/12	**25 954**	7 201	1 438	2 202	15 113	N/A
2012/13	**27 314**	8 101	1 591	2 514	15 108	N/A
2013/14	**28 014**	8 024	1 685	2 530	15 775	N/A
2014/15	**28 723**	8 468	1 815	2 522	15 919	N/A
2015/16	**29 454**	9 548	1 881	2 629	15 396	N/A
2016/17	**33 035**	9 968	1 957	2 921	15 151	3 038
2017/18	**36 233**	10 815	2 209	3 352	15 795	4 062

*Excludes doctoral students and post-doctoral fellows. Researchers includes specific categories of R&D personnel (from 2016/17).

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

N/A: data was not collected for these years.

Table C.35: R&D personnel in headcounts (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL R&D PERSONNEL (HEADCOUNTS)	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers*	**36 233**	**19 800**	**16 433**	**5 688**	**5 127**	**1 018**	**1 191**	**1 637**	**1 715**	**8 615**	**7 180**	**2 842**	**1 220**
Doctoral degree or equivalent	13 727	8 017	5 709	1 605	1 108	368	398	518	511	3 505	2 970	2 021	723
Master's, honours, bachelor or equivalent	18 708	9 831	8 877	3 371	3 227	536	671	971	1 010	4 280	3 577	673	392
Diplomas	3 798	1 951	1 847	712	792	114	122	147	195	830	633	148	105
Technicians directly supporting R&D	**11 219**	**6 673**	**4 546**	**2 524**	**1 975**	**637**	**591**	**598**	**371**	**2 508**	**1 184**	**406**	**424**
Doctoral degree or equivalent	396	192	204	28	28	9	44	7	13	80	76	68	43
Master's, honours, bachelor or equivalent	4 466	2 461	2 005	880	774	242	317	304	222	964	654	71	38
Diplomas	6 357	4 020	2 337	1 616	1 173	386	230	287	136	1 465	454	267	343
Other personnel directly supporting R&D	**11 203**	**5 580**	**5 623**	**2 728**	**2 171**	**482**	**879**	**684**	**394**	**1 343**	**1 755**	**344**	**424**
Doctoral degree or equivalent	378	164	214	42	44	8	51	11	15	82	86	21	18
Master's, honours, bachelor or equivalent	3 242	1 452	1 789	463	535	109	206	241	135	561	820	79	93
Diplomas	7 583	3 964	3 619	2 224	1 592	365	622	432	244	700	849	244	313
Total	58 655	32 053	26 602	10 940	9 273	2 137	2 661	2 918	2 481	12 466	10 119	3 592	2 068

*Researchers includes specific categories of R&D personnel (from 2016/17).

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

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

C.2. Sector tables

C.2.1. Business sector

Table C.36: Business sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	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	2016/17 R'000	2017/18 R'000
Basic research	1 073 117	1 267 759	1 025 389	922 888	802 753	968 504	845 527	906 730	909 278	1 021 152
Applied research	3 426 651	3 301 773	3 949 410	4 461 770	5 569 024	6 087 791	7 541 596	7 492 229	8 389 888	10 551 512
Experimental development research	7 832 244	6 569 705	5 084 210	5 079 364	4 198 949	4 726 553	4 903 827	5 416 037	5 482 104	4 286 521
Total	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.37: Proportional business sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Basic research	8.7	11.4	10.2	8.8	7.6	8.2	6.4	6.6	6.2	6.4
Applied research	27.8	29.6	39.3	42.6	52.7	51.7	56.7	54.2	56.8	66.5
Experimental development research	63.5	59.0	50.5	48.5	39.7	40.1	36.9	39.2	37.1	27.0
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 (2008/09 to 2017/18)

TYPE OF EXPENDITURE	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	2016/17 R'000	2017/18 R'000
Capital expenditure	**2 658 738**	**1 638 994**	**1 306 444**	**1 650 541**	**1 072 556**	**1 132 520**	**1 397 43**	**1 289 228**	**1 727 929**	**1 421 699**
Land: buildings & other structures	207 473	285 285	202 835	217 126	140 053	159 162	117 656	186 396	288 957	270 191
Vehicles, plant, machinery, equipment	2 451 265	1 353 709	1 103 609	1 433 415	932 503	973 358	1 279 587	1 102 833	1 438 972	1 151 508
Current expenditure	**9 673 274**	**9 500 243**	**8 752 566**	**8 813 481**	**9 498 170**	**10 650 328**	**11 893 708**	**12 525 767**	**13 053 341**	**14 437 485**
Labour costs	5 279 507	5 207 695	4 467 214	4 723 488	5 821 884	6 768 527	7 659 365	7 821 865	8 486 640	9 747 037
Other current expenditure	4 393 767	4 292 548	4 285 352	4 089 993	3 676 286	3 881 801	4 234 343	4 703 901	4 566 701	4 690 449
Total	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.39: Proportional business sector R&D expenditure by accounting category (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Capital expenditure	**21.6**	**14.7**	**13.0**	**15.8**	**10.1**	**9.6**	**10.5**	**9.3**	**11.7**	**9.0**
Land: buildings & other structures	1.7	2.6	2.0	2.1	1.3	1.4	0.9	1.3	2.0	1.7
Vehicles, plant, machinery, equipment	19.9	12.2	11.0	13.7	8.8	8.3	9.6	8.0	9.7	7.3
Current expenditure	**78.4**	**85.3**	**87.0**	**84.2**	**89.9**	**90.4**	**89.5**	**90.7**	**88.3**	**91.0**
Labour costs	42.8	46.8	44.4	45.1	55.1	57.4	57.6	56.6	57.4	61.5
Other current expenditure	35.6	38.5	42.6	39.1	34.8	32.9	31.9	34.0	30.9	29.6
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 (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	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	2016/17 R'000	2017/18 R'000
Biotechnology	268 923	330 232	341 695	422 121	499 589	556 275	578 747	729 299	685 170	721 698
Nanotechnology	56 881	150 474	102 670	171 808	225 557	170 479	217 216	134 063	268 320	113 260
Total	**325 804**	**480 706**	**444 366**	**593 929**	**725 145**	**726 754**	**795 963**	**863 362**	**953 490**	**834 958**
Business expenditure on R&D	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.41: Proportional business sector expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Biotechnology	2.2	3.0	3.4	4.0	4.7	4.7	4.4	5.3	4.6	4.6
Nanotechnology	0.5	1.4	1.0	1.6	2.1	1.4	1.6	1.0	1.8	0.7
Total	**2.6**	**4.3**	**4.4**	**5.7**	**6.9**	**6.2**	**6.0**	**6.2**	**6.5**	**5.3**

Table C.42: Business sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	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	2016/17 R'000	2017/18 R'000
Environment related	N/A	N/A	N/A	31 349	183 921	228 905	176 463	173 356	280 651	377 030
Open-source software	96 266	91 818	68 105	85 787	87 200	233 576	241 710	326 856	207 849	193 239
New materials	154 140	173 308	227 682	277 152	225 897	151 890	245 752	224 433	179 108	186 858
Tuberculosis (TB), HIV/AIDS, malaria	466 161	460 233	631 996	812 580	929 121	992 538	1 082 646	1 176 149	1 153 668	1 332 248
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33 099	42 291
Total	**716 567**	**725 359**	**927 783**	**1 206 869**	**1 426 139**	**1 606 909**	**1 746 571**	**1 900 794**	**1 854 375**	**2 131 666**
Business expenditure on R&D	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.43: Proportional business sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environment related	N/A	N/A	N/A	0.3	1.7	1.9	1.3	1.3	1.9	2.4
Open-source software	0.8	0.8	0.7	0.8	0.8	2.0	1.8	2.4	1.4	1.2
New materials	1.2	1.6	2.3	2.6	2.1	1.3	1.8	1.6	1.2	1.2
Tuberculosis (TB), HIV/AIDS, malaria	3.8	4.1	6.3	7.8	8.8	8.4	8.1	8.5	7.8	8.4
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2	0.3
Total	**5.8**	**6.5**	**9.2**	**11.5**	**13.5**	**13.6**	**13.1**	**13.8**	**12.5**	**13.4**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.44: Business sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural Sciences, Technology and Engineering	**11 902 551**	**10 743 523**	**9 612 221**	**9 992 916**	**9 127 446**	**9 765 859**	**10 977 250**	**11 447 693**	**11 918 539**	**11 793 445**
Mathematical sciences	183 255	183 426	110 543	204 594	149 220	209 344	211 324	119 900	138 858	188 550
Physical sciences	655 898	190 292	32 669	28 490	47 672	50 708	56 997	35 616	45 816	90 281
Chemical sciences	859 041	627 729	687 843	934 005	980 021	979 760	847 321	972 398	1 153 685	1 154 404
Earth sciences	95 034	90 098	106 759	92 439	102 892	109 665	118 539	93 302	104 072	160 745
Information, computer and communication technologies	2 412 430	2 855 355	2 502 454	2 481 028	1 576 163	1 610 718	1 908 985	2 572 364	3 111 146	2 584 726
Applied sciences and technologies	1 671 375	1 271 414	1 132 538	902 425	872 014	808 899	955 119	903 958	915 101	1 143 251
Engineering sciences	3 908 347	3 311 902	2 768 035	2 751 145	2 827 677	3 093 088	3 548 019	3 429 786	2 651 327	2 971 162

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Biological sciences	162 776	194 671	207 456	212 633	210 627	213 124	248 838	254 071	250 356	220 193
Agricultural sciences	293 357	323 603	371 310	471 529	444 593	593 315	665 703	671 194	686 697	778 583
Medical and health sciences	1 509 109	1 567 493	1 622 215	1 843 005	1 812 411	1 974 213	2 170 317	2 300 587	2 283 200	2 384 920
Environmental sciences	57 764	47 692	5 818	2 206	44 563	50 909	85 932	21 920	480 612	60 379
Material sciences	82 192	70 949	59 723	65 092	53 855	64 090	154 500	71 967	97 670	56 253
Marine sciences	11 975	8 899	4 859	4 324	5 738	8 026	5 655	630	0	0
Division 2: Social Sciences and Humanities	**429 461**	**395 714**	**446 789**	**471 106**	**1 443 280**	**2 016 989**	**2 313 701**	**2 367 302**	**2 862 731**	**4 065 740**
Social sciences	428 969	395 115	446 789	471 106	1 443 280	2 016 989	2 313 701	2 367 302	2 858 585	4 065 740
Humanities	491	599	0	0	0	0	0	0	4 146	0
Total	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.45: Proportional business sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural Sciences, Technology and Engineering	**96.5**	**96.4**	**95.6**	**95.5**	**86.3**	**82.9**	**82.6**	**82.9**	**80.6**	**74.4**
Mathematical sciences	1.5	1.6	1.1	2.0	1.4	1.8	1.6	0.9	0.9	1.2
Physical sciences	5.3	1.7	0.3	0.3	0.5	0.4	0.4	0.3	0.3	0.6
Chemical sciences	7.0	5.6	6.8	8.9	9.3	8.3	6.4	7.0	7.8	7.3
Earth sciences	0.8	0.8	1.1	0.9	1.0	0.9	0.9	0.7	0.7	1.0
Information, computer and communication technologies	19.6	25.6	24.9	23.7	14.9	13.7	14.4	18.6	21.0	16.3
Applied sciences and technologies	13.6	11.4	11.3	8.6	8.2	6.9	7.2	6.5	6.2	7.2
Engineering sciences	31.7	29.7	27.5	26.3	26.8	26.3	26.7	24.8	17.9	18.7
Biological sciences	1.3	1.7	2.1	2.0	2.0	1.8	1.9	1.8	1.7	1.4
Agricultural sciences	2.4	2.9	3.7	4.5	4.2	5.0	5.0	4.9	4.6	4.9
Medical and health sciences	12.2	14.1	16.1	17.6	17.1	16.8	16.3	16.7	15.4	15.0
Environmental sciences	0.5	0.4	0.1	0.0	0.4	0.4	0.6	0.2	3.3	0.4
Material sciences	0.7	0.6	0.6	0.6	0.5	0.5	1.2	0.5	0.7	0.4
Marine sciences	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Division 2: Social Sciences and Humanities	**3.5**	**3.6**	**4.4**	**4.5**	**13.7**	**17.1**	**17.4**	**17.1**	**19.4**	**25.6**
Social sciences	3.5	3.5	4.4	4.5	13.7	17.1	17.4	17.1	19.3	25.6
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 (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**908 781**	**959 761**	**1 103 510**	**813 259**	**1 040 025**	**1 096 986**	**1 034 893**	**937 964**	**830 331**	**1 187 443**
Defence	908 781	959 761	1 103 510	813 259	1 040 025	1 096 986	1 034 893	937 964	830 331	1 187 443
Division 2: Economic Development	**9 737 338**	**8 258 491**	**7 012 272**	**7 381 289**	**7 234 533**	**8 308 177**	**9 663 402**	**10 362 668**	**11 554 708**	**11 730 578**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	266 259	309 370	288 323	315 806	374 327	454 990	593 610	622 367	1 026 707	628 123
Animal production and animal primary products	74 302	110 295	46 709	46 316	38 484	69 916	74 045	74 267	66 547	41 588
Mineral resources (excluding Energy)	839 558	741 401	728 130	733 280	853 544	977 365	1 405 074	1 348 618	947 258	812 439
Energy resources	732 188	290 662	93 532	90 377	90 975	95 375	100 061	79 210	470 860	431 681
Energy supply	393 798	426 407	470 030	490 490	321 456	349 710	503 222	362 656	461 804	555 067
Manufacturing	2 562 745	2 037 129	1 747 369	1 863 289	1 639 077	1 869 926	2 096 271	2 106 255	1 924 020	1 965 446
Construction	1 295 717	367 510	16 284	46 158	96 071	125 059	138 237	55 625	54 328	22 942
Transport	621 479	843 301	872 149	920 081	951 435	1 080 427	935 483	1 046 235	1 098 281	1 124 099
Information and communication services	1 151 637	1 189 650	851 392	978 187	908 640	842 341	1 097 649	1 685 124	2 085 856	1 403 512
Commercial services	1 422 123	1 747 450	1 773 253	1 739 933	1 755 506	2 255 642	2 555 783	2 643 503	2 929 445	4 196 652
Economic framework	160 562	106 693	70 795	57 474	103 240	91 464	79 065	273 497	422 742	476 032
Natural resources	216 971	88 624	54 306	99 898	101 778	95 962	84 901	65 312	66 859	72 996
Division 3: Society	**1 019 848**	**1 224 481**	**1 041 616**	**1 232 867**	**1 242 066**	**1 303 321**	**1 435 870**	**1 433 935**	**1 498 255**	**2 027 742**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	930 645	1 103 816	880 549	1 054 182	1 045 048	1 097 446	1 212 844	1 216 127	1 289 142	1 364 830
Education and training	27 232	26 444	32 486	32 767	29 566	33 913	35 728	33 707	21 076	23 586
Social development and community services	61 971	94 220	128 581	145 918	167 452	171 962	187 298	184 102	188 036	639 326
Division 4: Environment	**221 747**	**211 208**	**211 025**	**220 698**	**173 535**	**171 747**	**219 212**	**196 802**	**201 177**	**283 454**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	91 953	53 022	51 845	58 565	46 213	43 935	55 885	62 471	45 213	116 313
Environmental aspects of development	31 493	22 456	55 577	42 226	17 957	14 344	38 437	18 915	48 553	52 852

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Environmental and other aspects	98 301	135 730	103 602	119 907	109 365	113 468	124 889	115 415	107 410	114 289
Division 5: Advancement of Knowledge	**444 298**	**485 296**	**690 587**	**815 909**	**880 567**	**902 617**	**937 575**	**883 626**	**696 800**	**629 967**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	439 330	479 999	682 401	813 150	877 557	899 840	932 030	880 474	696 770	629 967
Social sciences and humanities	4 968	5 298	8 186	2 758	3 010	2 776	5 545	3 152	30	0
Total	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.47: Proportional business sector R&D expenditure by socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**7.4**	**8.6**	**11.0**	**7.8**	**9.8**	**9.3**	**7.8**	**6.8**	**5.6**	**7.5**
Defence	7.4	8.6	11.0	7.8	9.8	9.3	7.8	6.8	5.6	7.5
Division 2: Economic Development	**79.0**	**74.1**	**69.7**	**70.5**	**68.4**	**70.5**	**72.7**	**75.0**	**78.2**	**74.0**
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	2.2	2.8	2.9	3.0	3.5	3.9	4.5	4.5	6.9	4.0
Animal production and animal primary products	0.6	1.0	0.5	0.4	0.4	0.6	0.6	0.5	0.5	0.3
Mineral resources (excluding Energy)	6.8	6.7	7.2	7.0	8.1	8.3	10.6	9.8	6.4	5.1
Energy resources	5.9	2.6	0.9	0.9	0.9	0.8	0.8	0.6	3.2	2.7
Energy supply	3.2	3.8	4.7	4.7	3.0	3.0	3.8	2.6	3.1	3.5
Manufacturing	20.8	18.3	17.4	17.8	15.5	15.9	15.8	15.2	13.0	12.4
Construction	10.5	3.3	0.2	0.4	0.9	1.1	1.0	0.4	0.4	0.1
Transport	5.0	7.6	8.7	8.8	9.0	9.2	7.0	7.6	7.4	7.1
Information and communication services	9.3	10.7	8.5	9.3	8.6	7.1	8.3	12.2	14.1	8.8
Commercial services	11.5	15.7	17.6	16.6	16.6	19.1	19.2	19.1	19.8	26.5
Economic framework	1.3	1.0	0.7	0.5	1.0	0.8	0.6	2.0	2.9	3.0
Natural resources	1.8	0.8	0.5	1.0	1.0	0.8	0.6	0.5	0.5	0.5

SOCIO-ECONOMIC OBJECTIVE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Division 3: Society	**8.3**	**11.0**	**10.4**	**11.8**	**11.8**	**11.1**	**10.8**	**10.4**	**10.1**	**12.8**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	7.5	9.9	8.8	10.1	9.9	9.3	9.1	8.8	8.7	8.6
Education and training	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.1
Social development and community services	0.5	0.8	1.3	1.4	1.6	1.5	1.4	1.3	1.3	4.0
Division 4: Environment	**1.8**	**1.9**	**2.1**	**2.1**	**1.6**	**1.5**	**1.6**	**1.4**	**1.4**	**1.8**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.7	0.5	0.5	0.6	0.4	0.4	0.4	0.5	0.3	0.7
Environmental aspects of development	0.3	0.2	0.6	0.4	0.2	0.1	0.3	0.1	0.3	0.3
Environmental and other aspects	0.8	1.2	1.0	1.1	1.0	1.0	0.9	0.8	0.7	0.7
Division 5: Advancement of Knowledge	**3.6**	**4.4**	**6.9**	**7.8**	**8.3**	**7.7**	**7.1**	**6.4**	**4.7**	**4.0**
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	3.6	4.3	6.8	7.8	8.3	7.6	7.0	6.4	4.7	4.0
Social sciences and humanities	0.0	0.0	0.1	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.48: Business sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	316 089	320 955	217 880	354 553	468 197	646 497	608 398	651 533	690 478	707 348
Free State	1 213 808	999 554	943 508	1 308 833	1 265 285	1 374 960	831 575	1 124 042	1 060 177	1 105 873
Gauteng	7 131 411	6 120 062	5 439 718	5 558 409	5 356 550	5 813 673	7 160 280	7 183 557	7 876 139	8 285 425
KwaZulu-Natal	1 255 509	1 183 636	1 280 014	1 160 507	1 237 563	1 434 084	1 501 659	1 436 737	1 553 130	1 679 718
Limpopo	75 675	49 375	41 850	62 728	127 451	140 026	161 331	145 736	171 567	223 014
Mpumalanga	201 550	161 154	139 771	157 158	222 974	301 831	435 770	339 985	284 655	304 990
North-West	222 630	267 528	256 428	45 267	380 144	435 849	681 634	451 891	526 962	565 486
Northern Cape	7 319	7 988	17 017	302 164	78 471	124 150	226 303	206 786	49 508	60 007
Western Cape	1 908 020	2 028 984	1 722 823	1 514 404	1 434 090	1 511 778	1 684 001	2 274 728	2 568 653	2 927 324
Total	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.49: Proportional business sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.6	2.9	2.2	3.4	4.4	5.5	4.6	4.7	4.7	4.5
Free State	9.8	9.0	9.4	12.5	12.0	11.7	6.3	8.1	7.2	7.0
Gauteng	57.8	54.9	54.1	53.1	50.7	49.3	53.9	52.0	53.3	52.2
KwaZulu-Natal	10.2	10.6	12.7	11.1	11.7	12.2	11.3	10.4	10.5	10.6
Limpopo	0.6	0.4	0.4	0.6	1.2	1.2	1.2	1.1	1.2	1.4
Mpumalanga	1.6	1.4	1.4	1.5	2.1	2.6	3.3	2.5	1.9	1.9
North-West	1.8	2.4	2.5	2.9	3.6	3.7	5.1	3.3	3.6	3.6
Northern Cape	0.1	0.1	0.2	0.4	0.7	1.1	1.7	1.5	0.3	0.4
Western Cape	15.5	18.2	17.1	14.5	13.6	12.8	12.7	16.5	17.4	18.5
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) (2008/09 to 2017/18)

STANDARD INDUSTRIAL CLASSIFICATION	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	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	**220 757**	**208 447**	**157 916**	**211 132**	**286 832**	**364 424**	**460 464**	**484 384**	**472 472**	**395 011**
Mining and Quarrying	**578 825**	**499 286**	**1 055 963**	**1 352 877**	**1 554 284**	**1 675 153**	**1 340 103**	**1 220 985**	**1 069 826**	**1 101 202**
Manufacturing	**4 787 581**	**4 321 327**	**3 592 204**	**3 551 234**	**3 476 647**	**3 793 066**	**4 501 146**	**4 442 466**	**4 107 936**	**4 473 167**
Manufacture of Food Products, Beverages and Tobacco Products	215 876	162 851	221 370	283 262	319 143	340 427	364 178	376 884	328 832	455 335
Manufacture of Textiles, Clothing and Leather Goods	13 755	16 946	2 437	0	2 073	32 091	34 609	9 335	8 932	21 968
Manufacture of Wood and Products of Wood and Cork, except furniture; Manufacture of Articles of Straw and Plaiting Materials; Manufacture of Paper and Paper Products; Manufacture of Publishing, Printing and Reproduction of Recorded Material	118 016	111 255	106 448	80 255	50 531	60 437	72 870	95 555	87 814	91 005
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	2 267 063	1 758 353	1 197 179	1 381 001	1 139 617	1 256 313	1 835 837	1 800 420	1 696 770	1 692 447
Manufacture of Non-Metallic Mineral Products	134 638	120 508	87 037	72 039	49 974	52 263	51 097	28 095	37 531	24 657
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	315 295	330 137	240 408	392 800	585 635	620 923	607 574	660 205	519 108	581 073
Manufacture of Electrical Machinery and Apparatus	166 498	146 169	207 954	310 599	312 102	254 042	302 575	381 971	455 378	635 655

STANDARD INDUSTRIAL CLASSIFICATION	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	2016/17 R'000	2017/18 R'000
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	511 356	591 774	590 174	639 217	656 639	742 033	706 308	569 127	629 240	625 773
Manufacture of Transport Equipment	984 235	1 022 589	881 958	310 145	267 788	334 276	408 448	402 772	321 638	316 503
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	60 849	60 743	57 240	81 914	93 145	100 261	117 649	118 102	22 692	28 752
Electricity, Gas & Water Supply	**2 306 297**	**955 690**	**536 050**	**494 745**	**385 770**	**355 720**	**548 015**	**439 157**	**544 850**	**639 298**
Construction	**6 105**	**3 490**	**3 213**	**6 495**	**9 051**	**8 037**	**6 637**	**5 613**	**4 297**	**3 562**
Wholesale and Retail	**334 131**	**434 522**	**620 541**	**547 194**	**179 383**	**100 176**	**85 491**	**42 977**	**54 553**	**84 403**
Transport, Storage & Communication	**425 235**	**415 243**	**354 311**	**484 222**	**467 411**	**451 336**	**632 243**	**897 359**	**1 543 763**	**978 548**
Financial Intermediation, Real Estate and Business Services	**3 377 896**	**3 777 124**	**3 326 985**	**3 645 625**	**3 914 543**	**4 724 439**	**5 357 151**	**5 910 332**	**6 555 245**	**7 744 370**
Community, Social and Personal Services	**295 185**	**524 108**	**411 826**	**170 499**	**296 805**	**310 498**	**359 701**	**371 723**	**428 328**	**439 625**
Total	**12 332 012**	**11 139 237**	**10 059 010**	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**

Table C.51: Proportional business sector R&D expenditure by Standard Industrial Classification Code (SIC) (2008/09 to 2017/18)

STANDARD INDUSTRIAL CLASSIFICATION	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Agriculture, Hunting, Forestry and Fishing	**1.8**	**1.9**	**1.6**	**2.0**	**2.7**	**3.1**	**3.5**	**3.5**	**3.2**	**2.5**
Mining and Quarrying	**4.7**	**4.5**	**10.5**	**12.9**	**14.7**	**14.2**	**10.1**	**8.8**	**7.2**	**6.9**
Manufacturing	**38.8**	**38.8**	**35.7**	**33.9**	**32.9**	**32.2**	**33.9**	**32.2**	**27.8**	**28.2**
Manufacture of Food Products, Beverages and Tobacco Products	1.8	1.5	2.2	2.7	3.0	2.9	2.7	2.7	2.2	2.9
Manufacture of Textiles, Clothing and Leather Goods	0.1	0.2	0.0	0.0	0.0	0.3	0.3	0.1	0.1	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	1.0	1.0	1.1	0.8	0.5	0.5	0.5	0.7	0.6	0.6
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	18.4	15.8	11.9	13.2	10.8	10.7	13.8	13.0	11.5	10.7
Manufacture of Non-Metallic Mineral Products	1.1	1.1	0.9	0.7	0.5	0.4	0.4	0.2	0.3	0.2
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	2.6	3.0	2.4	3.8	5.5	5.3	4.6	4.8	3.5	3.7

STANDARD INDUSTRIAL CLASSIFICATION	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Manufacture of Electrical Machinery and Apparatus	1.4	1.3	2.1	3.0	3.0	2.2	2.3	2.8	3.1	4.0
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	4.1	5.3	5.9	6.1	6.2	6.3	5.3	4.1	4.3	3.9
Manufacture of Transport Equipment	8.0	9.2	8.8	3.0	2.5	2.8	3.1	2.9	2.2	2.0
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0.5	0.5	0.6	0.8	0.9	0.9	0.9	0.9	0.2	0.2
Electricity, Gas & Water Supply	**18.7**	**8.6**	**5.3**	**4.7**	**3.6**	**3.0**	**4.1**	**3.2**	**3.7**	**4.0**
Construction	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**
Wholesale and Retail	**2.7**	**3.9**	**6.2**	**5.2**	**1.7**	**0.9**	**0.6**	**0.3**	**0.4**	**0.5**
Transport, Storage & Communication	**3.4**	**3.7**	**3.5**	**4.6**	**4.4**	**3.8**	**4.8**	**6.5**	**10.4**	**6.2**
Financial Intermediation, Real Estate and Business Services	**27.4**	**33.9**	**33.1**	**34.8**	**37.0**	**40.1**	**40.3**	**42.8**	**44.3**	**48.8**
Community, Social and Personal Services	**2.4**	**4.7**	**4.1**	**1.6**	**2.8**	**2.6**	**2.7**	**2.7**	**2.9**	**2.8**
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 (2008/09 to 2017/18)

YEAR	HEADCOUNTS				FULL TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
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
2016/17	**17 998**	6 463	6 156	5 379	**12 549.2**	4 777.3	4 149.4	3 622.5
2017/18	**17 554**	7 142	5 655	4 757	**12 952.9**	5 481.7	3 807.5	3 663.8

Note: Headcounts include non-SA R&D personnel (from 2016/17).

Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.53: Business sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**6 128**	3 945	2 183	**4 627**	2 835	1 792	75.5
Technicians directly supporting R&D	**6 090**	4 314	1 776	**4 227**	2 928	1 299	69.4
Other personnel directly supporting R&D	**5 027**	3 148	1 879	**3 604**	2 194	1 410	71.7
Total	**17 245**	**11 407**	**5 838**	**12 458**	**7 957**	**4 501**	**72.2**
2016/17	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**6 463**	4 071	2 392	**4 777.3**	2 807.4	1 969.9	73.9
Technicians directly supporting R&D	**6 156**	4 258	1 898	**4 149.4**	2 731.1	1 418.3	67.4
Other personnel directly supporting R&D	**5 379**	3 183	2 196	**3 622.5**	2 218.7	1 403.7	67.3
Total	**17 998**	**11 512**	**6 486**	**12 549.2**	**7 757.2**	**4 792.0**	**69.7**
2017/18	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**7 142**	4 515	2 627	**5 481.7**	3 263.5	2 218.2	76.8
Technicians directly supporting R&D	**5 655**	3 839	1 816	**3 807.5**	2 482.9	1 324.6	67.3
Other personnel directly supporting R&D	**4 757**	2 893	1 864	**3 663.8**	2 184.4	1 479.4	77.0
Total	**17 554**	**11 247**	**6 307**	**12 952.9**	**7 930.8**	**5 022.1**	**73.8**

Note: Headcounts include non-SA R&D personnel (from 2016/17).

Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.54: Business sector R&D personnel in headcounts by occupation, qualification, population group and gender (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**7 142**	**4 510**	**2 632**	**1 046**	**882**	**199**	**139**	**461**	**298**	**2 743**	**1 287**	**61**	**26**
Doctoral degree or equivalent	715	413	302	61	36	13	16	17	19	302	229	20	2
Master's, honours, bachelor or equivalent	4 716	3 130	1 586	617	454	132	75	378	219	1 971	828	32	10
Diplomas	1 711	967	744	368	392	54	48	66	60	470	230	9	14
Technicians directly supporting R&D	**5 655**	**3 840**	**1 815**	**1 115**	**770**	**341**	**195**	**410**	**236**	**1 961**	**608**	**13**	**6**
Doctoral degree or equivalent	60	26	34	4	10	0	2	2	5	18	16	2	1
Master's, honours, bachelor or equivalent	2 230	1 380	850	332	280	119	95	176	137	747	334	6	4
Diplomas	3 365	2 434	931	779	480	222	98	232	94	1 196	258	5	1
Other personnel directly supporting R&D	**4 757**	**2 901**	**1 856**	**1 348**	**617**	**158**	**283**	**446**	**242**	**859**	**708**	**90**	**6**
Doctoral degree or equivalent	111	39	72	12	17	0	34	4	5	23	16	0	0
Master's, honours, bachelor or equivalent	1 176	622	554	143	124	40	43	71	66	364	319	4	2
Diplomas	3 470	2 240	1 230	1 193	476	118	206	371	171	472	373	86	4
Total	**17 554**	**11 251**	**6 303**	**3 509**	**2 269**	**698**	**617**	**1 317**	**776**	**5 563**	**2 603**	**164**	**38**

Table C.55: Number of foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2015/16 to 2017/18)

COLLABORATION PARTNERS	2015/16		2016/17		2017/18	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	17	8	22	10	28	13
Higher education institutions	64	18	82	25	81	28
Members of own company	25	14	28	11	35	17
Not-for-profit organisations	7	1	12	3	11	5
Other companies	66	32	63	36	60	33
Science councils	41	10	55	10	59	11
Total number of R&D collaborations	**220**	**83**	**262**	**95**	**274**	**107**
No collaboration	8	11	N/A	N/A	N/A	N/A
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)	**2 193 307**	**306 449**	**N/A**	**N/A**	**N/A**	**N/A**

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

N/A: The indicator 'No collaboration' was not assessed from 2016/17 onwards. Collaboration expenditure was also not calculated for 2016/17 onwards.

C.2.1.1 Business sector: State-owned Enterprises

Table C.56: Business sector: SOEs – Number, R&D Expenditure, and R&D Expenditure as a proportion of BERD (2008/09 to 2017/18)

YEAR	NUMBER OF R&D PERFORMERS	R&D EXPENDITURE	PROPORTION OF BERD
		R'000	%
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
2016/17	16	2 621 883	17.7
2017/18	16	2 536 374	16.0

Table C.57: Business sector: SOEs – R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	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	2016/17 R'000	2017/18 R'000
Basic research	260 468	131 212	68 838	55 107	59 187	263 523	65 489	65 556	110 249	140 989
Applied research	1 130 064	866 097	835 262	832 505	805 106	641 358	1 216 953	860 904	1 588 222	1 886 756
Experimental development research	2 048 011	1 160 929	781 421	430 880	647 728	704 890	737 477	1 046 956	923 413	508 629
Total	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**	**2 621 883**	**2 536 374**

Table C.58: Business sector: SOEs – Proportional R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Basic research	7.6	6.1	4.1	4.2	3.9	16.4	3.2	3.3	4.2	5.6
Applied research	32.9	40.1	49.6	63.1	53.2	39.8	60.2	43.6	60.6	74.4
Experimental development research	59.6	53.8	46.4	32.7	42.8	43.8	36.5	53.1	35.2	20.1
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 (2008/09 to 2017/18)

TYPE OF EXPENDITURE	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	2016/17 R'000	2017/18 R'000
Capital expenditure	**1 422 478**	**401 776**	**408 927**	**333 325**	**179 959**	**245 077**	**355 725**	**122 272**	**726 071**	**702 156**
Land: buildings & other structures	37 655	60 525	47 672	14 032	11 195	12 920	16 307	31 884	183 145	173 025
Vehicles, plant, machinery, equipment	1 384 823	341 251	361 255	319 293	168 764	232 157	339 418	90 388	542 926	529 131
Current expenditure	**2 016 066**	**1 756 460**	**1 276 593**	**985 167**	**1 332 062**	**1 364 694**	**1 664 194**	**1 851 145**	**1 895 812**	**1 834 218**
Labour costs	1 262 273	1 033 378	692 407	658 509	795 414	849 371	922 321	976 713	1 040 703	968 562
Other current expenditure	753 793	723 082	584 186	326 658	536 648	515 323	741 873	874 432	855 109	865 656
Total	**3 438 544**	**2 158 236**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 417**	**2 621 883**	**2 536 374**

Table C.60: Business sector: SOEs – Proportional R&D expenditure by accounting category (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Capital expenditure	**41.4**	**18.6**	**24.3**	**25.3**	**11.9**	**15.2**	**17.6**	**6.2**	**27.7**	**27.7**
Land: buildings & other structures	1.1	2.8	2.8	1.1	0.7	0.8	0.8	1.6	7.0	6.8
Vehicles, plant, machinery, equipment	40.3	15.8	21.4	24.2	11.2	14.4	16.8	4.6	20.7	20.9
Current expenditure	**58.6**	**81.4**	**75.7**	**74.7**	**88.1**	**84.8**	**82.4**	**93.8**	**72.3**	**72.3**
Labour costs	36.7	47.9	41.1	49.9	52.6	52.8	45.7	49.5	39.7	38.2
Other current expenditure	21.9	33.5	34.7	24.8	35.5	32.0	36.7	44.3	32.6	34.1
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 (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	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	2016/17 R'000	2017/18 R'000
Biotechnology	11 236	6 834	15 100	14 615	23 479	21 845	16 591	12 278	16 457	18 514
Nanotechnology	1 045	2 553	2 995	7 103	3 768	654	700	144	0	0
Total	**12 281**	**9 386**	**18 095**	**21 717**	**27 247**	**22 499**	**17 290**	**12 422**	**16 457**	**18 514**
Business expenditure on R&D	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**	**2 621 883**	**2 536 374**

Table C.62: Business sector: SOEs – Proportional expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Biotechnology	0.3	0.3	0.9	1.1	1.6	1.4	0.8	0.6	0.6	0.7
Nanotechnology	0.0	0.1	0.2	0.5	0.2	0.0	0.0	0.0	0.0	0.0
Total	**0.4**	**0.4**	**1.1**	**1.6**	**1.8**	**1.4**	**0.9**	**0.6**	**0.6**	**0.7**

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

Table C.63: Business sector: SOEs – R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	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	2016/17 R'000	2017/18 R'000
Environment related	N/A	N/A	N/A	10 029	15 284	22 448	51 522	30 864	136 523	150 811
Open-source software	3 190	5 597	9 087	8 736	7 599	4 124	0	50 589	0	0
New materials	6 673	17 054	14 598	14 872	12 082	12 233	11 111	64 021	15 353	21 144
Tuberculosis (TB), HIV/AIDS, malaria	0	0	0	0	0	0	0	0	0	0
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32 571	33 063
Total	**9 863**	**22 652**	**23 684**	**33 636**	**34 965**	**38 806**	**62 633**	**145 474**	**184 446**	**205 018**
Business expenditure on R&D	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**	**2 621 883**	**2 536 374**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.64: Business sector: SOEs – Proportional R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environment related	N/A	N/A	N/A	0.8	1.0	1.4	2.6	1.6	5.2	5.9
Open-source software	0.1	0.3	0.5	0.7	0.5	0.3	0.0	2.6	0.0	0.0
New materials	0.2	0.8	0.9	1.1	0.8	0.8	0.6	3.2	0.6	0.8
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
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.2	1.3
Total	**0.3**	**1.0**	**1.4**	**2.6**	**2.3**	**2.4**	**3.1**	**7.4**	**7.0**	**8.1**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.65: Business sector: SOEs – R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural Sciences, Technology and Engineering	**3 426 021**	**2 145 037**	**1 670 869**	**1 318 492**	**1 512 021**	**1 609 771**	**1 963 779**	**1 963 821**	**2 524 169**	**2 437 185**
Mathematical sciences	31 148	34 896	38 311	142 930	86 576	93 820	137 076	87 387	85 055	134 335
Physical sciences	649 338	174 483	21 123	14 992	40 742	44 460	46 559	32 100	42 210	81 896
Chemical sciences	58 062	57 109	66 503	80 556	133 867	132 399	86 408	64 230	68 251	55 705
Earth sciences	28 149	25 151	27 912	0	44 006	48 671	24 356	12 254	17 750	17 522
Information, computer and communication technologies	98 303	88 484	64 163	126 456	155 601	168 174	304 806	541 009	935 325	483 015
Applied sciences and technologies	1 033 245	616 089	493 368	151 475	176 600	176 391	165 214	133 687	277 702	446 635
Engineering sciences	1 473 247	1 091 019	926 729	768 675	781 073	824 057	1 034 900	981 683	971 414	1 059 843
Biological sciences	2 889	2 727	0	0	13 496	30 701	29 183	33 874	13 112	12 338
Agricultural sciences	863	719	6 816	8 137	5 343	11 711	12 507	12 665	9 079	9 282
Medical and health sciences	0	0	15 614	17 491	18 012	18 316	49 357	36 548	23 990	76 571
Environmental sciences	39 093	41 092	3 052	0	42 440	45 772	59 270	16 310	47 674	51 225
Material sciences	6 967	8 296	7 279	7 780	8 605	9 198	9 849	12 073	32 605	8 818
Marine sciences	4 716	4 972	0	0	5659	6103	4294	0	0	0
Division 2: Social Sciences and Humanities	**12 522**	**13 201**	**14 651**	**0**	**0**	**0**	**56 140**	**9 595**	**97 714**	**99 189**
Social sciences	12 522	13 201	14 651	0	0	0	56 140	9 595	97 714	99 189
Humanities	0	0	0	0	0	0	0	0	0	0
Total	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**	**2 621 883**	**2 536 374**

Table C.66: Business sector: SOEs – Proportional R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural Sciences, Technology and Engineering	**99.6**	**99.4**	**99.1**	**100.0**	**100.0**	**100.0**	**97.2**	**99.5**	**96.3**	**96.1**
Mathematical sciences	0.9	1.6	2.3	10.8	5.7	5.8	6.8	4.4	3.2	5.3
Physical sciences	18.9	8.1	1.3	1.1	2.7	2.8	2.3	1.6	1.6	3.2
Chemical sciences	1.7	2.6	3.9	6.1	8.9	8.2	4.3	3.3	2.6	2.2
Earth sciences	0.8	1.2	1.7	0.0	2.9	3.0	1.2	0.6	0.7	0.7

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Information, computer and communication technologies	2.9	4.1	3.8	9.6	10.3	10.4	15.1	27.4	35.7	19.0
Applied sciences and technologies	30.0	28.5	29.3	11.5	11.7	11.0	8.2	6.8	10.6	17.6
Engineering sciences	42.8	50.6	55.0	58.3	51.7	51.2	51.2	49.7	37.1	41.8
Biological sciences	0.1	0.1	0.0	0.0	0.9	1.9	1.4	1.7	0.5	0.5
Agricultural sciences	0.0	0.0	0.4	0.6	0.4	0.7	0.6	0.6	0.3	0.4
Medical and health sciences	0.0	0.0	0.9	1.3	1.2	1.1	2.4	1.9	0.9	3.0
Environmental sciences	1.1	1.9	0.2	0.0	2.8	2.8	2.9	0.8	1.8	2.0
Material sciences	0.2	0.4	0.4	0.6	0.6	0.6	0.5	0.6	1.2	0.3
Marine sciences	0.1	0.2	0.0	0.0	0.4	0.4	0.2	0.0	0.0	0.0
Division 2: Social Sciences and Humanities	**0.4**	**0.6**	**0.9**	**0.0**	**0.0**	**0.0**	**2.8**	**0.5**	**3.7**	**3.9**
Social sciences	0.4	0.6	0.9	0.0	0.0	0.0	2.8	0.5	3.7	3.9
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 (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**730 541**	**696 861**	**718 698**	**356 627**	**485 487**	**512 440**	**563 927**	**399 183**	**304 302**	**676 595**
Defence	730 541	696 861	718 698	356 627	485 487	512 440	563 927	399 183	304 302	676 595
Division 2: Economic Development	**2 535 114**	**1 271 859**	**765 929**	**770 791**	**831 597**	**887 024**	**1 187 718**	**1 360 120**	**1 901 235**	**1 424 957**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	0	0	0	0	9 030	9 380	10 076	10 203	8 610	8 610
Animal production and animal primary products	2 877	2 396	1 704	4 069	0	0	0	0	0	0
Mineral resources (excluding Energy)	0	0	5 576	6 247	6 433	6 541	6 996	7 743	8 500	8 818
Energy resources	650 325	185 159	20 372	22 488	23 158	23 549	25 185	27 874	30 602	12 479
Energy supply	334 360	355 509	405 120	367 866	249 963	253 757	419 084	316 868	410 091	516 908
Manufacturing	21 896	43 790	26 828	57 794	77 574	105 372	178 376	103 757	110 104	112 307
Construction	1 272 653	342 212	603	26 433	70 899	99 484	81 944	0	0	0
Transport	180 028	266 227	250 553	60 839	125 965	122 633	126 069	253 742	333 284	335 410

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Information and communication services	44 360	46 766	35 131	179 318	193 815	191 811	270 175	609 251	873 600	302 316
Commercial services	19 183	19 856	19 290	1 504	9 893	10 644	11 434	16 235	16 878	18 002
Economic framework	9 433	9 944	0	17 049	36 408	40 833	37 065	14 447	109 566	110 107
Natural resources	0	0	752	27 185	28 459	23 019	21 316	0	0	0
Division 3: Society	**50 665**	**55 826**	**61 017**	**57 479**	**46 872**	**59 171**	**67 371**	**54 784**	**51 876**	**70 963**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	20 898	24 288	25 320	22 992	19 743	29 360	26 193	19 804	25 631	39 533
Education and training	2 609	2 750	3 052	11 496	10 862	13 281	14 266	14 447	0	0
Social development and community services	27 159	28 788	32 645	22 992	16 268	16 530	26 912	20 533	26 246	31 431
Division 4: Environment	**43 621**	**46 300**	**55 984**	**47 487**	**31 245**	**31 720**	**68 425**	**56 760**	**86 865**	**94 694**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	20 898	22 188	25 696	23 368	15 623	15 860	26 193	33 494	28 662	30 816
Environmental aspects of development	1 826	1 925	3 841	0	0	0	16 040	2 741	32 571	33 063
Environmental and other aspects	20 898	22 188	26 448	24 119	15 623	15 860	26 193	20 525	25 631	30 816
Division 5: Advancement of Knowledge	**78 602**	**87 391**	**83 891**	**86 108**	**116 819**	**119 417**	**132 476**	**102 570**	**277 605**	**269 165**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	73 906	82 441	75 716	83 349	113 836	116 668	129 393	99 448	277 605	269 165
Social sciences and humanities	4 696	4 951	8 176	2 758	2 983	2 750	3 083	3 122	0	0
Total	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**	**2 621 883**	**2 536 374**

Table C.68: Business sector: SOEs – Proportional R&D expenditure by Socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**21.2**	**32.3**	**42.6**	**27.0**	**32.1**	**31.8**	**27.9**	**20.2**	**11.6**	**26.7**
Defence	21.2	32.3	42.6	27.0	32.1	31.8	27.9	20.2	11.6	26.7
Division 2: Economic Development	**73.7**	**58.9**	**45.4**	**58.5**	**55.0**	**55.1**	**58.8**	**68.9**	**72.5**	**56.2**
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	0.0	0.0	0.0	0.6	0.6	0.5	0.5	0.3	0.3
Animal production and animal primary products	0.1	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Mineral resources (excluding Energy)	0.0	0.0	0.3	0.5	0.4	0.4	0.3	0.4	0.3	0.3
Energy resources	18.9	8.6	1.2	1.7	1.5	1.5	1.2	1.4	1.2	0.5
Energy supply	9.7	16.5	24.0	27.9	16.5	15.8	20.7	16.1	15.6	20.4
Manufacturing	0.6	2.0	1.6	4.4	5.1	6.5	8.8	5.3	4.2	4.4
Construction	37.0	15.9	0.0	2.0	4.7	6.2	4.1	0.0	0.0	0.0
Transport	5.2	12.3	14.9	4.6	8.3	7.6	6.2	12.9	12.7	13.2
Information and communication services	1.3	2.2	2.1	13.6	12.8	11.9	13.4	30.9	33.3	11.9
Commercial services	0.6	0.9	1.1	0.1	0.7	0.7	0.6	0.8	0.6	0.7
Economic framework	0.3	0.5	0.0	1.3	2.4	2.5	1.8	0.7	4.2	4.3
Natural resources	0.0	0.0	0.0	2.1	1.9	1.4	1.1	0.0	0.0	0.0
Division 3: Society	**1.5**	**2.6**	**3.6**	**4.4**	**3.1**	**3.7**	**3.3**	**2.8**	**2.0**	**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	0.6	1.1	1.5	1.7	1.3	1.8	1.3	1.0	1.0	1.6
Education and training	0.1	0.1	0.2	0.9	0.7	0.8	0.7	0.7	0.0	0.0
Social development and community services	0.8	1.3	1.9	1.7	1.1	1.0	1.3	1.0	1.0	1.2
Division 4: Environment	**1.3**	**2.1**	**3.3**	**3.6**	**2.1**	**2.0**	**3.4**	**2.9**	**3.3**	**3.7**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.6	1.0	1.5	1.8	1.0	1.0	1.3	1.7	1.1	1.2
Environmental aspects of development	0.1	0.1	0.2	0.0	0.0	0.0	0.8	0.1	1.2	1.3

SOCIO-ECONOMIC OBJECTIVE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.6	1.0	1.6	1.8	1.0	1.0	1.3	1.0	1.0	1.2
Division 5: Advancement of Knowledge	**2.3**	**4.0**	**5.0**	**6.5**	**7.7**	**7.4**	**6.6**	**5.2**	**10.6**	**10.6**
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	2.1	3.8	4.5	6.3	7.5	7.2	6.4	5.0	10.6	10.6
Social sciences and humanities	0.1	0.2	0.5	0.2	0.2	0.2	0.2	0.2	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.69: Business sector: SOEs – R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	16 648	17 582	12 562	21 897	33 436	38 634	37 244	10 854	45 081	52 404
Free State	3 938	17 432	24 865	31 842	28 367	26 428	25 193	10 854	42 824	45 798
Gauteng	3 015 137	1 603 650	1 169 019	915 824	1 014 194	1 012 556	1 448 092	1 558 538	1 937 851	1 682 598
KwaZulu-Natal	45 057	66 955	54 716	61 139	66 477	91 406	45 588	86 565	188 606	197 355
Limpopo	0	0	7 157	15 917	19 724	19 596	18 612	3 019	615	1 024
Mpumalanga	0	0	7 157	15 917	27 038	28 976	33 927	13 222	9 594	9 594
North-West	109 981	138 305	118 682	140 853	151 514	160 739	289 990	170 118	180 261	214 709
Northern Cape	0	0	7 157	17 446	18 630	52 104	17 998	2 397	0	409
Western Cape	247 782	314 314	284 206	97 655	152 641	179 332	103 275	117 850	217 052	332 484
Total	**3 438 543**	**2 158 238**	**1 685 520**	**1 318 492**	**1 512 021**	**1 609 771**	**2 019 919**	**1 973 416**	**2 621 883**	**2 536 374**

Table C.70: Business sector: SOEs – Proportional R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	0.5	0.8	0.7	1.7	2.2	2.4	1.8	0.5	1.7	2.1
Free State	0.1	0.8	1.5	2.4	1.9	1.6	1.2	0.5	1.6	1.8
Gauteng	87.7	74.3	69.4	69.5	67.1	62.9	71.7	79.0	73.9	66.3
KwaZulu-Natal	1.3	3.1	3.2	4.6	4.4	5.7	2.3	4.4	7.2	7.8
Limpopo	0.0	0.0	0.4	1.2	1.3	1.2	0.9	0.2	0.0	0.0
Mpumalanga	0.0	0.0	0.4	1.2	1.8	1.8	1.7	0.7	0.4	0.4
North-West	3.2	6.4	7.0	10.7	10.0	10.0	14.4	8.6	6.9	8.5
Northern Cape	0.0	0.0	0.4	1.3	1.2	3.2	0.9	0.1	0.0	0.0
Western Cape	7.2	14.6	16.9	7.4	10.1	11.1	5.1	6.0	8.3	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.71: Business sector: SOEs – R&D expenditure by Standard Industrial Classification code (2008/09 to 2017/18)

STANDARD INDUSTRIAL CLASSIFICATION	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	2016/17 R'000	2017/18 R'000
Agriculture, Hunting, Forestry and Fishing	575	479	0	0	12 592	17 187	18 413	18 646	20 052	20 390
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0
Manufacturing	552 419	547 593	530 635	248 309	444 185	475 294	480 601	370 407	161 096	461 776
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	1 290	1 340	1 439	1 458	1 230	1 230
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	74 080	99 411	61 654	58 362	69 607	72 216	77 350	8 616	14 489	24 007
Manufacture of Non-Metallic Mineral Products	0	0	6 692	7 496	7 719	7 850	8 395	0	0	0
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	20 798	21 252	0	84 285	224 661	272 253	293 575	297 289	75 855	146 953
Manufacture of Electrical Machinery and Apparatus	54 943	0	0	88 159	76 590	63 824	52 760	20 430	21 690	242 822
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	402 599	426 930	462 290	10 007	64 318	57 812	47 081	42 614	47 833	46 764
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0	0	0	0	0	0	0	0	0	0
Electricity, Gas & Water Supply	2 303 869	936 310	521 665	463 592	325 822	340 670	534 569	424 561	531 606	633 700
Construction	0	0	0	0	0	0	0	0	0	0
Wholesale and Retail	2 609	2 750	3 052	0	0	0	0	0	0	0
Transport, Storage & Communication	176 362	179 602	164 337	304 346	371 495	397 326	565 363	826 532	1 516 160	952 348
Financial Intermediation, Real Estate and Business Services	222 490	259 855	204 455	302 245	137 898	158 060	150 347	196 661	174 576	176 127
Community, Social and Personal Services	180 218	231 648	261 375	0	220 029	221 233	270 626	136 609	218 393	292 033
Total	3 438 543	2 158 238	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374

Table C.72: Business sector: SOEs – Proportional R&D expenditure by Standard Industrial Classification code (2008/09 to 2017/18)

STANDARD INDUSTRIAL CLASSIFICATION	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Agriculture, Hunting, Forestry and Fishing	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**	**1.1**	**0.9**	**0.9**	**0.8**	**0.8**
Mining and Quarrying	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Manufacturing	**16.1**	**25.4**	**31.5**	**18.8**	**29.4**	**29.5**	**23.8**	**18.8**	**6.1**	**18.2**
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	0.1	0.1	0.1	0.1	0.0	0.0
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	2.2	4.6	3.7	4.4	4.6	4.5	3.8	0.4	0.6	0.9
Manufacture of Non-Metallic Mineral Products	0.0	0.0	0.4	0.6	0.5	0.5	0.4	0.0	0.0	0.0
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	0.6	1.0	0.0	6.4	14.9	16.9	14.5	15.1	2.9	5.8
Manufacture of Electrical Machinery and Apparatus	1.6	0.0	0.0	6.7	5.1	4.0	2.6	1.0	0.8	9.6
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	11.7	19.8	27.4	0.8	4.3	3.6	2.3	2.2	1.8	1.8
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	**67.0**	**43.4**	**30.9**	**35.2**	**21.5**	**21.2**	**26.5**	**21.5**	**20.3**	**25.0**
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**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Transport, Storage & Communication	**5.1**	**8.3**	**9.7**	**23.1**	**24.6**	**24.7**	**28.0**	**41.9**	**57.8**	**37.5**
Financial Intermediation, Real Estate and Business Services	**6.5**	**12.0**	**12.1**	**22.9**	**9.1**	**9.8**	**7.4**	**10.0**	**6.7**	**6.9**
Community, Social and Personal Services	**5.2**	**10.7**	**15.5**	**0.0**	**14.6**	**13.7**	**13.4**	**6.9**	**8.3**	**11.5**
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 (2008/09 to 2017/18)

YEAR	HEADCOUNTS				FULL TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2008/09	**2 955**	1 301	863	791	**2 348.1**	1 075.5	703.3	569.3
2009/10	**2 550**	1 115	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	1 479	363	**1 335.3**	541.5	593.2	200.7
2015/16	**2 476**	959	1 163	354	**1 150.1**	477.7	587.9	84.5
2016/17	**2 983**	1 113	1 437	433	**1 213.8**	415.2	688.2	110.4
2017/18	**2 853**	1 509	1 021	323	**1 182.5**	668.6	394.4	119.6

Note: Headcounts include non-SA R&D personnal (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.74: Business sector: SOEs – R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
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**
2016/17	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**1 113**	899	214	**415.2**	315.4	99.8	37.3
Technicians directly supporting R&D	**1 437**	1 079	358	**688.2**	490.1	198.1	47.9
Other personnel directly supporting R&D	**433**	218	215	**110.4**	48.0	62.4	25.5
Total	**2 983**	**2 196**	**787**	1 213.8	**853.5**	**360.3**	**40.7**
2017/18	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**1 509**	1 228	281	**668.6**	539.9	128.8	44.3
Technicians directly supporting R&D	**1 021**	761	260	**394.4**	309.2	85.2	38.6
Other personnel directly supporting R&D	**323**	143	180	**119.6**	49.7	69.9	37.0
Total	**2 853**	**2 132**	**721**	1 182.5	**898.7**	**283.8**	**41.4**

Note: Headcounts include non-SA R&D personnal (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.75: Business sector: SOEs – R&D personnel in headcounts by occupation, qualification, population group and gender (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	1 509	1 228	281	445	109	49	14	130	41	589	106	15	11
Doctoral degree or equivalent	80	67	13	15	10	2	0	2	1	41	1	7	1
Master's, honours, bachelor or equivalent	957	768	189	219	76	33	10	96	34	413	67	7	2
Diplomas	472	393	79	211	23	14	4	32	6	135	38	1	8
Technicians directly supporting R&D	1 021	761	260	329	174	40	23	30	9	361	53	1	1
Doctoral degree or equivalent	5	4	1	0	0	0	0	0	0	3	1	1	0
Master's, honours, bachelor or equivalent	212	143	69	61	46	9	1	14	7	59	14	0	1
Diplomas	804	614	190	268	128	31	22	16	2	299	38	0	0
Other personnel directly supporting R&D	323	143	180	64	89	13	15	2	3	64	73	0	0
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0	0	0
Master's, honours, bachelor or equivalent	37	19	18	4	10	4	3	1	0	10	5	0	0
Diplomas	286	124	162	60	79	9	12	1	3	54	68	0	0
Total	2 853	2 132	721	838	372	102	52	162	53	1 014	232	16	12

Note: Headcounts include non-SA R&D personnal (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

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 to 2017/18)

COLLABORATION PARTNERS	2015/16		2016/17		2017/18	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	2	2	2	2	3	3
Higher education institutions	7	1	11	2	11	4
Members of own company	2	0	3	0	5	3
Not-for-profit organisations	2	1	3	1	3	1
Other companies	3	1	3	1	3	1
Science councils	5	1	9	1	10	2
Total number of R&D collaborations	21	6	31	7	35	14
No collaboration	0	1	N/A	N/A	N/A	N/A
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)	164 075	60 861	N/A	N/A	N/A	N/A

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

N/A: The indicator 'No collaboration' was not assessed from 2016/17 onwards. Collaboration expenditure was also not calculated for 2016/17 onwards.

C.2.2. Not-for-profit sector

Table C.77: Not-for-profit sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	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	2016/17 R'000	2017/18 R'000
Basic research	70 725	111 377	59 302	62 134	114 755	132 478	181 492	200 040	232 304	280 032
Applied research	131 259	53 530	87 435	79 105	346 179	322 295	426 132	508 738	558 059	661 575
Experimental development research	38 665	23 933	16 092	29 366	42 898	128 391	171 149	182 365	227 254	274 703
Total	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

Table C.78: Proportional not-for-profit sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Basic research	29.4	59.0	36.4	36.4	22.8	22.7	23.3	22.4	22.8	23.0
Applied research	54.5	28.3	53.7	46.4	68.7	55.3	54.7	57.1	54.8	54.4
Experimental development research	16.1	12.7	9.9	17.2	8.5	22.0	22.0	20.5	22.3	22.6
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 (2008/09 to 2017/18)

TYPE OF EXPENDITURE	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	2016/17 R'000	2017/18 R'000
Capital expenditure	**7 249**	**8 564**	**8 820**	**18 702**	**37 564**	**39 983**	**49 647**	**53 800**	**91 083**	**75 522**
Land: buildings & other structures	3 137	3 486	4 447	6 905	11 152	19 047	18 794	18 391	20 765	23 962
Vehicles, plant, machinery, equipment	4 112	5 078	4 373	11 797	26 412	20 936	30 853	35 409	70 318	51 560
Current expenditure	**233 400**	**180 276**	**154 010**	**151 903**	**466 269**	**543 182**	**729 125**	**837 342**	**926 534**	**1 140 787**
Labour costs	114 292	94 673	92 098	100 176	243 871	303 644	420 462	468 883	506 181	634 168
Other current expenditure	119 108	85 603	61 912	51 727	222 398	239 538	308 663	368 459	420 353	506 620
Total	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

Table C.80: Proportional not-for-profit sector R&D expenditure by accounting category (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Capital expenditure	**3.0**	**4.5**	**5.4**	**11.0**	**7.5**	**6.9**	**6.4**	**6.0**	**9.0**	**6.2**
Land: buildings & other structures	1.3	1.8	2.7	4.0	2.2	3.3	2.4	2.1	2.0	2.0
Vehicles, plant, machinery, equipment	1.7	2.7	2.7	6.9	5.2	3.6	4.0	4.0	6.9	4.2
Current expenditure	**97.0**	**95.5**	**94.6**	**89.0**	**92.5**	**93.1**	**93.6**	**94.0**	**91.0**	**93.8**
Labour costs	47.5	50.1	56.6	58.7	48.4	52.1	54.0	52.6	49.7	52.1
Other current expenditure	49.5	45.3	38.0	30.3	44.1	41.1	39.6	41.3	41.3	41.7
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 (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	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	2016/17 R'000	2017/18 R'000
Biotechnology	255	4 446	5 666	8 667	29 062	62 082	128 964	159 045	123 879	160 846
Nanotechnology	0	0	1 475	0	10 187	4 915	70 348	81 103	841	543
Total	**255**	**4 446**	**7 141**	**8 667**	**39 249**	**66 997**	**199 312**	**240 148**	**124 720**	**161 389**
NPO expenditure on R&D	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

Table C.82: Proportional not-for-profit sector expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Biotechnology	0.1	2.4	3.5	5.1	5.8	10.6	16.6	17.8	12.2	13.2
Nanotechnology	0.0	0.0	0.9	0.0	2.0	0.8	9.0	9.1	0.1	0.0
Total	**0.1**	**2.4**	**4.4**	**5.1**	**7.8**	**11.5**	**25.6**	**26.9**	**12.3**	**13.3**

Table C.83: Not-for-profit sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	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	2016/17 R'000	2017/18 R'000
Environment related	N/A	N/A	N/A	15 133	18 022	27 142	50 364	52 156	54 904	56 218
Open-source software	0	0	0	20	419	481	69 509	756	824	952
New materials	0	542	830	395	178	191	634	79 322	223	1 814
Tuberculosis (TB), HIV/AIDS, malaria	8 763	7 419	13 979	5 034	246 760	301 086	374 460	482 298	689 315	876 132
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0
Total	**8 763**	**7 962**	**14 809**	**20 581**	**265 379**	**328 901**	**494 966**	**614 532**	**745 265**	**935 117**
NPO expenditure on R&D	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.84: Proportional not-for-profit sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environment related	N/A	N/A	N/A	8.9	3.6	4.7	6.5	5.9	5.4	4.6
Open-source software	0.0	0.0	0.0	0.0	0.1	0.1	8.9	0.1	0.1	0.1
New materials	0.0	0.3	0.5	0.2	0.0	0.0	0.1	8.9	0.0	0.1
Tuberculosis (TB), HIV/AIDS, malaria	3.6	3.9	8.6	3.0	49.0	51.6	48.1	54.1	67.7	72.0
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0
Total	**3.6**	**4.2**	**9.1**	**12.1**	**52.7**	**56.4**	**63.6**	**69.0**	**73.2**	**76.9**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.85: Not-for-profit sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural Sciences, Technology and Engineering	**72 018**	**53 112**	**54 776**	**64 042**	**346 961**	**427 237**	**647 068**	**766 355**	**909 337**	**1 096 247**
Mathematical sciences	1 041	0	0	0	8 223	9 674	14 613	14 293	13 540	14 797
Physical sciences	0	6 422	0	0	765	802	989	1 191	1 300	1 504
Chemical sciences	0	0	0	0	0	1 309	0	0	0	0
Earth sciences	1 012	452	2 585	2 407	2 598	5 907	8 371	8 356	8 727	8 008
Information, computer and communication technologies	1 555	2 207	0	595	2 919	39	197	528	0	1 925
Applied sciences and technologies	0	0	0	1 487	4 317	4 666	19 123	30 565	29 946	29 379
Engineering sciences	0	0	0	0	4 075	4 915	4 638	4 005	3 393	1 572
Biological sciences	2 126	904	1 473	7 978	15 475	23 435	23 338	11 400	42 787	44 312

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Agricultural sciences	19 426	20 404	25 679	25 819	33 105	34 165	53 777	60 727	62 269	63 037
Medical and health sciences	36 032	13 999	15 920	17 423	265 031	329 293	497 588	614 889	719 902	905 867
Environmental sciences	8 396	6 014	3 433	7 553	10 122	12 238	23 548	19 552	25 746	24 150
Material sciences	0	0	0	0	0	0	0	0	0	0
Marine sciences	2 431	2 711	5 687	781	331	794	886	848	1 725	1 697
Division 2: Social Sciences and Humanities	**168 631**	**135 728**	**108 054**	**106 563**	**156 872**	**155 928**	**131 705**	**124 787**	**108 280**	**120 063**
Social sciences	165 924	133 340	104 306	104 842	142 525	147 029	122 105	117 549	98 355	109 068
Humanities	2 707	2 388	3 749	1 720	14 348	8 898	9 599	7 238	9 925	10 995
Total	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

Table C.86: Proportional not-for-profit sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural Sciences, Technology and Engineering	**29.9**	**28.1**	**33.6**	**37.5**	**68.9**	**73.3**	**83.1**	**86.0**	**89.4**	**90.1**
Mathematical sciences	0.4	0.0	0.0	0.0	1.6	1.7	1.9	1.6	1.3	1.2
Physical sciences	0.0	3.4	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1
Chemical sciences	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Earth sciences	0.4	0.2	1.6	1.4	0.5	1.0	1.1	0.9	0.9	0.7
Information, computer and communication technologies	0.6	1.2	0.0	0.3	0.6	0.0	0.0	0.1	0.0	0.2
Applied sciences and technologies	0.0	0.0	0.0	0.9	0.9	0.8	2.5	3.4	2.9	2.4
Engineering sciences	0.0	0.0	0.0	0.0	0.8	0.8	0.6	0.4	0.3	0.1
Biological sciences	0.9	0.5	0.9	4.7	3.1	4.0	3.0	1.3	4.2	3.6
Agricultural sciences	8.1	10.8	15.8	15.1	6.6	5.9	6.9	6.8	6.1	5.2
Medical and health sciences	15.0	7.4	9.8	10.2	52.6	56.5	63.9	69.0	70.7	74.5
Environmental sciences	3.5	3.2	2.1	4.4	2.0	2.1	3.0	2.2	2.5	2.0
Material sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marine sciences	1.0	1.4	3.5	0.5	0.1	0.1	0.1	0.1	0.2	0.1
Division 2: Social Sciences and Humanities	**70.1**	**71.9**	**66.4**	**62.5**	**31.1**	**26.7**	**16.9**	**14.0**	**10.6**	**9.9**
Social sciences	68.9	70.6	64.1	61.5	28.3	25.2	15.7	13.2	9.7	9.0
Humanities	1.1	1.3	2.3	1.0	2.8	1.5	1.2	0.8	1.0	0.9
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 (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**2 050**	**1 600**	**0**	**0**	**0**	**0**	**690**	**0**	**0**	**0**
Defence	2 050	1 600	0	0	0	0	690	0	0	0
Division 2: Economic Development	**69 810**	**71 939**	**65 777**	**60 758**	**110 866**	**113 991**	**152 573**	**157 608**	**129 359**	**118 415**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	17 520	18 873	25 441	24 850	36 127	35 511	28 974	32 936	35 240	35 197
Animal production and animal primary products	972	1 632	1 389	828	2 538	3 083	4 000	7 628	9 856	2 635
Mineral resources (excluding Energy)	0	0	763	0	8 150	9 831	9 242	7 955	7 708	0
Energy resources	1 760	2 604	1 653	969	2 538	3 083	3 993	4 008	3 278	4 022
Energy supply	2 575	3 774	3 307	3 430	4 363	8 690	7 663	6 242	10 628	7 994
Manufacturing	0	0	0	2 197	3 896	2 955	26 291	31 646	230	0
Construction	0	0	0	0	0	0	0	0	0	0
Transport	74	208	0	137	465	424	0	0	0	0
Information and communication services	0	0	0	1 480	2 031	1 823	316	2 411	327	2 513
Commercial services	827	970	0	0	0	0	0	1 135	1 962	1 675
Economic framework	39 059	39 463	27 068	22 228	45 252	42 423	54 435	53 406	47 465	57 125
Natural resources	7 022	4 414	6 157	4 640	5 507	6 167	17 659	10 242	12 665	7 253
Division 3: Society	**141 189**	**93 947**	**82 481**	**75 597**	**360 333**	**415 093**	**555 151**	**632 030**	**767 620**	**941 505**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	37 461	16 554	15 050	13 496	260 712	303 535	449 619	527 783	667 371	835 603
Education and training	32 308	19 986	22 303	23 762	58 894	63 833	61 150	59 917	59 123	61 652
Social development and community services	71 420	57 407	45 128	38 339	40 726	47 725	44 382	44 330	41 126	44 250
Division 4: Environment	**6 937**	**7 052**	**10 051**	**13 356**	**12 841**	**15 044**	**16 135**	**17 503**	**19 734**	**38 078**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	3 406	3 577	6 139	7 233	4 716	7 845	8 697	9 949	9 712	23 780
Environmental aspects of development	593	683	504	3 746	5 771	4 545	4 569	4 494	6 269	6 559

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Environmental and other aspects	2 938	2 792	3 408	2 377	2 355	2 654	2 869	3 060	3 753	7 739
Division 5: Advancement of Knowledge	**20 663**	**14 303**	**4 521**	**20 895**	**19 793**	**39 036**	**54 223**	**84 002**	**100 903**	**118 312**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	486	452	632	13 166	7 754	31 450	42 017	69 845	90 114	107 310
Social sciences and humanities	20 177	13 851	3 889	7 729	12 039	7 586	12 206	14 157	10 789	11 001
Total	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

Table C.88: Proportional not-for-profit sector R&D expenditure by socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**0.9**	**0.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**
Defence	0.9	0.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Division 2: Economic Development	**29.0**	**38.1**	**40.4**	**35.6**	**22.0**	**19.5**	**19.6**	**17.7**	**12.7**	**9.7**
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	7.3	10.0	15.6	14.6	7.2	6.1	3.7	3.7	3.5	2.9
Animal production and animal primary products	0.4	0.9	0.9	0.5	0.5	0.5	0.5	0.9	1.0	0.2
Mineral resources (excluding Energy)	0.0	0.0	0.5	0.0	1.6	1.7	1.2	0.9	0.8	0.0
Energy resources	0.7	1.4	1.0	0.6	0.5	0.5	0.5	0.4	0.3	0.3
Energy supply	1.1	2.0	2.0	2.0	0.9	1.5	1.0	0.7	1.0	0.7
Manufacturing	0.0	0.0	0.0	1.3	0.8	0.5	3.4	3.6	0.0	0.0
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Information and communication services	0.0	0.0	0.0	0.9	0.4	0.3	0.0	0.3	0.0	0.2
Commercial services	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1
Economic framework	16.2	20.9	16.6	13.0	9.0	7.3	7.0	6.0	4.7	4.7
Natural resources	2.9	2.3	3.8	2.7	1.1	1.1	2.3	1.1	1.2	0.6

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 3: Society	**58.7**	**49.7**	**50.7**	**44.3**	**71.5**	**71.2**	**71.3**	**70.9**	**75.4**	**77.4**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	15.6	8.8	9.2	7.9	51.7	52.0	57.7	59.2	65.6	68.7
Education and training	13.4	10.6	13.7	13.9	11.7	10.9	7.9	6.7	5.8	5.1
Social development and community services	29.7	30.4	27.7	22.5	8.1	8.2	5.7	5.0	4.0	3.6
Division 4: Environment	**2.9**	**3.7**	**6.2**	**7.8**	**2.5**	**2.6**	**2.1**	**2.0**	**1.9**	**3.1**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	1.4	1.9	3.8	4.2	0.9	1.3	1.1	1.1	1.0	2.0
Environmental aspects of development	0.2	0.4	0.3	2.2	1.1	0.8	0.6	0.5	0.6	0.5
Environmental and other aspects	1.2	1.5	2.1	1.4	0.5	0.5	0.4	0.3	0.4	0.6
Division 5: Advancement of Knowledge	**8.6**	**7.6**	**2.8**	**12.2**	**3.9**	**6.7**	**7.0**	**9.4**	**9.9**	**9.7**
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	0.2	0.2	0.4	7.7	1.5	5.4	5.4	7.8	8.9	8.8
Social sciences and humanities	8.4	7.3	2.4	4.5	2.4	1.3	1.6	1.6	1.1	0.9
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 (2008/09 to 2017/18)

PROVINCE	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	2016/17 R'000	2017/18 R'000
Eastern Cape	6 790	8 136	9 790	9 493	25 610	25 478	27 219	21 026	17 053	15 150
Free State	4 763	4 418	6 385	5 096	15 297	15 953	14 214	8 890	6 643	8 086
Gauteng	126 136	104 420	61 496	69 321	162 866	175 651	287 783	345 937	333 359	440 863
KwaZulu-Natal	40 492	30 548	35 765	33 740	163 221	166 603	181 052	232 636	277 770	317 706
Limpopo	5 138	4 524	4 541	7 449	11 779	13 719	49 971	56 143	64 105	78 996
Mpumalanga	10 332	8 311	13 206	16 027	23 195	26 979	30 594	25 944	29 964	32 775
North-West	2 339	2 382	5 612	6 353	42 960	72 446	105 904	97 918	136 641	133 473
Northern Cape	2 159	4 493	2 030	1 889	3 867	3 583	1 546	2 200	4 782	4 868
Western Cape	42 500	21 609	24 003	21 236	55 038	82 753	80 489	100 448	147 299	184 392
Total	**240 649**	**188 840**	**162 830**	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**

Table C.90: Proportional not-for-profit sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.8	4.3	6.0	5.6	5.1	4.4	3.5	2.4	1.7	1.2
Free State	2.0	2.3	3.9	3.0	3.0	2.7	1.8	1.0	0.7	0.7
Gauteng	52.4	55.3	37.8	40.6	32.3	30.1	37.0	38.8	32.8	36.2
KwaZulu-Natal	16.8	16.2	22.0	19.8	32.4	28.6	23.2	26.1	27.3	26.1
Limpopo	2.1	2.4	2.8	4.4	2.3	2.4	6.4	6.3	6.3	6.5
Mpumalanga	4.3	4.4	8.1	9.4	4.6	4.6	3.9	2.9	2.9	2.7
North-West	0.9	2.4	3.4	1.1	8.5	12.4	13.6	11.0	13.4	11.0
Northern Cape	1.0	1.3	1.2	3.7	0.8	0.6	0.2	0.2	0.5	0.4
Western Cape	17.7	11.4	14.7	12.4	10.9	14.2	10.3	11.3	14.5	15.2
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 (2008/09 to 2017/18)

YEAR	HEADCOUNTS				FULL TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
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	**768.0**	294.5	114.2	359.4
2013/14	**1 017**	435	205	377	**891.4**	338.4	195.1	357.9
2014/15	**1 471**	506	368	597	**1 231.2**	396.0	355.5	479.8
2015/16	**1 493**	465	436	592	**1 367.3**	384.8	411.2	571.2
2016/17	**1 616**	404	607	605	**1 469.5**	340.5	575.6	553.4
2017/18	**1 741**	425	678	638	**1 596.0**	346.1	644.7	605.2

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.92: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
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	**1 493**	**499**	**994**	**1 367.3**	**436.7**	**930.5**	**91.6**
2016/17	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**404**	187	217	**340.5**	149.7	190.8	84.3
Technicians directly supporting R&D	**607**	174	433	**575.6**	165.2	410.4	94.8
Other personnel directly supporting R&D	**605**	164	441	**553.4**	149.4	404.0	91.5
Total	**1 616**	**525**	**1 091**	**1 469.5**	**464.3**	**1 005.2**	**90.9**
2017/18	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**425**	181	244	**346.1**	139.8	206.4	81.4
Technicians directly supporting R&D	**678**	207	471	**644.7**	191.3	453.4	95.1
Other personnel directly supporting R&D	**638**	169	469	**605.2**	160.7	444.5	94.9
Total	**1 741**	**557**	**1 184**	**1 596.0**	**491.7**	**1 104.3**	**91.7**

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.93: Not-for-profit sector R&D personnel in headcounts by occupation, qualification, population group and gender (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**425**	**181**	**244**	**65**	**87**	**4**	**18**	**12**	**35**	**91**	**84**	**9**	**20**
Doctoral degree or equivalent	117	69	48	19	8	0	5	6	10	41	15	3	10
Master's, honours, bachelor or equivalent	271	95	176	37	66	2	12	4	24	46	64	6	10
Diplomas	37	17	20	9	13	2	1	2	1	4	5	0	0
Technicians directly supporting R&D	**678**	**207**	**471**	**155**	**352**	**10**	**20**	**9**	**59**	**24**	**35**	**9**	**5**
Doctoral degree or equivalent	1	1	0	0	0	0	0	0	0	0	0	1	0
Master's, honours, bachelor or equivalent	212	57	155	25	74	6	13	3	45	17	21	6	2
Diplomas	465	149	316	130	278	4	7	6	14	7	14	2	3
Other personnel directly supporting R&D	**638**	**169**	**469**	**126**	**322**	**7**	**23**	**12**	**44**	**14**	**65**	**10**	**15**
Doctoral degree or equivalent	6	1	5	1	2	0	0	0	3	0	0	0	0
Master's, honours, bachelor or equivalent	120	24	96	10	38	1	4	4	24	7	24	2	6
Diplomas	512	144	368	115	282	6	19	8	17	7	41	8	9
Total	**1 741**	**557**	**1 184**	**346**	**761**	**21**	**61**	**33**	**138**	**129**	**184**	**28**	**40**

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

C.2.3. Government sector

Table C.94: Government sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	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	2016/17 R'000	2017/18 R'000
Basic research	357 786	257 806	257 235	263 380	331 587	245 167	338 250	358 666	348 775	329 263
Applied research	601 688	621 762	600 205	812 067	873 469	1 194 866	1 292 421	1 390 221	1 444 821	1 685 367
Experimental development research	180 202	187 734	153 900	160 223	232 453	257 118	262 339	264 134	305 051	311 246
Total	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**

Table C.95: Proportional government sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Basic research	31.4	24.2	25.4	21.3	23.1	14.4	17.9	17.8	16.6	14.2
Applied research	52.8	58.3	59.3	65.7	60.8	70.4	68.3	69.1	68.8	72.5
Experimental development research	15.8	17.6	15.2	13.0	16.2	15.1	13.9	13.1	14.5	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.96: Government sector R&D expenditure by spheres and institutes of government and accounting category (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	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**	**14 959**	**65 541**	**59 418**	**62 485**	**61 703**	**76 493**	**59 114**
Capital expenditure	**N/A**	**N/A**	**N/A**	**144**	**18 605**	**23 033**	**12 921**	**13 059**	**20 271**	**13 265**
Land, buildings and other structures	N/A	N/A	N/A	0	5 400	10 000	6 537	6 598	9 575	7 065
Vehicles, plant, machinery, equipment	N/A	N/A	N/A	144	13 205	13 033	6 384	6 461	10 696	6 200
Current expenditure	**N/A**	**N/A**	**N/A**	**14 815**	**46 936**	**36 385**	**49 564**	**48 644**	**56 222**	**45 849**
Labour costs	N/A	N/A	N/A	12 715	30 131	27 513	39 314	38 687	41 407	38 279
Other current expenditure	N/A	N/A	N/A	2 100	16 805	8 872	10 250	9 957	14 815	7 570
Provincial departments	**232 062**	**245 031**	**284 539**	**335 607**	**372 231**	**390 301**	**421 126**	**401 512**	**405 760**	**411 195**
Capital expenditure	**24 249**	**39 748**	**30 475**	**42 895**	**45 895**	**45 930**	**39 325**	**43 918**	**48 084**	**35 517**
Land, buildings and other structures	2 515	11 238	13 022	10 674	7 255	6 348	5 500	7 900	12 264	14 864
Vehicles, plant, machinery, equipment	21 734	28 510	17 453	32 221	38 640	39 582	33 825	36 018	35 820	20 653
Current expenditure	**207 813**	**205 283**	**254 064**	**292 712**	**326 336**	**344 371**	**381 801**	**357 594**	**357 676**	**375 678**
Labour costs	129 187	138 397	182 175	206 583	236 367	233 321	248 823	225 621	252 286	264 285
Other current expenditure	78 626	66 886	71 889	86 129	89 969	111 050	132 978	131 973	105 390	111 393
National departments	**287 333**	**240 412**	**211 176**	**280 005**	**321 632**	**249 705**	**248 041**	**356 575**	**408 803**	**512 743**
Capital expenditure	**9 340**	**2 022**	**38 629**	**31 879**	**32 669**	**17 540**	**4 406**	**57 905**	**56 999**	**71 632**
Land, buildings and other structures	1 107	500	3 657	11 820	12 783	2 122	811	18 037	6 424	6 920
Vehicles, plant, machinery, equipment	8 233	1 522	34 972	20 059	19 886	15 418	3 595	39 868	50 575	64 712
Current expenditure	**277 993**	**238 390**	**172 547**	**248 126**	**288 963**	**232 165**	**243 635**	**298 670**	**351 804**	**441 111**
Labour costs	98 791	81 619	144 779	140 146	158 808	198 440	150 921	171 849	216 103	228 761
Other current expenditure	179 202	156 771	27 768	107 980	130 155	33 725	92 714	126 821	135 701	212 350
Government research institutes	**579 395**	**553 651**	**483 999**	**573 698**	**644 360**	**973 807**	**1 134 875**	**1 165 161**	**1 179 994**	**1 326 427**
Capital expenditure	**49 345**	**168 544**	**113 395**	**35 071**	**157 221**	**98 010**	**233 386**	**202 878**	**199 952**	**271 029**
Land, buildings and other structures	9 955	115 101	43 360	2 487	58 280	4 542	93 477	112 710	107 971	131 824
Vehicles, plant, machinery, equipment	39 390	53 443	70 035	32 584	98 941	93 468	139 909	90 168	91 981	139 205
Current expenditure	**530 050**	**385 107**	**370 604**	**538 627**	**487 139**	**875 797**	**901 489**	**962 283**	**980 042**	**1 055 398**
Labour costs	224 691	245 767	269 965	316 835	355 503	316 256	375 939	311 876	323 121	328 656
Other current expenditure	305 359	139 340	100 639	221 792	131 636	559 541	525 550	650 407	656 921	726 741
Museums	**40 886**	**28 208**	**31 626**	**31 400**	**33 745**	**23 920**	**26 484**	**28 070**	**27 596**	**16 396**
Capital expenditure	**4 002**	**4 087**	**3 699**	**3 256**	**649**	**946**	**1 996**	**2 005**	**2 704**	**796**
Land, buildings and other structures	2 331	2 491	2 141	2 337	30	638	687	663	774	0
Vehicles, plant, machinery, equipment	1 671	1 596	1 558	919	619	308	1 309	1 342	1 930	796
Current expenditure	**36 884**	**24 121**	**27 927**	**28 144**	**33 096**	**22 974**	**24 488**	**26 065**	**24 892**	**15 600**
Labour costs	27 141	17 839	20 814	21 413	25 471	20 769	22 429	23 751	24 004	14 775
Other current expenditure	9 743	6 282	7 113	6 731	7 625	2 205	2 059	2 314	888	825
Government sector	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**
Capital expenditure	**86 936**	**214 401**	**186 198**	**113 245**	**255 039**	**185 459**	**292 034**	**319 765**	**328 010**	**392 239**
Land, buildings and other structures	15 908	129 330	62 180	27 318	83 748	23 650	107 012	145 908	137 008	160 673
Vehicles, plant, machinery, equipment	71 028	85 071	124 018	85 927	171 291	161 809	185 022	173 857	191 002	231 566
Current expenditure	**1 052 740**	**852 901**	**825 142**	**1 122 424**	**1 182 470**	**1 511 692**	**1 600 976**	**1 693 256**	**1 770 636**	**1 933 636**
Labour costs	479 810	483 622	617 733	697 692	806 280	796 299	837 425	771 784	856 921	874 757
Other current expenditure	572 930	369 279	207 409	424 732	376 190	715 393	763 551	921 472	913 715	1 058 879

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 (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Municipalities	N/A	N/A	N/A	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	N/A	N/A	N/A	1.0	28.4	38.8	20.7	21.2	26.5	22.4
Land, buildings and other structures	N/A	N/A	N/A	0.0	8.2	16.8	10.5	10.7	12.5	12.0
Vehicles, plant, machinery, equipment	N/A	N/A	N/A	1.0	20.1	21.9	10.2	10.5	14.0	10.5
Current expenditure	N/A	N/A	N/A	99.0	71.6	61.2	79.3	78.8	73.5	77.6
Labour costs	N/A	N/A	N/A	85.0	46.0	46.3	62.9	62.7	54.1	64.8
Other current expenditure	N/A	N/A	N/A	14.0	25.6	14.9	16.4	16.1	19.4	12.8
Provincial departments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	10.4	16.2	10.7	12.8	12.3	11.8	9.3	10.9	11.9	8.6
Land, buildings and other structures	1.1	4.6	4.6	3.2	1.9	1.6	1.3	2.0	3.0	3.6
Vehicles, plant, machinery, equipment	9.4	11.6	6.1	9.6	10.4	10.1	8.0	9.0	8.8	5.0
Current expenditure	89.6	83.8	89.3	87.2	87.7	88.2	90.7	89.1	88.1	91.4
Labour costs	55.7	56.5	64.0	61.6	63.5	59.8	59.1	56.2	62.2	64.3
Other current expenditure	33.9	27.3	25.3	25.7	24.2	28.5	31.6	32.9	26.0	27.1
National departments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	3.3	0.8	18.3	11.4	10.2	7.0	1.8	16.2	13.9	14.0
Land, buildings and other structures	0.4	0.2	1.7	4.2	4.0	0.8	0.3	5.1	1.6	1.3
Vehicles, plant, machinery, equipment	2.9	0.6	16.6	7.2	6.2	6.2	1.4	11.2	12.4	12.6
Current expenditure	96.7	99.2	81.7	88.6	89.8	93.0	98.2	83.8	86.1	86.0
Labour costs	34.4	33.9	68.6	50.1	49.4	79.5	60.8	48.2	52.9	44.6
Other current expenditure	62.4	65.2	13.1	38.6	40.5	13.5	37.4	35.6	33.2	41.4
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	8.5	30.4	23.4	6.1	24.4	10.1	20.6	17.4	16.9	20.4
Land, buildings and other structures	1.7	20.8	9.0	0.4	9.0	0.5	8.2	9.7	9.2	9.9
Vehicles, plant, machinery, equipment	6.8	9.7	14.5	5.7	15.4	9.6	12.3	7.7	7.8	10.5
Current expenditure	91.5	69.6	76.6	93.9	75.6	89.9	79.4	82.6	83.1	79.6
Labour costs	38.8	44.4	55.8	55.2	55.2	32.5	33.1	26.8	27.4	24.8
Other current expenditure	52.7	25.2	20.8	38.7	20.4	57.5	46.3	55.8	55.7	54.8
Museums	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	9.8	14.5	11.7	10.4	1.9	4.0	7.5	7.1	9.8	4.9
Land, buildings and other structures	5.7	8.8	6.8	7.4	0.1	2.7	2.6	2.4	2.8	0.0
Vehicles, plant, machinery, equipment	4.1	5.7	4.9	2.9	1.8	1.3	4.9	4.8	7.0	4.9
Current expenditure	90.2	85.5	88.3	89.6	98.1	96.0	92.5	92.9	90.2	95.1
Labour costs	66.4	63.2	65.8	68.2	75.5	86.8	84.7	84.6	87.0	90.1
Other current expenditure	23.8	22.3	22.5	21.4	22.6	9.2	7.8	8.2	3.2	5.0
Government sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	7.6	20.1	18.4	9.2	17.7	10.9	15.4	15.9	15.6	16.9
Land, buildings and other structures	1.4	12.1	6.1	2.2	5.8	1.4	5.7	7.2	6.5	6.9
Vehicles, plant, machinery, equipment	6.2	8.0	12.3	7.0	11.9	9.5	9.8	8.6	9.1	10.0
Current expenditure	92.4	79.9	81.6	90.8	82.3	89.1	84.6	84.1	84.4	83.1
Labour costs	42.1	45.3	61.1	56.5	56.1	46.9	44.2	38.3	40.8	37.6
Other current expenditure	50.3	34.6	20.5	34.4	26.2	42.2	40.3	45.8	43.5	45.5

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 (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	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	2016/17 R'000	2017/18 R'000
Biotechnology	21 729	32 496	213 817	81 993	124 429	97 816	85 385	81 409	87 557	84 738
Nanotechnology	4 652	0	4 196	4 609	15 035	16 929	13 112	11 774	12 620	12 741
Total	**26 381**	**32 496**	**218 013**	**86 602**	**139 464**	**114 745**	**98 497**	**93 183**	**100 176**	**97 479**
Government expenditure on R&D	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**

Table C.99: Proportional government sector expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Biotechnology	1.9	3.0	21.1	6.6	8.7	5.8	4.5	4.0	4.2	3.6
Nanotechnology	0.4	0.0	0.4	0.4	1.0	1.0	0.7	0.6	0.6	0.5
Total	**2.3**	**3.0**	**21.6**	**7.0**	**9.7**	**6.8**	**5.2**	**4.6**	**4.8**	**4.2**

Table C.100: Government sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	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	2016/17 R'000	2017/18 R'000
Environment related	N/A	N/A	N/A	109 774	170 304	194 564	232 090	192 774	202 351	316 188
Open-source software	4 658	7 238	7 261	1 345	1 501	0	0	0	0	597
New materials	726	7 156	26 166	4 107	28 708	30 945	12 062	5 291	6 143	7 599
Tuberculosis (TB), HIV/AIDS, malaria	240	199 977	174 382	167 522	132 264	380 640	359 074	389 279	395 996	435 045
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	39 882	0
Total	**5 624**	**214 371**	**207 809**	**282 748**	**332 777**	**606 149**	**603 226**	**587 343**	**644 372**	**759 430**
Government expenditure on R&D	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.101: Proportional government sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environment related	N/A	N/A	N/A	8.9	11.8	11.5	12.3	9.6	9.6	13.6
Open-source software	0.4	0.7	0.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0
New materials	0.1	0.7	2.6	0.3	2.0	1.8	0.6	0.3	0.3	0.3
Tuberculosis (TB), HIV/AIDS, malaria	0.0	18.7	17.2	13.6	9.2	22.4	19.0	19.3	18.9	18.7
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.9	0.0
Total	**0.5**	**20.1**	**20.5**	**22.9**	**23.1**	**24.3**	**19.6**	**29.2**	**30.7**	**32.7**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.102: Government sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural Sciences, Technology and Engineering	**824 394**	**806 995**	**634 237**	**863 949**	**1 045 006**	**1 359 179**	**1 558 094**	**1 520 894**	**1 560 315**	**1 722 617**
Mathematical sciences	20 704	24 441	22 811	2 349	1 076	1 525	28 302	397	539	85
Physical sciences	45 804	12 093	0	0	5 064	0	30 154	26 455	28 529	49 051
Chemical sciences	17 009	21 698	10 653	1 223	21 823	19 394	61 881	61 688	68 937	73 898
Earth sciences	163 156	47 624	42 081	39 303	90 571	65 501	139 388	79 942	85 550	50 110
Information, computer and communication technologies	22 191	28 176	31 960	15 642	7 760	8 431	12 141	4 662	5 540	398
Applied sciences and technologies	15 852	9 315	4 154	10 183	32 467	23 216	29 723	22 531	25 444	23 016
Engineering sciences	11 487	14 996	4 165	4 515	10 430	11 853	13 176	12 129	13 572	17 076
Biological sciences	125 152	54 893	85 990	94 662	111 871	138 000	152 735	196 053	195 922	215 624
Agricultural sciences	200 598	274 781	225 441	362 241	460 921	397 687	506 445	471 798	485 417	523 343
Medical and health sciences	180 260	288 488	168 400	270 312	211 840	594 684	553 534	608 530	615 067	673 437
Environmental sciences	11 675	10 722	9 147	34 231	54 394	55 245	14 353	14 478	13 921	13 085
Material sciences	640	0	0	4 107	9 771	10 537	0	0	0	0
Marine sciences	9 866	19 768	29 434	25 182	27 019	33 106	16 262	22 232	21 877	83 495
Division 2: Social Sciences and Humanities	**315 282**	**260 308**	**377 103**	**371 720**	**392 503**	**337 972**	**334 916**	**492 127**	**538 331**	**603 258**
Social sciences	268 058	249 155	363 055	358 892	383 172	326 603	328 522	479 316	529 080	591 813
Humanities	47 225	11 152	14 048	12 828	9 331	11 369	6 394	12 811	9 251	11 445
Total	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**

Table C.103: Proportional government sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural Sciences, Technology and Engineering	**72.3**	**75.6**	**62.7**	**69.9**	**72.7**	**80.1**	**82.3**	**75.6**	**74.3**	**74.1**
Mathematical sciences	1.8	2.3	2.3	0.2	0.1	0.1	1.5	0.0	0.0	0.0
Physical sciences	4.0	1.1	0.0	0.0	0.4	0.0	1.6	1.3	1.4	2.1
Chemical sciences	1.5	2.0	1.1	0.1	1.5	1.1	3.3	3.1	3.3	3.2
Earth sciences	14.3	4.5	4.2	3.2	6.3	3.9	7.4	4.0	4.1	2.2

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Information, computer and communication technologies	1.9	2.6	3.2	1.3	0.5	0.5	0.6	0.2	0.3	0.0
Applied sciences and technologies	1.4	0.9	0.4	0.8	2.3	1.4	1.6	1.1	1.2	1.0
Engineering sciences	1.0	1.4	0.4	0.4	0.7	0.7	0.7	0.6	0.6	0.7
Biological sciences	11.0	5.1	8.5	7.7	7.8	8.1	8.1	9.7	9.3	9.3
Agricultural sciences	17.6	25.7	22.3	29.3	32.1	23.4	26.8	23.4	23.1	22.5
Medical and health sciences	15.8	27.0	16.7	21.9	14.7	35.0	29.2	30.2	29.3	29.0
Environmental sciences	1.0	1.0	0.9	2.8	3.8	3.3	0.8	0.7	0.7	0.6
Material sciences	0.1	0.0	0.0	0.3	0.7	0.6	0.0	0.0	0.0	0.0
Marine sciences	0.9	1.9	2.9	2.0	1.9	2.0	0.9	1.1	1.0	3.6
Division 2: Social Sciences and Humanities	**27.7**	**24.4**	**37.3**	**30.1**	**27.3**	**19.9**	**17.7**	**24.4**	**25.7**	**25.9**
Social sciences	23.5	23.3	35.9	29.0	26.7	19.2	17.4	23.8	25.2	25.4
Humanities	4.1	1.0	1.4	1.0	0.6	0.7	0.3	0.6	0.4	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.104: Government sector R&D expenditure by socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**0**	**0**	**2 303**	**2 736**	**19 314**	**21 118**	**21 472**	**42 233**	**34 213**	**7 582**
Defence	0	0	2 303	2 736	19 314	21 118	21 472	42 233	34 213	7 582
Division 2: Economic Development	**373 251**	**438 114**	**500 343**	**469 129**	**480 373**	**510 688**	**763 932**	**745 129**	**826 860**	**1 009 575**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	66 503	63 570	64 400	70 754	100 956	89 446	107 672	92 506	103 212	117 664
Animal production and animal primary products	78 619	84 842	91 877	86 710	93 504	137 279	156 437	125 737	134 227	129 024
Mineral resources (excluding Energy)	0	0	0	0	0	311	5 403	6 548	2 854	12 395
Energy resources	0	0	37	0	0	1 023	12 062	5 291	5 716	5 706
Energy supply	12 387	2 522	6 154	10 552	7 193	8 482	34 845	29 705	32 772	40 959
Manufacturing	320	5 444	15 870	1 005	1 557	1 544	79 583	1 318	5 201	5 433
Construction	2 484	0	148	9 545	543	741	4 312	1 394	1 501	1 584
Transport	12 073	4 369	9 377	10 964	8 774	1 672	24 105	21 537	24 896	21 926

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Information and communication services	11 965	13 244	44 257	20 590	5 678	5 515	14 397	7 977	6 071	19 938
Commercial services	2 405	9 957	7 471	4 708	3 587	12 162	15 532	13 531	12 616	47 515
Economic framework	105 080	161 326	187 931	157 364	161 541	116 604	167 690	262 289	343 537	394 216
Natural resources	81 415	92 838	72 820	96 938	97 042	135 909	141 895	177 298	154 258	213 214
Division 3: Society	**285 961**	**326 691**	**341 387**	**538 749**	**592 285**	**872 096**	**912 216**	**952 108**	**951 859**	**1 029 316**
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	74 784	77 845	106 522	221 435	171 741	487 130	475 983	482 472	511 031	554 746
Education and training	127 907	158 579	42 234	69 185	116 788	165 906	174 540	209 544	169 499	173 547
Social development and community services	83 270	90 268	192 630	248 129	303 756	219 061	261 693	260 092	271 328	301 023
Division 4: Environment	**99 985**	**72 614**	**85 347**	**130 742**	**199 677**	**172 006**	**127 394**	**191 334**	**204 573**	**208 704**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	83 429	45 360	40 610	83 089	137 679	124 445	91 677	107 265	116 996	100 339
Environmental aspects of development	12 424	18 153	27 635	38 467	51 795	38 877	27 206	53 541	55 508	50 936
Environmental and other aspects	4 132	9 101	17 102	9 186	10 204	8 684	8 511	30 528	32 069	57 429
Division 5: Advancement of Knowledge	**380 480**	**229 883**	**81 960**	**94 314**	**145 860**	**121 243**	**67 996**	**82 217**	**81 141**	**70 698**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	333 561	205 995	50 968	61 357	120 173	96 381	43 170	58 401	57 655	57 473
Social sciences and humanities	46 919	23 888	30 992	32 956	25 687	24 862	24 825	23 816	23 486	13 225
Total	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**

Table C.105: Proportional government sector R&D expenditure by socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**0.0**	**0.0**	**0.2**	**0.2**	**1.3**	**1.2**	**1.1**	**2.1**	**1.6**	**0.3**
Defence	0.0	0.0	0.2	0.2	1.3	1.2	1.1	2.1	1.6	0.3
Division 2: Economic Development	**32.8**	**41.0**	**49.5**	**38.0**	**33.4**	**30.1**	**40.4**	**37.0**	**39.4**	**43.4**
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	5.8	6.0	6.4	5.7	7.0	5.3	5.7	4.6	4.9	5.1
Animal production and animal primary products	6.9	7.9	9.1	7.0	6.5	8.1	8.3	6.2	6.4	5.5
Mineral resources (excluding Energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.1	0.5
Energy resources	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.3	0.3	0.2
Energy supply	1.1	0.2	0.6	0.9	0.5	0.5	1.8	1.5	1.6	1.8
Manufacturing	0.0	0.5	1.6	0.1	0.1	0.1	4.2	0.1	0.2	0.2
Construction	0.2	0.0	0.0	0.8	0.0	0.0	0.2	0.1	0.1	0.1
Transport	1.1	0.4	0.9	0.9	0.6	0.1	1.3	1.1	1.2	0.9
Information and communication services	1.0	1.2	4.4	1.7	0.4	0.3	0.8	0.4	0.3	0.9
Commercial services	0.2	0.9	0.7	0.4	0.2	0.7	0.8	0.7	0.6	2.0
Economic framework	9.2	15.1	18.6	12.7	11.2	6.9	8.9	13.0	16.4	16.9
Natural resources	7.1	8.7	7.2	7.8	6.8	8.0	7.5	8.8	7.4	9.2
Division 3: Society	**25.1**	**30.6**	**33.8**	**43.6**	**41.2**	**51.4**	**48.2**	**47.3**	**45.4**	**44.3**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	6.6	7.3	10.5	17.9	11.9	28.7	25.1	24.0	24.4	23.9
Education and training	11.2	14.9	4.2	5.6	8.1	9.8	9.2	10.4	8.1	7.5
Social development and community services	7.3	8.5	19.0	20.1	21.1	12.9	13.8	12.9	12.9	12.9
Division 4: Environment	**8.8**	**6.8**	**8.4**	**10.6**	**13.9**	**10.1**	**6.7**	**9.5**	**9.7**	**9.0**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	7.3	4.2	4.0	6.7	9.6	7.3	4.8	5.3	5.6	4.3
Environmental aspects of development	1.1	1.7	2.7	3.1	3.6	2.3	1.4	2.7	2.6	2.2

SOCIO-ECONOMIC OBJECTIVE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.4	0.9	1.7	0.7	0.7	0.5	0.4	1.5	1.5	2.5
Division 5: Advancement of Knowledge	**33.4**	**21.5**	**8.1**	**7.6**	**10.1**	**7.1**	**3.6**	**4.1**	**3.9**	**3.0**
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	29.3	19.3	5.0	5.0	8.4	5.7	2.3	2.9	2.7	2.5
Social sciences and humanities	4.1	2.2	3.1	2.7	1.8	1.5	1.3	1.2	1.1	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.106: Government sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	107 929	100 100	114 127	127 415	194 258	133 657	227 427	225 603	222 456	281 201
Free State	58 697	46 155	39 998	44 200	38 659	55 095	60 860	61 802	81 957	81 890
Gauteng	264 273	396 124	343 096	447 635	427 173	689 915	760 199	832 397	885 142	974 192
KwaZulu-Natal	115 302	54 914	48 056	126 857	168 029	161 962	177 517	187 088	172 655	206 551
Limpopo	55 252	60 421	57 797	65 017	74 621	95 668	83 683	84 232	76 541	86 876
Mpumalanga	39 103	68 796	69 980	78 335	80 201	77 479	93 566	112 173	107 237	104 154
North-West	70 741	29 176	43 048	44 618	45 573	73 576	56 719	61 815	57 994	60 594
Northern Cape	52 907	77 978	58 918	63 556	75 440	61 932	52 579	69 174	66 200	94 659
Western Cape	375 473	233 639	236 320	238 035	333 555	347 869	380 461	378 737	428 465	435 757
Total	**1 139 676**	**1 067 302**	**1 011 340**	**1 235 669**	**1 437 509**	**1 697 151**	**1 893 010**	**2 013 021**	**2 098 646**	**2 325 875**

Table C.107: Proportional government sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	9.5	9.4	11.3	10.3	13.5	7.9	12.0	11.2	10.6	12.1
Free State	5.2	4.3	4.0	3.6	2.7	3.2	3.2	3.1	3.9	3.5
Gauteng	23.2	37.1	33.9	36.2	29.7	40.7	40.2	41.4	42.2	41.9
KwaZulu-Natal	10.1	5.1	4.8	10.3	11.7	9.5	9.4	9.3	8.2	8.9
Limpopo	4.8	5.7	5.7	5.3	5.2	5.6	4.4	4.2	3.6	3.7
Mpumalanga	3.4	6.4	6.9	6.3	5.6	4.6	4.9	5.6	5.1	4.5
North-West	6.2	2.7	4.3	3.6	3.2	4.3	3.0	3.1	2.8	2.6
Northern Cape	4.6	7.3	5.8	5.1	5.2	3.6	2.8	3.4	3.2	4.1
Western Cape	32.9	21.9	23.4	19.3	23.2	20.5	20.1	18.8	20.4	18.7
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 (2008/09 to 2017/18)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2008/09	**2 963**	1 169	744	1 050	**2 073.9**	805.0	495.2	773.7
2009/10	**2 580**	986	509	1 085	**1 903.9**	680.4	356.8	866.7
2010/11	**2 704**	1 184	421	1 099	**2 178.6**	874.2	352.9	951.6
2011/12	**3 143**	1 411	432	1 300	**2 404.5**	1 009.8	330.4	1 064.3
2012/13	**3 252**	1 409	517	1 326	**2 597.0**	1 091.4	385.8	1 119.9
2013/14	**2 874**	1 229	518	1 127	**2 245.5**	923.7	366.3	955.4
2014/15	**2 893**	1 343	550	1 000	**2 181.5**	970.0	337.9	873.5
2015/16	**2 997**	1 573	537	887	**2 056.2**	953.9	365.7	736.7
2016/17	**3 076**	1 677	538	861	**2 031.6**	969.1	357.9	704.6
2017/18	**3 027**	1 671	517	839	**2 000.4**	899.1	347.7	753.7

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.109: Government sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
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**
2016/17	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**1 677**	774	903	**969.1**	461.0	508.1	57.8
Technicians directly supporting R&D	**538**	283	255	**357.9**	202.2	155.7	66.5
Other personnel directly supporting R&D	**861**	568	293	**704.6**	494.6	210.0	81.8
Total	**3 076**	**1 625**	**1 451**	**2 031.6**	**1 157.9**	**873.7**	**66.0**
2017/18	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**1 671**	756	915	**899.1**	429.4	469.7	53.8
Technicians directly supporting R&D	**517**	263	254	**347.7**	186.6	161.0	67.2
Other personnel directly supporting R&D	**839**	554	285	**753.7**	516.6	237.1	89.8
Total	**3 027**	**1 573**	**1 454**	**2 000.4**	**1 132.6**	**867.9**	**66.1**

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.110: Government sector R&D personnel in headcounts by occupation, qualification, population group and gender (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**1 671**	**756**	**915**	**433**	**503**	**54**	**69**	**41**	**83**	**223**	**259**	**5**	**1**
Doctoral degree or equivalent	277	144	133	53	16	7	11	12	16	71	90	1	0
Master's, honours, bachelor or equivalent	1 326	587	739	367	458	44	55	28	64	144	161	4	1
Diplomas	68	25	43	13	29	3	3	1	3	8	8	0	0
Technicians directly supporting R&D	**517**	**263**	**254**	**173**	**165**	**31**	**27**	**8**	**12**	**49**	**50**	**2**	**0**
Doctoral degree or equivalent	5	1	4	1	0	0	1	0	2	0	1	0	0
Master's, honours, bachelor or equivalent	313	149	164	104	108	14	14	6	7	24	35	1	0
Diplomas	199	113	86	68	57	17	12	2	3	25	14	1	0
Other personnel directly supporting R&D	**839**	**554**	**285**	**382**	**188**	**135**	**53**	**2**	**4**	**23**	**38**	**12**	**2**
Doctoral degree or equivalent	7	5	2	0	0	0	0	0	0	1	1	4	1
Master's, honours, bachelor or equivalent	79	39	40	23	21	6	6	0	0	5	13	5	0
Diplomas	753	510	243	359	167	129	47	2	4	17	24	3	1
Total	**3 027**	**1 573**	**1 454**	**988**	**856**	**220**	**149**	**51**	**99**	**295**	**347**	**19**	**3**

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

C.2.4. Science councils sector

Table C.111: Science councils sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	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	2016/17 R'000	2017/18 R'000
Basic research	776 406	776 505	871 635	900 830	937 826	970 785	1 166 491	1 348 533	1 372 702	1 349 946
Applied research	1 384 860	1 552 560	1 531 563	1 756 157	1 885 484	2 114 943	2 421 309	2 781 198	3 202 019	3 460 650
Experimental development research	976 077	1 129 009	1 192 825	1 072 693	1 202 689	1 218 827	1 416 869	1 611 166	1 561 462	1 502 748
Total	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

Table C.112: Proportional science councils sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Basic research	24.7	22.5	24.2	24.2	23.3	22.6	23.3	23.5	22.4	21.4
Applied research	44.1	44.9	42.6	47.1	46.8	49.1	48.4	48.4	52.2	54.8
Experimental development research	31.1	32.6	33.2	28.8	29.9	28.3	28.3	28.1	25.4	23.8
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 (2008/09 to 2017/18)

TYPE OF EXPENDITURE	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	2016/17 R'000	2017/18 R'000
Capital expenditure	**383 927**	**452 801**	**291 830**	**323 070**	**275 750**	**323 190**	**598 429**	**916 480**	**857 241**	**823 937**
Land: buildings & other structures	61 063	107 455	56 141	65 442	68 565	71 602	362 246	162 904	211 246	386 063
Vehicles, plant, machinery, equipment	322 864	345 346	235 689	257 628	207 185	251 588	236 183	753 576	645 995	437 874
Current expenditure	**2 753 416**	**3 005 273**	**3 304 193**	**3 406 610**	**3 750 248**	**3 981 366**	**4 406 240**	**4 824 418**	**5 278 942**	**5 489 407**
Labour costs	1 283 210	1 413 128	1 293 033	1 531 460	2 053 204	2 187 401	1 986 918	2 142 875	2 339 348	2 421 297
Other current expenditure	1 470 206	1 592 145	2 011 160	1 875 150	1 697 044	1 793 965	2 419 322	2 681 543	2 939 594	3 068 110
Total	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

Table C.114: Proportional science councils sector R&D expenditure by accounting category (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Capital expenditure	**12.2**	**13.1**	**8.1**	**8.7**	**6.8**	**7.5**	**12.0**	**16.0**	**14.0**	**13.1**
Land: buildings & other structures	1.9	3.1	1.6	1.8	1.7	1.7	7.2	2.8	3.4	6.1
Vehicles, plant, machinery, equipment	10.3	10.0	6.6	6.9	5.1	5.8	4.7	13.1	10.5	6.9
Current expenditure	**87.8**	**86.9**	**91.9**	**91.3**	**93.2**	**92.5**	**88.0**	**84.0**	**86.0**	**86.9**
Labour costs	40.9	40.9	36.0	41.1	51.0	50.8	39.7	37.3	38.1	38.4
Other current expenditure	46.9	46.0	55.9	50.3	42.2	41.7	48.3	46.7	47.9	48.6
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 (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	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	2016/17 R'000	2017/18 R'000
Biotechnology	207 250	183 844	199 934	208 466	145 671	143 868	312 793	320 048	360 163	299 783
Nanotechnology	173 834	117 215	101 386	102 007	118 555	114 990	125 107	139 107	139 783	272 372
Total	**381 084**	**301 058**	**301 320**	**310 473**	**264 226**	**258 857**	**437 900**	**459 154**	**499 946**	**572 155**
Science councils expenditure on R&D	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

Table C.116: Proportional science councils sector expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Biotechnology	6.6	5.3	5.6	5.6	3.6	3.3	6.3	5.6	5.9	4.7
Nanotechnology	5.5	3.4	2.8	2.7	2.9	2.7	2.5	2.4	2.3	4.3
Total	**12.1**	**8.7**	**8.4**	**8.3**	**6.6**	**6.0**	**8.7**	**8.0**	**8.1**	**9.1**

Table C.117: Science councils sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	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	2016/17 R'000	2017/18 R'000
Environment related	N/A	N/A	N/A	770 339	378 782	297 097	1 037 320	1 054 651	1 031 393	953 077
Open-source software	67 833	15 013	7 228	15 982	36 636	0	389 871	692 096	453 879	842 548
New materials	157 134	94 304	201 071	197 430	751 305	229 854	358 361	374 463	373 768	401 995
Tuberculosis (TB), HIV/AIDS, malaria	490 982	333 841	386 948	399 070	455 311	398 880	346 751	470 488	625 806	670 209
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	296 236	0
Total	**715 949**	**443 158**	**595 247**	**1 382 821**	**1 622 034**	**925 831**	**2 132 304**	**2 591 697**	**2 781 082**	**2 867 828**
Science councils expenditure on R&D	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.118: Proportional science councils sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environment related	N/A	N/A	N/A	20.7	9.4	6.9	20.7	18.4	16.8	15.1
Open-source software	2.2	0.4	0.2	0.4	0.9	0.0	7.8	12.1	7.4	13.3
New materials	5.0	2.7	5.6	5.3	18.7	5.3	7.2	6.5	6.1	6.4
Tuberculosis (TB), HIV/AIDS, malaria	15.6	9.7	10.8	10.7	11.3	9.3	6.9	8.2	10.2	10.6
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.8	0.0
Total	**22.8**	**12.8**	**16.6**	**37.1**	**40.3**	**21.5**	**42.6**	**45.1**	**45.3**	**45.4**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.119: Science councils sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural Sciences, Technology and Engineering	**2 916 350**	**3 258 392**	**3 414 985**	**3 517 520**	**3 819 642**	**4 109 105**	**4 800 742**	**5 486 847**	**5 889 463**	**6 112 974**
Mathematical sciences	40 632	37 678	113 396	117 637	134 046	128 291	48 258	54 212	47 890	61 223
Physical sciences	115 737	87 221	97 922	120 267	123 267	129 568	263 302	418 648	444 274	502 615
Chemical sciences	44 271	49 462	8 074	20 972	14 078	18 166	63 775	71 024	66 188	77 952
Earth sciences	167 463	179 999	94 642	100 921	112 406	110 092	162 880	181 876	254 414	198 140

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Information, computer and communication technologies	201 731	265 191	161 282	168 115	181 521	182 402	780 044	977 891	999 538	1 124 366
Applied sciences and technologies	139 267	153 830	924 104	954 616	1 092 098	1 046 934	277 649	296 162	475 568	356 409
Engineering sciences	863 084	947 315	365 980	278 125	292 940	349 666	1 001 486	1 107 289	1 016 283	1 171 287
Biological sciences	171 810	200 625	437 938	425 036	485 673	482 728	148 268	144 341	138 673	169 717
Agricultural sciences	442 060	647 750	479 449	582 438	594 638	859 600	1 075 165	1 043 494	1 067 146	989 974
Medical and health sciences	447 479	440 895	428 642	443 156	426 520	430 472	596 600	775 858	836 967	1 021 905
Environmental sciences	101 920	112 327	273 283	284 116	330 667	326 122	228 909	240 075	343 218	267 495
Material sciences	155 529	106 411	23 199	15 462	22 905	35 093	113 457	133 231	122 130	143 684
Marine sciences	25 368	29 689	7 073	6 656	8 885	9 970	40 949	42 747	77 173	28 207
Division 2: Social Sciences and Humanities	**220 993**	**199 682**	**181 038**	**212 160**	**206 356**	**195 452**	**203 927**	**254 050**	**246 721**	**200 370**
Social sciences	194 646	182 431	164 954	190 845	186 132	173 407	179 456	223 966	239 011	192 200
Humanities	26 347	17 250	16 084	21 315	20 224	22 044	24 471	30 084	7 710	8 170
Total	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

Table C.120: Proportional science councils sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural Sciences, Technology and Engineering	**93.0**	**94.2**	**95.0**	**94.3**	**94.9**	**95.5**	**95.9**	**95.6**	**96.0**	**96.8**
Mathematical sciences	1.3	1.1	3.2	3.2	3.3	3.0	1.0	0.9	0.8	1.0
Physical sciences	3.7	2.5	2.7	3.2	3.1	3.0	5.3	7.3	7.2	8.0
Chemical sciences	1.4	1.4	0.2	0.6	0.3	0.4	1.3	1.2	1.1	1.2
Earth sciences	5.3	5.2	2.6	2.7	2.8	2.6	3.3	3.2	4.1	3.1
Information, computer and communication technologies	6.4	7.7	4.5	4.5	4.5	4.2	15.6	17.0	16.3	17.8
Applied sciences and technologies	4.4	4.4	25.7	25.6	27.1	24.3	5.5	5.2	7.8	5.6
Engineering sciences	27.5	27.4	10.2	7.5	7.3	8.1	20.0	19.3	16.6	18.6
Biological sciences	5.5	5.8	12.2	11.4	12.1	11.2	3.0	2.5	2.3	2.7
Agricultural sciences	14.1	18.7	13.3	15.6	14.8	20.0	21.5	18.2	17.4	15.7
Medical and health sciences	14.3	12.7	11.9	11.9	10.6	10.0	11.9	13.5	13.6	16.2

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environmental sciences	3.2	3.2	7.6	7.6	8.2	7.6	4.6	4.2	5.6	4.2
Material sciences	5.0	3.1	0.6	0.4	0.6	0.8	2.3	2.3	2.0	2.3
Marine sciences	0.8	0.9	0.2	0.2	0.2	0.2	0.8	0.7	1.3	0.4
Division 2: Social Sciences and Humanities	**7.0**	**5.8**	**5.0**	**5.7**	**5.1**	**4.5**	**4.1**	**4.4**	**4.0**	**3.2**
Social sciences	6.2	5.3	4.6	5.1	4.6	4.0	3.6	3.9	3.9	3.0
Humanities	0.8	0.5	0.4	0.6	0.5	0.5	0.5	0.5	0.1	0.1
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 (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**280 219**	**311 288**	**228 376**	**243 083**	**279 989**	**262 203**	**762 464**	**826 261**	**754 207**	**915 281**
Defence	280 219	311 288	228 376	243 083	279 989	262 203	762 464	826 261	754 207	915 281
Division 2: Economic Development	**1 592 110**	**1 834 253**	**2 111 033**	**2 191 098**	**2 400 747**	**2 686 504**	**2 306 795**	**2 529 244**	**2 471 163**	**2 625 282**
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	349 907	485 470	478 437	448 531	473 133	624 675	413 737	396 612	396 536	368 829
Animal production and animal primary products	18 760	27 043	25 193	280 542	287 431	419 259	269 519	247 883	247 835	230 518
Mineral resources (excluding Energy)	67 418	387 531	294 203	202 919	213 007	234 273	232 114	265 006	255 226	274 778
Energy resources	379 859	32 136	90 342	94 385	108 360	106 823	5 590	5 063	8 108	6 682
Energy supply	0	0	0	14 715	13 237	2 937	0	0	0	1 468
Manufacturing	225 227	262 443	366 380	351 021	400 864	393 152	88 746	146 395	170 040	179 215
Construction	116 781	129 922	222 124	220 595	256 024	245 333	31 034	60 828	67 003	70 943
Transport	41 260	45 848	0	0	0	0	0	0	0	0
Information and communication services	24 146	68 506	115 342	127 021	141 495	135 629	396 310	419 252	410 724	462 785
Commercial services	19 536	5 465	14 152	15 522	25 053	19 724	5 236	5 671	7 756	2 937
Economic framework	106 105	84 205	97 367	72 109	70 509	75 411	537 499	664 440	571 815	713 045
Natural resources	243 111	305 685	407 492	363 738	411 634	429 288	327 009	318 094	336 119	314 082
Division 3: Society	**418 385**	**453 428**	**388 244**	**430 876**	**413 060**	**425 943**	**801 370**	**977 159**	**1 074 539**	**978 471**
Society unclassified	0	0	0	0	0	0	0	0	0	0

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Health	326 340	348 407	310 760	326 500	314 412	316 987	424 639	552 314	613 932	632 851
Education and training	50 525	65 761	50 676	68 852	64 941	72 216	335 946	374 704	145 215	98 348
Social development and community services	41 520	39 260	26 807	35 525	33 707	36 741	40 785	50 141	315 392	247 273
Division 4: Environment	**338 290**	**355 484**	**52 334**	**31 241**	**39 169**	**46 559**	**422 650**	**455 404**	**852 597**	**782 034**
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	173 945	190 926	24 043	19 956	22 939	28 295	402 820	426 582	466 312	434 251
Environmental aspects of development	59 943	48 262	19 333	8 623	13 665	14 071	15 824	14 179	17 451	13 215
Environmental and other aspects	104 402	116 296	8 958	2 662	2 565	4 194	4 006	14 644	368 834	334 567
Division 5: Advancement of Knowledge	**508 339**	**503 621**	**816 035**	**833 382**	**893 033**	**883 346**	**711 390**	**952 830**	**983 677**	**1 012 276**
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	407 189	381 098	674 421	694 254	760 107	746 397	422 429	620 283	692 258	708 020
Social sciences and humanities	101 150	122 523	141 614	139 127	132 926	136 949	288 961	332 547	291 419	304 256
Total	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

Table C.122: Proportional science councils sector R&D expenditure by socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**8.9**	**9.0**	**6.4**	**6.5**	**7.0**	**6.1**	**15.2**	**14.4**	**12.3**	**14.5**
Defence	8.9	9.0	6.4	6.5	7.0	6.1	15.2	14.4	12.3	14.5
Division 2: Economic Development	**50.7**	**53.0**	**58.7**	**58.7**	**59.6**	**62.4**	**46.1**	**44.1**	**40.3**	**41.6**
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	11.2	14.0	13.3	12.0	11.8	14.5	8.3	6.9	6.5	5.8
Animal production and animal primary products	0.6	0.8	0.7	7.5	7.1	9.7	5.4	4.3	4.0	3.7

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Mineral resources (excluding Energy)	2.1	11.2	8.2	5.4	5.3	5.4	4.6	4.6	4.2	4.4
Energy resources	12.1	0.9	2.5	2.5	2.7	2.5	0.1	0.1	0.1	0.1
Energy supply	0.0	0.0	0.0	0.4	0.3	0.1	0.0	0.0	0.0	0.0
Manufacturing	7.2	7.6	10.2	9.4	10.0	9.1	1.8	2.6	2.8	2.8
Construction	3.7	3.8	6.2	5.9	6.4	5.7	0.6	1.1	1.1	1.1
Transport	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Information and communication services	0.8	2.0	3.2	3.4	3.5	3.2	7.9	7.3	6.7	7.3
Commercial services	0.6	0.2	0.4	0.4	0.6	0.5	0.1	0.1	0.1	0.0
Economic framework	3.4	2.4	2.7	1.9	1.8	1.8	10.7	11.6	9.3	11.3
Natural resources	7.7	8.8	11.3	9.8	10.2	10.0	6.5	5.5	5.5	5.0
Division 3: Society	**13.3**	**13.1**	**10.8**	**11.6**	**10.3**	**9.9**	**16.0**	**17.0**	**17.5**	**15.5**
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	10.4	10.1	8.6	8.8	7.8	7.4	8.5	9.6	10.0	10.0
Education and training	1.6	1.9	1.4	1.8	1.6	1.7	6.7	6.5	2.4	1.6
Social development and community services	1.3	1.1	0.7	1.0	0.8	0.9	0.8	0.9	5.1	3.9
Division 4: Environment	**10.8**	**10.3**	**1.5**	**0.8**	**1.0**	**1.1**	**8.4**	**7.9**	**13.9**	**12.4**
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	5.5	5.5	0.7	0.5	0.6	0.7	8.0	7.4	7.6	6.9
Environmental aspects of development	1.9	1.4	0.5	0.2	0.3	0.3	0.3	0.2	0.3	0.2
Environmental and other aspects	3.3	3.4	0.2	0.1	0.1	0.1	0.1	0.3	6.0	5.3
Division 5: Advancement of Knowledge	**16.2**	**14.6**	**22.7**	**22.3**	**22.2**	**20.5**	**14.2**	**16.6**	**16.0**	**16.0**
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	13.0	11.0	18.8	18.6	18.9	17.3	8.4	10.8	11.3	11.2
Social sciences and humanities	3.2	3.5	3.9	3.7	3.3	3.2	5.8	5.8	4.7	4.8
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 (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	171 669	155 501	150 665	178 594	182 664	115 925	259 128	269 658	273 509	279 550
Free State	58 561	74 355	60 443	37 138	39 054	47 271	58 608	59 953	60 149	59 300
Gauteng	1 991 853	2 219 609	2 327 712	2 287 762	2 537 028	3 062 983	2 745 142	2 998 643	3 221 705	3 350 135
KwaZulu-Natal	231 033	235 432	249 137	292 246	307 302	239 387	484 142	575 016	477 823	540 084
Limpopo	63 455	78 662	66 250	99 104	105 150	7 286	117 270	111 649	114 852	107 457
Mpumalanga	55 547	66 881	55 690	100 476	103 468	62 349	124 613	122 432	128 883	118 267
North-West	41 541	51 295	42 854	104 139	110 361	39 615	153 911	153 676	108 010	97 730
Northern Cape	43 624	35 253	64 774	81 998	78 714	122 454	148 387	218 317	223 524	236 797
Western Cape	480 059	541 086	578 497	548 223	562 256	607 285	913 468	1 231 555	1 527 729	1 524 025
Total	**3 137 343**	**3 458 074**	**3 596 023**	**3 729 680**	**4 025 998**	**4 304 556**	**5 004 669**	**5 740 897**	**6 136 183**	**6 313 344**

Table C.124: Proportional science councils sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	5.5	4.5	4.2	4.8	4.5	2.7	5.2	4.7	4.5	4.4
Free State	1.9	2.2	1.7	1.0	1.0	1.1	1.2	1.0	1.0	0.9
Gauteng	63.5	64.2	64.7	61.3	63.0	71.2	54.9	52.2	52.5	53.1
KwaZulu-Natal	7.4	6.8	6.9	7.8	7.6	5.6	9.7	10.0	7.8	8.6
Limpopo	2.0	2.3	1.8	2.7	2.6	0.2	2.3	1.9	1.9	1.7
Mpumalanga	1.8	1.9	1.5	2.7	2.6	1.4	2.5	2.1	2.1	1.9
North-West	1.3	1.5	1.2	2.8	2.7	0.9	3.1	2.7	1.8	1.5
Northern Cape	1.4	1.0	1.8	2.2	2.0	2.8	3.0	3.8	3.6	3.8
Western Cape	15.3	15.6	16.1	14.7	14.0	14.1	18.3	21.5	24.9	24.1
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 (2008/09 to 2017/18)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
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	2 136.0
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	**4 361.2**	1 827.2	1 683.7	850.4
2016/17	**4 955**	2 189	1 818	948	**4 421.4**	1 940.5	1 676.0	804.9
2017/18	**4 866**	2 053	1 885	928	**4 294.9**	1 792.1	1 745.4	757.4

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.126: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2015/16	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**2 072**	1 174	898	**1 827.2**	1 036.4	790.8	88.2
Technicians directly supporting R&D	**1 839**	1 088	751	**1 683.7**	973.3	710.4	91.6
Other personnel directly supporting R&D	**1251**	671	580	**850.4**	409.4	441.0	68.0
Total	**5 162**	**2 933**	**2 229**	**4 361.2**	**2 419.1**	**1 942.2**	**84.5**
2016/17	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**2 189**	1 235	954	**1 940.5**	1 084.8	855.7	88.6
Technicians directly supporting R&D	**1 818**	1 076	742	**1 676.0**	975.2	700.8	92.2
Other personnel directly supporting R&D	**948**	469	479	**804.9**	373.8	431.1	84.9
Total	**4 955**	**2 780**	**2 175**	**4 421.4**	**2 433.8**	**1 987.6**	**89.2**
2017/18	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**2 053**	1 037	1 016	**1 792.1**	884.6	907.5	87.3
Technicians directly supporting R&D	**1 885**	1 012	873	**1 745.4**	914.1	831.3	92.6
Other personnel directly supporting R&D	**928**	623	305	**757.4**	507.6	249.8	81.6
Total	**4 866**	**2 672**	**2 194**	**4 294.9**	**2 306.3**	**1 988.6**	**88.3**

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.127: Science councils sector R&D personnel in headcounts by occupation, qualification, population group and gender (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	**2 053**	**1 037**	**1 016**	**384**	**316**	**92**	**217**	**96**	**96**	**293**	**317**	**172**	**70**
Doctoral degree or equivalent	892	501	391	134	66	34	86	35	35	161	160	137	44
Masters, honours, bachelor or equivalent	1 099	505	594	238	237	52	122	60	58	121	151	34	26
Diplomas	62	31	31	12	13	6	9	1	3	11	6	1	0
Technicians directly supporting R&D	**1 885**	**1 012**	**873**	**604**	**404**	**92**	**238**	**140**	**31**	**142**	**194**	**34**	**6**
Doctoral degree or equivalent	60	21	39	2	0	3	35	4	0	4	4	8	0
Masters, honours, bachelor or equivalent	1 054	543	511	294	220	49	139	107	16	71	130	22	6
Diplomas	771	448	323	308	184	40	64	29	15	67	60	4	0
Other personnel directly supporting R&D	**928**	**623**	**305**	**328**	**117**	**54**	**78**	**183**	**26**	**44**	**72**	**14**	**12**
Doctoral degree or equivalent	18	12	6	6	2	2	1	1	0	3	2	0	1
Masters, honours, bachelor or equivalent	474	338	136	131	49	24	19	149	15	26	49	8	4
Diplomas	436	273	163	191	66	28	58	33	11	15	21	6	7
Total	**4 866**	**2 672**	**2 194**	**1 316**	**837**	**238**	**533**	**419**	**153**	**479**	**583**	**220**	**88**

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.128: Science councils sector overview (2016/17 and 2017/18)

SCIENCE COUNCILS	2016/17				2017/18			
	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
African Institute of South Africa	0	0.0	0	0	0	0.0	0	0
Agricultural Research Council	991 340	542.0	198 268	78 781	922 073	482.0	184 415	89 370
Council for Scientific and Industrial Research	2 498 565	620.0	174 900	143 787	2 597 076	576.3	132 191	108 080
Council for Geoscience	193 898	97.0	38 780	73 127	146 839	97.8	22 026	29 375
Human Science Research Council	385 501	156.0	77 100	21 563	408 490	156.8	61 273	5 887
Medical Research Council	759 695	214.0	455 817	11 480	853 621	204.0	512 173	18 454
Mintek	327 551	152.4	65 510	34 258	363 281	150.4	72 656	51 466
National Research Foundation	979 633	159.1	362 327	494 245	1 021 965	124.8	365 213	521 305
Total	**6 136 183**	**1940.5**	**1 372 702**	**857 241**	**6 313 344**	**1 792**	**1 349 946**	**823 937**

C.2.5. Higher education sector

Table C.129: Higher education sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	1 965 121	2 459 733	2 634 722	3 290 328	3 843 906	3 785 149	4 601 453	5 395 693	6 679 585	7 243 562
Applied research	1 468 624	1 729 496	1 890 185	2 279 175	2 390 090	2 412 316	2 649 558	3 176 685	3 466 381	4 264 753
Experimental development research	757 621	911 994	899 695	1 039 712	1 099 157	1 095 388	1 126 565	1 304 245	1 513 291	1 501 561
Total	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

Table C.130: Proportional higher education sector R&D expenditure by type of research (2008/09 to 2017/18)

TYPE OF RESEARCH	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Basic research	46.9	48.2	48.6	49.8	52.4	51.9	54.9	54.6	57.3	55.7
Applied research	35.0	33.9	34.8	34.5	32.6	33.1	31.6	32.2	29.7	32.8
Experimental development research	18.1	17.9	16.6	15.7	15.0	15.0	13.4	13.2	13.0	11.5
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 (2008/09 to 2017/18)

TYPE OF EXPENDITURE	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	2016/17 R'000	2017/18 R'000
Capital expenditure	**281 193**	**376 057**	**393 758**	**564 179**	**602 116**	**706 336**	**779 789**	**1 141 349**	**1 092 704**	**1 386 695**
Land: buildings & other structures	38 564	97 533	146 602	137 530	192 324	256 114	200 253	198 032	616 761	874 171
Vehicles, plant, machinery, equipment	242 629	278 524	247 156	426 649	409 792	450 222	579 536	943 317	475 943	512 524
Current expenditure	**3 910 173**	**4 725 167**	**5 030 844**	**6 045 037**	**6 731 037**	**6 586 517**	**7 597 786**	**8 735 274**	**10 566 554**	**11 623 181**
Labour costs	1 504 542	1 710 183	1 883 176	2 481 322	2 996 929	3 248 542	3 539 733	3 576 140	4 315 989	5 080 369
Total cost of R&D postgraduate students	532 883	581 140	756 930	1 074 207	1 186 653	1 224 611	1 579 088	1 926 301	1 928 108	1 889 065
Other current expenditure*	1 872 748	2 433 844	2 390 738	2 489 508	2 547 455	2 113 364	2 478 965	3 232 833	4 322 457	4 653 747
Total	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

*Includes specific categories of R&D personnel costs (from 2016/17).

Table C.132: Proportional higher education sector R&D expenditure by accounting category (2008/09 to 2017/18)

TYPE OF EXPENDITURE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Capital expenditure	**6.7**	**7.4**	**7.3**	**8.5**	**8.2**	**9.7**	**9.3**	**11.6**	**9.4**	**10.7**
Land: buildings & other structures	0.9	1.9	2.7	2.1	2.6	3.5	2.4	2.0	5.3	6.7
Vehicles, plant, machinery, equipment	5.8	5.5	4.6	6.5	5.6	6.2	6.9	9.6	4.1	3.9
Current expenditure	**93.3**	**92.6**	**92.7**	**91.5**	**91.8**	**90.3**	**90.7**	**88.4**	**90.6**	**89.3**
Labour costs	35.9	33.5	34.7	37.5	40.9	44.5	42.3	36.2	37.0	39.1
Total cost of R&D postgraduate students	12.7	11.4	14.0	16.3	16.2	16.8	18.8	19.5	16.5	14.5
Other current expenditure*	44.7	47.7	44.1	37.7	34.7	29.0	29.6	32.7	37.1	35.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

*Includes specific categories of R&D personnel costs (from 2016/17).

Table C.133: Higher education sector expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	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	2016/17 R'000	2017/18 R'000
Biotechnology	303 483	366 900	381 225	344 039	380 727	406 285	470 837	553 562	531 958	529 948
Nanotechnology	153 013	156 176	204 802	317 649	293 300	356 826	393 137	505 380	431 558	319 610
Total	**456 496**	**523 076**	**586 027**	**661 688**	**674 028**	**763 111**	**863 974**	**1 058 942**	**963 516**	**849 558**
Higher Education expenditure on R&D	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

Table C.134: Proportional higher education sector expenditure on multidisciplinary areas of R&D (2008/09 to 2017/18)

MULTI-DISCIPLINARY AREA OF R&D	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Biotechnology	7.2	7.2	7.0	5.2	5.2	5.6	5.6	5.6	4.6	4.1
Nanotechnology	3.7	3.1	3.8	4.8	4.0	4.9	4.7	5.1	3.7	2.5
Total	**10.9**	**10.3**	**10.8**	**10.0**	**9.2**	**10.5**	**10.3**	**10.7**	**8.3**	**6.5**

Table C.135: Higher education sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	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	2016/17 R'000	2017/18 R'000
Environment related	N/A	N/A	N/A	770 339	300 006	340 386	499 958	583 723	883 069	1 112 755
Open-source software	49 532	58 643	75 195	15 982	85 508	105 008	117 646	125 883	164 097	196 300
New materials	202 242	283 711	266 419	197 430	321 744	381 136	436 975	462 962	449 336	252 340
Tuberculosis (TB), HIV/AIDS, malaria	650 502	815 431	845 216	399 070	714 966	794 810	845 245	944 490	1 082 645	1 308 224
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	264 712	258 472
Total	**902 276**	**1 157 785**	**1 186 830**	**1 382 821**	**1 422 224**	**1 621 339**	**1 899 823**	**2 117 058**	**2 843 859**	**3 128 090**
Higher Education expenditure on R&D	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.136: Proportional higher education sector R&D expenditure on selected areas of interest (2008/09 to 2017/18)

AREA OF INTEREST	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environment related	N/A	N/A	N/A	11.7	4.1	4.7	6.0	5.9	7.6	8.6
Open-source software	1.2	1.1	1.4	0.2	1.2	1.4	1.4	1.3	1.4	1.5
New materials	4.8	5.6	4.9	3.0	4.4	5.2	5.2	4.7	3.9	1.9
Tuberculosis (TB), HIV/AIDS, malaria	15.5	16.0	15.6	6.0	9.7	10.9	10.1	9.6	9.3	10.1
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.3	2.0
Total	**21.5**	**22.7**	**21.9**	**20.9**	**19.4**	**22.2**	**22.7**	**21.4**	**24.4**	**24.0**

N/A: Environment-related data were collected from the 2011/12 R&D Survey onwards. Space science data were collected for the first time in the 2016/17 R&D Survey.

Table C.137: Higher education sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Division 1: Natural Sciences, Technology and Engineering	**2 703 975**	**3 374 024**	**3 558 265**	**4 486 057**	**5 045 892**	**4 925 713**	**5 704 150**	**6 340 905**	**6 976 302**	**7 941 477**
Mathematical sciences	151 880	168 689	283 942	311 572	342 093	278 183	333 587	458 068	512 534	614 391
Physical sciences	135 002	352 628	175 110	189 341	193 849	198 735	230 826	287 830	356 090	427 400
Chemical sciences	136 528	161 856	158 775	317 389	444 258	286 511	326 992	386 300	472 883	362 105
Earth sciences	136 955	84 777	157 781	174 141	190 744	207 261	260 862	271 814	327 638	349 553

MAIN RESEARCH FIELD	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	2016/17 R'000	2017/18 R'000
Information, computer and communication technologies	125 413	121 750	112 985	186 870	232 090	192 911	245 257	322 406	378 763	295 577
Applied sciences and technologies	78 904	306 195	90 761	245 611	251 278	280 310	274 283	272 429	139 046	76 434
Engineering sciences	352 114	305 953	461 980	741 462	768 810	855 529	918 494	891 532	926 463	907 241
Biological sciences	282 280	349 343	593 219	610 408	731 389	721 229	825 432	846 897	788 716	912 256
Agricultural sciences	192 265	179 309	205 311	268 834	276 857	311 355	354 949	326 296	440 433	644 885
Medical and health sciences	966 365	1 195 597	1 226 127	1 245 284	1 391 838	1 339 755	1 641 683	2 089 591	2 412 996	2 554 061
Environmental sciences	68 869	52 431	60 458	111 612	147 367	166 493	180 324	79 430	128 784	760 600
Material sciences	68 467	76 732	26 629	81 749	68 849	82 479	100 358	93 871	67 707	6 751
Marine sciences	8 933	18 764	5 186	1 783	6 469	4 961	11 105	14 441	24 249	30 223
Division 2: Social Sciences and Humanities	**1 487 391**	**1 727 200**	**1 866 337**	**2 123 159**	**2 287 261**	**2 367 140**	**2 673 425**	**3 535 718**	**4 682 956**	**5 068 399**
Social sciences	967 204	1 273 479	1 433 610	1 664 653	1 844 744	1 825 026	2 056 555	2 855 673	3 770 136	4 209 945
Humanities	520 187	453 721	432 727	458 505	442 517	542 114	616 870	680 046	912 820	858 454
Total	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

Table C.138: Proportional higher education sector R&D expenditure by research field (2008/09 to 2017/18)

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Natural Sciences, Technology and Engineering	**64.5**	**66.1**	**65.6**	**67.9**	**68.8**	**67.5**	**68.1**	**64.2**	**59.8**	**61.0**
Mathematical sciences	3.6	3.3	5.2	4.7	4.7	3.8	4.0	4.6	4.4	4.7
Physical sciences	3.2	6.9	3.2	2.9	2.6	2.7	2.8	2.9	3.1	3.3
Chemical sciences	3.3	3.2	2.9	4.8	6.1	3.9	3.9	3.9	4.1	2.8
Earth sciences	3.3	1.7	2.9	2.6	2.6	2.8	3.1	2.8	2.8	2.7
Information, computer and communication technologies	3.0	2.4	2.1	2.8	3.2	2.6	2.9	3.3	3.2	2.3
Applied sciences and technologies	1.9	6.0	1.7	3.7	3.4	3.8	3.3	2.8	1.2	0.6
Engineering sciences	8.4	6.0	8.5	11.2	10.5	11.7	11.0	9.0	7.9	7.0
Biological sciences	6.7	6.8	10.9	9.2	10.0	9.9	9.9	8.6	6.8	7.0
Agricultural sciences	4.6	3.5	3.8	4.1	3.8	4.3	4.2	3.3	3.8	5.0
Medical and health sciences	23.1	23.4	22.6	18.8	19.0	18.4	19.6	21.2	20.7	19.6

MAIN RESEARCH FIELD	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Environmental sciences	1.6	1.0	1.1	1.7	2.0	2.3	2.2	0.8	1.1	5.8
Material sciences	1.6	1.5	0.5	1.2	0.9	1.1	1.2	1.0	0.6	0.1
Marine sciences	0.2	0.4	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.2
Division 2: Social Sciences and Humanities	**35.5**	**33.9**	**34.4**	**32.1**	**31.2**	**32.5**	**31.9**	**35.8**	**40.2**	**39.0**
Social sciences	23.1	25.0	26.4	25.2	25.2	25.0	24.5	28.9	32.3	32.4
Humanities	12.4	8.9	8.0	6.9	6.0	7.4	7.4	6.9	7.8	6.6
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 (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Division 1: Defence	**5 150**	**3 620**	**7 271**	**10 211**	**12 009**	**6 121**	**7 266**	**8 330**	**10 899**	**13 792**
Defence	5 150	3 620	7 271	10 211	12 009	6 121	7 266	8 330	10 899	13 792
Division 2: Economic Development	1 539 534	1 738 239	1 542 453	2 072 624	1 996 497	2 547 254	2 472 831	2 850 018	3 375 098	4 044 376
Economic Development unclassified	209 400	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	153 054	178 033	188 513	277 764	234 309	534 417	220 024	282 188	358 551	551 241
Animal production and animal primary products	117 255	130 828	128 705	151 334	176 645	173 865	190 421	199 545	288 114	390 549
Mineral resources (excluding Energy)	88 576	83 294	99 966	129 185	69 062	129 459	127 236	131 141	115 367	157 215
Energy resources	71 648	81 689	88 657	87 659	92 947	82 011	75 367	84 862	68 184	98 739
Energy supply	106 457	107 759	144 462	157 304	162 879	221 160	233 075	237 993	225 645	247 610
Manufacturing	210 009	297 303	245 037	272 287	348 845	340 630	329 083	380 258	444 203	478 631
Construction	46 175	23 858	73 340	116 141	74 322	79 775	96 642	111 437	177 750	223 367
Transport	29 517	30 456	24 045	53 043	31 830	32 503	38 549	47 577	72 250	101 938
Information and communication services	87 013	110 589	93 281	144 313	101 980	139 305	152 987	232 257	191 378	240 992
Commercial services	54 604	282 078	54 659	106 287	111 587	156 001	124 971	125 771	182 456	199 639
Economic framework	193 599	206 625	217 501	302 693	335 217	363 483	493 154	544 118	612 373	703 369
Natural resources	172 228	205 728	184 287	274 612	256 874	294 645	391 322	472 871	638 827	651 085
Division 3: Society	**1 359 797**	**1 177 651**	**1 393 700**	**1 583 800**	**1 865 914**	**1 569 371**	**2 180 662**	**2 820 755**	**3 266 113**	**3 540 172**
Society unclassified	209 400	0	0	0	0	0	0	0	0	0

SOCIO-ECONOMIC OBJECTIVE	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	2016/17 R'000	2017/18 R'000
Health	644 763	701 007	776 688	686 152	1 150 349	654 525	1 074 951	1 375 861	1 652 001	1 730 300
Education and training	227 502	187 291	294 482	359 897	402 285	547 108	739 611	925 245	912 877	1 041 714
Social development and community services	278 132	289 353	322 530	537 752	313 280	367 738	366 099	519 649	701 234	768 158
Division 4: Environment	**339 148**	**346 483**	**377 151**	**509 533**	**554 758**	**456 619**	**629 133**	**614 011**	**737 262**	**780 436**
Environment unclassified	69 800	0	0	0	0	0	0	0	0	0
Environmental knowledge	135 472	170 901	188 250	230 135	232 440	184 169	269 688	246 804	331 243	341 909
Environmental aspects of development	72 050	92 353	86 295	123 344	168 956	154 462	202 787	212 879	233 609	233 947
Environmental and other aspects	61 826	83 229	102 606	156 054	153 362	117 989	156 658	154 328	172 411	204 580
Division 5: Advancement of Knowledge	**947 737**	**1 835 231**	**2 104 026**	**2 433 048**	**2 903 975**	**2 713 487**	**3 087 684**	**3 583 508**	**4 269 886**	**4 631 099**
Advancement of Knowledge unclassified	209 400	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	423 469	969 079	1 263 802	1 443 913	1 731 540	1 633 257	2 006 195	2 262 831	2 887 227	3 269 179
Social sciences and humanities	314 868	866 152	840 223	989 135	1 172 435	1 080 231	1 081 488	1 320 677	1 382 659	1 361 920
Total	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

Table C.140: Proportional higher education sector R&D expenditure by socio-economic objective (2008/09 to 2017/18)

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Division 1: Defence	**0.1**	**0.1**	**0.1**	**0.2**	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Defence	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Division 2: Economic Development	**36.7**	**34.1**	**28.4**	**31.4**	**27.2**	**34.9**	**29.5**	**28.9**	**28.9**	**31.1**
Economic Development unclassified	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	3.7	3.5	3.5	4.2	3.2	7.3	2.6	2.9	3.1	4.2
Animal production and animal primary products	2.8	2.6	2.4	2.3	2.4	2.4	2.3	2.0	2.5	3.0

SOCIO-ECONOMIC OBJECTIVE	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %
Mineral resources (excluding Energy)	2.1	1.6	1.8	2.0	0.9	1.8	1.5	1.3	1.0	1.2
Energy resources	1.7	1.6	1.6	1.3	1.3	1.1	0.9	0.9	0.6	0.8
Energy supply	2.5	2.1	2.7	2.4	2.2	3.0	2.8	2.4	1.9	1.9
Manufacturing	5.0	5.8	4.5	4.1	4.8	4.7	3.9	3.9	3.8	3.7
Construction	1.1	0.5	1.4	1.8	1.0	1.1	1.2	1.1	1.5	1.7
Transport	0.7	0.6	0.4	0.8	0.4	0.4	0.5	0.5	0.6	0.8
Information and communication services	2.1	2.2	1.7	2.2	1.4	1.9	1.8	2.4	1.6	1.9
Commercial services	1.3	5.5	1.0	1.6	1.5	2.1	1.5	1.3	1.6	1.5
Economic framework	4.6	4.1	4.0	4.6	4.6	5.0	5.9	5.5	5.3	5.4
Natural resources	4.1	4.0	3.4	4.2	3.5	4.0	4.7	4.8	5.5	5.0
Division 3: Society	**32.4**	**23.1**	**25.7**	**24.0**	**25.4**	**21.5**	**26.0**	**28.6**	**28.0**	**27.2**
Society unclassified	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	15.4	13.7	14.3	10.4	15.7	9.0	12.8	13.9	14.2	13.3
Education and training	5.4	3.7	5.4	5.4	5.5	7.5	8.8	9.4	7.8	8.0
Social development and community services	6.6	5.7	5.9	8.1	4.3	5.0	4.4	5.3	6.0	5.9
Division 4: Environment	**8.1**	**6.8**	**7.0**	**7.7**	**7.6**	**6.3**	**7.5**	**6.2**	**6.3**	**6.0**
Environment unclassified	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	3.2	3.4	3.5	3.5	3.2	2.5	3.2	2.5	2.8	2.6
Environmental aspects of development	1.7	1.8	1.6	1.9	2.3	2.1	2.4	2.2	2.0	1.8
Environmental and other aspects	1.5	1.6	1.9	2.4	2.1	1.6	1.9	1.6	1.5	1.6
Division 5: Advancement of Knowledge	**22.6**	**36.0**	**38.8**	**36.8**	**39.6**	**37.2**	**36.9**	**36.3**	**36.6**	**35.6**
Advancement of Knowledge unclassified	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	10.1	19.0	23.3	21.8	23.6	22.4	23.9	22.9	24.8	25.1
Social sciences and humanities	7.5	17.0	15.5	15.0	16.0	14.8	12.9	13.4	11.9	10.5
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 (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	286 605	536 792	556 496	608 815	592 861	557 292	612 239	975 099	1 002 978	1 017 383
Free State	226 892	246 298	281 889	323 335	356 177	449 852	491 203	523 782	625 646	894 118
Gauteng	1 467 914	1 537 166	1 600 783	2 028 145	2 118 817	2 233 696	2 733 330	3 305 576	4 105 237	4 269 020
KwaZulu-Natal	567 999	662 518	677 740	902 386	1 137 258	750 507	843 111	903 664	1 157 722	1 428 653
Limpopo	86 635	147 397	224 603	349 559	300 435	187 317	216 352	229 364	301 809	358 543
Mpumalanga	72 590	88 680	119 231	170 966	182 192	147 134	174 657	190 716	148 981	155 430
North-West	150 125	190 570	184 514	275 088	311 325	405 963	404 575	444 135	469 171	449 196
Northern Cape	68 443	92 062	107 581	148 425	164 483	161 603	146 769	164 487	188 515	180 632
Western Cape	1 264 162	1 599 741	1 671 766	1 802 496	2 169 606	2 399 489	2 755 339	3 139 800	3 659 198	4 256 902
Total	**4 191 366**	**5 101 224**	**5 424 602**	**6 609 216**	**7 333 153**	**7 292 853**	**8 377 575**	**9 876 623**	**11 659 258**	**13 009 876**

Table C.142: Proportional higher education sector R&D expenditure by province (2008/09 to 2017/18)

PROVINCE	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	6.8	10.5	10.3	9.2	8.1	7.6	7.3	9.9	8.6	7.8
Free State	5.4	4.8	5.2	4.9	4.9	6.2	5.9	5.3	5.4	6.9
Gauteng	35.0	30.1	29.5	30.7	28.9	30.6	32.6	33.5	35.2	32.8
KwaZulu-Natal	13.6	13.0	12.5	13.7	15.5	10.3	10.1	9.1	9.9	11.0
Limpopo	2.1	2.9	4.1	5.3	4.1	2.6	2.6	2.3	2.6	2.8
Mpumalanga	1.7	1.7	2.2	2.6	2.5	2.0	2.1	1.9	1.3	1.2
North-West	3.6	3.7	3.4	4.2	4.2	5.6	4.8	4.5	4.0	3.5
Northern Cape	1.6	1.8	2.0	2.2	2.2	2.2	1.8	1.7	1.6	1.4
Western Cape	30.2	31.4	30.8	27.3	29.6	32.9	32.9	31.8	31.4	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.143: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation (2008/09 to 2017/18)

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL
2008/09	**20 223**	16 313	2 054	1 856	**4 859.3**	3 643.5	541.7	674.2
2009/10	**20 850**	17 010	2 115	1 725	**5 018.0**	3 761.8	579.8	676.4
2010/11	**19 970**	15 553	2 123	2 294	**5 023.0**	3 613.7	534.9	874.5
2011/12	**21 458**	16 294	2 344	2 820	**6 091.2**	4 355.3	673.4	1 062.5
2012/13	**22 691**	17 441	2 344	2 906	**6 571.5**	4 700.6	737.3	1 133.5
2013/14	**23 543**	18 212	2 284	3 047	**7 005.7**	5 000.5	843.7	1 161.5
2014/15	**24 701**	18 625	2 496	3 580	**7 237.8**	5 097.7	857.3	1 282.8
2015/16	**25 612**	19 217	2 616	3 779	**7 147.1**	4 701.9	1 000.3	1 445.0
2016/17	**28 658**	22 302	2 227	4 129	**7 652.9**	5 220.4	804.2	1 628.3
2017/18	**31 467**	24 942	2 484	4 041	**8 459.4**	6 040.6	838.0	1 580.8

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.144: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2015/16 to 2017/18)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
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
2016/17	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	46 028	24 903	21 125	19 628.8	10 809.5	8 819.3	42.6
Technicians directly supporting R&D	2 227	1 237	990	804.2	497.1	307.1	36.1
Other personnel directly supporting R&D	4 129	1 338	2 791	1 628.3	519.3	1 109.0	39.4
Total	52 384	27 478	24 906	22 061.4	11 826.0	10 235.4	42.1
2017/18	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	50 549	27 577	22 972	20 996.2	11 687.1	9 309.2	41.5
Technicians directly supporting R&D	2 484	1 352	1 132	838.0	514.6	323.4	33.7
Other personnel directly supporting R&D	4 041	1 341	2 700	1 580.8	501.1	1 079.7	39.1
Total	57 074	30 270	26 804	23 415.1	12 702.8	10 712.3	41.0

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.145: Higher education sector R&D personnel in headcounts by occupation and gender, and full-time equivalents by occupation (2015/16 to 2017/18)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
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
2016/17	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
Researchers*	22 302	11 690	10 612	5 220.4	23.4
Technicians directly supporting R&D	2 227	1 237	990	804.2	36.1
Other personnel directly supporting R&D	4 129	1 338	2 791	1 628.3	39.4
Total	28 658	14 265	14 393	7 652.9	26.7
2017/18	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
Researchers*	24 942	13 311	11 631	6 040.6	46.6
Technicians directly supporting R&D	2 484	1 352	1 132	838.0	45.6
Other personnel directly supporting R&D	4 041	1 341	2 700	1 580.8	66.8
Total	31 467	16 004	15 463	8 459	26.9

*Excludes doctoral students and post-doctoral fellows.

Includes specific categories of R&D personnel.

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.146: Higher education sector R&D postgraduates in headcounts by qualification and gender, and full-time equivalents by qualification (2015/16 to 2017/18)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
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
Master's students	38 501	18 258	20 243	17 780.9	46.2
Total	60 923	30 651	30 272	31 445.8	51.6
2016/17	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
Post-doctoral fellows	2 471	1 404	1 067	2 335.8	94.5
Doctoral students	21 255	11 809	9 446	12 072.7	56.8
Master's students (full research master's)	23 183	11 130	12 053	12 654.1	54.6
Master's students (coursework plus thesis with research component)	32 022	15 607	16 415	10 884.9	34.0
Total	78 931	39 950	38 981	37 947.4	48.1
2017/18	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
Post-doctoral fellows	2 741	1 545	1 196	2 597.6	94.8
Doctoral students	22 866	12 721	10 145	12 358.1	54.0
Master's students (full research master's)	24 769	11 702	13 067	12 348.9	49.9
Master's students (coursework plus thesis with research component)	30 272	14 261	16 011	10 740.1	35.5
Total	80 648	40 229	40 419	38 045	47.2

Note: Master's students are separated into two categories (from 2016/17).

Table C.147: Higher education sector R&D personnel in headcounts by occupation, qualification, population group and gender (2017/18)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers*	24 942	13 311	11 631	3 759	3 341	669	748	1 026	1 204	5 262	5 235	2 595	1 103
Doctoral degree or equivalent	11 726	6 890	4 836	1 338	982	314	280	448	431	2 930	2 476	1 860	667
Master's, honours, bachelor or equivalent	11 296	5 511	5 785	2 111	2 013	306	407	501	645	1 996	2 375	597	345
Diplomas	1 920	910	1 010	310	346	49	61	77	128	336	384	138	91
Technicians directly supporting R&D	2 484	1 352	1 132	477	284	163	111	31	33	333	297	348	407
Doctoral degree or equivalent	270	143	127	21	18	6	6	1	6	58	55	57	42
Master's, honours, bachelor or equivalent	657	332	325	125	92	54	56	12	17	105	134	36	26
Diplomas	1 557	877	680	331	174	103	49	18	10	170	108	255	339
Other personnel directly supporting R&D	4 041	1 341	2 700	548	924	128	441	42	77	405	869	218	389
Doctoral degree or equivalent	236	107	129	23	23	6	16	6	7	55	67	17	16
Master's, honours, bachelor or equivalent	1 392	431	961	156	302	38	134	17	30	160	414	60	81
Diplomas	2 413	803	1 610	369	599	84	291	19	40	190	388	141	292
Total	31 467	16 004	15 463	4 784	4 549	960	1 300	1 099	1 314	6 000	6 401	3 161	1 899

*Excludes doctoral students and post-doctoral fellows. Includes specific categories of R&D personnel.

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.148 Higher education sector overview (2017/18)

	R&D EXPENDITURE	RESEARCHER HEADCOUNT*	RESEARCHER FTE*	POSTGRAD HEADCOUNT	POSTGRAD FTE
	R' 000				
Private Universities	**85 055**	**249**	**105.5**	**325**	**175.3**
Universities	**11 918 281**	**21 314**	**5 252.9**	**23 471**	**13 625.7**
Nelson Mandela Metropolitan University	386 627	690	103.6	655	338.1
North West University	611 634	1 564	391.1	1 765	1 286.8
Rhodes University	328 725	432	148.1	684	684.0
Sefako Makgatho Health Sciences University**	175 082	610	122.0	71	54.2
University of Cape Town	1 862 888	1 289	507.8	2 441	1 554.4
University of Fort Hare	176 633	451	90.2	844	532.8
University of Johannesburg	588 932	1 267	287.8	1 211	720.2
University of KwaZulu Natal	874 633	2 209	499.0	3 556	1 725.8
University of Limpopo	181 035	597	174.9	306	209.8
University of Pretoria	1 194 050	2 643	662.1	2549	1 196.0
University of South Africa	762 953	1946	389.2	2 358	1 682.7
University of Stellenbosch	1 863 789	1 822	572.4	2 040	1 149.0
University of the Free State	472 591	706	193.1	1 123	643.0
University of the Western Cape	467 983	838	268.8	1 091	515.0
University of the Witwatersrand	1 764 923	3 955	598.8	2 367	1 041.6
University of Zululand	205 804	295	243.8	410	292.4
Universities of (Science) and Technology	**1 006 540**	**3 379**	**682.2**	**1 811**	**1 154.7**
Cape Peninsula University of Technology	240 380	591	104.6	307	307.0
Walter Sisulu University of Technology and Science	62 460	586	87.9	65	48.2
Central University of Technology	270 453	345	241.6	164	71.6
Durban Institute of Technology	126 327	418	57.9	382	275.2
Mangosuthu Technikon	35 638	188	39.3	12	12.0
Tshwane University of Technology	125 654	329	35.3	443	129.0
University of Venda for Science and Technology	61 247	455	45.5	351	245.7
Vaal University of Technology	84 380	467	70.1	87	66.0
TOTAL	**13 009 876**	**24 942**	**6 040.6**	**25 607**	**14 955.7**

**Data for Sefako Makgatho Health Sciences University are only from the HEMIS database. Collected personnel data may differ from HEMIS data in some cases due to definitional differences in personnel categories.

*Excludes post-doctoral and doctoral students.

Includes specific categories of R&D personnel.

Note: Headcounts include non-SA R&D staff from 2016/17. Non-South African personnel are classified as those that are not from South Africa but undertaking research for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.149: Gross Domestic Product (2008-2017)

YEAR	GDP LEVEL (CURRENT VALUES)	GDP LEVEL (CONSTANT 2010 VALUES)
	R MILL.	R MILL.
2008	2 369 063	2 708 601
2009	2 507 677	2 666 940
2010	2 748 008	2 748 008
2011	3 023 659	2 838 257
2012	3 253 852	2 901 078
2013	3 539 977	2 973 175
2014	3 805 350	3 028 090
2015	4 049 884	3 064 237
2016	4 359 060	3 076 465
2017	4 653 579	3 119 984

Data source: Stats SA (2019a)

D. DESCRIPTION OF SURVEY 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 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.

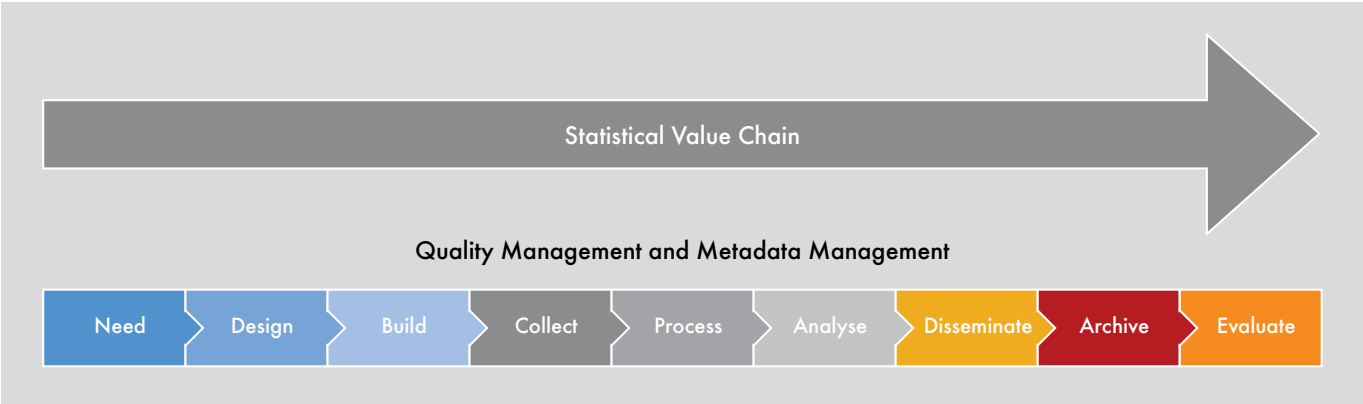
The scope of the survey includes all units performing R&D, either continuously or occasionally. Output tables are agreed in advance of the survey between CeSTII and the DSI as a standard.

The survey collects data in accordance with the guidelines recommended by the OECD in the Frascati Manual (OECD, 2002, 2015). This helps to maintain coherence and international comparability. The System of National Accounts (EC, IMF, OECD, UN and the World Bank, 2009) and the NSI 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 Statistics South Africa. 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 2017 annual reference period taken from the quarterly Stats SA GDP statistical release P0441 (Stats SA, 2019), and employment level is the value for the first quarter of 2017 obtained from the Stats SA Quarterly Labour Force Survey statistical release P02111 (Stats SA, 2019). The survey also uses the Standard Industrial Classification (Stats SA, 2004) codes for business sector industrial classifications employed by Stats SA.

Overall, HSRC-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 2017/18. Table D.1 describes each of the sectors, the fieldwork periods employed by sector, and also provides 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	Large, Medium and Small (Micro) business enterprises, including state-owned enterprises.	Financial year 2017-2018 (or the closest complete financial year).	A purposive design was used for the survey of the business sector, and the frame was constructed from the business register developed and maintained by HSRC-CeSTII since 2002. All known and likely R&D performers were targeted.	3 October 2018 - 1 July 2019
Not-for-profit	Non-governmental and not-for-profit entities. Those registered as Section 21 companies.	1 April 2017 to 31 March 2018 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.	8 October 2018 - 1 May 2019
Government	National and provincial departments, local government, museums, research institutes and other research units with an R&D component.	Financial year 1 April 2017 to 31 March 2018 (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.	1 October 2018 - 31 May 2019
Science councils	The nine science councils established through Acts of Parliament.	Financial year 1 April 2017 to 31 March 2018 or nearest complete financial year).	Seven statutory science councils were surveyed, using a census approach. Two of the nine science councils do not perform R&D.	1 October 2018 - 31 May 2019
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 2017).	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.	3 October 2018 - 1 July 2019

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. All five sectors were surveyed between 1 October 2018 and 1 July 2019.

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.

Changes made to the 2016/17 R&D Survey collection instruments on the R&D personnel tables for all sectors were maintained in the 2017/18 round of the survey. This was done in an effort to report on foreign employees that could not be categorised by population group during previous surveys. The R&D personnel changes included an additional classification of the population group of R&D personnel, as non-South African personnel.

Business sector

CeSTII has developed a register of known or likely R&D performers in the business sector from several information sources, including the JSE Top 100 Companies, Technology Top 100, Support Programme for Industrial Innovation (SPII) and Technology and Human Resources for Industry Programme (THRIP). A total of 483 business sector units were selected for the 2017/18 survey period. Out of this cohort, 390 units were reported as in-scope units.

A possible contributor to increased levels of non-response in recent years is attributed to resistance from respondents to participate in the survey. Such resistance may have been partly influenced by a negative effect on the outcomes of their R&D Tax Incentive applications.

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 has been an ongoing process of improvement in coverage of the not-for-profit sector through investigation of a comprehensive list of 2 203 registered NPOs. This list has now been exhausted and only 64 additional units were investigated for the 2017/18 period. The 64 units were not part of the 63 units that remained on the frame for 2016/17 R&D survey. From the investigation process (of 64 units), only two new units were identified as likely R&D performers. The NPO frame for the 2017/18 survey therefore comprised a total of 65 units.

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. A government workshop on the R&D survey was conducted on 26 March 2019 as a means to promote participation. Furthermore, two field visits were made to Western Cape-based national departments to assist respondents in completing the survey.

Higher education sector

In the 2017/18 R&D Survey, the survey frame for the higher education sector was 33, which consisted of 9 private universities and 24 public universities.

The funding of research chairs are included in these estimates.

Further amendments to the collection instrument included specific categories of R&D personnel relevant to higher education only — these are emeritus professors, research fellows, honorary research associates or equivalent. They do not incur a salary at the university but there are time and costs associated with them, therefore the separate headcount and FTE category. The Frascati guidelines classify specific categories of R&D personnel as researchers to be included for reporting R&D activity.

Costs incurred by the specific categories of R&D personnel are included as "specific categories of R&D personnel costs" and are included in the other current expenditure (Q8 of the HE questionnaire; see section F).

From the 2016/17 survey onwards, the master's student's category was split into two types: master's students (full research master's) and master's students (coursework plus thesis with research component).

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

The summary set of quality indicators for the collection and imputation phases of the survey processes in Table D.2 reflects an overall questionnaire response rate of 63.4%.

A partial reason for the relatively high number of out-of-scopes in the business sector 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 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[4] 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 2017/18 R&D survey.

In-scope units[5] were defined as units performing in-house R&D or with likely in-house R&D activity; units that indicated that no R&D had been performed during the 2017/18 period were classified as out-of-scope.

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:

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

[4] Adapted from Sarndal, Swensson, & Wretman (1992).

[5] This is the HSRC-CeSTII operational definition.

Table D.2: 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	WEIGHTED RESPONSE RATE
Business	483	483	198	47	285	65.4%	88.0%	13.3%	78.9%
Not-for-profit	127	65	29	2	36	57.1%	65.1%	6.3%	98.7%
Government	164	100	52	3	48	49.5%	67.0%	2.1%	96.7%
Science councils	13	13	0	0	13	100.0%	100.0%	0.0%	100.0%
Higher education	33	33	8	0	25	75.8%	75.8%	18.2%	86.5%
HE: Public	24	24	6	0	18	75.0%	75.0%	25.0%	86.4%
HE: Private	9	9	2	0	7	77.8%	77.8%	0.0%	100.0%
Total	820	694	287	52	407	63.4%	82.1%	10.9%	86.6%

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.3). Imputations are only used upon verification from respondents or where available information confirms continued R&D activity within a specific unit of measure.

A unit is selected for imputation only if sector leaders have convinced themselves of the existence of R&D activity in those units. Where it was not possible to obtain company confirmation, individual fieldworkers were responsible for providing evidence of ongoing R&D activity to qualify units for imputation. The survey employed varying degrees of imputation. In some cases, a total R&D expenditure figure reported by the respondent (by email or telephone) was used to impute the remaining data items using a model employing available sector R&D profiles. In other cases, publicly available data was used. Lastly, a R&D profile for a unit was generated based on its known historical R&D profile adjusted by an inflation factor. In the latter case, financial data on R&D were increased by a GDP inflation value of 6.930% in 2017/18.

Table D.3: 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)	50	3	0	0	0
Commuted (data more than one year old)	8	1	2	0	6
Total	58	4	2	0	6

Personnel data for non-responding higher education institutions were imputed from personnel data obtained from HEMIS. 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 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 (RDSMS). 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 HSRC-CeSTII and the DSI 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 State-owned Enterprises (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).

D.7. Dissemination

The 2017/18 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 HSRC-CeSTII and the DSI. The report can be downloaded from the HSRC-CeSTII website (http://www.hsrc.ac.za/en/departments/cestii/reports-cestii) alternatively the DSI 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 HSRC-CeSTII procedures. Hard copies of the data from the two most recent surveys are kept in safe storage at HSRC-CeSTII, while the data from older surveys are kept in safe storage off site. All data are stored electronically on secure servers, and daily back-ups of databases are generated.

E. REFERENCES

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STRICTLY CONFIDENTIAL

NATIONAL SURVEY OF RESEARCH & EXPERIMENTAL DEVELOPMENT INPUTS TO HIGHER EDUCATION [PUBLIC]
2017 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/reports-cestii. This survey covers the **Academic Year 1 January to 31 December 2017**.

DUE DATE
Kindly complete and return this form as soon as possible, but no later than **1 DECEMBER 2017.**

Return address: R&D Survey, PO BOX 15200, 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
Mrs Janine Senekal	021 466 7814	jsenekal@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
- 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

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.

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 2017 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 as appropriate

Yes **No**

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.

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
Researchers are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods

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).
- Post-graduate students enrolled to be reported separately.

2. Technicians directly supporting R&D
Persons doing technical tasks in support of R&D, normally under the direction and supervision of a researcher. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods and the use of research equipment, normally under the supervision of researchers.

3. Other personnel directly supporting R&D
Other supporting staff includes skilled and unskilled craftsmen, and administrative, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

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.

Specific categories of R&D personnel:
A specific type of external R&D personnel can be identified (almost exclusively) in the HE sector, namely that of a "professor emeritus". These individuals are retired professors who continue to research and collaborate in the academic activities of a university – without receiving any compensation (although, they may receive some logistical support for their activities). The relevant proportion of the costs linked to them should be included under "Other Current Costs" in Question 8D.

NOTE: ALL FOREIGN HEADCOUNTS TO BE REPORTED IN NON-SA CATEGORY.

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 2017.

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/ Asian		White		Non-SA		Sub-total		TOTAL
	M	F	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													
Specific categories of R&D personnel													
Professors Emeritus, research fellows, honorary research associates or equivalent											-	-	-
Volunteers											-	-	-
Specific R&D personnel total											-	-	-

CARRY TOTALS 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 <u>NOTE B</u> 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 -
Specific categories of R&D personnel								
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

<u>NOTE A: CALCULATION OF RESEARCHER HEADCOUNTS AND FTE'S USING HEMIS DATA</u>
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.

<u>NOTE B: CALCULATION OF TECHNICIAN AND OTHER SUPPORT STAFF HEADCOUNT AND FTE'S</u>
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/ Asian		White		All Races		M	F	
	M	F	M	F	M	F	M	F	M	F			
Post-doctoral fellows											-	-	-
Doctoral Students											-	-	-
Masters Students (research Master's)											-	-	-
Masters students (course work plus thesis with research component)													
TOTAL											-	-	

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 (research Master's)					
Masters students (course work plus thesis with research component)					
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 2017. 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**	
Specific categories of R&D personnel costs		

		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

Category	SUB TOTAL (R000's) made up of :								
	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**	100%

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 **100%**

13a. RESEARCH FIELDS (RF)

Classify R&D according to Research Fields (see Codes book) and provide the associated % of the <u>Total</u> 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 separate sheet if applicable.

	RF Codes	Percentage		RF Codes	Percentage
RF			RF		
RF			RF		
TOTAL					100%

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	
Space science	
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					**100%**

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.

	South Africa	Foreign	Foreign consisting of . . . (tick as appropriate)							
			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 INSIDE South Africa

R'000 Excluding VAT

17. State the value of R&D outsourced OUTSIDE South Africa

R'000 Excluding VAT

THANK YOU FOR YOUR TIME AND EFFORT!

G. USER SATISFACTION SURVEY

SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT: STATISTICAL REPORT 2017/18

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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