

# SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT



## STATISTICAL REPORT 2016/17



## ► DISSEMINATION

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### User feedback

A User Satisfaction Survey questionnaire is included in section 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](mailto:cestiidata@hsrc.ac.za). The feedback is analysed following each survey cycle to ensure the continued improvement of the R&D Survey.

### Revisions

The Department of Science and Technology (DST), Statistics South Africa (Stats SA) and the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicators (HSRC-CeSTII) reserve jointly 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 requirements and consistency monitoring such as that carried out by the Organisation for Economic Co-operation and Development (OECD), which conducts quality checks through global comparative analyses, time series analyses and other methods. Explanations of any revisions will be made available and accessible on the DST and HSRC websites.



## ► FOREWORD



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

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

The Statistics Act (No. 6 of 1999) mandates the Statistician-General (SG) to coordinate statistical production in the country, even beyond the confines of Statistics South Africa (Stats SA). Accordingly, each R&D survey is subjected to a quality assessment process which is undertaken by a Clearance Committee, prior to its publication. This is done in accordance with the South African Statistical Quality Assessment Framework (SASQAF), to ensure the survey remains credible and true to its purpose.

There have been changes in the R&D landscape over the previous years. It is vital for the survey to adapt accordingly. As such, the 2016/17 R&D Survey introduced minor refinements, to mark the initial phase of incorporating the 2015 revisions to the Frascati Manual, an international guide for R&D statistics. The changes have added new sub-categories of R&D personnel data, but these have had minimal effect on the time series. Scoping for the next phase of this process has commenced, and clearly indicates a need for consultations locally and exchanges of practices with other countries, both to address domestic R&D measurement requirements and to maintain international comparability.

Through the quality assessment process, the Clearance Committee noted that the 2016/17 R&D Survey was conducted following good practices, and met most of the set quality requirements. The questionnaire response rate was 68.9%, which is below the set standard of 75%. The collection rate was 81.8%, which is above the standard of 75%. These two key quality indicators capture the dynamics of R&D performing units across the five sectors covered by this survey, which include units that perform R&D more consistently and those that do not. To reduce imputations, specific public higher education institutions should be assisted to address common R&D data collection constraints. Efforts to expand the universe of R&D performers in the business sector must continue, and the survey design should gradually adapt to the changes in the way R&D is funded and organised within firms.

Given my assessment of the recommendations of the Clearance Committee, I endorse the 2016/17 R&D Survey results, and encourage its use by stakeholders.

A handwritten signature in black ink, which appears to read 'Risenga Maluleke'. The signature is fluid and cursive.

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 the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicators (HSRC-CeSTII) on behalf of the Department of Science and Technology (DST).

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

The support and contributions of Imraan Patel, Godfrey Mashamba, Tshidi Mamogobo, Kgomoetso Matlapeng and Nangamso Mnwana of the DST are very much appreciated.

Technical inputs and advice by the DST and Statistics South Africa teams, as well as the Clearance Committee for Science, Technology and Innovation Statistical Reports, have helped to 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.

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

The HSRC-CeSTII project team for the 2016/17 South African National Survey of Research and Experimental Development comprised: Lindiwe Binda, Mario Clayford, Nozibele Gcora, Zinziswa Hlakula, Firdous Khan, Lwando Kondlo, Glenda Kruss, Loyiso Maciko, Xolisa Magawana, Nhlanhla Malaza, Hlamulo Makelane, Maria Maluleke, Jerry Mathekga, Neo Molotja, Vuyiseka Mpikwa, Precious Mudavanhu, Nazeem Mustapha, Saahier Parker, Gerard Ralphs, Theodore Sass, Natasha Saunders, Janine Senekal, Moses Sithole, Natalie Vlotman, Sibusiso Ziqubu, and Thembinkosi Zulu.

We further acknowledge the contributions of the HSRC's ICT support staff, Noor Fakier and Siphamandla Bidli, and the report's graphic designer, Tracey Watson.





## ► ABBREVIATIONS

<b>AIDS</b>	Acquired Immune Deficiency Syndrome
<b>BERD</b>	Business Expenditure on R&D
<b>CeSTII</b>	Centre for Science, Technology and Innovation Indicators
<b>DST</b>	Department of Science and Technology
<b>FTE</b>	Full-time Equivalent
<b>GDP</b>	Gross Domestic Product
<b>GERD</b>	Gross Domestic Expenditure on R&D
<b>GOVERD</b>	Government Intramural Expenditure on R&D
<b>HEMIS</b>	Higher Education Management Information System
<b>HERD</b>	Expenditure on R&D in the Higher Education Sector
<b>HIV</b>	Human Immunodeficiency Virus
<b>HSRC</b>	Human Sciences Research Council
<b>ICT</b>	Information and Communication Technologies
<b>NESTI</b>	National Experts on Science and Technology Indicators
<b>NPO</b>	Not-for-profit Organisation
<b>NSI</b>	National System of Innovation
<b>NSO</b>	National Statistical Organisation
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>R&amp;D</b>	Research and Experimental Development
<b>RDSMS</b>	Research and Development Survey Management System
<b>SA</b>	South Africa
<b>SASQAF</b>	South African Statistical Quality Assessment Framework
<b>SOE</b>	State-owned Enterprise
<b>SEO</b>	Socio-economic Objective
<b>SIC</b>	Standard Industrial Classification
<b>SNA</b>	System of National Accounts
<b>SPII</b>	Support Programme for Industrial Innovation
<b>Stats SA</b>	Statistics South Africa
<b>SVC</b>	Statistical Value Chain
<b>TB</b>	Tuberculosis
<b>VAT</b>	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, 1<sup>st</sup> Quarter 2018 (Stats SA, 2018a).

**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, 1<sup>st</sup> Quarter 2018 (Stats SA, 2018a).

**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 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-technology 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.

**Non-South African personnel** are classified as those that are not from South Africa but undertaking research for a period exceeding six months. This classification aligns with the South African System of National Accounts classification that classifies non-South Africans into temporary residents or permanent residents. R&D personnel may be permanent or temporary residents. The conditions are that they have to be involved in the R&D Survey during the survey period, and on contract of six months or longer.

**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** comprises 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<sup>1</sup>.

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

**Research and experimental development (R&D)** comprise creative 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 Programmes 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, 2018b) 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).

<sup>1</sup> Prior to 2016/17, emeritus professors, honorary fellows and research fellows were not required to be explicitly included in the estimates of R&D personnel.

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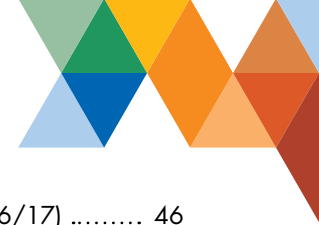


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## ► A. INTRODUCTION

This Statistical Report presents data tables from the 2016/17 South African National Survey of Research and Experimental Development (R&D Survey). The report provides key findings of the survey with commentary and standard summary tables of 2016/17, along with time series data from previous iterations of the survey. The Statistical Report is published together with the Main Analysis Report, which provides selected analyses of survey data.

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

- **The business enterprise sector**, comprising all industries and size classes of enterprises, including state-owned enterprises (SOEs).
- **The government sector**, comprising departments in the three spheres of national, provincial and local government with an R&D component, government research institutions, and museums.
- **The not-for-profit sector**, comprising non-governmental and other organisations formally registered as not-for-profit institutions.
- **The higher education sector**, comprising all public higher education institutions and private higher education institutions with an R&D component.
- **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 categories recommended by the Organisation for Economic Co-operation and Development (OECD) in *The Measurement of Scientific and Technological Activities: Proposed Standard Practice for Surveys on Research and Experimental Development*, known as the Frascati Manual (OECD, 2015). It adjusts for the South African situation, which demands a split of government into a government sector and a science council sector.

R&D statistics are presented in tables according to the following categories:

- Gross domestic expenditure on research and development (GERD), and R&D expenditure by R&D-performing sectors.
- Local and international sources of funding for R&D sectors.
- R&D expenditure by field of research, socio-economic objective and by industrial sector in the business sector (including SOEs).
- 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.

GDP values were obtained from the Statistics South Africa (Stats SA) GDP statistical release P0441 (Stats SA, 2018a), and the total employment level was taken from the Stats SA Quarterly Labour Force Survey statistical release P0211, 1<sup>st</sup> Quarter (Stats SA, 2018b).

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 series.

The indicator of full-time equivalent researchers per 1000 in total employed will be revised in the next publication, to adjust for revisions in external data 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, 2015). This is only used indicatively in this report to assist users of data for R&D capitalisation purposes. Full implementation of this procedure will be done once the changes published in the seventh edition of the Frascati Manual have been finalised.

The R&D Survey is undergoing changes in what it collects, based on user needs and international standards. Since the 2014/15 R&D Survey, the R&D performance of the SOEs was distinguished from that of the business sector. This was to enable the assessment of the R&D activities of SOEs separately and in doing so address new user needs for this type of data.



The 2016/17 R&D Survey data collection included new items across all sectors. Space science was included for the first time as part of R&D expenditure indicators. There were two additional items effected to questionnaires where personnel are concerned. Firstly, there was a change in methodology on how the number of personnel was calculated. For instance, the non-South African R&D personnel was counted separately from their South African counterparts. Approximations of the effect the latter change has had on estimates of R&D personnel and the associated labour costs are recorded in the methodology section in section D of this report.

Secondly, R&D personnel in the higher education sector were re-classified and broken down to include other categories such as emeritus professors, honorary fellows and research fellows.

Section B highlights main findings of the 2016/17 R&D Survey, including commentary on the key developments. Section C contains a detailed set of tables describing survey results for 2016/17 and the preceding nine years. The description of the survey methodology is contained in section D, and the higher education sector questionnaire for the 2016/17 survey is reproduced in section F.





## ► B. KEY FINDINGS FOR 2016/17

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

South Africa's gross domestic expenditure on research and experimental development (GERD) stood at R35.693 billion at current Rand values in 2016/17. At constant 2010 prices, GERD increased to R25.305 billion. Growth in GERD is slowing down in real terms. The year-on-year change in real GERD was 1.5 percentage points lower than it was in 2015/16 at 3.5% (Table B.1).

GERD as a percentage of GDP rose two basis points to 0.82% in 2016/17.

**Table B.1: Summary of key statistics and indicators (2014/15 to 2016/17)**

KEY INDICATOR	2014/15	2015/16	2016/17
<b>Expenditure on R&amp;D</b>			
Gross domestic expenditure on R&D (GERD) (Rm)	29 345	32 337	35 693
Business enterprise expenditure on R&D (BERD) (Rm)	13 291	13 815	14 781
Not-for-profit (NPO) expenditure on R&D (Rm)	779	891	1 018
Government expenditure on R&D (GOVERD) (Rm)	1 893	2 013	2 099
Science council (SCI) expenditure on R&D (Rm)	5 005	5 741	6 136
Higher education (HE) expenditure on R&D (HERD) (Rm)	8 378	9 877	11 659
Gross domestic expenditure on R&D in constant 2010 prices (Rm)	23 304	24 458	25 305
<b>Funding sources</b>			
Government-funded* R&D (Rm)	12 873	14 426	16 428
Business-funded R&D (Rm)	11 982	12 578	14 046
Foreign funding of R&D (Rm)	3 566	4 210	4 172
Foreign funding of BERD (Rm)	1 419	1 533	1 339
Foreign funding of NPO R&D (Rm)	457	501	640
Foreign funding of GOVERD (Rm)	179	500	512
Foreign funding of SCI R&D (Rm)	431	470	538
Foreign funding of HERD (Rm)	1 080	1 206	1 143
<b>R&amp;D personnel</b>			
Total R&D personnel (FTE**)	38 465.0	41 054.5	42 533.0
Total researchers# (FTE**)	23 571.9	26 159.4	27 656.2
Total researchers# (headcount)	48 479	51 877	56 761
Female researchers# (headcounts)	21 471	23 334	25 591
<b>Indicators computed from R&amp;D survey</b>			
GERD as a percentage of GDP (%)	0.77	0.80	0.82
Civil GERD as a percentage of GDP (%)	0.72	0.75	0.78
Basic research (R millions)	7 133	8 210	9 543
Total R&D personnel (FTE**) per 1 000 in total employment	2.5	2.6	2.6
Total researchers# (FTE**) per 1 000 in total employment	1.5	1.7	1.7
Female researcher# headcounts as a percentage of total researcher headcounts (%)	44.3	44.4	45.1
<b>Indicators obtained from external data sources</b>			
Gross domestic product (GDP) level at current prices (Rm)	3 805 350	4 051 421	4 350 314
GDP (%)	1.8	1.3	0.6
SA employment ('000)	15 459	15 663	16 212

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

\*\*FTE: Full-time equivalent.

#Includes doctoral students and post-doctoral fellows. Also includes emeritus professors, research fellows and honorary research fellows (2016/17 only). These categories do not incur salary, but there are time and costs (included in "Other current costs") associated with them.

Note: Headcounts include non-SA R&D personnel in 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.

## Notable developments reflected in key indicators

### Economic environment

GDP decreased by 0.7 of a percentage point to 0.6% in 2016.

### Higher education sector R&D expenditure drove growth in R&D intensity

The higher education sector was the largest contributor to the overall increase in GERD of R827 million (in constant 2010 values). The higher education sector contributed an amount of R790 million (in constant 2010 values) to the increase in R&D expenditure (see Table C.1).

R&D expenditure in the business sector increased by only 0.2%, with the SOEs contributing R365 million (in constant 2010 values) to this. The private sector (that is the business sector, excluding SOEs) showed a decreased R&D expenditure (in constant 2010 values). The government sector decreased expenditure by 2.4%, whereas the science council sector showed only marginal growth.

### Manufacturing and mining R&D expenditure continues to decrease

In real terms, business sector R&D expenditure increased only marginally in 2016/17. On the one hand, the financial services sector (financial intermediation, real estate and business services) increased its proportional share by 1.5 percentage points to comprise 44.3% of BERD in 2016/17 (see Table C.51). On the other hand, the manufacturing sector continued its decline and decreased its proportional share by 4.4 percentage points to comprise 27.8% of BERD in 2016/17.

### The provincial distribution of R&D activity has changed slightly over the last ten years

While most R&D activity is still performed in Gauteng, the proportion of R&D performed in that province has decreased from 2007/08 to 2016/17. Over the same period, the Western Cape has seen growth in R&D activity, with the Eastern Cape also showing an increase in R&D performed, relative to the other provinces (see Table C.18).

### There is growth in funding of R&D from both the broader government sector and business

Government funding (inclusive of science councils funding and higher education own funds) continues to outstrip business funding of R&D in 2016/17. After showing signs of slowing down in 2015/16, the growth in funds from the business sector has increased from R12.578 billion to R14.046 billion in 2016/17. Similarly, government funded R&D increased from R14.426 billion to R16.428 billion (Table C.19).

The contribution by foreign sources to funding of R&D across all sectors stands at 11.7% of GERD in 2016/17 (Table C.20). Over the ten-year period starting in 2007/08, foreign funding of South African R&D has increased in real terms by R485 million. Most foreign R&D stakes are in the business sector. However, foreign funding of the business sector has declined in real terms since 2007/8. The higher education sector has seen the most growth in funding for R&D from overseas.

### Researcher FTEs as a proportion of employed persons are unchanged at 1.7 per 1000 employed

R&D personnel (inclusive of doctoral students and post-doctoral fellows at universities) have increased by 5 098 headcounts to 80 029 in 2016/17 (see Table C.28 for the trends).

Researcher FTEs (including post-doctoral fellows and doctoral students) increased from 26 159.4 to 27 656.2 in 2016/17 (Table C.28). The number of FTE researchers per 1000 in total employment was 1.7 in 2015/16 and remains unchanged in 2016/17 at 1.7 (Table C.28). The proportion of female researchers increased by 0.7 of a percentage point to 45.1% in 2016/17 (Table B.1).







## R&D performed continued to tend towards applied research

Prior to 2010/11, there was more experimental research than applied or basic research performed in South Africa. From 2011/12 onward, there has been more applied research performed in South Africa than basic research or experimental research. In 2016/17, applied research comprised 47.8% of GERD, while basic and experimental research consisted of 26.7% and 25.5% of GERD, respectively (see Table C.6). This is the first time that the amount of experimental research has been exceeded by the amount of basic research.

Over the last ten years, most of the R&D in South Africa has consistently been conducted in the engineering sciences, information, computer and communication technology sciences, medical and health sciences and social sciences. The 2016/17 results show that the majority of R&D activity is now taking place in social sciences (21.0%), followed by medical and health science (19.2%), and then the engineering sciences, at (12.9%) (Table C.14). R&D expenditure on medical and health sciences is now lower than those in the social science research field. The rapid growth in social sciences, starting in 2011/12, derived from activities taking place in the business sector (Table C.44), followed by the higher education sector (Table C.137). Since 2014/15, R&D expenditure on engineering sciences, which for many years prior to 2011/12 was the leading research field, has been declining.

## R&D in areas of special interest

In 2016/17, only R&D expenditure on the environment (environmental and environmental related research) increased in real terms. R&D on the environment has shown sustained growth since 2010/11 and a marked increase to reach a level of R2.600 billion (Table C.11) in 2016/17.

R&D in biotechnology dropped 0.7 of a percentage point to 5.0% of GERD, and R&D in nanotechnology decreased by 0.3 of a percentage point to 2.4% of GERD (Table C.10).

The largest amount of R&D expenditure, amounting to R3.490 billion (Table C.11), is still spent on communicable diseases (TB/HIV/AIDS and malaria).

Expenditure data on space science was collected for the first time in the 2016/17 R&D Survey, and it was estimated to be at a level of R634 million, most of which was spent in the science council and higher education sectors.

## State-owned enterprises

The contribution of SOEs to R&D activity in the business sector has increased by 3.4 percentage points to 17.7% in 2016/17 (see Table C.56).

## ► C. TABLES

### Note:

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

### C.1. General survey results

#### C.1.1. Expenditure on research and experimental development

**Table C.1: R&D expenditure by sector (2007/08 to 2016/17)**

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2007/08	18 624 013	1 154 399	2 886 094	3 621 862	10 738 456	223 202
2008/09	21 041 046	1 139 676	3 137 343	4 191 366	12 332 012	240 649
2009/10	20 954 677	1 067 302	3 458 074	5 101 224	11 139 237	188 840
2010/11	20 253 805	1 011 340	3 596 023	5 424 602	10 059 010	162 830
2011/12	22 209 192	1 235 669	3 729 680	6 609 216	10 464 022	170 605
2012/13	23 871 219	1 437 509	4 025 998	7 333 153	10 570 726	503 833
2013/14	25 660 573	1 697 151	4 304 556	7 292 853	11 782 848	583 165
2014/15	29 344 977	1 893 010	5 004 669	8 377 575	13 290 951	778 772
2015/16	32 336 679	2 013 021	5 740 897	9 876 623	13 814 995	891 142
2016/17	35 692 973	2 098 646	6 136 183	11 659 258	14 781 270	1 017 616

Note: Improved coverage of the NPO sector in 2012/13 resulted in a R281 509 000 increase in expenditure, contributing 1.2% of GERD. In 2015/16, coverage was again improved, which resulted in a R185 302 000 increase in expenditure, contributing 0.6% of GERD.

**Table C.2: R&D expenditure by sector, constant 2010 Rand values (2007/08 to 2016/17)**

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2007/08	23 173 759	1 436 412	3 591 151	4 506 663	13 361 803	277 729
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



**Table C.3: R&D expenditure percentage composition by sector (2007/08 to 2016/17)**

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2007/08	6.2	15.5	19.4	57.7	1.2
2008/09	5.4	14.9	19.9	58.6	1.1
2009/10	5.1	16.5	24.3	53.2	0.9
2010/11	5.0	17.8	26.8	49.7	0.8
2011/12	5.6	16.8	29.8	47.1	0.8
2012/13	6.0	16.9	30.7	44.3	2.1
2013/14	6.6	16.8	28.4	45.9	2.3
2014/15	6.5	17.1	28.5	45.3	2.7
2015/16	6.2	17.8	30.5	42.7	2.8
2016/17	5.9	17.2	32.7	41.4	2.9

**Table C.4: R&D expenditure as a percentage of GDP by sector (2007/08 to 2016/17)**

YEAR	GERD/GDP	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%	%
2007/08	0.88	0.05	0.14	0.17	0.51	0.01
2008/09	0.89	0.05	0.13	0.18	0.52	0.01
2009/10	0.84	0.04	0.14	0.20	0.44	0.01
2010/11	0.74	0.04	0.13	0.20	0.37	0.01
2011/12	0.73	0.04	0.12	0.22	0.35	0.01
2012/13	0.73	0.04	0.12	0.23	0.32	0.02
2013/14	0.72	0.05	0.12	0.21	0.33	0.02
2014/15	0.77	0.05	0.13	0.22	0.35	0.02
2015/16	0.80	0.05	0.14	0.24	0.34	0.02
2016/17	0.82	0.05	0.14	0.27	0.34	0.02

**Table C.5: R&D expenditure by type of research (2007/08 to 2016/17)**

YEAR	GERD	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	R'000	R'000	R'000	R'000
2007/08	18 624 013	3 830 806	6 373 681	8 419 526
2008/09	21 041 046	4 243 156	7 013 082	9 784 808
2009/10	20 954 676	5 553 399	6 578 902	8 822 375
2010/11	20 253 804	4 848 283	8 058 799	7 346 722
2011/12	22 209 192	5 439 561	9 388 273	7 381 358
2012/13	23 871 219	6 030 827	11 064 247	6 776 146
2013/14	25 660 573	6 102 085	12 132 211	7 426 277
2014/15	29 344 977	7 133 213	14 331 016	7 880 748
2015/16	32 336 679	8 209 662	15 349 070	8 777 948
2016/17	35 692 973	9 542 644	17 061 167	9 089 162

**Table C.6: Proportional R&D expenditure by type of research (2007/08 to 2016/17)**

YEAR	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	%	%	%
2007/08	20.6	34.2	45.2
2008/09	20.2	33.3	46.5
2009/10	26.5	31.4	42.1
2010/11	23.9	39.8	36.3
2011/12	24.5	42.3	33.2
2012/13	25.3	46.3	28.4
2013/14	23.8	47.3	28.9
2014/15	24.3	48.8	26.9
2015/16	25.4	47.5	27.1
2016/17	26.7	47.8	25.5

**Table C.7: R&D expenditure by accounting category (2007/08 to 2016/17)**

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

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

**Table C.8: Proportional R&D expenditure by accounting category (2007/08 to 2016/17)**

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
	%	%	%	%	%	%	%
2007/08	2.0	9.1	11.0	43.9	2.7	42.4	89.0
2008/09	1.6	14.7	16.2	41.2	2.5	40.1	83.8
2009/10	3.0	9.9	12.8	42.5	2.8	41.9	87.2
2010/11	2.3	8.5	10.8	41.2	3.7	44.2	89.2
2011/12	2.0	10.0	12.0	42.9	4.8	40.2	88.0
2012/13	2.1	7.3	9.4	49.9	5.0	35.7	90.6
2013/14	2.1	7.2	9.3	51.8	4.8	34.1	90.7
2014/15	2.7	7.9	10.6	49.2	5.4	34.8	89.4
2015/16	2.2	9.3	11.5	45.7	6.0	36.8	88.5
2016/17	3.6	7.9	11.5	46.2	5.4	36.9	88.5

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



**Table C.9: Expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

YEAR	GERD	BIOTECHNOLOGY	NANOTECHNOLOGY
	R'000	R'000	R'000
2007/08	18 624 014	648 704	248 521
2008/09	21 041 046	801 640	388 380
2009/10	20 954 677	917 917	423 865
2010/11	20 253 805	1 142 337	414 529
2011/12	22 209 192	1 065 286	596 072
2012/13	23 871 219	1 179 478	662 634
2013/14	25 660 573	1 266 325	664 139
2014/15	29 344 977	1 576 727	818 919
2015/16	32 336 679	1 843 363	871 426
2016/17	35 692 973	1 788 728	853 121

**Table C.10: Proportional expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

YEAR	BIOTECHNOLOGY	NANOTECHNOLOGY
	%	%
2007/08	3.5	1.3
2008/09	3.8	1.8
2009/10	4.4	2.0
2010/11	5.6	2.0
2011/12	4.8	2.7
2012/13	4.9	2.8
2013/14	4.9	2.6
2014/15	5.4	2.8
2015/16	5.7	2.7
2016/17	5.0	2.4

**Table C.11: R&D expenditure on selected areas of interest (2007/08 to 2016/17)**

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
2007/08	18 624 013	254 808	1 120 028	N/A	298 746	N/A
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

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 (2007/08 to 2016/17)**

YEAR	OPEN-SOURCE SOFTWARE	TUBERCULOSIS (TB), HIV/AIDS, MALARIA	ENVIRONMENT / ENVIRONMENT RELATED	NEW MATERIALS	SPACE SCIENCE
	%	%	%	%	%
2007/08	1.4	6.0	N/A	1.6	N/A
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

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 (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Division 1:</b>										
Natural sciences, technology and engineering	16 306 332	18 419 289	18 236 046	17 274 483	18 924 485	19 384 947	20 587 093	23 687 304	25 562 694	27 253 955
Mathematical sciences	341 624	397 512	414 234	530 693	636 153	634 658	627 017	636 084	646 870	713 360
Physical sciences	793 006	952 441	648 657	305 701	338 098	370 616	379 813	582 267	769 739	876 009
Chemical sciences	784 145	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
Earth sciences	524 133	563 619	402 949	403 848	409 212	499 210	498 427	690 040	635 291	780 402
Information, computer and communication technologies	2 598 218	2 763 320	3 272 679	2 808 681	2 852 251	2 000 453	1 994 502	2 946 625	3 877 852	4 494 987
Applied sciences and technologies	1 832 546	1 905 397	1 740 755	2 151 557	2 114 322	2 252 175	2 164 025	1 555 897	1 525 646	1 585 106
Engineering sciences	4 189 408	5 135 032	4 580 166	3 600 159	3 775 247	3 903 931	4 315 051	5 485 812	5 444 740	4 611 038
Biological sciences	723 280	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
Agricultural sciences	1 264 628	1 147 706	1 445 847	1 307 191	1 710 860	1 810 114	2 196 122	2 656 038	2 573 509	2 741 962
Medical and health sciences	2 616 439	3 139 245	3 506 472	3 461 304	3 819 180	4 107 641	4 668 417	5 459 721	6 389 455	6 868 131
Environmental sciences	222 514	248 625	229 186	352 139	439 719	587 113	611 007	533 065	375 455	992 281
Material sciences	365 813	306 828	254 092	109 551	166 411	155 379	192 199	368 315	299 069	287 507
Marine sciences	50 579	58 573	79 830	52 238	38 726	48 442	56 857	74 858	80 897	125 024
<b>Division 2:</b>										
Social sciences and humanities	2 317 681	2 621 757	2 718 631	2 979 322	3 284 707	4 486 272	5 073 480	5 657 674	6 773 985	8 439 018
Social sciences	1 809 308	2 024 801	2 233 521	2 512 714	2 790 339	3 999 853	4 489 054	5 000 339	6 043 806	7 495 167
Humanities	508 373	596 956	485 110	466 608	494 368	486 420	584 426	657 335	730 179	943 851
<b>Total</b>	<b>18 624 013</b>	<b>21 041 046</b>	<b>20 954 677</b>	<b>20 253 805</b>	<b>22 209 192</b>	<b>23 871 219</b>	<b>25 660 573</b>	<b>29 344 977</b>	<b>32 336 679</b>	<b>35 692 973</b>



**Table C.14: Proportional R&D expenditure by research field (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Natural sciences, technology and engineering</b>	<b>87.6</b>	<b>87.5</b>	<b>87.0</b>	<b>85.3</b>	<b>85.2</b>	<b>81.2</b>	<b>80.2</b>	<b>80.7</b>	<b>79.1</b>	<b>76.4</b>
Mathematical sciences	1.8	1.9	2.0	2.6	2.9	2.7	2.4	2.2	2.0	2.0
Physical sciences	4.3	4.5	3.1	1.5	1.5	1.6	1.5	2.0	2.4	2.5
Chemical sciences	4.2	5.0	4.1	4.3	5.7	6.1	5.1	4.4	4.6	4.9
Earth sciences	2.8	2.7	1.9	2.0	1.8	2.1	1.9	2.4	2.0	2.2
Information, computer and communication technologies	14.0	13.1	15.6	13.9	12.8	8.4	7.8	10.0	12.0	12.6
Applied sciences and technologies	9.8	9.1	8.3	10.6	9.5	9.4	8.4	5.3	4.7	4.4
Engineering sciences	22.5	24.4	21.9	17.8	17.0	16.4	16.8	18.7	16.8	12.9
Biological sciences	3.9	3.5	3.8	6.5	6.1	6.5	6.2	4.8	4.5	4.0
Agricultural sciences	6.8	5.5	6.9	6.5	7.7	7.6	8.6	9.1	8.0	7.7
Medical and health sciences	14.0	14.9	16.7	17.1	17.2	17.2	18.2	18.6	19.8	19.2
Environmental sciences	1.2	1.2	1.1	1.7	2.0	2.5	2.4	1.8	1.2	2.8
Material sciences	2.0	1.5	1.2	0.5	0.7	0.7	0.7	1.3	0.9	0.8
Marine sciences	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.4
<b>Division 2: Social sciences and humanities</b>	<b>12.4</b>	<b>12.5</b>	<b>13.0</b>	<b>14.7</b>	<b>14.8</b>	<b>18.8</b>	<b>19.8</b>	<b>19.3</b>	<b>20.9</b>	<b>23.6</b>
Social sciences	9.7	9.6	10.7	12.4	12.6	16.8	17.5	17.0	18.7	21.0
Humanities	2.7	2.8	2.3	2.3	2.2	2.0	2.3	2.2	2.3	2.6
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.15: R&D expenditure by socio-economic objectives (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVES	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Division 1: Defence</b>	<b>1 135 278</b>	<b>1 196 200</b>	<b>1 276 269</b>	<b>1 341 460</b>	<b>1 069 289</b>	<b>1 351 337</b>	<b>1 386 428</b>	<b>1 826 784</b>	<b>1 814 789</b>	<b>1 629 650</b>
Defence	1 135 278	1 196 200	1 276 269	1 341 460	1 069 289	1 351 337	1 386 428	1 826 784	1 814 789	1 629 650
<b>Division 2: Economic development</b>	<b>11 724 590</b>	<b>13 312 043</b>	<b>12 341 036</b>	<b>11 231 879</b>	<b>12 174 897</b>	<b>12 223 017</b>	<b>14 166 615</b>	<b>15 359 534</b>	<b>16 644 668</b>	<b>18 357 187</b>
Economic development unclassified	171 520	209 400	0	0	0	0	0	0	0	0
Plant production and plant primary products	931 733	853 243	1 055 316	1 045 114	1 137 706	1 218 852	1 739 038	1 364 018	1 426 609	1 920 246

<b>SOCIO-ECONOMIC OBJECTIVES</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>
Animal production and animal primary products	279 914	289 909	354 639	293 873	565 729	598 602	803 403	694 423	655 059	746 579
Mineral resources (excluding energy)	1 075 821	995 552	1 212 226	1 123 063	1 065 384	1 143 762	1 351 239	1 779 068	1 759 268	1 328 413
Energy resources	709 891	1 185 455	407 091	274 220	273 390	294 820	288 314	197 072	178 434	556 147
Energy supply	364 876	515 216	540 463	623 953	676 491	509 128	590 980	778 805	636 596	730 849
Manufacturing	2 676 911	2 998 301	2 602 319	2 374 657	2 489 799	2 394 239	2 608 207	2 619 974	2 665 871	2 543 694
Construction	1 150 733	1 461 157	521 289	311 897	392 440	426 960	450 907	270 226	229 284	300 582
Transport	595 065	704 404	924 183	905 571	984 225	992 504	1 115 027	998 136	1 115 349	1 195 426
Information and communication services	1 240 972	1 274 761	1 381 989	1 104 273	1 271 591	1 159 823	1 124 614	1 661 660	2 347 021	2 694 355
Commercial services	1 457 410	1 499 495	2 045 919	1 849 534	1 866 449	1 895 734	2 443 529	2 701 523	2 789 611	3 134 235
Economic framework	548 517	604 404	598 312	600 662	611 868	715 759	689 386	1 331 844	1 797 751	1 997 933
Natural resources	521 228	720 746	697 290	725 062	839 825	872 835	961 971	962 787	1 043 816	1 208 728
<b>Division 3: Society</b>	<b>2 827 775</b>	<b>3 225 179</b>	<b>3 276 198</b>	<b>3 247 428</b>	<b>3 861 889</b>	<b>4 473 657</b>	<b>4 585 825</b>	<b>5 885 267</b>	<b>6 815 987</b>	<b>7 558 386</b>
Society unclassified	171 520	209 400	0	0	0	0	0	0	0	0
Health	1 790 225	2 013 993	2 247 629	2 089 570	2 301 764	2 942 262	2 859 623	3 638 036	4 154 557	4 733 478
Education and training	389 138	465 475	458 060	442 181	554 463	672 473	882 976	1 346 974	1 603 117	1 307 791
Social development and community services	476 892	536 312	570 508	715 677	1 005 662	858 922	843 226	900 257	1 058 313	1 517 117
<b>Division 4: Environment</b>	<b>854 997</b>	<b>1 006 106</b>	<b>992 840</b>	<b>735 909</b>	<b>905 570</b>	<b>979 981</b>	<b>861 976</b>	<b>1 414 524</b>	<b>1 475 053</b>	<b>2 015 344</b>
Environment unclassified	57 173	69 800	0	0	0	0	0	0	0	0
Environmental knowledge	375 069	488 204	463 786	310 888	398 977	443 987	388 688	828 768	853 071	969 476
Environmental aspects of development	195 300	176 503	181 907	189 344	216 406	258 144	226 299	288 823	304 008	361 391
Environmental and other aspects	227 455	271 599	347 147	235 677	290 187	277 849	246 989	296 934	317 975	684 478
<b>Division 5: Advancement of knowledge</b>	<b>2 081 375</b>	<b>2 301 517</b>	<b>3 068 334</b>	<b>3 697 128</b>	<b>4 197 547</b>	<b>4 843 227</b>	<b>4 659 729</b>	<b>4 858 868</b>	<b>5 586 182</b>	<b>6 132 406</b>
Advancement of knowledge unclassified	171 520	209 400	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	1 456 357	1 604 035	2 036 622	2 672 224	3 025 841	3 497 129	3 407 325	3 445 842	3 891 834	4 424 024
Social sciences and humanities	453 498	488 082	1 031 712	1 024 904	1 171 706	1 346 098	1 252 404	1 413 026	1 694 348	1 708 382
<b>Total</b>	<b>18 624 015</b>	<b>21 041 046</b>	<b>20 954 677</b>	<b>20 253 805</b>	<b>22 209 192</b>	<b>23 871 219</b>	<b>25 660 573</b>	<b>29 344 977</b>	<b>32 336 679</b>	<b>35 692 973</b>





**Table C.16: Proportional R&D expenditure by socio-economic objectives (2007/08 to 2016/17)**

<b>SOCIO-ECONOMIC OBJECTIVES</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
<b>Division 1:</b>										
Defence	6.1	5.7	6.1	6.6	4.8	5.7	5.4	6.2	5.6	4.6
Defence	6.1	5.7	6.1	6.6	4.8	5.7	5.4	6.2	5.6	4.6
<b>Division 2:</b>										
<b>Economic development</b>	<b>63.0</b>	<b>63.3</b>	<b>58.9</b>	<b>55.5</b>	<b>54.8</b>	<b>51.2</b>	<b>55.2</b>	<b>52.3</b>	<b>51.5</b>	<b>51.4</b>
Economic development unclassified	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	5.0	4.1	5.0	5.2	5.1	5.1	6.8	4.6	4.4	5.4
Animal production and animal primary products	1.5	1.4	1.7	1.5	2.5	2.5	3.1	2.4	2.0	2.1
Mineral resources (excluding energy)	5.8	4.7	5.8	5.5	4.8	4.8	5.3	6.1	5.4	3.7
Energy resources	3.8	5.6	1.9	1.4	1.2	1.2	1.1	0.7	0.6	1.6
Energy supply	2.0	2.4	2.6	3.1	3.0	2.1	2.3	2.7	2.0	2.0
Manufacturing	14.4	14.2	12.4	11.7	11.2	10.0	10.2	8.9	8.2	7.1
Construction	6.2	6.9	2.5	1.5	1.8	1.8	1.8	0.9	0.7	0.8
Transport	3.2	3.3	4.4	4.5	4.4	4.2	4.3	3.4	3.4	3.3
Information and communication services	6.7	6.1	6.6	5.5	5.7	4.9	4.4	5.7	7.3	7.5
Commercial services	7.8	7.1	9.8	9.1	8.4	7.9	9.5	9.2	8.6	8.8
Economic framework	2.9	2.9	2.9	3.0	2.8	3.0	2.7	4.5	5.6	5.6
Natural resources	2.8	3.4	3.3	3.6	3.8	3.7	3.7	3.3	3.2	3.4
<b>Division 3:</b>										
<b>Society</b>	<b>15.2</b>	<b>15.3</b>	<b>15.6</b>	<b>16.0</b>	<b>17.4</b>	<b>18.7</b>	<b>17.9</b>	<b>20.1</b>	<b>21.1</b>	<b>21.2</b>
Society unclassified	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	9.6	9.6	10.7	10.3	10.4	12.3	11.1	12.4	12.8	13.3
Education and training	2.1	2.2	2.2	2.2	2.5	2.8	3.4	4.6	5.0	3.7
Social development and community services	2.6	2.5	2.7	3.5	4.5	3.6	3.3	3.1	3.3	4.3
<b>Division 4:</b>										
<b>Environment</b>	<b>4.6</b>	<b>4.8</b>	<b>4.7</b>	<b>3.6</b>	<b>4.1</b>	<b>4.1</b>	<b>3.4</b>	<b>4.8</b>	<b>4.6</b>	<b>5.6</b>
Environment unclassified	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	2.0	2.3	2.2	1.5	1.8	1.9	1.5	2.8	2.6	2.7
Environmental aspects of development	1.0	0.8	0.9	0.9	1.0	1.1	0.9	1.0	0.9	1.0

SOCIO-ECONOMIC OBJECTIVES	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	1.2	1.3	1.7	1.2	1.3	1.2	1.0	1.0	1.0	1.9
Division 5: Advancement of knowledge	11.2	10.9	14.6	18.3	18.9	20.3	18.2	16.6	17.3	17.2
Advancement of knowledge unclassified	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	7.8	7.6	9.7	13.2	13.6	14.6	13.3	11.7	12.0	12.4
Social sciences and humanities	2.4	2.3	4.9	5.1	5.3	5.6	4.9	4.8	5.2	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.17: R&D expenditure by province (2007/08 to 2016/17)**

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
2007/08	18 624 014	826 925	1 098 210	9 620 752	2 081 166	263 784	452 950	169 937	453 574	3 656 717
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

**Table C.18: Proportional R&D expenditure by province (2007/08 to 2016/17)**

YEAR	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMA-LANGA	NORTHERN CAPE	NORTH-WEST	WESTERN CAPE
	%	%	%	%	%	%	%	%	%
2007/08	4.4	5.9	51.7	11.2	1.4	2.4	0.9	2.4	19.6
2008/09	4.2	7.4	52.2	10.5	1.4	1.8	0.8	2.3	19.3
2009/10	5.4	6.5	49.5	10.3	1.6	1.9	1.0	2.6	21.1
2010/11	5.2	6.6	48.3	11.3	2.0	2.0	1.2	2.6	20.9
2011/12	5.8	7.7	46.8	11.3	2.6	2.4	1.5	3.3	18.6
2012/13	6.1	7.2	44.4	12.6	2.6	2.6	1.7	3.7	19.1
2013/14	5.8	7.6	46.7	10.7	1.7	2.4	1.8	4.0	19.3
2014/15	5.9	5.0	46.6	10.9	2.1	2.9	2.0	4.8	19.8
2015/16	6.6	5.5	45.4	10.3	1.9	2.4	2.0	3.7	22.0
2016/17	6.2	5.1	46.0	10.2	2.0	2.0	1.5	3.6	23.3



## C.1.2. Source of R&D funds

**Table C.19: Funding for R&D by source (2007/08 to 2016/17)**

YEAR	TOTAL FUNDS	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	R'000	R'000	R'000	R'000	R'000
2007/08	18 624 059	8 510 101	7 945 949	180 927	1 987 082
2008/09	21 041 046	9 497 510	8 973 490	175 219	2 394 827
2009/10	20 954 676	9 313 028	8 907 527	195 682	2 538 439
2010/11	20 253 805	9 018 874	8 128 246	661 676	2 445 009
2011/12	22 209 192	9 561 917	8 663 105	653 674	3 330 496
2012/13	23 871 219	10 831 893	9 152 042	770 300	3 116 984
2013/14	25 660 573	11 007 083	10 615 902	722 361	3 315 227
2014/15	29 344 977	12 873 458	11 981 974	923 530	3 566 015
2015/16	32 336 679	14 425 992	12 578 499	1 122 328	4 209 861
2016/17	35 692 973	16 427 596	14 045 892	1 047 980	4 171 507

\*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 (2007/08 to 2016/17)**

YEAR	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	%	%	%	%
2007/08	45.7	42.7	1.0	10.7
2008/09	45.1	42.6	0.8	11.4
2009/10	44.4	42.5	0.9	12.1
2010/11	44.5	40.1	3.3	12.1
2011/12	43.1	39.0	2.9	15.0
2012/13	45.4	38.3	3.2	13.1
2013/14	42.9	41.4	2.8	12.9
2014/15	43.9	40.8	3.1	12.2
2015/16	44.6	38.9	3.5	13.0
2016/17	46.0	39.4	2.9	11.7

\*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 (2016/17)**

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	20 386 471	57.1	1 077 349	51.3	310 931	5.1	6 417 216	55.0	12 451 802	84.2	129 174	12.7
Internal sources	20 386 471	57.1	1 077 349	51.3	310 931	5.1	6 417 216	55.0	12 451 802	84.2	129 174	12.7
Government	8 622 100	24.2	453 615	21.6	4 765 874	77.7	2 805 030	24.1	453 958	3.1	143 623	14.1
Grants	3 876 531	10.9	431 660	20.6	3 137 990	51.1	N/A	N/A	231 273	1.6	75 608	7.4
Contracts	1 940 539	5.4	21 955	1.0	1 627 884	26.5	N/A	N/A	222 685	1.5	68 015	6.7
All other	2 805 030	7.9	N/A	N/A	N/A	N/A	2 805 030	24.1	N/A	N/A	N/A	N/A
Business	1 594 090	4.5	1 261	0.1	483 166	7.9	906 651	7.8	134 307	0.9	68 705	6.8
Local business	1 594 090	4.5	1 261	0.1	483 166	7.9	906 651	7.8	134 307	0.9	68 705	6.8
Other SA sources	918 806	2.6	54 331	2.6	38 710	0.6	386 910	3.3	402 542	2.7	36 313	3.6
Higher education	55 468	0.2	0	0.0	7 931	0.1	31 232	0.3	230	0.0	16 075	1.6
Not-for-profit	581 321	1.6	54 331	2.6	30 779	0.5	77 688	0.7	400 233	2.7	18 290	1.8
Individual donations	282 016	0.8	0	0.0	0	0.0	277 990	2.4	2 079	0.0	1 947	0.2
Foreign	4 171 507	11.7	512 090	24.4	537 503	8.8	1 143 451	9.8	1 338 662	9.1	639 801	62.9
All sources	4 171 507	11.7	512 090	24.4	537 503	8.8	1 143 451	9.8	1 338 662	9.1	639 801	62.9
Total	35 692 973	100.0	2 098 646	100.0	6 136 183	100.0	11 659 258	100.0	14 781 270	100.0	1 017 616	100.0

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

**Table C.22: Government-funded\* R&D by sector (2007/08 to 2016/17)**

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2007/08	8 510 055	1 091 049	2 297 322	2 761 557	2 326 728	33 399
2008/09	9 497 510	1 068 527	2 602 458	3 226 674	2 567 140	32 711
2009/10	9 313 028	1 008 475	2 917 683	3 918 620	1 429 766	38 484
2010/11	9 018 874	990 290	2 932 489	4 222 092	832 173	41 830
2011/12	9 561 917	1 112 307	3 310 894	4 598 426	499 298	40 992
2012/13	10 831 893	1 269 337	3 368 555	5 395 871	683 669	114 461
2013/14	11 007 083	1 436 141	3 412 790	5 369 334	685 670	103 148
2014/15	12 873 458	1 711 809	4 319 393	6 020 572	690 396	131 288
2015/16	14 425 992	1 425 598	4 922 223	7 393 857	522 631	161 682
2016/17	16 427 596	1 530 964	5 076 805	9 222 246	453 958	143 623

\*Includes science council and university own funds.

**Table C.23: Proportional government-funded\* R&D by sector (2007/08 to 2016/17)**

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2007/08	12.8	27.0	32.5	27.3	0.4
2008/09	11.3	27.4	34.0	27.0	0.3
2009/10	10.8	31.3	42.1	15.4	0.4
2010/11	11.0	32.5	46.8	9.2	0.5
2011/12	11.6	34.6	48.1	5.2	0.4
2012/13	11.7	31.1	49.8	6.3	1.1
2013/14	13.0	31.0	48.8	6.2	0.9
2014/15	13.3	33.6	46.8	5.4	1.0
2015/16	9.9	34.1	51.3	3.6	1.1
2016/17	9.3	30.9	56.1	2.8	0.9

\*Includes science council and university own funds.



**Table C.24: Business-funded R&D by sector (2007/08 to 2016/17)**

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2007/08	7 945 949	5 343	263 098	519 804	7 133 913	23 791
2008/09	8 973 490	15 980	137 356	454 184	8 339 379	26 591
2009/10	8 907 527	2 326	120 528	609 250	8 142 996	32 427
2010/11	8 128 246	2 406	198 206	367 340	7 528 667	31 627
2011/12	8 663 105	1 355	67 614	505 510	8 056 545	32 081
2012/13	9 152 042	11 552	135 729	577 527	8 402 340	24 894
2013/14	10 615 902	1 759	419 469	588 598	9 552 717	53 359
2014/15	11 981 974	290	222 892	885 280	10 810 428	63 084
2015/16	12 578 499	41 109	326 648	770 448	11 384 710	55 585
2016/17	14 045 892	1 261	483 166	906 651	12 586 109	68 705

**Table C.25: Proportional business-funded R&D by sector (2007/08 to 2016/17)**

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2007/08	0.1	3.3	6.5	89.8	0.3
2008/09	0.2	1.5	5.1	92.9	0.3
2009/10	0.0	1.4	6.8	91.4	0.4
2010/11	0.0	2.4	4.5	92.6	0.4
2011/12	0.0	0.8	5.8	93.0	0.4
2012/13	0.1	1.5	6.3	91.8	0.3
2013/14	0.0	4.0	5.5	90.0	0.5
2014/15	0.0	1.9	7.4	90.2	0.5
2015/16	0.3	2.6	6.1	90.5	0.4
2016/17	0.0	3.4	6.5	89.6	0.5

**Table C.26: Foreign-funded R&D by sector (2007/08 to 2016/17)**

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2007/08	1 987 082	56 172	298 906	320 286	1 180 193	131 525
2008/09	2 394 827	53 348	392 008	410 038	1 396 033	143 400
2009/10	2 538 439	54 129	416 571	443 109	1 538 917	85 713
2010/11	2 445 009	16 236	460 580	473 145	1 442 334	52 714
2011/12	3 330 496	118 127	321 257	1 272 173	1 562 277	56 662
2012/13	3 116 984	143 994	510 846	1 010 244	1 189 865	262 035
2013/14	3 315 227	258 531	454 527	1 042 627	1 226 966	332 576
2014/15	3 566 015	179 473	431 215	1 079 732	1 418 823	456 772
2015/16	4 209 861	499 966	469 507	1 206 192	1 532 766	501 430
2016/17	4 171 507	512 090	537 503	1 143 451	1 338 662	639 801

**Table C.27: Proportional foreign-funded R&D by sector (2007/08 to 2016/17)**

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2007/08	2.8	15.0	16.1	59.4	6.6
2008/09	2.2	16.4	17.1	58.3	6.0
2009/10	2.1	16.4	17.5	60.6	3.4
2010/11	0.7	18.8	19.4	59.0	2.2
2011/12	3.5	9.6	38.2	46.9	1.7
2012/13	4.6	16.4	32.4	38.2	8.4
2013/14	7.8	13.7	31.4	37.0	10.0
2014/15	5.0	12.1	30.3	39.8	12.8
2015/16	11.9	11.2	28.7	36.4	11.9
2016/17	12.3	12.9	27.4	32.1	15.3

### C.1.3. R&D personnel

**Table C.28: R&D personnel in headcounts and full-time equivalents by occupation (2007/08 to 2016/17)**

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

\*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.29: R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15 to 2016/17)**

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
2014/15							
Researchers*	48 479	27 008	21 471	23 571.9	13 184.7	10 387.2	48.6
Technicians directly supporting R&D	12 183	7 688	4 495	7 731.3	4 867.9	2 863.4	63.5
Other personnel directly supporting R&D	11 738	5 915	5 823	7 161.9	3 833.0	3 328.9	61.0
<b>Total</b>	<b>72 400</b>	<b>40 611</b>	<b>31 789</b>	<b>38 465.0</b>	<b>21 885.6</b>	<b>16 579.5</b>	<b>53.1</b>
2015/16							
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
<b>Total</b>	<b>74 931</b>	<b>41 636</b>	<b>33 295</b>	<b>41 054.5</b>	<b>23 131.4</b>	<b>17 923.1</b>	<b>54.8</b>
2016/17							
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
<b>Total</b>	<b>80 029</b>	<b>43 920</b>	<b>36 109</b>	<b>42 533.0</b>	<b>23 639.1</b>	<b>18 893.9</b>	<b>53.1</b>

\*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.30: R&D personnel in headcounts by sector (2007/08 to 2016/17)**

YEAR	TOTAL R&D PERSONNEL (HEADCOUNTS*)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2007/08	59 344	2 794	5 988	32 109	17 951	502
2008/09	58 895	2 963	5 609	31 226	18 595	502
2009/10	59 494	2 580	5 926	32 392	18 216	380
2010/11	55 531	2 704	4 923	32 571	14 933	400
2011/12	59 487	3 143	4 494	36 157	15 288	405
2012/13	64 917	3 252	5 399	38 205	17 155	906
2013/14	68 838	2 874	5 884	41 464	17 599	1 017
2014/15	72 400	2 893	4 836	44 457	18 743	1 471
2015/16	74 931	2 997	5 162	48 034	17 245	1 493
2016/17	80 029	3 076	4 955	52 384	17 998	1 616

\*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.31: R&D personnel full-time equivalents by sector (2007/08 to 2016/17)**

YEAR	TOTAL R&D PERSONNEL* (FTEs)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2007/08	31 354.4	1 950.0	5 058.8	11 505.3	12 461.3	379.1
2008/09	30 801.6	2 073.9	4 699.9	11 169.0	12 492.5	366.4
2009/10	30 891.3	1 903.9	4 782.7	11 870.4	12 024.6	309.7
2010/11	29 486.4	2 178.6	4 312.4	12 477.3	10 205.1	313.1
2011/12	30 978.4	2 404.5	3 803.5	14 563.4	9 894.9	312.1
2012/13	35 050.3	2 597.0	4 748.5	15 614.4	11 322.3	768.0
2013/14	37 956.5	2 245.5	5 164.5	17 777.7	11 877.4	891.4
2014/15	38 465.0	2 181.5	4 180.4	17 944.4	12 927.5	1 231.2
2015/16	41 054.5	2 056.2	4 361.2	20 812.0	12 457.8	1 367.3
2016/17	42 533.0	2 031.6	4 421.4	22 061.4	12 549.2	1 469.5

\*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 (2007/08 to 2016/17)**

YEAR	TOTAL RESEARCHERS (HEADCOUNTS*)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2007/08	40 084	1 138	2 594	27 752	8 336	264
2008/09	39 955	1 169	2 648	27 316	8 560	262
2009/10	40 797	986	2 669	28 552	8 366	224
2010/11	37 901	1 184	1 941	28 154	6 372	250
2011/12	40 653	1 411	1 803	30 993	6 192	254
2012/13	42 828	1 409	1 879	32 955	6 191	394
2013/14	45 935	1 229	1 956	36 133	6 182	435
2014/15	48 479	1 343	1 988	38 381	6 261	506
2015/16	51 877	1 573	2 072	41 639	6 128	465
2016/17	56 761	1 677	2 189	46 028	6 463	404

\*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.33: Researcher headcounts by gender (2007/08 to 2016/17)**

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	MALE	FEMALE
2007/08	29 327	18 022	11 305
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

\*Excludes doctoral students and post-doctoral fellows. Researchers 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.34: Researcher headcounts by race (2007/08 to 2016/17)**

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	AFRICAN	COLOURED	INDIAN/ASIAN	WHITE	NON-SA
2007/08	29 327	6 566	1 398	2 434	18 929	N/A
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

\*Excludes doctoral students and post-doctoral fellows. Researchers 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.35: R&D personnel in headcounts (2016/17)**

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
<b>Researchers*</b>	<b>33 035</b>	<b>17 957</b>	<b>15 078</b>	<b>5 245</b>	<b>4 858</b>	<b>962</b>	<b>1 019</b>	<b>1 432</b>	<b>1 470</b>	<b>8 240</b>	<b>6 757</b>	<b>2 079</b>	<b>974</b>
Doctoral degree or equivalent	11 649	6 820	4 829	1 445	955	323	312	397	376	3 277	2 650	1 378	536
Master's, honours, bachelor or equivalent	18 024	9 491	8 533	3 289	3 081	533	572	911	952	4 219	3 574	540	354
Diplomas	3 361	1 646	1 715	511	821	105	136	124	142	744	533	161	85
<b>Technicians directly supporting R&amp;D</b>	<b>11 346</b>	<b>7 028</b>	<b>4 318</b>	<b>2 379</b>	<b>1 921</b>	<b>721</b>	<b>428</b>	<b>530</b>	<b>347</b>	<b>3 072</b>	<b>1 282</b>	<b>327</b>	<b>340</b>
Doctoral degree or equivalent	284	180	104	32	24	6	6	3	11	114	57	24	6
Master's, honours, bachelor or equivalent	4 425	2 485	1 940	805	811	309	199	232	225	1 079	657	59	48
Diplomas	6 637	4 363	2 274	1 558	1 106	431	185	311	121	1 818	575	245	285
<b>Other personnel directly supporting R&amp;D</b>	<b>11 922</b>	<b>5 722</b>	<b>6 200</b>	<b>2 956</b>	<b>2 643</b>	<b>510</b>	<b>775</b>	<b>512</b>	<b>422</b>	<b>1 378</b>	<b>1 891</b>	<b>367</b>	<b>469</b>
Doctoral degree or equivalent	391	186	206	53	54	9	12	17	15	94	101	13	23
Master's, honours, bachelor or equivalent	3 405	1 391	2 014	521	701	95	179	107	153	539	859	129	121
Diplomas	8 125	4 145	3 980	2 401	1 896	407	586	400	266	706	906	231	326
<b>Total</b>	<b>56 303</b>	<b>30 707</b>	<b>25 596</b>	<b>10 536</b>	<b>9 330</b>	<b>2 179</b>	<b>2 211</b>	<b>2 477</b>	<b>2 255</b>	<b>12 753</b>	<b>10 020</b>	<b>2 761</b>	<b>1 780</b>

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

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

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.

## C.2. Sector tables

### C.2.1. Business sector

**Table C.36: Business sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Basic research	929 134	1 073 117	1 267 759	1 025 389	922 888	802 753	968 504	845 527	906 730	909 278
Applied research	3 077 341	3 426 651	3 301 773	3 949 410	4 461 770	5 569 024	6 087 791	7 541 596	7 492 229	8 389 888
Experimental research	6 731 981	7 832 244	6 569 705	5 084 210	5 079 364	4 198 949	4 726 553	4 903 827	5 416 037	5 482 104
<b>Total</b>	<b>10 738 456</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>

**Table C.37: Proportional business sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Basic research	8.7	8.7	11.4	10.2	8.8	7.6	8.2	6.4	6.6	6.2
Applied research	28.7	27.8	29.6	39.3	42.6	52.7	51.7	56.7	54.2	56.8
Experimental research	62.7	63.5	59.0	50.5	48.5	39.7	40.1	36.9	39.2	37.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.38: Business sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Capital expenditure</b>	<b>1 445 305</b>	<b>2 658 738</b>	<b>1 638 994</b>	<b>1 306 444</b>	<b>1 650 541</b>	<b>1 072 556</b>	<b>1 132 520</b>	<b>1 397 243</b>	<b>1 289 228</b>	<b>1 727 929</b>
Land: buildings & other structures	262 994	207 473	285 285	202 835	217 126	140 053	159 162	117 656	186 396	288 957
Vehicles, plant, machinery, equipment	1 182 311	2 451 265	1 353 709	1 103 609	1 433 415	932 503	973 358	1 279 587	1 102 833	1 438 972
<b>Current expenditure</b>	<b>9 293 151</b>	<b>9 673 274</b>	<b>9 500 243</b>	<b>8 752 566</b>	<b>8 813 481</b>	<b>9 498 170</b>	<b>10 650 328</b>	<b>11 893 708</b>	<b>12 525 767</b>	<b>13 053 341</b>
Labour costs	4 881 074	5 279 507	5 207 695	4 467 214	4 723 488	5 821 884	6 768 527	7 659 365	7 821 865	8 486 640
Other current expenditure	4 412 077	4 393 767	4 292 548	4 285 352	4 089 993	3 676 286	3 881 801	4 234 343	4 703 901	4 566 701
<b>Total</b>	<b>10 738 456</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>



**Table C.39: Proportional business sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Capital expenditure	13.5	21.6	14.7	13.0	15.8	10.1	9.6	10.5	9.3	11.7
Land: buildings & other structures	2.4	1.7	2.6	2.0	2.1	1.3	1.4	0.9	1.3	2.0
Vehicles, plant, machinery, equipment	11.0	19.9	12.2	11.0	13.7	8.8	8.3	9.6	8.0	9.7
Current expenditure	86.5	78.4	85.3	87.0	84.2	89.9	90.4	89.5	90.7	88.3
Labour costs	45.5	42.8	46.8	44.4	45.1	55.1	57.4	57.6	56.6	57.4
Other current expenditure	41.1	35.6	38.5	42.6	39.1	34.8	32.9	31.9	34.0	30.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.40: Business sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Biotechnology	169 410	268 923	330 232	341 695	422 121	499 589	556 275	578 747	729 299	685 170
Nanotechnology	30 314	56 881	150 474	102 670	171 808	225 557	170 479	217 216	134 063	268 320
<b>Total</b>	<b>199 724</b>	<b>325 804</b>	<b>480 706</b>	<b>444 366</b>	<b>593 929</b>	<b>725 145</b>	<b>726 754</b>	<b>795 963</b>	<b>863 362</b>	<b>953 490</b>
Business expenditure on R&D	10 738 456	12 332 012	11 139 237	10 059 010	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270

**Table C.41: Proportional business sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Biotechnology	1.6	2.2	3.0	3.4	4.0	4.7	4.7	4.4	5.3	4.6
Nanotechnology	0.3	0.5	1.4	1.0	1.6	2.1	1.4	1.6	1.0	1.8
<b>Total</b>	<b>1.9</b>	<b>2.6</b>	<b>4.3</b>	<b>4.4</b>	<b>5.7</b>	<b>6.9</b>	<b>6.2</b>	<b>6.0</b>	<b>6.2</b>	<b>6.5</b>

**Table C.42: Business sector R&D expenditure on selected areas of interest (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Environment related	N/A	N/A	N/A	N/A	31 349	183 921	228 905	176 463	173 356	280 651
Open-source software	114 195	96 266	91 818	68 105	85 787	87 200	233 576	241 710	326 856	207 849
New materials	72 992	154 140	173 308	227 682	277 152	225 897	151 890	245 752	224 433	179 108
Tuberculosis (TB), HIV/AIDS, malaria	302 122	466 161	460 233	631 996	812 580	929 121	992 538	1 082 646	1 176 149	1 153 668
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33 099
<b>Total</b>	<b>489 309</b>	<b>716 567</b>	<b>725 359</b>	<b>927 783</b>	<b>1 206 869</b>	<b>1 426 139</b>	<b>1 606 909</b>	<b>1 746 571</b>	<b>1 900 794</b>	<b>1 854 375</b>
<b>Business expenditure on R&amp;D</b>	<b>10 738 456</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Environment related	N/A	N/A	N/A	N/A	0.3	1.7	1.9	1.3	1.3	1.9
Open-source software	1.1	0.8	0.8	0.7	0.8	0.8	2.0	1.8	2.4	1.4
New materials	0.7	1.2	1.6	2.3	2.6	2.1	1.3	1.8	1.6	1.2
Tuberculosis (TB), HIV/AIDS, malaria	2.8	3.8	4.1	6.3	7.8	8.8	8.4	8.1	8.5	7.8
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2
<b>Total</b>	<b>4.6</b>	<b>5.8</b>	<b>6.5</b>	<b>9.2</b>	<b>11.5</b>	<b>13.5</b>	<b>13.6</b>	<b>13.1</b>	<b>13.8</b>	<b>12.5</b>

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 (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>10 357 433</b>	<b>11 902 551</b>	<b>10 743 523</b>	<b>9 612 221</b>	<b>9 992 916</b>	<b>9 127 446</b>	<b>9 765 859</b>	<b>10 977 250</b>	<b>11 447 693</b>	<b>11 918 539</b>
Mathematical sciences	176 077	183 255	183 426	110 543	204 594	149 220	209 344	211 324	119 900	138 858
Physical sciences	507 646	655 898	190 292	32 669	28 490	47 672	50 708	56 997	35 616	45 816
Chemical sciences	580 146	859 041	627 729	687 843	934 005	980 021	979 760	847 321	972 398	1 153 685
Earth sciences	93 014	95 034	90 098	106 759	92 439	102 892	109 665	118 539	93 302	104 072
Information, computer and communication technologies	2 182 253	2 412 430	2 855 355	2 502 454	2 481 028	1 576 163	1 610 718	1 908 985	2 572 364	3 111 146
Applied sciences and technologies	1 581 438	1 671 375	1 271 414	1 132 538	902 425	872 014	808 899	955 119	903 958	915 101
Engineering sciences	3 237 265	3 908 347	3 311 902	2 768 035	2 751 145	2 827 677	3 093 088	3 548 019	3 429 786	2 651 327



MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biological sciences	161 058	162 776	194 671	207 456	212 633	210 627	213 124	248 838	254 071	250 356
Agricultural sciences	311 287	293 357	323 603	371 310	471 529	444 593	593 315	665 703	671 194	686 697
Medical and health sciences	1 268 551	1 509 109	1 567 493	1 622 215	1 843 005	1 812 411	1 974 213	2 170 317	2 300 587	2 283 200
Environmental sciences	62 355	57 764	47 692	5 818	2 206	44 563	50 909	85 932	21 920	480 612
Material sciences	184 625	82 192	70 949	59 723	65 092	53 855	64 090	154 500	71 967	97 670
Marine sciences	11 719	11 975	8 899	4 859	4 324	5 738	8 026	5 655	630	0
Division 2: Social Sciences and Humanities	381 023	429 461	395 714	446 789	471 106	1 443 280	2 016 989	2 313 701	2 367 302	2 862 731
Social sciences	380 554	428 969	395 115	446 789	471 106	1 443 280	2 016 989	2 313 701	2 367 302	2 858 585
Humanities	469	491	599	0	0	0	0	0	0	4 146
<b>Total</b>	<b>10 738 456</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>

**Table C.45: Proportional business sector R&D expenditure by research field (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural Sciences, Technology and Engineering	96.5	96.5	96.4	95.6	95.5	86.3	82.9	82.6	82.9	80.6
Mathematical sciences	1.6	1.5	1.6	1.1	2.0	1.4	1.8	1.6	0.9	0.9
Physical sciences	4.7	5.3	1.7	0.3	0.3	0.5	0.4	0.4	0.3	0.3
Chemical sciences	5.4	7.0	5.6	6.8	8.9	9.3	8.3	6.4	7.0	7.8
Earth sciences	0.9	0.8	0.8	1.1	0.9	1.0	0.9	0.9	0.7	0.7
Information, computer and communication technologies	20.3	19.6	25.6	24.9	23.7	14.9	13.7	14.4	18.6	21.0
Applied sciences and technologies	14.7	13.6	11.4	11.3	8.6	8.2	6.9	7.2	6.5	6.2
Engineering sciences	30.1	31.7	29.7	27.5	26.3	26.8	26.3	26.7	24.8	17.9
Biological sciences	1.5	1.3	1.7	2.1	2.0	2.0	1.8	1.9	1.8	1.7
Agricultural sciences	2.9	2.4	2.9	3.7	4.5	4.2	5.0	5.0	4.9	4.6
Medical and health sciences	11.8	12.2	14.1	16.1	17.6	17.1	16.8	16.3	16.7	15.4
Environmental sciences	0.6	0.5	0.4	0.1	0.0	0.4	0.4	0.6	0.2	3.3
Material sciences	1.7	0.7	0.6	0.6	0.6	0.5	0.5	1.2	0.5	0.7
Marine sciences	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Division 2: Social Sciences and Humanities	3.5	3.5	3.6	4.4	4.5	13.7	17.1	17.4	17.1	19.4
Social sciences	3.5	3.5	3.5	4.4	4.5	13.7	17.1	17.4	17.1	19.3
Humanities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.46: Business sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>
<b>Division 1:</b>										
<b>Defence</b>	<b>900 909</b>	<b>908 781</b>	<b>959 761</b>	<b>1 103 510</b>	<b>813 259</b>	<b>1 040 025</b>	<b>1 096 986</b>	<b>1 034 893</b>	<b>937 964</b>	<b>830 331</b>
Defence	900 909	908 781	959 761	1 103 510	813 259	1 040 025	1 096 986	1 034 893	937 964	830 331
<b>Division 2:</b>										
<b>Economic Development</b>	<b>8 399 187</b>	<b>9 737 338</b>	<b>8 258 491</b>	<b>7 012 272</b>	<b>7 381 289</b>	<b>7 234 533</b>	<b>8 308 177</b>	<b>9 663 402</b>	<b>10 362 668</b>	<b>11 554 708</b>
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	279 437	266 259	309 370	288 323	315 806	374 327	454 990	593 610	622 367	1 026 707
Animal production and animal primary products	78 657	74 302	110 295	46 709	46 316	38 484	69 916	74 045	74 267	66 547
Mineral resources (excluding Energy)	937 628	839 558	741 401	728 130	733 280	853 544	977 365	1 405 074	1 348 618	947 258
Energy resources	585 453	732 188	290 662	93 532	90 377	90 975	95 375	100 061	79 210	470 860
Energy supply	252 064	393 798	426 407	470 030	490 490	321 456	349 710	503 222	362 656	461 804
Manufacturing	2 117 823	2 562 745	2 037 129	1 747 369	1 863 289	1 639 077	1 869 926	2 096 271	2 106 255	1 924 020
Construction	1 017 969	1 295 717	367 510	16 284	46 158	96 071	125 059	138 237	55 625	54 328
Transport	523 022	621 479	843 301	872 149	920 081	951 435	1 080 427	935 483	1 046 235	1 098 281
Information and communication services	1 087 198	1 151 637	1 189 650	851 392	978 187	908 640	842 341	1 097 649	1 685 124	2 085 856
Commercial services	1 347 470	1 422 123	1 747 450	1 773 253	1 739 933	1 755 506	2 255 642	2 555 783	2 643 503	2 929 445
Economic framework	41 756	160 562	106 693	70 795	57 474	103 240	91 464	79 065	273 497	422 742
Natural resources	130 711	216 971	88 624	54 306	99 898	101 778	95 962	84 901	65 312	66 859
<b>Division 3:</b>										
<b>Society</b>	<b>915 567</b>	<b>1 019 848</b>	<b>1 224 481</b>	<b>1 041 616</b>	<b>1 232 867</b>	<b>1 242 066</b>	<b>1 303 321</b>	<b>1 435 870</b>	<b>1 433 935</b>	<b>1 498 255</b>
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	857 364	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
Education and training	12 204	27 232	26 444	32 486	32 767	29 566	33 913	35 728	33 707	21 076
Social development and community services	45 999	61 971	94 220	128 581	145 918	167 452	171 962	187 298	184 102	188 036
<b>Division 4:</b>										
<b>Environment</b>	<b>164 552</b>	<b>221 747</b>	<b>211 208</b>	<b>211 025</b>	<b>220 698</b>	<b>173 535</b>	<b>171 747</b>	<b>219 212</b>	<b>196 802</b>	<b>201 177</b>
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	62 551	91 953	53 022	51 845	58 565	46 213	43 935	55 885	62 471	45 213
Environmental aspects of development	33 901	31 493	22 456	55 577	42 226	17 957	14 344	38 437	18 915	48 553



SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environmental and other aspects	68 100	98 301	135 730	103 602	119 907	109 365	113 468	124 889	115 415	107 410
<b>Division 5: Advancement of Knowledge</b>	<b>358 242</b>	<b>444 298</b>	<b>485 296</b>	<b>690 587</b>	<b>815 909</b>	<b>880 567</b>	<b>902 617</b>	<b>937 575</b>	<b>883 626</b>	<b>696 800</b>
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	353 694	439 330	479 999	682 401	813 150	877 557	899 840	932 030	880 474	696 770
Social sciences and humanities	4 548	4 968	5 298	8 186	2 758	3 010	2 776	5 545	3 152	30
<b>Total</b>	<b>10 738 457</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>

**Table C.47: Proportional business sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Defence</b>	<b>8.4</b>	<b>7.4</b>	<b>8.6</b>	<b>11.0</b>	<b>7.8</b>	<b>9.8</b>	<b>9.3</b>	<b>7.8</b>	<b>6.8</b>	<b>5.6</b>
Defence	8.4	7.4	8.6	11.0	7.8	9.8	9.3	7.8	6.8	5.6
<b>Division 2: Economic Development</b>	<b>78.2</b>	<b>79.0</b>	<b>74.1</b>	<b>69.7</b>	<b>70.5</b>	<b>68.4</b>	<b>70.5</b>	<b>72.7</b>	<b>75.0</b>	<b>78.2</b>
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	2.6	2.2	2.8	2.9	3.0	3.5	3.9	4.5	4.5	6.9
Animal production and animal primary products	0.7	0.6	1.0	0.5	0.4	0.4	0.6	0.6	0.5	0.5
Mineral resources (excluding Energy)	8.7	6.8	6.7	7.2	7.0	8.1	8.3	10.6	9.8	6.4
Energy resources	5.5	5.9	2.6	0.9	0.9	0.9	0.8	0.8	0.6	3.2
Energy supply	2.3	3.2	3.8	4.7	4.7	3.0	3.0	3.8	2.6	3.1
Manufacturing	19.7	20.8	18.3	17.4	17.8	15.5	15.9	15.8	15.2	13.0
Construction	9.5	10.5	3.3	0.2	0.4	0.9	1.1	1.0	0.4	0.4
Transport	4.9	5.0	7.6	8.7	8.8	9.0	9.2	7.0	7.6	7.4
Information and communication services	10.1	9.3	10.7	8.5	9.3	8.6	7.1	8.3	12.2	14.1
Commercial services	12.5	11.5	15.7	17.6	16.6	16.6	19.1	19.2	19.1	19.8
Economic framework	0.4	1.3	1.0	0.7	0.5	1.0	0.8	0.6	2.0	2.9
Natural resources	1.2	1.8	0.8	0.5	1.0	1.0	0.8	0.6	0.5	0.5

<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
<b>Division 3:</b>										
<b>Society</b>	<b>8.5</b>	<b>8.3</b>	<b>11.0</b>	<b>10.4</b>	<b>11.8</b>	<b>11.8</b>	<b>11.1</b>	<b>10.8</b>	<b>10.4</b>	<b>10.1</b>
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	8.0	7.5	9.9	8.8	10.1	9.9	9.3	9.1	8.8	8.7
Education and training	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.1
Social development and community services	0.4	0.5	0.8	1.3	1.4	1.6	1.5	1.4	1.3	1.3
<b>Division 4:</b>										
<b>Environment</b>	<b>1.5</b>	<b>1.8</b>	<b>1.9</b>	<b>2.1</b>	<b>2.1</b>	<b>1.6</b>	<b>1.5</b>	<b>1.6</b>	<b>1.4</b>	<b>1.4</b>
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	0.7	0.5	0.5	0.6	0.4	0.4	0.4	0.5	0.3
Environmental aspects of development	0.3	0.3	0.2	0.6	0.4	0.2	0.1	0.3	0.1	0.3
Environmental and other aspects	0.6	0.8	1.2	1.0	1.1	1.0	1.0	0.9	0.8	0.7
<b>Division 5:</b>										
<b>Advancement of Knowledge</b>	<b>3.3</b>	<b>3.6</b>	<b>4.4</b>	<b>6.9</b>	<b>7.8</b>	<b>8.3</b>	<b>7.7</b>	<b>7.1</b>	<b>6.4</b>	<b>4.7</b>
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	3.3	3.6	4.3	6.8	7.8	8.3	7.6	7.0	6.4	4.7
Social sciences and humanities	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.48: Business sector R&D expenditure by province (2007/08 to 2016/17)**

<b>PROVINCE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>
Eastern Cape	283 488	316 089	320 955	217 880	354 553	468 197	646 497	608 398	651 533	690 478
Free State	786 225	1 213 808	999 554	943 508	1 308 833	1 265 285	1 374 960	831 575	1 124 042	1 060 177
Gauteng	6 142 233	7 131 411	6 120 062	5 439 718	5 558 409	5 356 550	5 813 673	7 160 280	7 183 557	7 876 139
KwaZulu-Natal	1 302 260	1 255 509	1 183 636	1 280 014	1 160 507	1 237 563	1 434 084	1 501 659	1 436 737	1 553 130
Limpopo	71 687	75 675	49 375	41 850	62 728	127 451	140 026	161 331	145 736	171 567
Mpumalanga	196 368	201 550	161 154	139 771	157 158	222 974	301 831	435 770	339 985	284 655
North-West	193 339	222 630	267 528	256 428	45 267	380 144	435 849	681 634	451 891	526 962
Northern Cape	7 450	7 319	7 988	17 017	302 164	78 471	124 150	226 303	206 786	49 508
Western Cape	1 755 404	1 908 020	2 028 984	1 722 823	1 514 404	1 434 090	1 511 778	1 684 001	2 274 728	2 568 653
<b>Total</b>	<b>10 738 456</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>





**Table C.49: Proportional business sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.6	2.6	2.9	2.2	3.4	4.4	5.5	4.6	4.7	4.7
Free State	7.3	9.8	9.0	9.4	12.5	12.0	11.7	6.3	8.1	7.2
Gauteng	57.2	57.8	54.9	54.1	53.1	50.7	49.3	53.9	52.0	53.3
KwaZulu-Natal	12.1	10.2	10.6	12.7	11.1	11.7	12.2	11.3	10.4	10.5
Limpopo	0.7	0.6	0.4	0.4	0.6	1.2	1.2	1.2	1.1	1.2
Mpumalanga	1.8	1.6	1.4	1.4	1.5	2.1	2.6	3.3	2.5	1.9
North-West	1.8	1.8	2.4	2.5	2.9	3.6	3.7	5.1	3.3	3.6
Northern Cape	0.1	0.1	0.1	0.2	0.4	0.7	1.1	1.7	1.5	0.3
Western Cape	16.3	15.5	18.2	17.1	14.5	13.6	12.8	12.7	16.5	17.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.50: Business sector R&D expenditure by Standard Industrial Classification Code (SIC) (2007/08 to 2016/17)**

STANDARD INDUSTRIAL CLASSIFICATION	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	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	213 808	220 757	208 447	157 916	211 132	286 832	364 424	460 464	484 384	472 472
Mining and Quarrying	559 332	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
Manufacturing	4 222 127	4 787 581	4 321 327	3 592 204	3 551 234	3 476 647	3 793 066	4 501 146	4 442 466	4 107 936
Manufacture of Food Products, Beverages and Tobacco Products	196 238	215 876	162 851	221 370	283 262	319 143	340 427	364 178	376 884	328 832
Manufacture of Textiles, Clothing and Leather Goods	17 888	13 755	16 946	2 437	0	2 073	32 091	34 609	9 335	8 932
Manufacture of Wood and Products of Wood and Cork, except furniture; Manufacture of Articles of Straw and Plaiting Materials; Manufacture of Paper and Paper Products; Manufacture of Publishing, Printing and Reproduction of Recorded Material	118 535	118 016	111 255	106 448	80 255	50 531	60 437	72 870	95 555	87 814
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	1 579 382	2 267 063	1 758 353	1 197 179	1 381 001	1 139 617	1 256 313	1 835 837	1 800 420	1 696 770
Manufacture of Non-Metallic Mineral Products	183 758	134 638	120 508	87 037	72 039	49 974	52 263	51 097	28 095	37 531
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	500 715	315 295	330 137	240 408	392 800	585 635	620 923	607 574	660 205	519 108
Manufacture of Electrical Machinery and Apparatus	187 612	166 498	146 169	207 954	310 599	312 102	254 042	302 575	381 971	455 378

STANDARD INDUSTRIAL CLASSIFICATION	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	506 497	511 356	591 774	590 174	639 217	656 639	742 033	706 308	569 127	629 240
Manufacture of Transport Equipment	924 053	984 235	1 022 589	881 958	310 145	267 788	334 276	408 448	402 772	321 638
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	7 449	60 849	60 743	57 240	81 914	93 145	100 261	117 649	118 102	22 692
Electricity, Gas & Water Supply	1 737 511	2 306 297	955 690	536 050	494 745	385 770	355 720	548 015	439 157	544 850
Construction	6 043	6 105	3 490	3 213	6 495	9 051	8 037	6 637	5 613	4 297
Wholesale and Retail	317 780	334 131	434 522	620 541	547 194	179 383	100 176	85 491	42 977	54 553
Transport, Storage & Communication	490 138	425 235	415 243	354 311	484 222	467 411	451 336	632 243	897 359	1 543 763
Financial Intermediation, Real Estate and Business Services	2 759 550	3 377 896	3 777 124	3 326 985	3 645 625	3 914 543	4 724 439	5 357 151	5 910 332	6 555 245
Community, Social and Personal Services	432 167	295 185	524 108	411 826	170 499	296 805	310 498	359 701	371 723	428 328
<b>Total</b>	<b>10 738 456</b>	<b>12 332 012</b>	<b>11 139 237</b>	<b>10 059 010</b>	<b>10 464 022</b>	<b>10 570 726</b>	<b>11 782 848</b>	<b>13 290 951</b>	<b>13 814 995</b>	<b>14 781 270</b>

**Table C.51: Proportional business sector R&D expenditure by Standard Industrial Classification Code (SIC) (2007/08 to 2016/17)**

STANDARD INDUSTRIAL CLASSIFICATION	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Agriculture, Hunting, Forestry and Fishing	2.0	1.8	1.9	1.6	2.0	2.7	3.1	3.5	3.5	3.2
Mining and Quarrying	5.2	4.7	4.5	10.5	12.9	14.7	14.2	10.1	8.8	7.2
<b>Manufacturing</b>	<b>39.3</b>	<b>38.8</b>	<b>38.8</b>	<b>35.7</b>	<b>33.9</b>	<b>32.9</b>	<b>32.2</b>	<b>33.9</b>	<b>32.2</b>	<b>27.8</b>
Manufacture of Food Products, Beverages and Tobacco Products	1.8	1.8	1.5	2.2	2.7	3.0	2.9	2.7	2.7	2.2
Manufacture of Textiles, Clothing and Leather Goods	0.2	0.1	0.2	0.0	0.0	0.0	0.3	0.3	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	1.1	1.0	1.0	1.1	0.8	0.5	0.5	0.5	0.7	0.6
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	14.7	18.4	15.8	11.9	13.2	10.8	10.7	13.8	13.0	11.5
Manufacture of Non-Metallic Mineral Products	1.7	1.1	1.1	0.9	0.7	0.5	0.4	0.4	0.2	0.3
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	4.7	2.6	3.0	2.4	3.8	5.5	5.3	4.6	4.8	3.5



STANDARD INDUSTRIAL CLASSIFICATION	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Manufacture of Electrical Machinery and Apparatus	1.7	1.4	1.3	2.1	3.0	3.0	2.2	2.3	2.8	3.1
Manufacture of Radio, Television and Communication Equipment and Apparatus; Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	4.7	4.1	5.3	5.9	6.1	6.2	6.3	5.3	4.1	4.3
Manufacture of Transport Equipment	8.6	8.0	9.2	8.8	3.0	2.5	2.8	3.1	2.9	2.2
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0.1	0.5	0.5	0.6	0.8	0.9	0.9	0.9	0.9	0.2
Electricity, Gas & Water Supply	16.2	18.7	8.6	5.3	4.7	3.6	3.0	4.1	3.2	3.7
Construction	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Wholesale and Retail	3.0	2.7	3.9	6.2	5.2	1.7	0.9	0.6	0.3	0.4
Transport, Storage & Communication	4.6	3.4	3.7	3.5	4.6	4.4	3.8	4.8	6.5	10.4
Financial Intermediation, Real Estate and Business Services	25.7	27.4	33.9	33.1	34.8	37.0	40.1	40.3	42.8	44.3
Community, Social and Personal Services	4.0	2.4	4.7	4.1	1.6	2.8	2.6	2.7	2.7	2.9
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 (2007/08 to 2016/17)**

YEAR	HEADCOUNTS				FULL TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2007/08	17 951	8 336	5 303	4 312	12 461.3	6 047.5	3 796.4	2 617.4
2008/09	18 595	8 560	5 584	4 451	12 492.5	6 172.0	3 809.9	2 510.6
2009/10	18 216	8 366	5 362	4 488	12 024.6	6 059.5	3 612.6	2 352.6
2010/11	14 933	6 372	4 630	3 931	10 205.1	4 804.0	3 318.7	2 082.3
2011/12	15 288	6 192	5 095	4 001	9 894.9	4 451.9	3 343.5	2 099.5
2012/13	17 155	6 191	6 394	4 570	11 322.3	4 555.9	4 065.5	2 700.9
2013/14	17 599	6 182	6 397	5 020	11 877.4	4 530.1	4 253.1	3 094.2
2014/15	18 743	6 261	6 912	5 570	12 927.5	4 636.2	4 494.4	3 796.9
2015/16	17 245	6 128	6 090	5 027	12 457.8	4 626.8	4 227.4	3 603.6
2016/17	17 998	6 463	6 156	5 379	12 549.2	4 777.3	4 149.4	3 622.5

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.53: Business sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15, 2015/16 and 2016/17)**

OCCUPATION 2014/15	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	6 261	3 945	2 316	4 636	2 799	1 837	74.0
Technicians directly supporting R&D	6 912	4 816	2 096	4 494	3 088	1 406	65.0
Other personnel directly supporting R&D	5 570	3 328	2 242	3 797	2 352	1 444	68.2
<b>Total</b>	<b>18 743</b>	<b>12 089</b>	<b>6 654</b>	<b>12 928</b>	<b>8 240</b>	<b>4 688</b>	<b>69.0</b>
2015/16	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	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
<b>Total</b>	<b>17 245</b>	<b>11 407</b>	<b>5 838</b>	<b>12 458</b>	<b>7 957</b>	<b>4 501</b>	<b>72.2</b>
2016/17	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	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
<b>Total</b>	<b>17 998</b>	<b>11 512</b>	<b>6 486</b>	<b>12 549.2</b>	<b>7 757.2</b>	<b>4 792.0</b>	<b>69.7</b>

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.54: Business sector R&D personnel in headcounts by occupation, qualification, population group and gender (2016/17)**

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
<b>Researchers</b>	<b>6 463</b>	<b>4 071</b>	<b>2 392</b>	<b>746</b>	<b>791</b>	<b>177</b>	<b>117</b>	<b>372</b>	<b>233</b>	<b>2 692</b>	<b>1 215</b>	<b>85</b>	<b>36</b>
Doctoral degree or equivalent	704	468	236	70	37	16	16	16	21	345	161	21	1
Master's, honours, bachelor or equivalent	4 235	2 836	1 399	518	371	124	62	298	155	1 831	778	66	33
Diplomas	1 523	767	756	201	474	49	51	54	41	452	186	10	6
<b>Technicians directly supporting R&amp;D</b>	<b>6 156</b>	<b>4 258</b>	<b>1 898</b>	<b>1 049</b>	<b>759</b>	<b>457</b>	<b>247</b>	<b>428</b>	<b>198</b>	<b>2 303</b>	<b>679</b>	<b>22</b>	<b>15</b>
Doctoral degree or equivalent	52	22	30	3	11	0	1	2	2	15	16	1	0
Master's, honours, bachelor or equivalent	2 244	1 428	816	282	287	239	102	160	115	736	302	10	10
Diplomas	3 860	2 808	1 052	780	481	243	106	282	91	1 491	368	12	4
<b>Other personnel directly supporting R&amp;D</b>	<b>5 379</b>	<b>3 183</b>	<b>2 196</b>	<b>1 565</b>	<b>932</b>	<b>184</b>	<b>223</b>	<b>424</b>	<b>254</b>	<b>878</b>	<b>769</b>	<b>133</b>	<b>18</b>
Doctoral degree or equivalent	102	48	55	15	17	0	3	5	4	25	29	3	1
Master's, honours, bachelor or equivalent	1 230	625	605	169	170	31	37	64	70	320	320	41	7
Diplomas	4 046	2 510	1 536	1 400	753	154	185	367	192	494	395	95	11
<b>Total</b>	<b>17 998</b>	<b>11 512</b>	<b>6 486</b>	<b>3 359</b>	<b>2 482</b>	<b>817</b>	<b>587</b>	<b>1 223</b>	<b>685</b>	<b>5 872</b>	<b>2 663</b>	<b>240</b>	<b>69</b>



**Table C.55: Number of foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2014/15, 2015/16 and 2016/17)**

COLLABORATION PARTNERS	2014/15		2015/16		2016/17	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	14	10	17	8	22	10
Higher education institutions	66	19	64	18	82	25
Members of own company	25	8	25	14	28	11
Not-for-profit organisations	6	3	7	1	12	3
Other companies	56	30	66	32	63	36
Science councils	44	9	41	10	55	10
<b>Total number of R&amp;D collaborations</b>	<b>211</b>	<b>79</b>	<b>220</b>	<b>83</b>	<b>262</b>	<b>95</b>
No collaboration	20	21	8	11	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)	2 653 929	1 357 157	2 193 307	306 449	N/A	N/A

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

N/A: Total in-house plus outsourced R&D collaboration expenditure and No collaboration was not collected for 2016/17.

### 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 (2007/08 to 2016/17)**

YEAR	NUMBER OF R&D PERFORMERS	R&D EXPENDITURE R'000	PROPORTION OF BERD %
2007/08	19	2 765 729	25.8
2008/09	21	3 438 543	27.9
2009/10	21	2 158 238	19.4
2010/11	19	1 685 520	16.8
2011/12	18	1 318 492	12.6
2012/13	19	1 512 021	14.3
2013/14	19	1 609 771	13.7
2014/15	19	2 019 919	15.2
2015/16	18	1 973 416	14.3
2016/17	16	2 621 883	17.7

Note: Revised SOEs list differs from the 2014/15 list.

**Table C.57: Business sector: SOEs – R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Basic research	206 464	260 468	131 212	68 838	55 107	59 187	263 523	65 489	65 556	110 249
Applied research	913 054	1 130 064	866 097	835 262	832 505	805 106	641 358	1 216 953	860 904	1 588 222
Experimental research	1 646 211	2 048 011	1 160 929	781 421	430 880	647 728	704 890	737 477	1 046 956	923 413
<b>Total</b>	<b>2 765 729</b>	<b>3 438 543</b>	<b>2 158 238</b>	<b>1 685 520</b>	<b>1 318 492</b>	<b>1 512 021</b>	<b>1 609 771</b>	<b>2 019 919</b>	<b>1 973 416</b>	<b>2 621 883</b>

**Table C.58: Business sector: SOEs – Proportional R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Basic research	7.5	7.6	6.1	4.1	4.2	3.9	16.4	3.2	3.3	4.2
Applied research	33.0	32.9	40.1	49.6	63.1	53.2	39.8	60.2	43.6	60.6
Experimental research	59.5	59.6	53.8	46.4	32.7	42.8	43.8	36.5	53.1	35.2
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.59: Business sector: SOEs – R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Capital expenditure</b>	<b>480 108</b>	<b>1 422 478</b>	<b>401 776</b>	<b>408 927</b>	<b>333 325</b>	<b>179 959</b>	<b>245 077</b>	<b>355 725</b>	<b>122 272</b>	<b>726 071</b>
Land: buildings & other structures	107 001	37 655	60 525	47 672	14 032	11 195	12 920	16 307	31 884	183 145
Vehicles, plant, machinery, equipment	373 107	1 384 823	341 251	361 255	319 293	168 764	232 157	339 418	90 388	542 926
<b>Current expenditure</b>	<b>2 285 621</b>	<b>2 016 066</b>	<b>1 756 460</b>	<b>1 276 593</b>	<b>985 167</b>	<b>1 332 062</b>	<b>1 364 694</b>	<b>1 664 194</b>	<b>1 851 145</b>	<b>1 895 812</b>
Labour costs	1 147 839	1 262 273	1 033 378	692 407	658 509	795 414	849 371	922 321	976 713	1 040 703
Other current expenditure	1 137 782	753 793	723 082	584 186	326 658	536 648	515 323	741 873	874 432	855 109
<b>Total</b>	<b>2 765 729</b>	<b>3 438 544</b>	<b>2 158 236</b>	<b>1 685 520</b>	<b>1 318 492</b>	<b>1 512 021</b>	<b>1 609 771</b>	<b>2 019 919</b>	<b>1 973 417</b>	<b>2 621 883</b>

**Table C.60: Business sector: SOEs – Proportional R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
<b>Capital expenditure</b>	<b>17.4</b>	<b>41.4</b>	<b>18.6</b>	<b>24.3</b>	<b>25.3</b>	<b>11.9</b>	<b>15.2</b>	<b>17.6</b>	<b>6.2</b>	<b>27.7</b>
Land: buildings & other structures	3.9	1.1	2.8	2.8	1.1	0.7	0.8	0.8	1.6	7.0
Vehicles, plant, machinery, equipment	13.5	40.3	15.8	21.4	24.2	11.2	14.4	16.8	4.6	20.7
<b>Current expenditure</b>	<b>82.6</b>	<b>58.6</b>	<b>81.4</b>	<b>75.7</b>	<b>74.7</b>	<b>88.1</b>	<b>84.8</b>	<b>82.4</b>	<b>93.8</b>	<b>72.3</b>
Labour costs	41.5	36.7	47.9	41.1	49.9	52.6	52.8	45.7	49.5	39.7
Other current expenditure	41.1	21.9	33.5	34.7	24.8	35.5	32.0	36.7	44.3	32.6
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



**Table C.61: Business sector: SOEs – Expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	11 729	11 236	6 834	15 100	14 615	23 479	21 845	16 591	12 278	16 457
Nanotechnology	1 993	1 045	2 553	2 995	7 103	3 768	654.135	699.57945	144	0
<b>Total</b>	<b>13 722</b>	<b>12 281</b>	<b>9 386</b>	<b>18 095</b>	<b>21 717</b>	<b>27 247</b>	<b>22 499</b>	<b>17 290</b>	<b>12 422</b>	<b>16 457</b>
Business expenditure on R&D	2 765 729	3 438 543	2 158 238	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883

**Table C.62: Business sector: SOEs – Proportional expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Biotechnology	0.4	0.3	0.3	0.9	1.1	1.6	1.4	0.8	0.6	0.6
Nanotechnology	0.1	0.0	0.1	0.2	0.5	0.2	0.0	0.0	0.0	0.0
<b>Total</b>	<b>0.5</b>	<b>0.4</b>	<b>0.4</b>	<b>1.1</b>	<b>1.6</b>	<b>1.8</b>	<b>1.4</b>	<b>0.9</b>	<b>0.6</b>	<b>0.6</b>

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment related	N/A	N/A	N/A	N/A	10 029	15 284	22 448	51 522	30 864	136 523
Open-source software	2 566	3 190	5 597	9 087	8 736	7 599	4 124	0	50 589	0
New materials	2 919	6 673	17 054	14 598	14 872	12 082	12 233	11 111	64 021	15 353
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	N/A	32 571
<b>Total</b>	<b>5 484</b>	<b>9 863</b>	<b>22 652</b>	<b>23 684</b>	<b>33 636</b>	<b>34 965</b>	<b>38 806</b>	<b>62 633</b>	<b>145 474</b>	<b>184 446</b>
Business expenditure on R&D	2 765 729	3 438 543	2 158 238	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environment related	N/A	N/A	N/A	N/A	0.8	1.0	1.4	2.6	1.6	5.2
Open-source software	0.1	0.1	0.3	0.5	0.7	0.5	0.3	0.0	2.6	0.0
New materials	0.1	0.2	0.8	0.9	1.1	0.8	0.8	0.6	3.2	0.6
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	N/A	1.2
<b>Total</b>	<b>0.2</b>	<b>0.3</b>	<b>1.0</b>	<b>1.4</b>	<b>2.6</b>	<b>2.3</b>	<b>2.4</b>	<b>3.1</b>	<b>7.4</b>	<b>7.0</b>

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&amp;D expenditure by research field (2007/08 to 2016/17)

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Natural Sciences, Technology and Engineering	2 753 974	3 426 021	2 145 037	1 670 869	1 318 492	1 512 021	1 609 771	1 963 779	1 963 821	2 524 169
Mathematical sciences	29 281	31 148	34 896	38 311	142 930	86 576	93 820	137 076	87 387	85 055
Physical sciences	499 480	649 338	174 483	21 123	14 992	40 742	44 460	46 559	32 100	42 210
Chemical sciences	71 947	58 062	57 109	66 503	80 556	133 867	132 399	86 408	64 230	68 251
Earth sciences	22 338	28 149	25 151	27 912	0	44 006	48 671	24 356	12 254	17 750
Information, computer and communication technologies	62 425	98 303	88 484	64 163	126 456	155 601	168 174	304 806	541 009	935 325
Applied sciences and technologies	899 041	1 033 245	616 089	493 368	151 475	176 600	176 391	165 214	133 687	277 702
Engineering sciences	1 112 617	1 473 247	1 091 019	926 729	768 675	781 073	824 057	1 034 900	981 683	971 414
Biological sciences	4 020	2 889	2 727	0	0	13 496	30 701	29 183	33 874	13 112
Agricultural sciences	3 194	863.1	718.8	6 816	8 137	5 343	11 711	12 507	12 665	9 079
Medical and health sciences	0	0	0	15 614	17 491	18 012	18 316	49 357	36 548	23 990
Environmental sciences	37 822	39 093	41 092	3 052	0	42 440	45 772	59 270	16 310	47 674
Material sciences	7 092	6 967	8 296	7 279	7 780	8 605	9 198	9 849	12 073	32 605
Marine sciences	4 716	4 716	4 972	0	0	5659	6103	4294	0	0
Division 2: Social Sciences and Humanities	11 755	12 522	13 201	14 651	0	0	0	56 140	9 595	97 714
Social sciences	11 755	12 522	13 201	14 651	0	0	0	56 140	9 595	97 714
Humanities	0	0	0	0	0	0	0	0	0	0
Total	2 765 729	3 438 543	2 158 238	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883

Table C.66: Business sector: SOEs – Proportional R&amp;D expenditure by research field (2007/08 to 2016/17)

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural Sciences, Technology and Engineering	99.6	99.6	99.4	99.1	100.0	100.0	100.0	97.2	99.5	96.3
Mathematical sciences	1.1	0.9	1.6	2.3	10.8	5.7	5.8	6.8	4.4	3.2
Physical sciences	18.1	18.9	8.1	1.3	1.1	2.7	2.8	2.3	1.6	1.6
Chemical sciences	2.6	1.7	2.6	3.9	6.1	8.9	8.2	4.3	3.3	2.6
Earth sciences	0.8	0.8	1.2	1.7	0.0	2.9	3.0	1.2	0.6	0.7





MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Information, computer and communication technologies	2.3	2.9	4.1	3.8	9.6	10.3	10.4	15.1	27.4	35.7
Applied sciences and technologies	32.5	30.0	28.5	29.3	11.5	11.7	11.0	8.2	6.8	10.6
Engineering sciences	40.2	42.8	50.6	55.0	58.3	51.7	51.2	51.2	49.7	37.1
Biological sciences	0.1	0.1	0.1	0.0	0.0	0.9	1.9	1.4	1.7	0.5
Agricultural sciences	0.1	0.0	0.0	0.4	0.6	0.4	0.7	0.6	0.6	0.3
Medical and health sciences	0.0	0.0	0.0	0.9	1.3	1.2	1.1	2.4	1.9	0.9
Environmental sciences	1.4	1.1	1.9	0.2	0.0	2.8	2.8	2.9	0.8	1.8
Material sciences	0.3	0.2	0.4	0.4	0.6	0.6	0.6	0.5	0.6	1.2
Marine sciences	0.2	0.1	0.2	0.0	0.0	0.4	0.4	0.2	0.0	0.0
Division 2: Social Sciences and Humanities	0.4	0.4	0.6	0.9	0.0	0.0	0.0	2.8	0.5	3.7
Social sciences	0.4	0.4	0.6	0.9	0.0	0.0	0.0	2.8	0.5	3.7
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 (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1:										
Defence	642 320	730 541	696 861	718 698	356 627	485 487	512 440	563 927	399 183	304 302
Defence	642 320	730 541	696 861	718 698	356 627	485 487	512 440	563 927	399 183	304 302
Division 2:										
Economic Development	1 983 888	2 535 114	1 271 859	765 929	770 791	831 597	887 024	1187718.471	1360119.532	1901234.948
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	0	0	0	0	0	9030	9380	10075.639	10203.2	8610
Animal production and animal primary products	6 388	2 877	2 396	1 704	4 069	0	0	0	0	0
Mineral resources (excluding Energy)	2 674	0	0	5 576	6 247	6 433	6 541	6 996	7 743	8 500
Energy resources	505 453	650 325	185 159	20 372	22 488	23 158	23 549	25 185	27 874	30 602
Energy supply	213 649	334 360	355 509	405 120	367 866	249 963	253 757	419 084	316 868	410 091
Manufacturing	22 089	21 896	43 790	26 828	57 794	77 574	105 372	178 376	103 757	110 104
Construction	997 680	1 272 653	342 212	603	26 433	70 899	99 484	81 944	0	0
Transport	164 445	180 028	266 227	250 553	60 839	125 965	122 633	126 069	253 742	333 284

<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>
Information and communication services	47 776	44 360	46 766	35 131	179 318	193 815	191 811	270 175	609 251	873 600
Commercial services	14 301	19 183	19 856	19 290	1 504	9 893	10 644	11 434	16 235	16 878
Economic framework	9 433	9 433	9 944	0	17 049	36 408	40 833	37 065	14 447	109 566
Natural resources		0	0	751.8	27 185	28 459	23 019	21 316	0	0
<b>Division 3:</b>										
<b>Society</b>	<b>37 707</b>	<b>50 665</b>	<b>55 826</b>	<b>61 017</b>	<b>57 479</b>	<b>46 872</b>	<b>59 171</b>	<b>67371.1975</b>	<b>54783.8642</b>	<b>51 876</b>
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	13 353	20 898	24 288	25 320	22 992	19 743	29 360	26 193	19 804	25 631
Education and training	2 449	2 609	2 750	3 052	11 496	10 862	13 281	14 266	14 447	0
Social development and community services	21 905	27 159	28 788	32 645	22 992	16 268	16 530	26 912	20 533	26 246
<b>Division 4:</b>										
<b>Environment</b>	<b>28 420</b>	<b>43 621</b>	<b>46 300</b>	<b>55 984</b>	<b>47 487</b>	<b>31 245</b>	<b>31 720</b>	<b>68425.459</b>	<b>56760.157</b>	<b>86 865</b>
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	13 353	20 898	22 188	25 696	23 368	15 623	15 860	26 193	33 494	28 662
Environmental aspects of development	1 714	1 826	1 925	3 841	0	0	0	16 040	2 741	32 571
Environmental and other aspects	13 353	20 898	22 188	26 448	24 119	15 623	15 860	26 193	20 525	25 631
<b>Division 5:</b>										
<b>Advancement of Knowledge</b>	<b>73 394</b>	<b>78 602</b>	<b>87 391</b>	<b>83 891</b>	<b>86 108</b>	<b>116 819</b>	<b>119 417</b>	<b>132476.301</b>	<b>102570.014</b>	<b>277 605</b>
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	68 986	73 906	82 441	75 716	83 349	113 836	116 668	129 393	99 448	277 605
Social sciences and humanities	4 408	4 696	4 951	8 176	2 758	2 983	2 750	3 083	3 122	0
<b>Total</b>	<b>2 765 729</b>	<b>3 438 543</b>	<b>2 158 238</b>	<b>1 685 520</b>	<b>1 318 492</b>	<b>1 512 021</b>	<b>1 609 771</b>	<b>2 019 919</b>	<b>1 973 416</b>	<b>2 621 883</b>





**Table C.68: Business sector: SOEs – Proportional R&D expenditure by Socio-economic objective (2007/08 to 2016/17)**

<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
	%	%	%	%	%	%	%	%	%	%
<b>Division 1:</b>										
<b>Defence</b>	<b>23.2</b>	<b>21.2</b>	<b>32.3</b>	<b>42.6</b>	<b>27.0</b>	<b>32.1</b>	<b>31.8</b>	<b>27.9</b>	<b>20.2</b>	<b>11.6</b>
Defence	23.2	21.2	32.3	42.6	27.0	32.1	31.8	27.9	20.2	11.6
<b>Division 2:</b>										
<b>Economic Development</b>	<b>71.7</b>	<b>73.7</b>	<b>58.9</b>	<b>45.4</b>	<b>58.5</b>	<b>55.0</b>	<b>55.1</b>	<b>58.8</b>	<b>68.9</b>	<b>72.5</b>
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	0.0	0.6	0.6	0.5	0.5	0.3
Animal production and animal primary products	0.2	0.1	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0
Mineral resources (excluding Energy)	0.1	0.0	0.0	0.3	0.5	0.4	0.4	0.3	0.4	0.3
Energy resources	18.3	18.9	8.6	1.2	1.7	1.5	1.5	1.2	1.4	1.2
Energy supply	7.7	9.7	16.5	24.0	27.9	16.5	15.8	20.7	16.1	15.6
Manufacturing	0.8	0.6	2.0	1.6	4.4	5.1	6.5	8.8	5.3	4.2
Construction	36.1	37.0	15.9	0.0	2.0	4.7	6.2	4.1	0.0	0.0
Transport	5.9	5.2	12.3	14.9	4.6	8.3	7.6	6.2	12.9	12.7
Information and communication services	1.7	1.3	2.2	2.1	13.6	12.8	11.9	13.4	30.9	33.3
Commercial services	0.5	0.6	0.9	1.1	0.1	0.7	0.7	0.6	0.8	0.6
Economic framework	0.3	0.3	0.5	0.0	1.3	2.4	2.5	1.8	0.7	4.2
Natural resources	0.0	0.0	0.0	0.0	2.1	1.9	1.4	1.1	0.0	0.0
<b>Division 3:</b>										
<b>Society</b>	<b>1.4</b>	<b>1.5</b>	<b>2.6</b>	<b>3.6</b>	<b>4.4</b>	<b>3.1</b>	<b>3.7</b>	<b>3.3</b>	<b>2.8</b>	<b>2.0</b>
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	0.5	0.6	1.1	1.5	1.7	1.3	1.8	1.3	1.0	1.0
Education and training	0.1	0.1	0.1	0.2	0.9	0.7	0.8	0.7	0.7	0.0
Social development and community services	0.8	0.8	1.3	1.9	1.7	1.1	1.0	1.3	1.0	1.0
<b>Division 4:</b>										
<b>Environment</b>	<b>1.0</b>	<b>1.3</b>	<b>2.1</b>	<b>3.3</b>	<b>3.6</b>	<b>2.1</b>	<b>2.0</b>	<b>3.4</b>	<b>2.9</b>	<b>3.3</b>
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.5	0.6	1.0	1.5	1.8	1.0	1.0	1.3	1.7	1.1
Environmental aspects of development	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.8	0.1	1.2

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.5	0.6	1.0	1.6	1.8	1.0	1.0	1.3	1.0	1.0
<b>Division 5: Advancement of Knowledge</b>	<b>2.7</b>	<b>2.3</b>	<b>4.0</b>	<b>5.0</b>	<b>6.5</b>	<b>7.7</b>	<b>7.4</b>	<b>6.6</b>	<b>5.2</b>	<b>10.6</b>
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	2.5	2.1	3.8	4.5	6.3	7.5	7.2	6.4	5.0	10.6
Social sciences and humanities	0.2	0.1	0.2	0.5	0.2	0.2	0.2	0.2	0.2	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.69: Business sector: SOEs – R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	12 103	16 648	17 582	12 562	21 897	33 436	38 634	37 244	10 854	45 081
Free State	9 242	3 938	17 432	24 865	31 842	28 367	26 428	25 193	10 854	42 824
Gauteng	2 439 748	3 015 137	1 603 650	1 169 019	915 824	1 014 194	1 012 556	1 448 092	1 558 538	1 937 851
KwaZulu-Natal	27 888	45 057	66 955	54 716	61 139	66 477	91 406	45 588	86 565	188 606
Limpopo	127.76	0	0	7 157	15 917	19 724	19 596	18 612	3 019	615
Mpumalanga	0	0	0	7 157	15 917	27 038	28 976	33 927	13 222	9 594
North-West	93 832	109 981	138 305	118 682	140 853	151 514	160 739	289 990	170 118	180 261
Northern Cape	0	0	0	7 157	17 446	18 630	52 104	17 998	2 397	0
Western Cape	182 788	247 782	314 314	284 206	97 655	152 641	179 332	103 275	117 850	217 052
<b>Total</b>	<b>2 765 729</b>	<b>3 438 543</b>	<b>2 158 238</b>	<b>1 685 520</b>	<b>1 318 492</b>	<b>1 512 021</b>	<b>1 609 771</b>	<b>2 019 919</b>	<b>1 973 416</b>	<b>2 621 883</b>

**Table C.70: Business sector: SOEs – Proportional R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	0.4	0.5	0.8	0.7	1.7	2.2	2.4	1.8	0.5	1.7
Free State	0.3	0.1	0.8	1.5	2.4	1.9	1.6	1.2	0.5	1.6
Gauteng	88.2	87.7	74.3	69.4	69.5	67.1	62.9	71.7	79.0	73.9
KwaZulu-Natal	1.0	1.3	3.1	3.2	4.6	4.4	5.7	2.3	4.4	7.2
Limpopo	0.0	0.0	0.0	0.4	1.2	1.3	1.2	0.9	0.2	0.0
Mpumalanga	0.0	0.0	0.0	0.4	1.2	1.8	1.8	1.7	0.7	0.4
North-West	3.4	3.2	6.4	7.0	10.7	10.0	10.0	14.4	8.6	6.9
Northern Cape	0.0	0.0	0.0	0.4	1.3	1.2	3.2	0.9	0.1	0.0
Western Cape	6.6	7.2	14.6	16.9	7.4	10.1	11.1	5.1	6.0	8.3
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>





**Table C.71: Business sector: SOEs – R&D expenditure by Standard Industrial Classification code (2007/08 to 2016/17)**

STANDARD INDUSTRIAL CLASSIFICATION	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Agriculture, Hunting, Forestry and Fishing	1 278	575	479	0	0	12 592	17 187	18 413	18 646	20 052
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0
Manufacturing	493 453	552 419	547 593	530 635	248 309	444 185	475 294	480 601	370 407	161 096
Manufacture of Food Products, Beverages and Tobacco Products	0	0	0	0	0	0	0	0	0	0
Manufacture of Textiles, Clothing and Leather Goods	0	0	0	0	0	0	0	0	0	0
Manufacture of Wood and Products of Wood and Cork, except furniture; Manufacture of Articles of Straw and Plaiting Materials; Manufacture of Paper and Paper Products; Manufacture of Publishing, Printing and Reproduction of Recorded Material	0	0	0	0	0	1 290	1 340	1 439	1 458	1 230
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	57 797	74 080	99 411	61 654	58 362	69 607	72 216	77 350	8 616	14 489
Manufacture of Non-Metallic Mineral Products	2 651	0	0	6 692	7 496	7 719	7 850	8 395	0	0
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	32 089	20 798	21 252	0	84 285	224 661	272 253	293 575	297 289	75 855
Manufacture of Electrical Machinery and Apparatus	51 780	54 943	0	0	88 159	76 590	63 824	52 760	20 430	21 690
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	349 136	402 599	426 930	462 290	10 007	64 318	57 812	47 081	42 614	47 833
Manufacture of Furniture; Recycling; Manufacturing not elsewhere classified	0	0	0	0	0	0	0	0	0	0
Electricity, Gas & Water Supply	1 735 709	2 303 869	936 310	521 665	463 592	325 822	340 670	534 569	424 561	531 606
Construction	0	0	0	0	0	0	0	0	0	0
Wholesale and Retail	2 449	2 609	2 750	3 052	0	0	0	0	0	0
Transport, Storage & Communication	218 121	176 362	179 602	164 337	304 346	371 495	397 326	565 363	826 532	1 516 160
Financial Intermediation, Real Estate and Business Services	138 320	222 490	259 855	204 455	302 245	137 898	158 060	150 347	196 661	174 576
Community, Social and Personal Services	176 401	180 218	231 648	261 375	0	220 029	221 233	270 626	136 609	218 393
<b>Total</b>	<b>2 765 729</b>	<b>3 438 543</b>	<b>2 158 238</b>	<b>1 685 520</b>	<b>1 318 492</b>	<b>1 512 021</b>	<b>1 609 771</b>	<b>2 019 919</b>	<b>1 973 416</b>	<b>2 621 883</b>



**Table C.72: Business sector: SOEs – Proportional R&D expenditure by Standard Industrial Classification code (2007/08 to 2016/17)**

STANDARD INDUSTRIAL CLASSIFICATION	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Agriculture, Hunting, Forestry and Fishing	0.0	0.0	0.0	0.0	0.0	0.8	1.1	0.9	0.9	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	17.8	16.1	25.4	31.5	18.8	29.4	29.5	23.8	18.8	6.1
Manufacture of Food Products, Beverages and Tobacco Products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of Textiles, Clothing and Leather Goods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of Wood and Products of Wood and Cork, except furniture; Manufacture of Articles of Straw and Plaiting Materials; Manufacture of Paper and Paper Products; Manufacture of Publishing, Printing and Reproduction of Recorded Material	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
Manufacture of Refined Petroleum, Coke and Nuclear Fuel; Manufacture of Chemicals and Chemical Products (incl. Pharmaceuticals); Manufacture of Rubber and Plastic Products	2.1	2.2	4.6	3.7	4.4	4.6	4.5	3.8	0.4	0.6
Manufacture of Non-Metallic Mineral Products	0.1	0.0	0.0	0.4	0.6	0.5	0.5	0.4	0.0	0.0
Manufacture of Basic Metals, Fabricated Metal Products, Machinery & Equipment; Manufacture of Office, Accounting and Computing Machinery	1.2	0.6	1.0	0.0	6.4	14.9	16.9	14.5	15.1	2.9
Manufacture of Electrical Machinery and Apparatus	1.9	1.6	0.0	0.0	6.7	5.1	4.0	2.6	1.0	0.8
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	12.6	11.7	19.8	27.4	0.8	4.3	3.6	2.3	2.2	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	62.8	67.0	43.4	30.9	35.2	21.5	21.2	26.5	21.5	20.3
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wholesale and Retail	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Transport, Storage & Communication	7.9	5.1	8.3	9.7	23.1	24.6	24.7	28.0	41.9	57.8
Financial Intermediation, Real Estate and Business Services	5.0	6.5	12.0	12.1	22.9	9.1	9.8	7.4	10.0	6.7
Community, Social and Personal Services	6.4	5.2	10.7	15.5	0.0	14.6	13.7	13.4	6.9	8.3
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



**Table C.73: Business sector: SOEs – R&D personnel in headcounts and full-time equivalents by occupation (2007/08 to 2016/17)**

YEAR	HEADCOUNTS				FULL TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2007/08	2 822	1 217	777	828	2 242.4	1 006.5	642.2	593.7
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

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.74: Business sector: SOEs – R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15 to 2016/17)**

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
<b>2014/15</b>							
Researchers	918	751	167	541.5	433.7	107.8	59.0
Technicians directly supporting R&D	1 479	1 113	366	593.2	483.2	110.0	40.1
Other personnel directly supporting R&D	363	179	184	200.7	86.2	114.5	55.3
<b>Total</b>	<b>2 760</b>	<b>2 043</b>	<b>717</b>	<b>1 335.3</b>	<b>1 003.1</b>	<b>332.3</b>	<b>48.4</b>
<b>2015/16</b>							
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
<b>Total</b>	<b>2 476</b>	<b>1 818</b>	<b>658</b>	<b>1 150.1</b>	<b>841.7</b>	<b>308.4</b>	<b>46.4</b>
<b>2016/17</b>							
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
<b>Total</b>	<b>2 983</b>	<b>2 196</b>	<b>787</b>	<b>1 213.8</b>	<b>853.5</b>	<b>360.3</b>	<b>40.7</b>

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.75: Business sector: SOEs – R&D personnel in headcounts by occupation, qualification, population group and gender (2016/17)**

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
<b>Researchers</b>	<b>1 113</b>	<b>899</b>	<b>214</b>	<b>265</b>	<b>94</b>	<b>39</b>	<b>11</b>	<b>108</b>	<b>31</b>	<b>479</b>	<b>77</b>	<b>8</b>	<b>1</b>
Doctoral degree or equivalent	95	83	12	20	8	3	0	4	1	51	2	5	0
Master's, honours, bachelor or equivalent	892	719	173	225	71	32	8	93	26	365	66	3	1
Diplomas	126	97	29	20	14	4	2	11	4	63	8	0	0
<b>Technicians directly supporting R&amp;D</b>	<b>1 437</b>	<b>1 079</b>	<b>358</b>	<b>356</b>	<b>182</b>	<b>35</b>	<b>20</b>	<b>26</b>	<b>11</b>	<b>662</b>	<b>145</b>	<b>0</b>	<b>0</b>
Doctoral degree or equivalent	1	1	0	0	0	0	0	0	0	1	0	0	0
Master's, honours, bachelor or equivalent	246	170	77	75	55	7	3	12	8	74	10	0	0
Diplomas	1 189	908	281	281	126	27	17	14	3	587	134	0	0
<b>Other personnel directly supporting R&amp;D</b>	<b>433</b>	<b>218</b>	<b>215</b>	<b>141</b>	<b>130</b>	<b>9</b>	<b>11</b>	<b>5</b>	<b>2</b>	<b>63</b>	<b>72</b>	<b>0</b>	<b>0</b>
Doctoral degree or equivalent	0	0	0	0	0	0	0	0	0	0	0	0	0
Master's, honours, bachelor or equivalent	46	25	21	12	11	0	4	2	1	11	6	0	0
Diplomas	387	193	194	129	120	9	7	2	1	53	66	0	0
<b>Total</b>	<b>2 983</b>	<b>2 196</b>	<b>787</b>	<b>762</b>	<b>406</b>	<b>83</b>	<b>42</b>	<b>139</b>	<b>45</b>	<b>1 204</b>	<b>293</b>	<b>8</b>	<b>1</b>

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.76: Business sector: SOEs – Number of foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2014/15 to 2016/17)**

COLLABORATION PARTNERS	2014/15		2015/16		2016/17	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	2	1	2	2	2	2
Higher education institutions	3	0	7	1	11	2
Members of own company	0	0	2	0	3	0
Not-for-profit organisations	0	0	2	1	3	1
Other companies	3	1	3	1	3	1
Science councils	4	1	5	1	9	1
<b>Total number of R&amp;D collaborations</b>	<b>12</b>	<b>3</b>	<b>21</b>	<b>6</b>	<b>31</b>	<b>7</b>
No collaboration	0	0	0	1	N/A	N/A
<b>R&amp;D EXPENDITURE</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>
Total in-house plus outsourced R&D collaboration expenditure (excl. VAT)	3 264	50	164 075	60 861	N/A	N/A

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

N/A: Total in-house plus outsourced R&D collaboration expenditure and No collaboration was not collected for 2016/17.





## C.2.2. Not-for-profit sector

The improvement in coverage for 2016/2017 did not contribute to the increase in GERD. The increase in GERD for 2016/2017 was due to a number of large R&D active organisations who reported higher expenditure in R&D for that specific period. Hence, differs with what had happened in 2012/13. Care is advised when making inferences on trends in the NPO sector.

**Table C.77: Not-for-profit sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Basic research	65 337	70 725	111 377	59 302	62 134	114 755	132 478	181 492	200 040	232 304
Applied research	119 982	131 259	53 530	87 435	79 105	346 179	322 295	426 132	508 738	558 059
Experimental research	37 883	38 665	23 933	16 092	29 366	42 898	128 391	171 149	182 365	227 254
<b>Total</b>	<b>223 202</b>	<b>240 649</b>	<b>188 840</b>	<b>162 830</b>	<b>170 605</b>	<b>503 833</b>	<b>583 165</b>	<b>778 772</b>	<b>891 142</b>	<b>1 017 616</b>

Note: Improved coverage of the NPO sector in 2012/13, resulted in a R281 509 000 increase in expenditure, contributing 1.2% of GERD. In 2015/16, coverage was again improved, which resulted in a R185 302 000 increase in expenditure, contributing 0.6% of GERD.

**Table C.78: Proportional not-for-profit sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Basic research	29.3	29.4	59.0	36.4	36.4	22.8	22.7	23.3	22.4	22.8
Applied research	53.8	54.5	28.3	53.7	46.4	68.7	55.3	54.7	57.1	54.8
Experimental research	17.0	16.1	12.7	9.9	17.2	8.5	22.0	22.0	20.5	22.3
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.79: Not-for-profit sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Capital expenditure</b>	<b>7 025</b>	<b>7 249</b>	<b>8 564</b>	<b>8 820</b>	<b>18 702</b>	<b>37 564</b>	<b>39 983</b>	<b>49 647</b>	<b>53 800</b>	<b>91 083</b>
Land: buildings & other structures	2 959	3 137	3 486	4 447	6 905	11 152	19 047	18 794	18 391	20 765
Vehicles, plant, machinery, equipment	4 066	4 112	5 078	4 373	11 797	26 412	20 936	30 853	35 409	70 318
<b>Current expenditure</b>	<b>216 177</b>	<b>233 400</b>	<b>180 276</b>	<b>154 010</b>	<b>151 903</b>	<b>466 269</b>	<b>543 182</b>	<b>729 125</b>	<b>837 342</b>	<b>926 534</b>
Labour costs	109 147	114 292	94 673	92 098	100 176	243 871	303 644	420 462	468 883	506 181
Other current expenditure	107 030	119 108	85 603	61 912	51 727	222 398	239 538	308 663	368 459	420 353
<b>Total</b>	<b>223 202</b>	<b>240 649</b>	<b>188 840</b>	<b>162 830</b>	<b>170 605</b>	<b>503 833</b>	<b>583 165</b>	<b>778 772</b>	<b>891 142</b>	<b>1 017 616</b>

**Table C.80: Proportional not-for-profit sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Capital expenditure	3.1	3.0	4.5	5.4	11.0	7.5	6.9	6.4	6.0	9.0
Land: buildings & other structures	1.3	1.3	1.8	2.7	4.0	2.2	3.3	2.4	2.1	2.0
Vehicles, plant, machinery, equipment	1.8	1.7	2.7	2.7	6.9	5.2	3.6	4.0	4.0	6.9
Current expenditure	96.9	97.0	95.5	94.6	89.0	92.5	93.1	93.6	94.0	91.0
Labour costs	48.9	47.5	50.1	56.6	58.7	48.4	52.1	54.0	52.6	49.7
Other current expenditure	48.0	49.5	45.3	38.0	30.3	44.1	41.1	39.6	41.3	41.3
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.81: Not-for-profit sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Biotechnology	491	255	4 446	5 666	8 667	29 062	62 082	128 964	159 045	123 879
Nanotechnology	0	0	0	1 475	0	10 187	4 915	70 348	81 103	841
<b>Total</b>	<b>491</b>	<b>255</b>	<b>4 446</b>	<b>7 141</b>	<b>8 667</b>	<b>39 249</b>	<b>66 997</b>	<b>199 312</b>	<b>240 148</b>	<b>124 720</b>
NPO expenditure on R&D	223 202	240 649	188 840	162 830	170 605	503 833	583 165	778 772	891 142	1 017 616

**Table C.82: Proportional not-for-profit sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Biotechnology	0.2	0.1	2.4	3.5	5.1	5.8	10.6	16.6	17.8	12.2
Nanotechnology	0.0	0.0	0.0	0.9	0.0	2.0	0.8	9.0	9.1	0.1
<b>Total</b>	<b>0.2</b>	<b>0.1</b>	<b>2.4</b>	<b>4.4</b>	<b>5.1</b>	<b>7.8</b>	<b>11.5</b>	<b>25.6</b>	<b>26.9</b>	<b>12.3</b>



**Table C.83: Not-for-profit sector R&D expenditure on selected areas of interest (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Environment related	N/A	N/A	N/A	N/A	15 133	18 022	27 142	50 364	52 156	54 904
Open-source software	0	0	0	0	20	419	481	69 509	756	824
New materials	0	0	542	830	395	178	191	634	79 322	223
Tuberculosis (TB), HIV/AIDS, malaria	0	8 763	7 419	13 979	5 034	246 760	301 086	374 460	482 298	689 315
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
<b>Total</b>	<b>0</b>	<b>8 763</b>	<b>7 962</b>	<b>14 809</b>	<b>20 581</b>	<b>265 379</b>	<b>328 901</b>	<b>494 966</b>	<b>614 532</b>	<b>745 265</b>
<b>NPO expenditure on R&amp;D</b>	<b>223 202</b>	<b>240 649</b>	<b>188 840</b>	<b>162 830</b>	<b>170 605</b>	<b>503 833</b>	<b>583 165</b>	<b>778 772</b>	<b>891 142</b>	<b>1 017 616</b>

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Environment related	N/A	N/A	N/A	N/A	8.9	3.6	4.7	6.5	5.9	5.4
Open-source software	0.0	0.0	0.0	0.0	0.0	0.1	0.1	8.9	0.1	0.1
New materials	0.0	0.0	0.3	0.5	0.2	0.0	0.0	0.1	8.9	0.0
Tuberculosis (TB), HIV/AIDS, malaria	0.0	3.6	3.9	8.6	3.0	49.0	51.6	48.1	54.1	67.7
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0
<b>Total</b>	<b>0.0</b>	<b>3.6</b>	<b>4.2</b>	<b>9.1</b>	<b>12.1</b>	<b>52.7</b>	<b>56.4</b>	<b>63.6</b>	<b>69.0</b>	<b>73.2</b>

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 (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>61 494</b>	<b>72 018</b>	<b>53 112</b>	<b>54 776</b>	<b>64 042</b>	<b>346 961</b>	<b>427 237</b>	<b>647 068</b>	<b>766 355</b>	<b>909 337</b>
Mathematical sciences	0	1 041	0	0	0	8 223	9 674	14 613	14 293	13 540
Physical sciences	0	0	6 422	0	0	765	802	989	1 191	1 300
Chemical sciences	0	0	0	0	0	0	1 309	0	0	0
Earth sciences	459	1 012	452	2 585	2 407	2 598	5 907	8 371	8 356	8 727
Information, computer and communication technologies	1 446	1 555	2 207	0	595	2 919	39	197	528	0
Applied sciences and technologies	0	0	0	0	1 487	4 317	4 666	19 123	30 565	29 946
Engineering sciences	0	0	0	0	0	4 075	4 915	4 638	4 005	3 393
Biological sciences	2 005	2 126	904	1 473	7 978	15 475	23 435	23 338	11 400	42 787

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	18 324	19 426	20 404	25 679	25 819	33 105	34 165	53 777	60 727	62 269
Medical and health sciences	29 603	36 032	13 999	15 920	17 423	265 031	329 293	497 588	614 889	719 902
Environmental sciences	7 363	8 396	6 014	3 433	7 553	10 122	12 238	23 548	19 552	25 746
Material sciences	0	0	0	0	0	0	0	0	0	0
Marine sciences	2 294	2 431	2 711	5 687	781	331	794	886	848	1 725
<b>Division 2: Social Sciences and Humanities</b>	<b>161 708</b>	<b>168 631</b>	<b>135 728</b>	<b>108 054</b>	<b>106 563</b>	<b>156 872</b>	<b>155 928</b>	<b>131 705</b>	<b>124 787</b>	<b>108 280</b>
Social sciences	159 155	165 924	133 340	104 306	104 842	142 525	147 029	122 105	117 549	98 355
Humanities	2 553	2 707	2 388	3 749	1 720	14 348	8 898	9 599	7 238	9 925
<b>Total</b>	<b>223 202</b>	<b>240 649</b>	<b>188 840</b>	<b>162 830</b>	<b>170 605</b>	<b>503 833</b>	<b>583 165</b>	<b>778 772</b>	<b>891 142</b>	<b>1 017 616</b>

**Table C.86: Proportional not-for-profit sector R&D expenditure by research field (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>27.6</b>	<b>29.9</b>	<b>28.1</b>	<b>33.6</b>	<b>37.5</b>	<b>68.9</b>	<b>73.3</b>	<b>83.1</b>	<b>86.0</b>	<b>89.4</b>
Mathematical sciences	0.0	0.4	0.0	0.0	0.0	1.6	1.7	1.9	1.6	1.3
Physical sciences	0.0	0.0	3.4	0.0	0.0	0.2	0.1	0.1	0.1	0.1
Chemical sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Earth sciences	0.2	0.4	0.2	1.6	1.4	0.5	1.0	1.1	0.9	0.9
Information, computer and communication technologies	0.6	0.6	1.2	0.0	0.3	0.6	0.0	0.0	0.1	0.0
Applied sciences and technologies	0.0	0.0	0.0	0.0	0.9	0.9	0.8	2.5	3.4	2.9
Engineering sciences	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.6	0.4	0.3
Biological sciences	0.9	0.9	0.5	0.9	4.7	3.1	4.0	3.0	1.3	4.2
Agricultural sciences	8.2	8.1	10.8	15.8	15.1	6.6	5.9	6.9	6.8	6.1
Medical and health sciences	13.3	15.0	7.4	9.8	10.2	52.6	56.5	63.9	69.0	70.7
Environmental sciences	3.3	3.5	3.2	2.1	4.4	2.0	2.1	3.0	2.2	2.5
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	1.0	1.4	3.5	0.5	0.1	0.1	0.1	0.1	0.2
<b>Division 2: Social Sciences and Humanities</b>	<b>72.4</b>	<b>70.1</b>	<b>71.9</b>	<b>66.4</b>	<b>62.5</b>	<b>31.1</b>	<b>26.7</b>	<b>16.9</b>	<b>14.0</b>	<b>10.6</b>
Social sciences	71.3	68.9	70.6	64.1	61.5	28.3	25.2	15.7	13.2	9.7
Humanities	1.1	1.1	1.3	2.3	1.0	2.8	1.5	1.2	0.8	1.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



Table C.87: Not-for-profit sector R&amp;D expenditure by socio-economic objective (2007/08 to 2016/17)

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Division 1:</b>										
<b>Defence</b>	<b>1 438</b>	<b>2 050</b>	<b>1 600</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>690</b>	<b>0</b>	<b>0</b>
Defence	1 438	2 050	1 600	0	0	0	0	690	0	0
<b>Division 2:</b>										
<b>Economic Development</b>	<b>63 450</b>	<b>69 810</b>	<b>71 939</b>	<b>65 777</b>	<b>60 758</b>	<b>110 866</b>	<b>113 991</b>	<b>152 573</b>	<b>157 608</b>	<b>129 359</b>
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	16 030	17 520	18 873	25 441	24 850	36 127	35 511	28 974	32 936	35 240
Animal production and animal primary products	918	972	1 632	1 389	828	2 538	3 083	4 000	7 628	9 856
Mineral resources (excluding Energy)	0	0	0	763	0	8 150	9 831	9 242	7 955	7 708
Energy resources	1 000	1 760	2 604	1 653	969	2 538	3 083	3 993	4 008	3 278
Energy supply	1 438	2 575	3 774	3 307	3 430	4 363	8 690	7 663	6 242	10 628
Manufacturing	0	0	0	0	2 197	3 896	2 955	26 291	31 646	230
Construction	0	0	0	0	0	0	0	0	0	0
Transport	70	74	208	0	137	465	424	0	0	0
Information and communication services	0	0	0	0	1 480	2 031	1 823	316	2 411	327
Commercial services	782	827	970	0	0	0	0	0	1 135	1 962
Economic framework	36 588	39 059	39 463	27 068	22 228	45 252	42 423	54 435	53 406	47 465
Natural resources	6 624	7 022	4 414	6 157	4 640	5 507	6 167	17 659	10 242	12 665
<b>Division 3:</b>										
<b>Society</b>	<b>129 159</b>	<b>141 189</b>	<b>93 947</b>	<b>82 481</b>	<b>75 597</b>	<b>360 333</b>	<b>415 093</b>	<b>555 151</b>	<b>632 030</b>	<b>767 620</b>
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	33 549	37 461	16 554	15 050	13 496	260 712	303 535	449 619	527 783	667 371
Education and training	32 161	32 308	19 986	22 303	23 762	58 894	63 833	61 150	59 917	59 123
Social development and community services	63 449	71 420	57 407	45 128	38 339	40 726	47 725	44 382	44 330	41 126
<b>Division 4:</b>										
<b>Environment</b>	<b>5 885</b>	<b>6 937</b>	<b>7 052</b>	<b>10 051</b>	<b>13 356</b>	<b>12 841</b>	<b>15 044</b>	<b>16 135</b>	<b>17 503</b>	<b>19 734</b>
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	2 553	3 406	3 577	6 139	7 233	4 716	7 845	8 697	9 949	9 712
Environmental aspects of development	559	593	683	504	3 746	5 771	4 545	4 569	4 494	6 269

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environmental and other aspects	2 773	2 938	2 792	3 408	2 377	2 355	2 654	2 869	3 060	3 753
<b>Division 5: Advancement of Knowledge</b>	<b>23 271</b>	<b>20 663</b>	<b>14 303</b>	<b>4 521</b>	<b>20 895</b>	<b>19 793</b>	<b>39 036</b>	<b>54 223</b>	<b>84 002</b>	<b>100 903</b>
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	459	486	452	632	13 166	7 754	31 450	42 017	69 845	90 114
Social sciences and humanities	22 812	20 177	13 851	3 889	7 729	12 039	7 586	12 206	14 157	10 789
<b>Total</b>	<b>223 203</b>	<b>240 649</b>	<b>188 840</b>	<b>162 830</b>	<b>170 605</b>	<b>503 833</b>	<b>583 165</b>	<b>778 772</b>	<b>891 142</b>	<b>1 017 616</b>

**Table C.88: Proportional not-for-profit sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Defence</b>	<b>0.6</b>	<b>0.9</b>	<b>0.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.1</b>	<b>0.0</b>	<b>0.0</b>
Defence	0.6	0.9	0.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0
<b>Division 2: Economic Development</b>	<b>28.4</b>	<b>29.0</b>	<b>38.1</b>	<b>40.4</b>	<b>35.6</b>	<b>22.0</b>	<b>19.5</b>	<b>19.6</b>	<b>17.7</b>	<b>12.7</b>
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	7.2	7.3	10.0	15.6	14.6	7.2	6.1	3.7	3.7	3.5
Animal production and animal primary products	0.4	0.4	0.9	0.9	0.5	0.5	0.5	0.5	0.9	1.0
Mineral resources (excluding Energy)	0.0	0.0	0.0	0.5	0.0	1.6	1.7	1.2	0.9	0.8
Energy resources	0.4	0.7	1.4	1.0	0.6	0.5	0.5	0.5	0.4	0.3
Energy supply	0.6	1.1	2.0	2.0	2.0	0.9	1.5	1.0	0.7	1.0
Manufacturing	0.0	0.0	0.0	0.0	1.3	0.8	0.5	3.4	3.6	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	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Information and communication services	0.0	0.0	0.0	0.0	0.9	0.4	0.3	0.0	0.3	0.0
Commercial services	0.4	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Economic framework	16.4	16.2	20.9	16.6	13.0	9.0	7.3	7.0	6.0	4.7
Natural resources	3.0	2.9	2.3	3.8	2.7	1.1	1.1	2.3	1.1	1.2



SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 3:</b>										
<b>Society</b>	<b>57.9</b>	<b>58.7</b>	<b>49.7</b>	<b>50.7</b>	<b>44.3</b>	<b>71.5</b>	<b>71.2</b>	<b>71.3</b>	<b>70.9</b>	<b>75.4</b>
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	15.0	15.6	8.8	9.2	7.9	51.7	52.0	57.7	59.2	65.6
Education and training	14.4	13.4	10.6	13.7	13.9	11.7	10.9	7.9	6.7	5.8
Social development and community services	28.4	29.7	30.4	27.7	22.5	8.1	8.2	5.7	5.0	4.0
<b>Division 4:</b>										
<b>Environment</b>	<b>2.6</b>	<b>2.9</b>	<b>3.7</b>	<b>6.2</b>	<b>7.8</b>	<b>2.5</b>	<b>2.6</b>	<b>2.1</b>	<b>2.0</b>	<b>1.9</b>
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	1.1	1.4	1.9	3.8	4.2	0.9	1.3	1.1	1.1	1.0
Environmental aspects of development	0.3	0.2	0.4	0.3	2.2	1.1	0.8	0.6	0.5	0.6
Environmental and other aspects	1.2	1.2	1.5	2.1	1.4	0.5	0.5	0.4	0.3	0.4
<b>Division 5:</b>										
<b>Advancement of Knowledge</b>	<b>10.4</b>	<b>8.6</b>	<b>7.6</b>	<b>2.8</b>	<b>12.2</b>	<b>3.9</b>	<b>6.7</b>	<b>7.0</b>	<b>9.4</b>	<b>9.9</b>
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	0.2	0.4	7.7	1.5	5.4	5.4	7.8	8.9
Social sciences and humanities	10.2	8.4	7.3	2.4	4.5	2.4	1.3	1.6	1.6	1.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.89: Not-for-profit sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	6 164	6 790	8 136	9 790	9 493	25 610	25 478	27 219	21 026	17 053
Free State	1 255	4 763	4 418	6 385	5 096	15 297	15 953	14 214	8 890	6 643
Gauteng	115 499	126 136	104 420	61 496	69 321	162 866	175 651	287 783	345 937	333 359
KwaZulu-Natal	42 141	40 492	30 548	35 765	33 740	163 221	166 603	181 052	232 636	277 770
Limpopo	4 602	5 138	4 524	4 541	7 449	11 779	13 719	49 971	56 143	64 105
Mpumalanga	9 930	10 332	8 311	13 206	16 027	23 195	26 979	30 594	25 944	29 964
North-West	2 207	2 339	2 382	5 612	6 353	42 960	72 446	105 904	97 918	136 641
Northern Cape	2 038	2 159	4 493	2 030	1 889	3 867	3 583	1 546	2 200	4 782
Western Cape	39 367	42 500	21 609	24 003	21 236	55 038	82 753	80 489	100 448	147 299
<b>Total</b>	<b>223 203</b>	<b>240 649</b>	<b>188 840</b>	<b>162 830</b>	<b>170 605</b>	<b>503 833</b>	<b>583 165</b>	<b>778 772</b>	<b>891 142</b>	<b>1 017 616</b>

**Table C.90: Proportional not-for-profit sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.8	2.8	4.3	6.0	5.6	5.1	4.4	3.5	2.4	1.7
Free State	0.6	2.0	2.3	3.9	3.0	3.0	2.7	1.8	1.0	0.7
Gauteng	51.7	52.4	55.3	37.8	40.6	32.3	30.1	37.0	38.8	32.8
KwaZulu-Natal	18.9	16.8	16.2	22.0	19.8	32.4	28.6	23.2	26.1	27.3
Limpopo	2.1	2.1	2.4	2.8	4.4	2.3	2.4	6.4	6.3	6.3
Mpumalanga	4.4	4.3	4.4	8.1	9.4	4.6	4.6	3.9	2.9	2.9
North-West	1.0	0.9	2.4	3.4	1.1	8.5	12.4	13.6	11.0	13.4
Northern Cape	0.9	1.0	1.3	1.2	3.7	0.8	0.6	0.2	0.2	0.5
Western Cape	17.6	17.7	11.4	14.7	12.4	10.9	14.2	10.3	11.3	14.5
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.91: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation (2007/08 to 2016/17)**

YEAR	HEADCOUNTS				FULL TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2007/08	502	264	77	161	379.1	215.6	56.5	107.0
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

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.92: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15 to 2016/17)**

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
<b>2014/15</b>							
Researchers	506	234	272	396.0	177.1	218.9	78.3
Technicians directly supporting R&D	368	116	252	355.5	110.0	245.5	96.6
Other personnel directly supporting R&D	597	167	430	479.8	123.4	356.3	80.4
<b>Total</b>	<b>1 471</b>	<b>517</b>	<b>954</b>	<b>1 231.2</b>	<b>410.5</b>	<b>820.7</b>	<b>83.7</b>
<b>2015/16</b>							
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
<b>Total</b>	<b>1 493</b>	<b>499</b>	<b>994</b>	<b>1 367.3</b>	<b>436.7</b>	<b>930.5</b>	<b>91.6</b>
<b>2016/17</b>							
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
<b>Total</b>	<b>1 616</b>	<b>525</b>	<b>1 091</b>	<b>1 469.5</b>	<b>464.3</b>	<b>1 005.2</b>	<b>90.9</b>

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.93: Not-for-profit sector R&D personnel in headcounts by occupation, qualification, population group and gender (2016/17)**

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
<b>Researchers</b>	<b>404</b>	<b>187</b>	<b>217</b>	<b>64</b>	<b>74</b>	<b>5</b>	<b>18</b>	<b>16</b>	<b>31</b>	<b>89</b>	<b>73</b>	<b>13</b>	<b>21</b>
Doctoral degree or equivalent	118	70	48	20	9	0	6	6	9	42	14	2	10
Master's, honours, bachelor or equivalent	260	107	153	39	57	3	9	10	21	46	55	9	11
Diplomas	26	10	16	5	8	2	3	0	1	1	4	2	0
<b>Technicians directly supporting R&amp;D</b>	<b>607</b>	<b>174</b>	<b>433</b>	<b>133</b>	<b>315</b>	<b>3</b>	<b>18</b>	<b>8</b>	<b>54</b>	<b>25</b>	<b>38</b>	<b>5</b>	<b>8</b>
Doctoral degree or equivalent	2	2	0	0	0	0	0	0	0	2	0	0	0
Master's, honours, bachelor or equivalent	204	46	158	25	70	1	13	5	44	14	25	1	6
Diplomas	401	126	275	108	245	2	5	3	10	9	13	4	2
<b>Other personnel directly supporting R&amp;D</b>	<b>605</b>	<b>164</b>	<b>441</b>	<b>122</b>	<b>313</b>	<b>3</b>	<b>19</b>	<b>13</b>	<b>42</b>	<b>16</b>	<b>60</b>	<b>10</b>	<b>7</b>
Doctoral degree or equivalent	3	0	3	0	0	0	0	0	2	0	0	0	1
Master's, honours, bachelor or equivalent	123	28	95	16	43	0	3	3	21	7	26	2	2
Diplomas	479	136	343	106	270	3	16	10	19	9	34	8	4
<b>Total</b>	<b>1 616</b>	<b>525</b>	<b>1 091</b>	<b>319</b>	<b>702</b>	<b>11</b>	<b>55</b>	<b>37</b>	<b>127</b>	<b>130</b>	<b>171</b>	<b>28</b>	<b>36</b>

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.

### C.2.3. Government sector

**Table C.94: Government sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Basic research	322 270	357 786	257 806	257 235	263 380	331 587	245 167	338 250	358 666	348 775
Applied research	599 162	601 688	621 762	600 205	812 067	873 469	1 194 866	1 292 421	1 390 221	1 444 821
Experimental research	232 967	180 202	187 734	153 900	160 223	232 453	257 118	262 339	264 134	305 051
<b>Total</b>	<b>1 154 399</b>	<b>1 139 676</b>	<b>1 067 302</b>	<b>1 011 340</b>	<b>1 235 669</b>	<b>1 437 509</b>	<b>1 697 151</b>	<b>1 893 010</b>	<b>2 013 021</b>	<b>2 098 646</b>

**Table C.95: Proportional government sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
Basic research	27.9	31.4	24.2	25.4	21.3	23.1	14.4	17.9	17.8	16.6
Applied research	51.9	52.8	58.3	59.3	65.7	60.8	70.4	68.3	69.1	68.8
Experimental research	20.2	15.8	17.6	15.2	13.0	16.2	15.1	13.9	13.1	14.5
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.96: Government sector R&D expenditure by spheres and institutes of government and accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Municipalities</b>	N/A	N/A	N/A	N/A	14 959	65 541	59 418	62 485	61 703	76 493
Capital expenditure	N/A	N/A	N/A	N/A	144	18 605	23 033	12 921	13 059	20 271
Land: buildings and other structures	N/A	N/A	N/A	N/A	0	5 400	10 000	6 537	6 598	9 575
Vehicles, plant, machinery, equipment	N/A	N/A	N/A	N/A	144	13 205	13 033	6 384	6 461	10 696
Current expenditure	N/A	N/A	N/A	N/A	14 815	46 936	36 385	49 564	48 644	56 222
Labour costs	N/A	N/A	N/A	N/A	12 715	30 131	27 513	39 314	38 687	41 407
Other current expenditure	N/A	N/A	N/A	N/A	2 100	16 805	8 872	10 250	9 957	14 815
<b>Provincial departments</b>	253 418	232 062	245 031	284 539	335 607	372 231	390 301	421 126	401 512	405 760
Capital expenditure	37 336	24 249	39 748	30 475	42 895	45 895	45 930	39 325	43 918	48 084
Land: buildings and other structures	8 681	2 515	11 238	13 022	10 674	7 255	6 348	5 500	7 900	12 264
Vehicles, plant, machinery, equipment	28 655	21 734	28 510	17 453	32 221	38 640	39 582	33 825	36 018	35 820
Current expenditure	216 082	207 813	205 283	254 064	292 712	326 336	344 371	381 801	357 594	357 676
Labour costs	135 695	129 187	138 397	182 175	206 583	236 367	233 321	248 823	225 621	252 286
Other current expenditure	80 387	78 626	66 886	71 889	86 129	89 969	111 050	132 978	131 973	105 390
<b>National departments</b>	499 085	287 333	240 412	211 176	280 005	321 632	249 705	248 041	356 575	408 803
Capital expenditure	22 507	9 340	2 022	38 629	31 879	32 669	17 540	4 406	57 905	56 999
Land: buildings and other structures	0	1 107	500	3 657	11 820	12 783	2 122	811	18 037	6 424
Vehicles, plant, machinery, equipment	22 507	8 233	1 522	34 972	20 059	19 886	15 418	3 595	39 868	50 575
Current expenditure	476 578	277 993	238 390	172 547	248 126	288 963	232 165	243 635	298 670	351 804
Labour costs	120 257	98 791	81 619	144 779	140 146	158 808	198 440	150 921	171 849	216 103
Other current expenditure	356 321	179 202	156 771	27 768	107 980	130 155	33 725	92 714	126 821	135 701
<b>Government research institutes</b>	365 468	579 395	553 651	483 999	573 698	644 360	973 807	1 134 875	1 165 161	1 179 994
Capital expenditure	38 837	49 345	168 544	113 395	35 071	157 221	98 010	233 386	202 878	199 952
Land: buildings and other structures	10 225	9 955	115 101	43 360	2 487	58 280	4 542	93 477	112 710	107 971
Vehicles, plant, machinery, equipment	28 612	39 390	53 443	70 035	32 584	98 941	93 468	139 909	90 168	91 981
Current expenditure	326 631	530 050	385 107	370 604	538 627	487 139	875 797	901 489	962 283	980 042
Labour costs	183 167	224 691	245 767	269 965	316 835	355 503	316 256	375 939	311 876	323 121
Other current expenditure	143 464	305 359	139 340	100 639	221 792	131 636	559 541	525 550	650 407	656 921
<b>Museums</b>	36 428	40 886	28 208	31 626	31 400	33 745	23 920	26 484	28 070	27 596
Capital expenditure	1 644	4 002	4 087	3 699	3 256	649	946	1 996	2 005	2 704
Land: buildings and other structures	460	2 331	2 491	2 141	2 337	30	638	687	663	774
Vehicles, plant, machinery, equipment	1 184	1 671	1 596	1 558	919	619	308	1 309	1 342	1 930
Current expenditure	34 784	36 884	24 121	27 927	28 144	33 096	22 974	24 488	26 065	24 892
Labour costs	25 041	27 141	17 839	20 814	21 413	25 471	20 769	22 429	23 751	24 004
Other current expenditure	9 743	9 743	6 282	7 113	6 731	7 625	2 205	2 059	2 314	888
<b>Government sector</b>	1 154 399	1 139 676	1 067 302	1 011 340	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646
Capital expenditure	100 324	86 936	214 401	186 198	113 245	255 039	185 459	292 034	319 765	328 010
Land: buildings and other structures	19 366	15 908	129 330	62 180	27 318	83 748	23 650	107 012	145 908	137 008
Vehicles, plant, machinery, equipment	80 958	71 028	85 071	124 018	85 927	171 291	161 809	185 022	173 857	191 002
Current expenditure	1 054 075	1 052 740	852 901	825 142	1 122 424	1 182 470	1 511 692	1 600 976	1 693 256	1 770 636
Labour costs	464 160	479 810	483 622	617 733	697 692	806 280	796 299	837 425	771 784	856 921
Other current expenditure	589 915	572 930	369 279	207 409	424 732	376 190	715 393	763 551	921 472	913 715

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 (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Municipalities</b>	N/A	N/A	N/A	N/A	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	N/A	N/A	N/A	N/A	1.0	28.4	38.8	20.7	21.2	26.5
Land: buildings and other structures	N/A	N/A	N/A	N/A	0.0	8.2	16.8	10.5	10.7	12.5
Vehicles, plant, machinery, equipment	N/A	N/A	N/A	N/A	1.0	20.1	21.9	10.2	10.5	14.0
Current expenditure	N/A	N/A	N/A	N/A	99.0	71.6	61.2	79.3	78.8	73.5
Labour costs	N/A	N/A	N/A	N/A	85.0	46.0	46.3	62.9	62.7	54.1
Other current expenditure	N/A	N/A	N/A	N/A	14.0	25.6	14.9	16.4	16.1	19.4
<b>Provincial departments</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	14.7	10.4	16.2	10.7	12.8	12.3	11.8	9.3	10.9	11.9
Land: buildings and other structures	3.4	1.1	4.6	4.6	3.2	1.9	1.6	1.3	2.0	3.0
Vehicles, plant, machinery, equipment	11.3	9.4	11.6	6.1	9.6	10.4	10.1	8.0	9.0	8.8
Current expenditure	85.3	89.6	83.8	89.3	87.2	87.7	88.2	90.7	89.1	88.1
Labour costs	53.5	55.7	56.5	64.0	61.6	63.5	59.8	59.1	56.2	62.2
Other current expenditure	31.7	33.9	27.3	25.3	25.7	24.2	28.5	31.6	32.9	26.0
<b>National departments</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	4.5	3.3	0.8	18.3	11.4	10.2	7.0	1.8	16.2	13.9
Land: buildings and other structures	0.0	0.4	0.2	1.7	4.2	4.0	0.8	0.3	5.1	1.6
Vehicles, plant, machinery, equipment	4.5	2.9	0.6	16.6	7.2	6.2	6.2	1.4	11.2	12.4
Current expenditure	95.5	96.7	99.2	81.7	88.6	89.8	93.0	98.2	83.8	86.1
Labour costs	24.1	34.4	33.9	68.6	50.1	49.4	79.5	60.8	48.2	52.9
Other current expenditure	71.4	62.4	65.2	13.1	38.6	40.5	13.5	37.4	35.6	33.2
<b>Government research institutes</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	10.6	8.5	30.4	23.4	6.1	24.4	10.1	20.6	17.4	16.9
Land: buildings and other structures	2.8	1.7	20.8	9.0	0.4	9.0	0.5	8.2	9.7	9.2
Vehicles, plant, machinery, equipment	7.8	6.8	9.7	14.5	5.7	15.4	9.6	12.3	7.7	7.8
Current expenditure	89.4	91.5	69.6	76.6	93.9	75.6	89.9	79.4	82.6	83.1
Labour costs	50.1	38.8	44.4	55.8	55.2	55.2	32.5	33.1	26.8	27.4
Other current expenditure	39.3	52.7	25.2	20.8	38.7	20.4	57.5	46.3	55.8	55.7
<b>Museums</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	4.5	9.8	14.5	11.7	10.4	1.9	4.0	7.5	7.1	9.8
Land: buildings and other structures	1.3	5.7	8.8	6.8	7.4	0.1	2.7	2.6	2.4	2.8
Vehicles, plant, machinery, equipment	3.3	4.1	5.7	4.9	2.9	1.8	1.3	4.9	4.8	7.0
Current expenditure	95.5	90.2	85.5	88.3	89.6	98.1	96.0	92.5	92.9	90.2
Labour costs	68.7	66.4	63.2	65.8	68.2	75.5	86.8	84.7	84.6	87.0
Other current expenditure	26.7	23.8	22.3	22.5	21.4	22.6	9.2	7.8	8.2	3.2
<b>Government sector</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	8.7	7.6	20.1	18.4	9.2	17.7	10.9	15.4	15.9	15.6
Land: buildings and other structures	1.7	1.4	12.1	6.1	2.2	5.8	1.4	5.7	7.2	6.5
Vehicles, plant, machinery, equipment	7.0	6.2	8.0	12.3	7.0	11.9	9.5	9.8	8.6	9.1
Current expenditure	91.3	92.4	79.9	81.6	90.8	82.3	89.1	84.6	84.1	84.4
Labour costs	40.2	42.1	45.3	61.1	56.5	56.1	46.9	44.2	38.3	40.8
Other current expenditure	51.1	50.3	34.6	20.5	34.4	26.2	42.2	40.3	45.8	43.5

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 (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	8 639	21 729	32 496	213 817	81 993	124 429	97 816	85 385	81 409	87 557
Nanotechnology	0	4 652	0	4 196	4 609	15 035	16 929	13 112	11 774	12 620
<b>Total</b>	<b>8 639</b>	<b>26 381</b>	<b>32 496</b>	<b>218 013</b>	<b>86 602</b>	<b>139 464</b>	<b>114 745</b>	<b>98 497</b>	<b>93 183</b>	<b>100 176</b>
Government expenditure on R&D	1 154 399	1 139 676	1 067 302	1 011 340	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646

**Table C.99: Proportional government sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Biotechnology	0.7	1.9	3.0	21.1	6.6	8.7	5.8	4.5	4.0	4.2
Nanotechnology	0.0	0.4	0.0	0.4	0.4	1.0	1.0	0.7	0.6	0.6
<b>Total</b>	<b>0.7</b>	<b>2.3</b>	<b>3.0</b>	<b>21.6</b>	<b>7.0</b>	<b>9.7</b>	<b>6.8</b>	<b>5.2</b>	<b>4.6</b>	<b>4.8</b>

**Table C.100: Government sector R&D expenditure on selected areas of interest (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment related	N/A	N/A	N/A	N/A	109 774	170 304	194 564	232 090	192 774	202 351
Open-source software	21 494	4 658	7 238	7 261	1 345	1 501	0	0	0	0
New materials	630	726	7 156	26 166	4 107	28 708	30 945	12 062	5 291	6 143
Tuberculosis (TB), HIV/AIDS, malaria	263	240	199 977	174 382	167 522	132 264	380 640	359 074	389 279	395 996
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	39 882
<b>Total</b>	<b>22 387</b>	<b>5 624</b>	<b>214 371</b>	<b>207 809</b>	<b>282 748</b>	<b>332 777</b>	<b>411 585</b>	<b>371 135</b>	<b>587 343</b>	<b>644 372</b>
Government expenditure on R&D	1 154 399	1 139 676	1 067 302	1 011 340	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environment related	N/A	N/A	N/A	N/A	8.9	11.8	11.5	12.3	9.6	9.6
Open-source software	1.9	0.4	0.7	0.7	0.1	0.1	0.0	0.0	0.0	0.0
New materials	0.1	0.1	0.7	2.6	0.3	2.0	1.8	0.6	0.3	0.3
Tuberculosis (TB), HIV/AIDS, malaria	0.0	0.0	18.7	17.2	13.6	9.2	22.4	19.0	19.3	18.9
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.9
<b>Total</b>	<b>1.9</b>	<b>0.5</b>	<b>20.1</b>	<b>20.5</b>	<b>22.9</b>	<b>23.1</b>	<b>24.3</b>	<b>19.6</b>	<b>29.2</b>	<b>30.7</b>

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&amp;D expenditure by research field (2007/08 to 2016/17)

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>874 425</b>	<b>824 394</b>	<b>806 995</b>	<b>634 237</b>	<b>863 949</b>	<b>1 045 006</b>	<b>1 359 179</b>	<b>1 558 094</b>	<b>1 520 894</b>	<b>1 560 315</b>
Mathematical sciences	20 643	20 704	24 441	22 811	2 349	1 076	1 525	28 302	397	539
Physical sciences	45 052	45 804	12 093	0	0	5 064	0	30 154	26 455	28 529
Chemical sciences	22 672	17 009	21 698	10 653	1 223	21 823	19 394	61 881	61 688	68 937
Earth sciences	161 815	163 156	47 624	42 081	39 303	90 571	65 501	139 388	79 942	85 550
Information, computer and communication technologies	82 123	22 191	28 176	31 960	15 642	7 760	8 431	12 141	4 662	5 540
Applied sciences and technologies	15 286	15 852	9 315	4 154	10 183	32 467	23 216	29 723	22 531	25 444
Engineering sciences	14 164	11 487	14 996	4 165	4 515	10 430	11 853	13 176	12 129	13 572
Biological sciences	113 409	125 152	54 893	85 990	94 662	111 871	138 000	152 735	196 053	195 922
Agricultural sciences	208 662	200 598	274 781	225 441	362 241	460 921	397 687	506 445	471 798	485 417
Medical and health sciences	173 929	180 260	288 488	168 400	270 312	211 840	594 684	553 534	608 530	615 067
Environmental sciences	8 589	11 675	10 722	9 147	34 231	54 394	55 245	14 353	14 478	13 921
Material sciences	637	640	0	0	4 107	9 771	10 537	0	0	0
Marine sciences	7 445	9 866	19 768	29 434	25 182	27 019	33 106	16 262	22 232	21 877
<b>Division 2: Social Sciences and Humanities</b>	<b>279 974</b>	<b>315 282</b>	<b>260 308</b>	<b>377 103</b>	<b>371 720</b>	<b>392 503</b>	<b>337 972</b>	<b>334 916</b>	<b>492 127</b>	<b>538 331</b>
Social sciences	235 299	268 058	249 155	363 055	358 892	383 172	326 603	328 522	479 316	529 080
Humanities	44 676	47 225	11 152	14 048	12 828	9 331	11 369	6 394	12 811	9 251
<b>Total</b>	<b>1 154 399</b>	<b>1 139 676</b>	<b>1 067 302</b>	<b>1 011 340</b>	<b>1 235 669</b>	<b>1 437 509</b>	<b>1 697 151</b>	<b>1 893 010</b>	<b>2 013 021</b>	<b>2 098 646</b>

Table C.103: Proportional government sector R&amp;D expenditure by research field (2007/08 to 2016/17)

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>75.7</b>	<b>72.3</b>	<b>75.6</b>	<b>62.7</b>	<b>69.9</b>	<b>72.7</b>	<b>80.1</b>	<b>82.3</b>	<b>75.6</b>	<b>74.3</b>
Mathematical sciences	1.8	1.8	2.3	2.3	0.2	0.1	0.1	1.5	0.0	0.0
Physical sciences	3.9	4.0	1.1	0.0	0.0	0.4	0.0	1.6	1.3	1.4
Chemical sciences	2.0	1.5	2.0	1.1	0.1	1.5	1.1	3.3	3.1	3.3
Earth sciences	14.0	14.3	4.5	4.2	3.2	6.3	3.9	7.4	4.0	4.1

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Information, computer and communication technologies	7.1	1.9	2.6	3.2	1.3	0.5	0.5	0.6	0.2	0.3
Applied sciences and technologies	1.3	1.4	0.9	0.4	0.8	2.3	1.4	1.6	1.1	1.2
Engineering sciences	1.2	1.0	1.4	0.4	0.4	0.7	0.7	0.7	0.6	0.6
Biological sciences	9.8	11.0	5.1	8.5	7.7	7.8	8.1	8.1	9.7	9.3
Agricultural sciences	18.1	17.6	25.7	22.3	29.3	32.1	23.4	26.8	23.4	23.1
Medical and health sciences	15.1	15.8	27.0	16.7	21.9	14.7	35.0	29.2	30.2	29.3
Environmental sciences	0.7	1.0	1.0	0.9	2.8	3.8	3.3	0.8	0.7	0.7
Material sciences	0.1	0.1	0.0	0.0	0.3	0.7	0.6	0.0	0.0	0.0
Marine sciences	0.6	0.9	1.9	2.9	2.0	1.9	2.0	0.9	1.1	1.0
<b>Division 2: Social Sciences and Humanities</b>	<b>24.3</b>	<b>27.7</b>	<b>24.4</b>	<b>37.3</b>	<b>30.1</b>	<b>27.3</b>	<b>19.9</b>	<b>17.7</b>	<b>24.4</b>	<b>25.7</b>
Social sciences	20.4	23.5	23.3	35.9	29.0	26.7	19.2	17.4	23.8	25.2
Humanities	3.9	4.1	1.0	1.4	1.0	0.6	0.7	0.3	0.6	0.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.104: Government sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Division 1:</b>										
Defence	0	0	0	2 303	2 736	19 314	21 118	21 472	42 233	34 213
Defence	0	0	0	2 303	2 736	19 314	21 118	21 472	42 233	34 213
<b>Division 2:</b>										
<b>Economic Development</b>	<b>429 646</b>	<b>373 251</b>	<b>438 114</b>	<b>500 343</b>	<b>469 129</b>	<b>480 373</b>	<b>510 688</b>	<b>763 932</b>	<b>745 129</b>	<b>826 860</b>
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	79 290	66 503	63 570	64 400	70 754	100 956	89 446	107 672	92 506	103 212
Animal production and animal primary products	79 997	78 619	84 842	91 877	86 710	93 504	137 279	156 437	125 737	134 227
Mineral resources (excluding Energy)	0	0	0	0	0	0	311	5 403	6 548	2 854
Energy resources	0	0	0	37	0	0	1 023	12 062	5 291	5 716
Energy supply	14 290	12 387	2 522	6 154	10 552	7 193	8 482	34 845	29 705	32 772
Manufacturing	318	320	5 444	15 870	1 005	1 557	1 544	79 583	1 318	5 201
Construction	3 219	2 484	0	148	9 545	543	741	4 312	1 394	1 501
Transport	15 386	12 073	4 369	9 377	10 964	8 774	1 672	24 105	21 537	24 896



<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>	<b>R'000</b>
Information and communication services	69 318	11 965	13 244	44 257	20 590	5 678	5 515	14 397	7 977	6 071
Commercial services	6 897	2 405	9 957	7 471	4 708	3 587	12 162	15 532	13 531	12 616
Economic framework	98 537	105 080	161 326	187 931	157 364	161 541	116 604	167 690	262 289	343 537
Natural resources	62 394	81 415	92 838	72 820	96 938	97 042	135 909	141 895	177 298	154 258
<b>Division 3:</b>										
<b>Society</b>	<b>265 948</b>	<b>285 961</b>	<b>326 691</b>	<b>341 387</b>	<b>538 749</b>	<b>592 285</b>	<b>872 096</b>	<b>912 216</b>	<b>952 108</b>	<b>951 859</b>
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	69 493	74 784	77 845	106 522	221 435	171 741	487 130	475 983	482 472	511 031
Education and training	111 407	127 907	158 579	42 234	69 185	116 788	165 906	174 540	209 544	169 499
Social development and community services	85 048	83 270	90 268	192 630	248 129	303 756	219 061	261 693	260 092	271 328
<b>Division 4:</b>										
<b>Environment</b>	<b>103 372</b>	<b>99 985</b>	<b>72 614</b>	<b>85 347</b>	<b>130 742</b>	<b>199 677</b>	<b>172 006</b>	<b>127 394</b>	<b>191 334</b>	<b>204 573</b>
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	71 734	83 429	45 360	40 610	83 089	137 679	124 445	91 677	107 265	116 996
Environmental aspects of development	20 797	12 424	18 153	27 635	38 467	51 795	38 877	27 206	53 541	55 508
Environmental and other aspects	10 841	4 132	9 101	17 102	9 186	10 204	8 684	8 511	30 528	32 069
<b>Division 5:</b>										
<b>Advancement of Knowledge</b>	<b>355 434</b>	<b>380 480</b>	<b>229 883</b>	<b>81 960</b>	<b>94 314</b>	<b>145 860</b>	<b>121 243</b>	<b>67 996</b>	<b>82 217</b>	<b>81 141</b>
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	324 409	333 561	205 995	50 968	61 357	120 173	96 381	43 170	58 401	57 655
Social sciences and humanities	31 025	46 919	23 888	30 992	32 956	25 687	24 862	24 825	23 816	23 486
<b>Total</b>	<b>1 154 400</b>	<b>1 139 676</b>	<b>1 067 302</b>	<b>1 011 340</b>	<b>1 235 669</b>	<b>1 437 509</b>	<b>1 697 151</b>	<b>1 893 010</b>	<b>2 013 021</b>	<b>2 098 646</b>

**Table C.105: Proportional government sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
%	%	%	%	%	%	%	%	%	%	%
<b>Division 1:</b>										
<b>Defence</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.2</b>	<b>0.2</b>	<b>1.3</b>	<b>1.2</b>	<b>1.1</b>	<b>2.1</b>	<b>1.6</b>
Defence	0.0	0.0	0.0	0.2	0.2	1.3	1.2	1.1	2.1	1.6
<b>Division 2:</b>										
<b>Economic Development</b>	<b>37.2</b>	<b>32.8</b>	<b>41.0</b>	<b>49.5</b>	<b>38.0</b>	<b>33.4</b>	<b>30.1</b>	<b>40.4</b>	<b>37.0</b>	<b>39.4</b>
Economic Development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	6.9	5.8	6.0	6.4	5.7	7.0	5.3	5.7	4.6	4.9
Animal production and animal primary products	6.9	6.9	7.9	9.1	7.0	6.5	8.1	8.3	6.2	6.4
Mineral resources (excluding Energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.1
Energy resources	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.3	0.3
Energy supply	1.2	1.1	0.2	0.6	0.9	0.5	0.5	1.8	1.5	1.6
Manufacturing	0.0	0.0	0.5	1.6	0.1	0.1	0.1	4.2	0.1	0.2
Construction	0.3	0.2	0.0	0.0	0.8	0.0	0.0	0.2	0.1	0.1
Transport	1.3	1.1	0.4	0.9	0.9	0.6	0.1	1.3	1.1	1.2
Information and communication services	6.0	1.0	1.2	4.4	1.7	0.4	0.3	0.8	0.4	0.3
Commercial services	0.6	0.2	0.9	0.7	0.4	0.2	0.7	0.8	0.7	0.6
Economic framework	8.5	9.2	15.1	18.6	12.7	11.2	6.9	8.9	13.0	16.4
Natural resources	5.4	7.1	8.7	7.2	7.8	6.8	8.0	7.5	8.8	7.4
<b>Division 3:</b>										
<b>Society</b>	<b>23.0</b>	<b>25.1</b>	<b>30.6</b>	<b>33.8</b>	<b>43.6</b>	<b>41.2</b>	<b>51.4</b>	<b>48.2</b>	<b>47.3</b>	<b>45.4</b>
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	6.0	6.6	7.3	10.5	17.9	11.9	28.7	25.1	24.0	24.4
Education and training	9.7	11.2	14.9	4.2	5.6	8.1	9.8	9.2	10.4	8.1
Social development and community services	7.4	7.3	8.5	19.0	20.1	21.1	12.9	13.8	12.9	12.9
<b>Division 4:</b>										
<b>Environment</b>	<b>9.0</b>	<b>8.8</b>	<b>6.8</b>	<b>8.4</b>	<b>10.6</b>	<b>13.9</b>	<b>10.1</b>	<b>6.7</b>	<b>9.5</b>	<b>9.7</b>
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	6.2	7.3	4.2	4.0	6.7	9.6	7.3	4.8	5.3	5.6
Environmental aspects of development	1.8	1.1	1.7	2.7	3.1	3.6	2.3	1.4	2.7	2.6





SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.9	0.4	0.9	1.7	0.7	0.7	0.5	0.4	1.5	1.5
Division 5: Advancement of Knowledge	30.8	33.4	21.5	8.1	7.6	10.1	7.1	3.6	4.1	3.9
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	28.1	29.3	19.3	5.0	5.0	8.4	5.7	2.3	2.9	2.7
Social sciences and humanities	2.7	4.1	2.2	3.1	2.7	1.8	1.5	1.3	1.2	1.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.106: Government sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	122 191	107 929	100 100	114 127	127 415	194 258	133 657	227 427	225 603	222 456
Free State	62 116	58 697	46 155	39 998	44 200	38 659	55 095	60 860	61 802	81 957
Gauteng	292 757	264 273	396 124	343 096	447 635	427 173	689 915	760 199	832 397	885 142
KwaZulu-Natal	76 458	115 302	54 914	48 056	126 857	168 029	161 962	177 517	187 088	172 655
Limpopo	40 217	55 252	60 421	57 797	65 017	74 621	95 668	83 683	84 232	76 541
Mpumalanga	74 690	39 103	68 796	69 980	78 335	80 201	77 479	93 566	112 173	107 237
North-West	42 500	70 741	29 176	43 048	44 618	45 573	73 576	56 719	61 815	57 994
Northern Cape	66 921	52 907	77 978	58 918	63 556	75 440	61 932	52 579	69 174	66 200
Western Cape	376 550	375 473	233 639	236 320	238 035	333 555	347 869	380 461	378 737	428 465
<b>Total</b>	<b>1 154 399</b>	<b>1 139 676</b>	<b>1 067 302</b>	<b>1 011 340</b>	<b>1 235 669</b>	<b>1 437 509</b>	<b>1 697 151</b>	<b>1 893 010</b>	<b>2 013 021</b>	<b>2 098 646</b>

**Table C.107: Proportional government sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	10.6	9.5	9.4	11.3	10.3	13.5	7.9	12.0	11.2	10.6
Free State	5.4	5.2	4.3	4.0	3.6	2.7	3.2	3.2	3.1	3.9
Gauteng	25.4	23.2	37.1	33.9	36.2	29.7	40.7	40.2	41.4	42.2
KwaZulu-Natal	6.6	10.1	5.1	4.8	10.3	11.7	9.5	9.4	9.3	8.2
Limpopo	3.5	4.8	5.7	5.7	5.3	5.2	5.6	4.4	4.2	3.6
Mpumalanga	6.5	3.4	6.4	6.9	6.3	5.6	4.6	4.9	5.6	5.1
North-West	3.7	6.2	2.7	4.3	3.6	3.2	4.3	3.0	3.1	2.8
Northern Cape	5.8	4.6	7.3	5.8	5.1	5.2	3.6	2.8	3.4	3.2
Western Cape	32.6	32.9	21.9	23.4	19.3	23.2	20.5	20.1	18.8	20.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.108: Government sector R&D personnel in headcounts and full-time equivalents by occupation (2007/08 to 2016/17)**

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2007/08	2 794	1 138	739	917	1 950.0	757.6	495.6	696.9
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

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

**Table C.109: Government sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15, 2015/16 and 2016/17)**

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
<b>2014/15</b>							
Researchers	1 343	615	728	970.0	460.1	509.9	72.2
Technicians directly supporting R&D	550	298	252	337.9	200.1	137.8	61.4
Other personnel directly supporting R&D	1 000	680	320	873.5	617.6	255.9	87.3
<b>Total</b>	<b>2 893</b>	<b>1 593</b>	<b>1 300</b>	<b>2 181.5</b>	<b>1 277.8</b>	<b>903.6</b>	<b>75.4</b>
<b>2015/16</b>							
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
<b>Total</b>	<b>2 997</b>	<b>1 593</b>	<b>1 404</b>	<b>2 056.2</b>	<b>1 169.5</b>	<b>886.7</b>	<b>68.6</b>
<b>2016/17</b>							
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
<b>Total</b>	<b>3 076</b>	<b>1 625</b>	<b>1 451</b>	<b>2 031.6</b>	<b>1 157.9</b>	<b>873.7</b>	<b>66.0</b>

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.110: Government sector R&D personnel in headcounts by occupation, qualification, population group and gender (2016/17)**

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
<b>Researchers</b>	<b>1 677</b>	<b>774</b>	<b>903</b>	<b>427</b>	<b>501</b>	<b>51</b>	<b>64</b>	<b>42</b>	<b>78</b>	<b>248</b>	<b>258</b>	<b>6</b>	<b>2</b>
Doctoral degree or equivalent	288	157	131	46	21	9	6	13	15	86	89	3	0
Master's, honours, bachelor or equivalent	1 337	589	748	367	461	37	56	28	63	154	167	3	1
Diplomas	52	28	24	14	19	5	2	1	0	8	2	0	1
<b>Technicians directly supporting R&amp;D</b>	<b>538</b>	<b>283</b>	<b>255</b>	<b>181</b>	<b>157</b>	<b>35</b>	<b>29</b>	<b>8</b>	<b>11</b>	<b>59</b>	<b>58</b>	<b>0</b>	<b>0</b>
Doctoral degree or equivalent	4	2	2	1	0	0	0	0	1	1	1	0	0
Master's, honours, bachelor or equivalent	306	149	157	105	99	9	14	6	8	29	36	0	0
Diplomas	228	132	96	75	58	26	15	2	2	29	21	0	0
<b>Other personnel directly supporting R&amp;D</b>	<b>861</b>	<b>568</b>	<b>293</b>	<b>407</b>	<b>190</b>	<b>134</b>	<b>53</b>	<b>3</b>	<b>5</b>	<b>24</b>	<b>41</b>	<b>0</b>	<b>4</b>
Doctoral degree or equivalent	2	0	2	0	0	0	0	0	0	0	2	0	0
Master's, honours, bachelor or equivalent	68	33	35	20	17	4	6	2	1	7	11	0	0
Diplomas	791	535	256	387	173	130	47	1	4	17	28	0	4
<b>Total</b>	<b>3 076</b>	<b>1 625</b>	<b>1 451</b>	<b>1 015</b>	<b>848</b>	<b>220</b>	<b>146</b>	<b>53</b>	<b>94</b>	<b>331</b>	<b>357</b>	<b>6</b>	<b>6</b>

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.

## C.2.4. Science councils sector

**Table C.111: Science councils sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	804 731	776 406	776 505	871 635	900 830	937 826	970 785	1 166 491	1 348 533	1 372 702
Applied research	1 314 770	1 384 860	1 552 560	1 531 563	1 756 157	1 885 484	2 114 943	2 421 309	2 781 198	3 202 019
Experimental research	766 593	976 077	1 129 009	1 192 825	1 072 693	1 202 689	1 218 827	1 416 869	1 611 166	1 561 462
<b>Total</b>	<b>2 886 094</b>	<b>3 137 343</b>	<b>3 458 074</b>	<b>3 596 023</b>	<b>3 729 680</b>	<b>4 025 998</b>	<b>4 304 556</b>	<b>5 004 669</b>	<b>5 740 897</b>	<b>6 136 183</b>

**Table C.112: Proportional science councils sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Basic research	27.9	24.7	22.5	24.2	24.2	23.3	22.6	23.3	23.5	22.4
Applied research	45.6	44.1	44.9	42.6	47.1	46.8	49.1	48.4	48.4	52.2
Experimental research	26.6	31.1	32.6	33.2	28.8	29.9	28.3	28.3	28.1	25.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



**Table C.113: Science councils sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Capital expenditure</b>	<b>205 857</b>	<b>383 927</b>	<b>452 801</b>	<b>291 830</b>	<b>323 070</b>	<b>275 750</b>	<b>323 190</b>	<b>598 429</b>	<b>916 480</b>	<b>857 241</b>
Land: buildings & other structures	30 704	61 063	107 455	56 141	65 442	68 565	71 602	362 246	162 904	211 246
Vehicles, plant, machinery, equipment	175 153	322 864	345 346	235 689	257 628	207 185	251 588	236 183	753 576	645 995
<b>Current expenditure</b>	<b>2 680 237</b>	<b>2 753 416</b>	<b>3 005 273</b>	<b>3 304 193</b>	<b>3 406 610</b>	<b>3 750 248</b>	<b>3 981 366</b>	<b>4 406 240</b>	<b>4 824 418</b>	<b>5 278 942</b>
Labour costs	1 250 480	1 283 210	1 413 128	1 293 033	1 531 460	2 053 204	2 187 401	1 986 918	2 142 875	2 339 348
Other current expenditure	1 429 757	1 470 206	1 592 145	2 011 160	1 875 150	1 697 044	1 793 965	2 419 322	2 681 543	2 939 594
<b>Total</b>	<b>2 886 094</b>	<b>3 137 343</b>	<b>3 458 074</b>	<b>3 596 023</b>	<b>3 729 680</b>	<b>4 025 998</b>	<b>4 304 556</b>	<b>5 004 669</b>	<b>5 740 897</b>	<b>6 136 183</b>

**Table C.114: Proportional science councils sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
<b>Capital expenditure</b>	<b>7.1</b>	<b>12.2</b>	<b>13.1</b>	<b>8.1</b>	<b>8.7</b>	<b>6.8</b>	<b>7.5</b>	<b>12.0</b>	<b>16.0</b>	<b>14.0</b>
Land: buildings & other structures	1.1	1.9	3.1	1.6	1.8	1.7	1.7	7.2	2.8	3.4
Vehicles, plant, machinery, equipment	6.1	10.3	10.0	6.6	6.9	5.1	5.8	4.7	13.1	10.5
<b>Current expenditure</b>	<b>92.9</b>	<b>87.8</b>	<b>86.9</b>	<b>91.9</b>	<b>91.3</b>	<b>93.2</b>	<b>92.5</b>	<b>88.0</b>	<b>84.0</b>	<b>86.0</b>
Labour costs	43.3	40.9	40.9	36.0	41.1	51.0	50.8	39.7	37.3	38.1
Other current expenditure	49.5	46.9	46.0	55.9	50.3	42.2	41.7	48.3	46.7	47.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.115: Science councils sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Biotechnology	216 292	207 250	183 844	199 934	208 466	145 671	143 868	312 793	320 048	360 163
Nanotechnology	47 802	173 834	117 215	101 386	102 007	118 555	114 990	125 107	139 107	139 783
<b>Total</b>	<b>264 094</b>	<b>381 084</b>	<b>301 058</b>	<b>301 320</b>	<b>310 473</b>	<b>264 226</b>	<b>258 857</b>	<b>437 900</b>	<b>459 154</b>	<b>499 946</b>
Science councils expenditure on R&D	2 886 094	3 137 343	3 458 074	3 596 023	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183



**Table C.116: Proportional science councils sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Biotechnology	7.5	6.6	5.3	5.6	5.6	3.6	3.3	6.3	5.6	5.9
Nanotechnology	1.7	5.5	3.4	2.8	2.7	2.9	2.7	2.5	2.4	2.3
<b>Total</b>	<b>9.2</b>	<b>12.1</b>	<b>8.7</b>	<b>8.4</b>	<b>8.3</b>	<b>6.5</b>	<b>6.0</b>	<b>8.8</b>	<b>8.0</b>	<b>8.1</b>

**Table C.117: Science councils sector R&D expenditure on selected areas of interest (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment related	N/A	N/A	N/A	N/A	770 339	378 782	297 097	1 037 320	1 054 651	1 031 393
Open-source software	77 885	67 833	15 013	7 228	15 982	36 636	0	389 871	692 096	453 879
New materials	64 131	157 134	94 304	201 071	197 430	751 305	229 854	358 361	374 463	373 768
Tuberculosis (TB), HIV/AIDS, malaria	233 917	490 982	333 841	386 948	399 070	455 311	398 880	346 751	470 488	625 806
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	296 236
<b>Total</b>	<b>375 933</b>	<b>715 949</b>	<b>443 158</b>	<b>595 247</b>	<b>1 382 821</b>	<b>1 622 034</b>	<b>925 831</b>	<b>2 132 304</b>	<b>2 591 697</b>	<b>2 781 082</b>
Science councils expenditure on R&D	2 886 094	3 137 343	3 458 074	3 596 023	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environment related	N/A	N/A	N/A	N/A	20.7	9.4	6.9	20.7	18.4	16.8
Open-source software	2.7	2.2	0.4	0.2	0.4	0.9	0.0	7.8	12.1	7.4
New materials	2.2	5.0	2.7	5.6	5.3	18.7	5.3	7.2	6.5	6.1
Tuberculosis (TB), HIV/AIDS, malaria	8.1	15.6	9.7	10.8	10.7	11.3	9.3	6.9	8.2	10.2
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.8
<b>Total</b>	<b>13.0</b>	<b>22.8</b>	<b>12.8</b>	<b>16.6</b>	<b>37.1</b>	<b>40.3</b>	<b>21.5</b>	<b>42.6</b>	<b>45.1</b>	<b>45.3</b>

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 (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Natural Sciences, Technology and Engineering	2 623 455	2 916 350	3 258 392	3 414 985	3 517 520	3 819 642	4 109 105	4 800 742	5 486 847	5 889 463
Mathematical sciences	35 551	40 632	37 678	113 396	117 637	134 046	128 291	48 258	54 212	47 890
Physical sciences	93 583	115 737	87 221	97 922	120 267	123 267	129 568	263 302	418 648	444 274
Chemical sciences	37 430	44 271	49 462	8 074	20 972	14 078	18 166	63 775	71 024	66 188
Earth sciences	147 427	167 463	179 999	94 642	100 921	112 406	110 092	162 880	181 876	254 414



MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Information, computer and communication technologies	212 796	201 731	265 191	161 282	168 115	181 521	182 402	780 044	977 891	999 538
Applied sciences and technologies	138 849	139 267	153 830	924 104	954 616	1 092 098	1 046 934	277 649	296 162	475 568
Engineering sciences	643 349	863 084	947 315	365 980	278 125	292 940	349 666	1 001 486	1 107 289	1 016 283
Biological sciences	175 592	171 810	200 625	437 938	425 036	485 673	482 728	148 268	144 341	138 673
Agricultural sciences	566 561	442 060	647 750	479 449	582 438	594 638	859 600	1 075 165	1 043 494	1 067 146
Medical and health sciences	358 726	447 479	440 895	428 642	443 156	426 520	430 472	596 600	775 858	836 967
Environmental sciences	85 414	101 920	112 327	273 283	284 116	330 667	326 122	228 909	240 075	343 218
Material sciences	108 068	155 529	106 411	23 199	15 462	22 905	35 093	113 457	133 231	122 130
Marine sciences	20 108	25 368	29 689	7 073	6 656	8 885	9 970	40 949	42 747	77 173
<b>Division 2: Social Sciences and Humanities</b>	<b>262 639</b>	<b>220 993</b>	<b>199 682</b>	<b>181 038</b>	<b>212 160</b>	<b>206 356</b>	<b>195 452</b>	<b>203 927</b>	<b>254 050</b>	<b>246 721</b>
Social sciences	238 019	194 646	182 431	164 954	190 845	186 132	173 407	179 456	223 966	239 011
Humanities	24 620	26 347	17 250	16 084	21 315	20 224	22 044	24 471	30 084	7 710
<b>Total</b>	<b>2 886 094</b>	<b>3 137 343</b>	<b>3 458 074</b>	<b>3 596 023</b>	<b>3 729 680</b>	<b>4 025 998</b>	<b>4 304 556</b>	<b>5 004 669</b>	<b>5 740 897</b>	<b>6 136 183</b>

**Table C.120: Proportional science councils sector R&D expenditure by research field (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>90.9</b>	<b>93.0</b>	<b>94.2</b>	<b>95.0</b>	<b>94.3</b>	<b>94.9</b>	<b>95.5</b>	<b>95.9</b>	<b>95.6</b>	<b>96.0</b>
Mathematical sciences	1.2	1.3	1.1	3.2	3.2	3.3	3.0	1.0	0.9	0.8
Physical sciences	3.2	3.7	2.5	2.7	3.2	3.1	3.0	5.3	7.3	7.2
Chemical sciences	1.3	1.4	1.4	0.2	0.6	0.3	0.4	1.3	1.2	1.1
Earth sciences	5.1	5.3	5.2	2.6	2.7	2.8	2.6	3.3	3.2	4.1
Information, computer and communication technologies	7.4	6.4	7.7	4.5	4.5	4.5	4.2	15.6	17.0	16.3
Applied sciences and technologies	4.8	4.4	4.4	25.7	25.6	27.1	24.3	5.5	5.2	7.8
Engineering sciences	22.3	27.5	27.4	10.2	7.5	7.3	8.1	20.0	19.3	16.6
Biological sciences	6.1	5.5	5.8	12.2	11.4	12.1	11.2	3.0	2.5	2.3
Agricultural sciences	19.6	14.1	18.7	13.3	15.6	14.8	20.0	21.5	18.2	17.4
Medical and health sciences	12.4	14.3	12.7	11.9	11.9	10.6	10.0	11.9	13.5	13.6



MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environmental sciences	3.0	3.2	3.2	7.6	7.6	8.2	7.6	4.6	4.2	5.6
Material sciences	3.7	5.0	3.1	0.6	0.4	0.6	0.8	2.3	2.3	2.0
Marine sciences	0.7	0.8	0.9	0.2	0.2	0.2	0.2	0.8	0.7	1.3
Division 2: Social Sciences and Humanities	9.1	7.0	5.8	5.0	5.7	5.1	4.5	4.1	4.4	4.0
Social sciences	8.2	6.2	5.3	4.6	5.1	4.6	4.0	3.6	3.9	3.9
Humanities	0.9	0.8	0.5	0.4	0.6	0.5	0.5	0.5	0.5	0.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.121: Science councils sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
<b>Division 1:</b>										
<b>Defence</b>	<b>228 603</b>	<b>280 219</b>	<b>311 288</b>	<b>228 376</b>	<b>243 083</b>	<b>279 989</b>	<b>262 203</b>	<b>762 464</b>	<b>826 261</b>	<b>754 207</b>
Defence	228 603	280 219	311 288	228 376	243 083	279 989	262 203	762 464	826 261	754 207
<b>Division 2:</b>										
<b>Economic Development</b>	<b>1 560 688</b>	<b>1 592 110</b>	<b>1 834 253</b>	<b>2 111 033</b>	<b>2 191 098</b>	<b>2 400 747</b>	<b>2 686 504</b>	<b>2 306 795</b>	<b>2 529 244</b>	<b>2 471 163</b>
Economic Development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	433 850	349 907	485 470	478 437	448 531	473 133	624 675	413 737	396 612	396 536
Animal production and animal primary products	25 124	18 760	27 043	25 193	280 542	287 431	419 259	269 519	247 883	247 835
Mineral resources (excluding Energy)	63 469	67 418	387 531	294 203	202 919	213 007	234 273	232 114	265 006	255 226
Energy resources	38 979	379 859	32 136	90 342	94 385	108 360	106 823	5 590	5 063	8 108
Energy supply	874	0	0	0	14 715	13 237	2 937	0	0	0
Manufacturing	385 822	225 227	262 443	366 380	351 021	400 864	393 152	88 746	146 395	170 040
Construction	101 232	116 781	129 922	222 124	220 595	256 024	245 333	31 034	60 828	67 003
Transport	33 817	41 260	45 848	0	0	0	0	0	0	0
Information and communication services	17 429	24 146	68 506	115 342	127 021	141 495	135 629	396 310	419 252	410 724
Commercial services	8 975	19 536	5 465	14 152	15 522	25 053	19 724	5 236	5 671	7 756
Economic framework	206 878	106 105	84 205	97 367	72 109	70 509	75 411	537 499	664 440	571 815
Natural resources	244 239	243 111	305 685	407 492	363 738	411 634	429 288	327 009	318 094	336 119
<b>Division 3:</b>										
<b>Society</b>	<b>368 010</b>	<b>418 385</b>	<b>453 428</b>	<b>388 244</b>	<b>430 876</b>	<b>413 060</b>	<b>425 943</b>	<b>801 370</b>	<b>977 159</b>	<b>1 074 539</b>
Society unclassified	0	0	0	0	0	0	0	0	0	0

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Health	272 905	326 340	348 407	310 760	326 500	314 412	316 987	424 639	552 314	613 932
Education and training	37 449	50 525	65 761	50 676	68 852	64 941	72 216	335 946	374 704	145 215
Social development and community services	57 656	41 520	39 260	26 807	35 525	33 707	36 741	40 785	50 141	315 392
<b>Division 4: Environment</b>	<b>263 325</b>	<b>338 290</b>	<b>355 484</b>	<b>52 334</b>	<b>31 241</b>	<b>39 169</b>	<b>46 559</b>	<b>422 650</b>	<b>455 404</b>	<b>852 597</b>
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	130 041	173 945	190 926	24 043	19 956	22 939	28 295	402 820	426 582	466 312
Environmental aspects of development	46 190	59 943	48 262	19 333	8 623	13 665	14 071	15 824	14 179	17 451
Environmental and other aspects	87 094	104 402	116 296	8 958	2 662	2 565	4 194	4 006	14 644	368 834
<b>Division 5: Advancement of Knowledge</b>	<b>465 468</b>	<b>508 339</b>	<b>503 621</b>	<b>816 035</b>	<b>833 382</b>	<b>893 033</b>	<b>883 346</b>	<b>711 390</b>	<b>952 830</b>	<b>983 677</b>
Advancement of Knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	361 714	407 189	381 098	674 421	694 254	760 107	746 397	422 429	620 283	692 258
Social sciences and humanities	103 754	101 150	122 523	141 614	139 127	132 926	136 949	288 961	332 547	291 419
<b>Total</b>	<b>2 886 094</b>	<b>3 137 343</b>	<b>3 458 074</b>	<b>3 596 023</b>	<b>3 729 680</b>	<b>4 025 998</b>	<b>4 304 556</b>	<b>5 004 669</b>	<b>5 740 897</b>	<b>6 136 183</b>

**Table C.122: Proportional science councils sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Defence</b>	<b>7.9</b>	<b>8.9</b>	<b>9.0</b>	<b>6.4</b>	<b>6.5</b>	<b>7.0</b>	<b>6.1</b>	<b>15.2</b>	<b>14.4</b>	<b>12.3</b>
Defence	7.9	8.9	9.0	6.4	6.5	7.0	6.1	15.2	14.4	12.3
<b>Division 2: Economic Development</b>	<b>54.1</b>	<b>50.7</b>	<b>53.0</b>	<b>58.7</b>	<b>58.7</b>	<b>59.6</b>	<b>62.4</b>	<b>46.1</b>	<b>44.1</b>	<b>40.3</b>
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	15.0	11.2	14.0	13.3	12.0	11.8	14.5	8.3	6.9	6.5
Animal production and animal primary products	0.9	0.6	0.8	0.7	7.5	7.1	9.7	5.4	4.3	4.0





SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Mineral resources (excluding Energy)	2.2	2.1	11.2	8.2	5.4	5.3	5.4	4.6	4.6	4.2
Energy resources	1.4	12.1	0.9	2.5	2.5	2.7	2.5	0.1	0.1	0.1
Energy supply	0.0	0.0	0.0	0.0	0.4	0.3	0.1	0.0	0.0	0.0
Manufacturing	13.4	7.2	7.6	10.2	9.4	10.0	9.1	1.8	2.6	2.8
Construction	3.5	3.7	3.8	6.2	5.9	6.4	5.7	0.6	1.1	1.1
Transport	1.2	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Information and communication services	0.6	0.8	2.0	3.2	3.4	3.5	3.2	7.9	7.3	6.7
Commercial services	0.3	0.6	0.2	0.4	0.4	0.6	0.5	0.1	0.1	0.1
Economic framework	7.2	3.4	2.4	2.7	1.9	1.8	1.8	10.7	11.6	9.3
Natural resources	8.5	7.7	8.8	11.3	9.8	10.2	10.0	6.5	5.5	5.5
<b>Division 3: Society</b>	<b>12.8</b>	<b>13.3</b>	<b>13.1</b>	<b>10.8</b>	<b>11.6</b>	<b>10.3</b>	<b>9.9</b>	<b>16.0</b>	<b>17.0</b>	<b>17.5</b>
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	9.5	10.4	10.1	8.6	8.8	7.8	7.4	8.5	9.6	10.0
Education and training	1.3	1.6	1.9	1.4	1.8	1.6	1.7	6.7	6.5	2.4
Social development and community services	2.0	1.3	1.1	0.7	1.0	0.8	0.9	0.8	0.9	5.1
<b>Division 4: Environment</b>	<b>9.1</b>	<b>10.8</b>	<b>10.3</b>	<b>1.5</b>	<b>0.8</b>	<b>1.0</b>	<b>1.1</b>	<b>8.4</b>	<b>7.9</b>	<b>13.9</b>
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	4.5	5.5	5.5	0.7	0.5	0.6	0.7	8.0	7.4	7.6
Environmental aspects of development	1.6	1.9	1.4	0.5	0.2	0.3	0.3	0.3	0.2	0.3
Environmental and other aspects	3.0	3.3	3.4	0.2	0.1	0.1	0.1	0.1	0.3	6.0
<b>Division 5: Advancement of Knowledge</b>	<b>16.1</b>	<b>16.2</b>	<b>14.6</b>	<b>22.7</b>	<b>22.3</b>	<b>22.2</b>	<b>20.5</b>	<b>14.2</b>	<b>16.6</b>	<b>16.0</b>
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	12.5	13.0	11.0	18.8	18.6	18.9	17.3	8.4	10.8	11.3
Social sciences and humanities	3.6	3.2	3.5	3.9	3.7	3.3	3.2	5.8	5.8	4.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.123: Science councils sector R&D expenditure by province(2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	138 342	171 669	155 501	150 665	178 594	182 664	115 925	259 128	269 658	273 509
Free State	67 901	58 561	74 355	60 443	37 138	39 054	47 271	58 608	59 953	60 149
Gauteng	1 809 272	1 991 853	2 219 609	2 327 712	2 287 762	2 537 028	3 062 983	2 745 142	2 998 643	3 221 705
KwaZulu-Natal	201 009	231 033	235 432	249 137	292 246	307 302	239 387	484 142	575 016	477 823
Limpopo	67 562	63 455	78 662	66 250	99 104	105 150	7 286	117 270	111 649	114 852
Mpumalanga	66 333	55 547	66 881	55 690	100 476	103 468	62 349	124 613	122 432	128 883
North-West	49 390	41 541	51 295	42 854	104 139	110 361	39 615	153 911	153 676	108 010
Northern Cape	45 250	43 624	35 253	64 774	81 998	78 714	122 454	148 387	218 317	223 524
Western Cape	441 036	480 059	541 086	578 497	548 223	562 256	607 285	913 468	1 231 555	1 527 729
<b>Total</b>	<b>2 886 094</b>	<b>3 137 343</b>	<b>3 458 074</b>	<b>3 596 023</b>	<b>3 729 680</b>	<b>4 025 998</b>	<b>4 304 556</b>	<b>5 004 669</b>	<b>5 740 897</b>	<b>6 136 183</b>

**Table C.124: Proportional science councils sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	4.8	5.5	4.5	4.2	4.8	4.5	2.7	5.2	4.7	4.5
Free State	2.4	1.9	2.2	1.7	1.0	1.0	1.1	1.2	1.0	1.0
Gauteng	62.7	63.5	64.2	64.7	61.3	63.0	71.2	54.9	52.2	52.5
KwaZulu-Natal	7.0	7.4	6.8	6.9	7.8	7.6	5.6	9.7	10.0	7.8
Limpopo	2.3	2.0	2.3	1.8	2.7	2.6	0.2	2.3	1.9	1.9
Mpumalanga	2.3	1.8	1.9	1.5	2.7	2.6	1.4	2.5	2.1	2.1
North-West	1.7	1.3	1.5	1.2	2.8	2.7	0.9	3.1	2.7	1.8
Northern Cape	1.6	1.4	1.0	1.8	2.2	2.0	2.8	3.0	3.8	3.6
Western Cape	15.3	15.3	15.6	16.1	14.7	14.0	14.1	18.3	21.5	24.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.125: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation (2007/08 to 2016/17)**

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2007/08	5 988	2 594	1 351	2 043	5 058.8	2 300.2	1 099.2	1 659.4
2008/09	5 609	2 648	1 302	1 659	4 699.9	2 246.7	1 119.1	1 334.0
2009/10	5 926	2 669	1 381	1 876	4 782.7	2 251.5	1 179.4	1 351.8
2010/11	4 923	1 941	1 336	1 646	4 312.4	1 777.3	1 155.5	1 379.6
2011/12	4 494	1 803	1 333	1 358	3 803.5	1 634.9	1 172.4	996.1
2012/13	5 399	1 879	1 403	2 117	4 748.5	1 697.1	1 279.6	1 771.8
2013/14	5 884	1 956	1 396	2 532	5 164.5	1 781.3	1 247.3	2 136.0
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	1 251	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

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.126: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15, 2015/16 and 2016/17)**

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
<b>2014/15</b>							
Researchers	1 988	1 154	834	1 765.4	1 016.5	748.9	88.8
Technicians directly supporting R&D	1 857	1 077	780	1 686.2	959.9	726.3	90.8
Other personnel directly supporting R&D	991	564	427	728.9	364.7	364.2	73.6
<b>Total</b>	<b>4 836</b>	<b>2 795</b>	<b>2 041</b>	<b>4 180.4</b>	<b>2 341.1</b>	<b>1 839.4</b>	<b>86.4</b>
<b>2015/16</b>							
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	1 251	671	580	850.4	409.4	441.0	68.0
<b>Total</b>	<b>5 162</b>	<b>2 933</b>	<b>2 229</b>	<b>4 361.2</b>	<b>2 419.1</b>	<b>1 942.2</b>	<b>84.5</b>
<b>2016/17</b>							
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
<b>Total</b>	<b>4 955</b>	<b>2 780</b>	<b>2 175</b>	<b>4 421.4</b>	<b>2 433.8</b>	<b>1 987.6</b>	<b>89.2</b>

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.127: Science councils sector R&D personnel in headcounts by occupation, qualification, population group and gender (2016/17)**

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
<b>Researchers</b>	<b>2 189</b>	<b>1 235</b>	<b>954</b>	<b>493</b>	<b>384</b>	<b>58</b>	<b>74</b>	<b>84</b>	<b>100</b>	<b>483</b>	<b>347</b>	<b>117</b>	<b>49</b>
Doctoral degree or equivalent	911	564	347	186	86	22	31	27	33	243	162	86	35
Masters, honours, bachelor or equivalent	1 212	630	582	294	285	30	42	57	63	220	178	29	14
Diplomas	66	41	25	13	13	6	1	0	4	20	7	2	0
<b>Technicians directly supporting R&amp;D</b>	<b>1 818</b>	<b>1 076</b>	<b>742</b>	<b>576</b>	<b>439</b>	<b>81</b>	<b>40</b>	<b>57</b>	<b>53</b>	<b>331</b>	<b>202</b>	<b>31</b>	<b>8</b>
Doctoral degree or equivalent	53	47	6	2	1	0	0	0	2	36	2	9	1
Masters, honours, bachelor or equivalent	981	524	457	262	256	20	21	49	40	174	133	19	7
Diplomas	784	505	279	312	182	61	19	8	11	121	67	3	0
<b>Other personnel directly supporting R&amp;D</b>	<b>948</b>	<b>469</b>	<b>479</b>	<b>332</b>	<b>286</b>	<b>46</b>	<b>70</b>	<b>31</b>	<b>36</b>	<b>48</b>	<b>71</b>	<b>12</b>	<b>16</b>
Doctoral degree or equivalent	16	11	5	5	1	2	0	0	1	4	1	0	2
Masters, honours, bachelor or equivalent	504	232	272	145	172	19	14	26	26	35	53	7	7
Diplomas	428	226	202	182	113	25	56	5	9	9	17	5	7
<b>Total</b>	<b>4 955</b>	<b>2 780</b>	<b>2 175</b>	<b>1 401</b>	<b>1 109</b>	<b>185</b>	<b>184</b>	<b>172</b>	<b>189</b>	<b>862</b>	<b>620</b>	<b>160</b>	<b>73</b>

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.128: Science councils sector overview (2015/16 and 2016/17)**

SCIENCE COUNCILS	2015/16				2016/17			
	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	991 531	542.0	198 306	54 231	991 340	542.0	198 268	78 781
Council for Scientific and Industrial Research	2 342 179	631.0	234 218	308 043	2 498 565	620.0	174 900	143 787
Council for Geoscience	141 787	94.9	28 357	40 002	193 898	97.0	38 780	73 127
Human Science Research Council	334 271	143.2	66 854	15 342	385 501	156.0	77 100	21 563
Medical Research Council	719 738	171.0	431 843	42 751	759 695	214.0	455 817	11 480
Mintek	338 956	105.6	67 791	38 730	327 551	152.4	65 510	34 258
National Research Foundation	872 436	139.5	321 163	417 381	979 633	159.1	362 327	494 245
<b>Total</b>	<b>5 740 897</b>	<b>1827.2</b>	<b>1 348 533</b>	<b>916 480</b>	<b>6 136 183</b>	<b>1940.5</b>	<b>1 372 702</b>	<b>857 241</b>

### C.2.5. Higher education sector

**Table C.129: Higher education sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	1 709 334	1 965 121	2 459 733	2 634 722	3 290 328	3 843 906	3 785 149	4 601 453	5 395 693	6 679 585
Applied research	1 262 425	1 468 624	1 729 496	1 890 185	2 279 175	2 390 090	2 412 316	2 649 558	3 176 685	3 466 381
Experimental research	650 102	757 621	911 994	899 695	1 039 712	1 099 157	1 095 388	1 126 565	1 304 245	1 513 291
<b>Total</b>	<b>3 621 861</b>	<b>4 191 366</b>	<b>5 101 224</b>	<b>5 424 602</b>	<b>6 609 216</b>	<b>7 333 153</b>	<b>7 292 853</b>	<b>8 377 575</b>	<b>9 876 623</b>	<b>11 659 258</b>

**Table C.130: Proportional higher education sector R&D expenditure by type of research (2007/08 to 2016/17)**

TYPE OF RESEARCH	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Basic research	47.2	46.9	48.2	48.6	49.8	52.4	51.9	54.9	54.6	57.3
Applied research	34.9	35.0	33.9	34.8	34.5	32.6	33.1	31.6	32.2	29.7
Experimental research	17.9	18.1	17.9	16.6	15.7	15.0	15.0	13.4	13.2	13.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



**Table C.131: Higher education sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
<b>Capital expenditure</b>	<b>295 813</b>	<b>281 193</b>	<b>376 057</b>	<b>393 758</b>	<b>564 179</b>	<b>602 116</b>	<b>706 336</b>	<b>779 789</b>	<b>1 141 349</b>	<b>1 092 704</b>
Land: buildings & other structures	51 734	38 564	97 533	146 602	137 530	192 324	256 114	200 253	198 032	616 761
Vehicles, plant, machinery, equipment	244 079	242 629	278 524	247 156	426 649	409 792	450 222	579 536	943 317	475 943
<b>Current expenditure</b>	<b>3 326 049</b>	<b>3 910 173</b>	<b>4 725 167</b>	<b>5 030 844</b>	<b>6 045 037</b>	<b>6 731 037</b>	<b>6 586 517</b>	<b>7 597 786</b>	<b>8 735 274</b>	<b>10 566 554</b>
Labour costs	1 466 379	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
Total cost of R&D postgraduate students	495 128	532 883	581 140	756 930	1 074 207	1 186 653	1 224 611	1 579 088	1 926 301	1 928 108
Other current expenditure*	1 364 542	1 872 748	2 433 844	2 390 738	2 489 508	2 547 455	2 113 364	2 478 965	3 232 833	4 322 457
<b>Total</b>	<b>3 621 862</b>	<b>4 191 366</b>	<b>5 101 224</b>	<b>5 424 602</b>	<b>6 609 216</b>	<b>7 333 153</b>	<b>7 292 853</b>	<b>8 377 575</b>	<b>9 876 623</b>	<b>11 659 258</b>

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

**Table C.132: Proportional higher education sector R&D expenditure by accounting category (2007/08 to 2016/17)**

TYPE OF EXPENDITURE	2007/08 %	2008/09 %	2009/10 %	2010/11 %	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %
<b>Capital expenditure</b>	<b>8.2</b>	<b>6.7</b>	<b>7.4</b>	<b>7.3</b>	<b>8.5</b>	<b>8.2</b>	<b>9.7</b>	<b>9.3</b>	<b>11.6</b>	<b>9.4</b>
Land: buildings & other structures	1.4	0.9	1.9	2.7	2.1	2.6	3.5	2.4	2.0	5.3
Vehicles, plant, machinery, equipment	6.7	5.8	5.5	4.6	6.5	5.6	6.2	6.9	9.6	4.1
<b>Current expenditure</b>	<b>91.8</b>	<b>93.3</b>	<b>92.6</b>	<b>92.7</b>	<b>91.5</b>	<b>91.8</b>	<b>90.3</b>	<b>90.7</b>	<b>88.4</b>	<b>90.6</b>
Labour costs	40.5	35.9	33.5	34.7	37.5	40.9	44.5	42.3	36.2	37.0
Total cost of R&D postgraduate students	13.7	12.7	11.4	14.0	16.3	16.2	16.8	18.8	19.5	16.5
Other current expenditure*	37.7	44.7	47.7	44.1	37.7	34.7	29.0	29.6	32.7	37.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

**Table C.133: Higher education sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08 R'000	2008/09 R'000	2009/10 R'000	2010/11 R'000	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000
Biotechnology	253 872	303 483	366 900	381 225	344 039	380 727	406 285	470 837	553 562	531 958
Nanotechnology	170 405	153 013	156 176	204 802	317 649	293 300	356 826	393 137	505 380	431 558
<b>Total</b>	<b>424 277</b>	<b>456 496</b>	<b>523 076</b>	<b>586 027</b>	<b>661 688</b>	<b>674 028</b>	<b>763 111</b>	<b>863 974</b>	<b>1 058 942</b>	<b>963 516</b>
<b>Higher Education expenditure on R&amp;D</b>	<b>3 621 862</b>	<b>4 191 366</b>	<b>5 101 224</b>	<b>5 424 602</b>	<b>6 609 216</b>	<b>7 333 153</b>	<b>7 292 853</b>	<b>8 377 575</b>	<b>9 876 623</b>	<b>11 659 258</b>

**Table C.134: Proportional higher education sector expenditure on multidisciplinary areas of R&D (2007/08 to 2016/17)**

MULTI-DISCIPLINARY AREA OF R&D	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Biotechnology	7.0	7.2	7.2	7.0	5.2	5.2	5.6	5.6	5.6	4.6
Nanotechnology	4.7	3.7	3.1	3.8	4.8	4.0	4.9	4.7	5.1	3.7
<b>Total</b>	<b>11.7</b>	<b>10.9</b>	<b>10.3</b>	<b>10.8</b>	<b>10.0</b>	<b>9.2</b>	<b>10.5</b>	<b>10.3</b>	<b>10.7</b>	<b>8.3</b>

**Table C.135: Higher education sector R&D expenditure on selected areas of interest (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment related	N/A	N/A	N/A	N/A	770 339	300 006	340 386	499 958	583 723	883 069
Open-source software	41 234	49 532	58 643	75 195	15 982	85 508	105 008	117 646	125 883	164 097
New materials	160 993	202 242	283 711	266 419	197 430	321 744	381 136	436 975	462 962	449 336
Tuberculosis (TB), HIV/AIDS, malaria	583 726	650 502	815 431	845 216	399 070	714 966	794 810	845 245	944 490	1 082 645
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	264 712
<b>Total</b>	<b>785 953</b>	<b>902 276</b>	<b>1 157 785</b>	<b>1 186 830</b>	<b>1 382 821</b>	<b>1 422 224</b>	<b>1 621 339</b>	<b>1 899 823</b>	<b>2 117 058</b>	<b>2 843 859</b>
Higher Education expenditure on R&D	3 621 862	4 191 366	5 101 224	5 424 602	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258

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 (2007/08 to 2016/17)**

AREA OF INTEREST	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environment related	N/A	N/A	N/A	N/A	11.7	4.1	4.7	6.0	5.9	7.6
Open-source software	1.1	1.2	1.1	1.4	0.2	1.2	1.4	1.4	1.3	1.4
New materials	4.4	4.8	5.6	4.9	3.0	4.4	5.2	5.2	4.7	3.9
Tuberculosis (TB), HIV/AIDS, malaria	16.1	15.5	16.0	15.6	6.0	9.7	10.9	10.1	9.6	9.3
Space science	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.3
<b>Total</b>	<b>21.7</b>	<b>21.5</b>	<b>22.7</b>	<b>21.9</b>	<b>20.9</b>	<b>19.4</b>	<b>22.2</b>	<b>22.7</b>	<b>21.4</b>	<b>24.4</b>

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(2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Natural Sciences, Technology and Engineering	2 389 525	2 703 975	3 374 024	3 558 265	4 486 057	5 045 892	4 925 713	5 704 150	6 340 905	6 976 302
Mathematical sciences	109 354	151 880	168 689	283 942	311 572	342 093	278 183	333 587	458 068	512 534
Physical sciences	146 726	135 002	352 628	175 110	189 341	193 849	198 735	230 826	287 830	356 090
Chemical sciences	143 897	136 528	161 856	158 775	317 389	444 258	286 511	326 992	386 300	472 883
Earth sciences	121 419	136 955	84 777	157 781	174 141	190 744	207 261	260 862	271 814	327 638



MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Information, computer and communication technologies	119 600	125 413	121 750	112 985	186 870	232 090	192 911	245 257	322 406	378 763
Applied sciences and technologies	96 972	78 904	306 195	90 761	245 611	251 278	280 310	274 283	272 429	139 046
Engineering sciences	294 630	352 114	305 953	461 980	741 462	768 810	855 529	918 494	891 532	926 463
Biological sciences	271 216	282 280	349 343	593 219	610 408	731 389	721 229	825 432	846 897	788 716
Agricultural sciences	159 793	192 265	179 309	205 311	268 834	276 857	311 355	354 949	326 296	440 433
Medical and health sciences	785 630	966 365	1 195 597	1 226 127	1 245 284	1 391 838	1 339 755	1 641 683	2 089 591	2 412 996
Environmental sciences	58 793	68 869	52 431	60 458	111 612	147 367	166 493	180 324	79 430	128 784
Material sciences	72 484	68 467	76 732	26 629	81 749	68 849	82 479	100 358	93 871	67 707
Marine sciences	9 013	8 933	18 764	5 186	1 783	6 469	4 961	11 105	14 441	24 249
<b>Division 2: Social Sciences and Humanities</b>	<b>1 232 337</b>	<b>1 487 391</b>	<b>1 727 200</b>	<b>1 866 337</b>	<b>2 123 159</b>	<b>2 287 261</b>	<b>2 367 140</b>	<b>2 673 425</b>	<b>3 535 718</b>	<b>4 682 956</b>
Social sciences	796 281	967 204	1 273 479	1 433 610	1 664 653	1 844 744	1 825 026	2 056 555	2 855 673	3 770 136
Humanities	436 056	520 187	453 721	432 727	458 505	442 517	542 114	616 870	680 046	912 820
<b>Total</b>	<b>3 621 862</b>	<b>4 191 366</b>	<b>5 101 224</b>	<b>5 424 602</b>	<b>6 609 216</b>	<b>7 333 153</b>	<b>7 292 853</b>	<b>8 377 575</b>	<b>9 876 623</b>	<b>11 659 258</b>

**Table C.138: Proportional higher education sector R&D expenditure by research field (2007/08 to 2016/17)**

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Natural Sciences, Technology and Engineering</b>	<b>66.0</b>	<b>64.5</b>	<b>66.1</b>	<b>65.6</b>	<b>67.9</b>	<b>68.8</b>	<b>67.5</b>	<b>68.1</b>	<b>64.2</b>	<b>59.8</b>
Mathematical sciences	3.0	3.6	3.3	5.2	4.7	4.7	3.8	4.0	4.6	4.4
Physical sciences	4.1	3.2	6.9	3.2	2.9	2.6	2.7	2.8	2.9	3.1
Chemical sciences	4.0	3.3	3.2	2.9	4.8	6.1	3.9	3.9	3.9	4.1
Earth sciences	3.4	3.3	1.7	2.9	2.6	2.6	2.8	3.1	2.8	2.8
Information, computer and communication technologies	3.3	3.0	2.4	2.1	2.8	3.2	2.6	2.9	3.3	3.2
Applied sciences and technologies	2.7	1.9	6.0	1.7	3.7	3.4	3.8	3.3	2.8	1.2
Engineering sciences	8.1	8.4	6.0	8.5	11.2	10.5	11.7	11.0	9.0	7.9
Biological sciences	7.5	6.7	6.8	10.9	9.2	10.0	9.9	9.9	8.6	6.8
Agricultural sciences	4.4	4.6	3.5	3.8	4.1	3.8	4.3	4.2	3.3	3.8
Medical and health sciences	21.7	23.1	23.4	22.6	18.8	19.0	18.4	19.6	21.2	20.7

MAIN RESEARCH FIELD	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Environmental sciences	1.6	1.6	1.0	1.1	1.7	2.0	2.3	2.2	0.8	1.1
Material sciences	2.0	1.6	1.5	0.5	1.2	0.9	1.1	1.2	1.0	0.6
Marine sciences	0.2	0.2	0.4	0.1	0.0	0.1	0.1	0.1	0.1	0.2
Division 2: Social Sciences and Humanities	34.0	35.5	33.9	34.4	32.1	31.2	32.5	31.9	35.8	40.2
Social sciences	22.0	23.1	25.0	26.4	25.2	25.2	25.0	24.5	28.9	32.3
Humanities	12.0	12.4	8.9	8.0	6.9	6.0	7.4	7.4	6.9	7.8
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 (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1:										
Defence	4 328	5 150	3 620	7 271	10 211	12 009	6 121	7 266	8 330	10 899
Defence	4 328	5 150	3 620	7 271	10 211	12 009	6 121	7 266	8 330	10 899
Division 2:										
Economic Development	1 271 620	1 539 534	1 738 239	1 542 453	2 072 624	1 996 497	2 547 254	2 472 831	2 850 018	3 375 098
Economic Development unclassified	171 520	209 400	0	0	0	0	0	0	0	0
Plant production and plant primary products	123 126	153 054	178 033	188 513	277 764	234 309	534 417	220 024	282 188	358 551
Animal production and animal primary products	95 219	117 255	130 828	128 705	151 334	176 645	173 865	190 421	199 545	288 114
Mineral resources (excluding Energy)	74 725	88 576	83 294	99 966	129 185	69 062	129 459	127 236	131 141	115 367
Energy resources	84 459	71 648	81 689	88 657	87 659	92 947	82 011	75 367	84 862	68 184
Energy supply	96 209	106 457	107 759	144 462	157 304	162 879	221 160	233 075	237 993	225 645
Manufacturing	172 947	210 009	297 303	245 037	272 287	348 845	340 630	329 083	380 258	444 203
Construction	28 313	46 175	23 858	73 340	116 141	74 322	79 775	96 642	111 437	177 750
Transport	22 770	29 517	30 456	24 045	53 043	31 830	32 503	38 549	47 577	72 250
Information and communication services	67 026	87 013	110 589	93 281	144 313	101 980	139 305	152 987	232 257	191 378
Commercial services	93 285	54 604	282 078	54 659	106 287	111 587	156 001	124 971	125 771	182 456
Economic framework	164 759	193 599	206 625	217 501	302 693	335 217	363 483	493 154	544 118	612 373
Natural resources	77 260	172 228	205 728	184 287	274 612	256 874	294 645	391 322	472 871	638 827
Division 3:										
Society	1 149 091	1 359 797	1 177 651	1 393 700	1 583 800	1 865 914	1 569 371	2 180 662	2 820 755	3 266 113
Society unclassified	171 520	209 400	0	0	0	0	0	0	0	0





SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Health	556 914	644 763	701 007	776 688	686 152	1 150 349	654 525	1 074 951	1 375 861	1 652 001
Education and training	195 917	227 502	187 291	294 482	359 897	402 285	547 108	739 611	925 245	912 877
Social development and community services	224 740	278 132	289 353	322 530	537 752	313 280	367 738	366 099	519 649	701 234
<b>Division 4: Environment</b>	<b>317 863</b>	<b>339 148</b>	<b>346 483</b>	<b>377 151</b>	<b>509 533</b>	<b>554 758</b>	<b>456 619</b>	<b>629 133</b>	<b>614 011</b>	<b>737 262</b>
Environment unclassified	57 173	69 800	0	0	0	0	0	0	0	0
Environmental knowledge	108 189	135 472	170 901	188 250	230 135	232 440	184 169	269 688	246 804	331 243
Environmental aspects of development	93 853	72 050	92 353	86 295	123 344	168 956	154 462	202 787	212 879	233 609
Environmental and other aspects	58 648	61 826	83 229	102 606	156 054	153 362	117 989	156 658	154 328	172 411
<b>Division 5: Advancement of Knowledge</b>	<b>878 959</b>	<b>947 737</b>	<b>1 835 231</b>	<b>2 104 026</b>	<b>2 433 048</b>	<b>2 903 975</b>	<b>2 713 487</b>	<b>3 087 684</b>	<b>3 583 508</b>	<b>4 269 886</b>
Advancement of Knowledge unclassified	171 520	209 400	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	416 081	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
Social sciences and humanities	291 359	314 868	866 152	840 223	989 135	1 172 435	1 080 231	1 081 488	1 320 677	1 382 659
<b>Total</b>	<b>3 621 862</b>	<b>4 191 366</b>	<b>5 101 224</b>	<b>5 424 602</b>	<b>6 609 216</b>	<b>7 333 153</b>	<b>7 292 853</b>	<b>8 377 575</b>	<b>9 876 623</b>	<b>11 659 258</b>

**Table C.140: Proportional higher education sector R&D expenditure by socio-economic objective (2007/08 to 2016/17)**

SOCIO-ECONOMIC OBJECTIVE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
<b>Division 1: Defence</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>
Defence	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
<b>Division 2: Economic Development</b>	<b>35.1</b>	<b>36.7</b>	<b>34.1</b>	<b>28.4</b>	<b>31.4</b>	<b>27.2</b>	<b>34.9</b>	<b>29.5</b>	<b>28.9</b>	<b>28.9</b>
Economic Development unclassified	4.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	3.4	3.7	3.5	3.5	4.2	3.2	7.3	2.6	2.9	3.1
Animal production and animal primary products	2.6	2.8	2.6	2.4	2.3	2.4	2.4	2.3	2.0	2.5

<b>SOCIO-ECONOMIC OBJECTIVE</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2013/14</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>
	%	%	%	%	%	%	%	%	%	%
Mineral resources (excluding Energy)	2.1	2.1	1.6	1.8	2.0	0.9	1.8	1.5	1.3	1.0
Energy resources	2.3	1.7	1.6	1.6	1.3	1.3	1.1	0.9	0.9	0.6
Energy supply	2.7	2.5	2.1	2.7	2.4	2.2	3.0	2.8	2.4	1.9
Manufacturing	4.8	5.0	5.8	4.5	4.1	4.8	4.7	3.9	3.9	3.8
Construction	0.8	1.1	0.5	1.4	1.8	1.0	1.1	1.2	1.1	1.5
Transport	0.6	0.7	0.6	0.4	0.8	0.4	0.4	0.5	0.5	0.6
Information and communication services	1.9	2.1	2.2	1.7	2.2	1.4	1.9	1.8	2.4	1.6
Commercial services	2.6	1.3	5.5	1.0	1.6	1.5	2.1	1.5	1.3	1.6
Economic framework	4.5	4.6	4.1	4.0	4.6	4.6	5.0	5.9	5.5	5.3
Natural resources	2.1	4.1	4.0	3.4	4.2	3.5	4.0	4.7	4.8	5.5
<b>Division 3: Society</b>	<b>31.7</b>	<b>32.4</b>	<b>23.1</b>	<b>25.7</b>	<b>24.0</b>	<b>25.4</b>	<b>21.5</b>	<b>26.0</b>	<b>28.6</b>	<b>28.0</b>
Society unclassified	4.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	15.4	15.4	13.7	14.3	10.4	15.7	9.0	12.8	13.9	14.2
Education and training	5.4	5.4	3.7	5.4	5.4	5.5	7.5	8.8	9.4	7.8
Social development and community services	6.2	6.6	5.7	5.9	8.1	4.3	5.0	4.4	5.3	6.0
<b>Division 4: Environment</b>	<b>8.8</b>	<b>8.1</b>	<b>6.8</b>	<b>7.0</b>	<b>7.7</b>	<b>7.6</b>	<b>6.3</b>	<b>7.5</b>	<b>6.2</b>	<b>6.3</b>
Environment unclassified	1.6	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	3.0	3.2	3.4	3.5	3.5	3.2	2.5	3.2	2.5	2.8
Environmental aspects of development	2.6	1.7	1.8	1.6	1.9	2.3	2.1	2.4	2.2	2.0
Environmental and other aspects	1.6	1.5	1.6	1.9	2.4	2.1	1.6	1.9	1.6	1.5
<b>Division 5: Advancement of Knowledge</b>	<b>24.3</b>	<b>22.6</b>	<b>36.0</b>	<b>38.8</b>	<b>36.8</b>	<b>39.6</b>	<b>37.2</b>	<b>36.9</b>	<b>36.3</b>	<b>36.6</b>
Advancement of Knowledge unclassified	4.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	11.5	10.1	19.0	23.3	21.8	23.6	22.4	23.9	22.9	24.8
Social sciences and humanities	8.0	7.5	17.0	15.5	15.0	16.0	14.8	12.9	13.4	11.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



**Table C.141: Higher education sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	276 740	286 605	536 792	556 496	608 815	592 861	557 292	612 239	975 099	1 002 978
Free State	180 713	226 892	246 298	281 889	323 335	356 177	449 852	491 203	523 782	625 646
Gauteng	1 260 991	1 467 914	1 537 166	1 600 783	2 028 145	2 118 817	2 233 696	2 733 330	3 305 576	4 105 237
KwaZulu-Natal	459 299	567 999	662 518	677 740	902 386	1 137 258	750 507	843 111	903 664	1 157 722
Limpopo	79 716	86 635	147 397	224 603	349 559	300 435	187 317	216 352	229 364	301 809
Mpumalanga	105 629	72 590	88 680	119 231	170 966	182 192	147 134	174 657	190 716	148 981
North-West	166 137	150 125	190 570	184 514	275 088	311 325	405 963	404 575	444 135	469 171
Northern Cape	48 277	68 443	92 062	107 581	148 425	164 483	161 603	146 769	164 487	188 515
Western Cape	1 044 360	1 264 162	1 599 741	1 671 766	1 802 496	2 169 606	2 399 489	2 755 339	3 139 800	3 659 198
<b>Total</b>	<b>3 621 862</b>	<b>4 191 366</b>	<b>5 101 224</b>	<b>5 424 602</b>	<b>6 609 216</b>	<b>7 333 153</b>	<b>7 292 853</b>	<b>8 377 575</b>	<b>9 876 623</b>	<b>11 659 258</b>

**Table C.142: Proportional higher education sector R&D expenditure by province (2007/08 to 2016/17)**

PROVINCE	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	7.6	6.8	10.5	10.3	9.2	8.1	7.6	7.3	9.9	8.6
Free State	5.0	5.4	4.8	5.2	4.9	4.9	6.2	5.9	5.3	5.4
Gauteng	34.8	35.0	30.1	29.5	30.7	28.9	30.6	32.6	33.5	35.2
KwaZulu-Natal	12.7	13.6	13.0	12.5	13.7	15.5	10.3	10.1	9.1	9.9
Limpopo	2.2	2.1	2.9	4.1	5.3	4.1	2.6	2.6	2.3	2.6
Mpumalanga	2.9	1.7	1.7	2.2	2.6	2.5	2.0	2.1	1.9	1.3
North-West	4.6	3.6	3.7	3.4	4.2	4.2	5.6	4.8	4.5	4.0
Northern Cape	1.3	1.6	1.8	2.0	2.2	2.2	2.2	1.8	1.7	1.6
Western Cape	28.8	30.2	31.4	30.8	27.3	29.6	32.9	32.9	31.8	31.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Table C.143: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation (2007/08 to 2016/17)**

YEAR	HEADCOUNTS				FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL
2007/08	21 365	17 008	2 006	2 351	5 178.1	3 672.3	612.8	893.0
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

\*Excludes post-graduate students, but includes specific categories of R&D personnel.

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.144: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2014/15, 2015/16 and 2016/17)**

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
<b>2014/15</b>							
Researchers*	38 381	21 060	17 321	15 804.3	8 731.8	7 072.5	41.2
Technicians directly supporting R&D	2 496	1 381	1 115	857.3	509.5	347.8	34.3
Other personnel directly supporting R&D	3 580	1 176	2 404	1 282.8	374.8	908.0	35.8
<b>Total</b>	<b>44 457</b>	<b>23 617</b>	<b>20 840</b>	<b>17 944.4</b>	<b>9 616.2</b>	<b>8 328.3</b>	<b>40.4</b>
<b>2015/16</b>							
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
<b>Total</b>	<b>48 034</b>	<b>25 204</b>	<b>22 830</b>	<b>20 812.0</b>	<b>11 149.0</b>	<b>9 663.0</b>	<b>43.3</b>
<b>2016/17</b>							
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
<b>Total</b>	<b>52 384</b>	<b>27 478</b>	<b>24 906</b>	<b>22 061.4</b>	<b>11 826.0</b>	<b>10 235.4</b>	<b>42.1</b>

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

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.145: Higher education sector R&D personnel in headcounts by occupation and gender, and full-time equivalents by occupation (2014/15, 2015/16 and 2016/17)**

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
<b>2014/15</b>					
Researchers*	18 625	9 876	8 749	5 097.7	27.4
Technicians directly supporting R&D	2 496	1 381	1 115	857.3	34.3
Other personnel directly supporting R&D	3 580	1 176	2 404	1 282.8	35.8
<b>Total</b>	<b>24 701</b>	<b>12 433</b>	<b>12 268</b>	<b>7 237.8</b>	<b>29.3</b>
<b>2015/16</b>					
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
<b>Total</b>	<b>25 612</b>	<b>12 811</b>	<b>12 801</b>	<b>7 147.1</b>	<b>27.9</b>
<b>2016/17</b>					
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
<b>Total</b>	<b>28 658</b>	<b>14 265</b>	<b>14 393</b>	<b>7 652.9</b>	<b>26.7</b>

\*Excludes doctoral students and post-doctoral fellows.

Includes specific categories of R&D personnel.

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.146: Higher education sector R&D postgraduates in headcounts by qualification and gender, and full-time equivalents by qualification (2014/15, 2015/16 and 2016/17)**

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
2014/15	TOTAL	MALE	FEMALE	TOTAL	FTEs AS % OF HEADCOUNTS
Post-doctoral fellows	1 983	1 183	800	1 876.8	94.6
Doctoral students	17 773	10 001	7 772	8 829.8	49.7
Master's students	35 746	17 241	18 505	16 796.7	47.0
<b>Total</b>	<b>55 502</b>	<b>28 425</b>	<b>27 077</b>	<b>27 503.3</b>	<b>49.6</b>
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
<b>Total</b>	<b>60 923</b>	<b>30 651</b>	<b>30 272</b>	<b>31 445.8</b>	<b>51.6</b>
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
<b>Total</b>	<b>78 931</b>	<b>39 950</b>	<b>38 981</b>	<b>37 947.4</b>	<b>48.1</b>

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

**Table C.147: Higher education sector R&D personnel in headcounts by occupation, qualification, population group and gender (2016/17)**

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
<b>Researchers*</b>	<b>22 302</b>	<b>11 690</b>	<b>10 612</b>	<b>3 472</b>	<b>3 016</b>	<b>658</b>	<b>735</b>	<b>922</b>	<b>1 044</b>	<b>4 792</b>	<b>4 954</b>	<b>1 846</b>	<b>863</b>
Doctoral degree or equivalent	9 628	5 561	4 067	1 123	802	276	253	335	298	2 561	2 224	1 266	490
Master's, honours, bachelor or equivalent	10 980	5 329	5 651	2 071	1 907	339	403	518	650	1 968	2 396	433	295
Diplomas	1 694	800	894	278	307	43	79	69	96	263	334	147	78
<b>Technicians directly supporting R&amp;D</b>	<b>2 227</b>	<b>1 237</b>	<b>990</b>	<b>440</b>	<b>251</b>	<b>145</b>	<b>94</b>	<b>29</b>	<b>31</b>	<b>354</b>	<b>305</b>	<b>269</b>	<b>309</b>
Doctoral degree or equivalent	173	107	66	26	12	6	5	1	6	60	38	14	5
Master's, honours, bachelor or equivalent	690	338	352	131	99	40	49	12	18	126	161	29	25
Diplomas	1 364	792	572	283	140	99	40	16	7	168	106	226	279
<b>Other personnel directly supporting R&amp;D</b>	<b>4 129</b>	<b>1 338</b>	<b>2 791</b>	<b>530</b>	<b>922</b>	<b>143</b>	<b>410</b>	<b>41</b>	<b>85</b>	<b>412</b>	<b>950</b>	<b>212</b>	<b>424</b>
Doctoral degree or equivalent	268	127	141	33	36	7	9	12	8	65	69	10	19
Master's, honours, bachelor or equivalent	1 480	473	1 007	171	299	41	119	12	35	170	449	79	105
Diplomas	2 381	738	1 643	326	587	95	282	17	42	177	432	123	300
<b>Total</b>	<b>28 658</b>	<b>14 265</b>	<b>14 393</b>	<b>4 442</b>	<b>4 189</b>	<b>946</b>	<b>1 239</b>	<b>992</b>	<b>1 160</b>	<b>5 558</b>	<b>6 209</b>	<b>2 327</b>	<b>1 596</b>

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

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.148 Higher education sector overview (2016/17)

	R&D EXPENDITURE	RESEARCHER HEADCOUNT*	RESEARCHER FTE*	POSTGRAD HEADCOUNT	POSTGRAD FTE
	R' 000				
<b>Private Universities</b>	<b>55 611</b>	<b>165</b>	<b>63.6</b>	<b>90</b>	<b>37.4</b>
<b>Universities</b>	<b>10 819 202</b>	<b>19 054</b>	<b>4693.7</b>	<b>21 988</b>	<b>13 462</b>
Nelson Mandela Metropolitan University	293 683	502	95.2	692	354.3
North West University	612 147	1 604	401.0	1 731	1 263.0
Rhodes University	319 207	451	154.1	690	690.0
Sefako Makgatho Health Sciences University**	180 368	551	116.2	89	62.3
University of Cape Town	1 653 977	1 318	528.4	2 322	1 479.9
University of Fort Hare	253 317	423	81.6	760	464.0
University of Johannesburg	560 139	848	228.2	1 061	577.0
University of KwaZulu Natal	870 535	1 528	443.3	3 380	1 633.4
University of Limpopo	138 653	473	94.2	258	251.0
University of Pretoria	1 151 103	2 097	522.8	2 578	1 220.0
University of South Africa	685 302	1 804	378.7	2 286	1 632.3
University of Stellenbosch	1 472 808	1 812	583.3	1 882	1 053.8
University of the Free State	440 432	657	187.3	1 043	564.0
University of the Western Cape	415 038	965	296.6	770	463.5
University of the Witwatersrand	1 686 626	3 710	543.8	2 184	1 565.8
University of Zululand	85 866	311	39.1	262	188.2
<b>Universities of (Science) and Technology</b>	<b>784 445</b>	<b>3 083</b>	<b>463.0</b>	<b>1 648</b>	<b>908.7</b>
Cape Peninsula University of Technology	222 784	650	113.7	255	255.0
Walter Sisulu University of Technology and Science	90 241	615	92.3	65	48.2
Central University of Technology	93 957	205	51.1	166	64.9
Durban Institute of Technology	83 557	347	45.8	347	183.2
Mangosuthu Technikon	16 654	195	16.7	7	7.0
Tshwane University of Technology	138 724	237	40.3	424	76.5
University of Venda for Science and Technology	58 006	436	43.6	320	224.0
Vaal University of Technology	80 521	398	59.7	64	49.9
<b>TOTAL</b>	<b>11 659 258</b>	<b>22 302</b>	<b>5 220.4</b>	<b>23 726</b>	<b>14 408.5</b>

\*\*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 for only 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 (2007-2016)**

YEAR	GDP LEVEL (CURRENT VALUES)	GDP LEVEL (CONSTANT 2010 VALUES)
	R MILL.	R MILL.
2007	2 109 501	2 624 841
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	4 051 421	3 066 836
2016	4 350 314	3 084 174

Data source: Stats SA (2018b)

## ► D. METHODOLOGICAL NOTES

### D.1. Survey design and planning

The South African National Survey of Research and Experimental Development (R&D Survey) is commissioned by the Department of Science and Technology (DST) and 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 (Table D.1) (OECD, 2015). In South Africa, the science councils are extracted from the government sector and are reported separately, thus comprising a fifth sector for South Africa.

The scope of the survey includes all units performing R&D, either continuously or occasionally. As is standard, CeSTII and DST agreed on output tables in advance. This report contains the results for the 2016/17 reference period.

**Table D.1: Main institutional sectors in the economy**

SYSTEM OF NATIONAL ACCOUNTS SECTOR	NATIONAL SYSTEM OF INNOVATION SECTOR DESCRIPTION
Non-financial corporations Financial corporations	<b>Business enterprise sector:</b> "All firms, organisations and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant price. The private non-profit institutions mainly serving them."
General government	<b>Government sector:</b> "All departments, offices and other bodies which furnish, but normally do not sell to the community, those common services, other than higher education, which cannot otherwise be conveniently and economically provided, as well as those that administer the state and the economic and social policy of the community. (Public enterprises are included in the business enterprise sector.) [Non-profit institutions] controlled and mainly financed by government, but not administered by the higher education sector."
Non-profit institutions serving households Households	<b>Private non-profit sector:</b> "Non-market, private non-profit institutions serving households (i.e. the general public). Private individuals or households."
Included in other SNA sectors	<b>Higher education:</b> "All universities, colleges of technology and other institutions of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations and clinics operating under the direct control of or administered by or associated with higher education institutions."
Rest of the world	<b>Abroad</b>

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

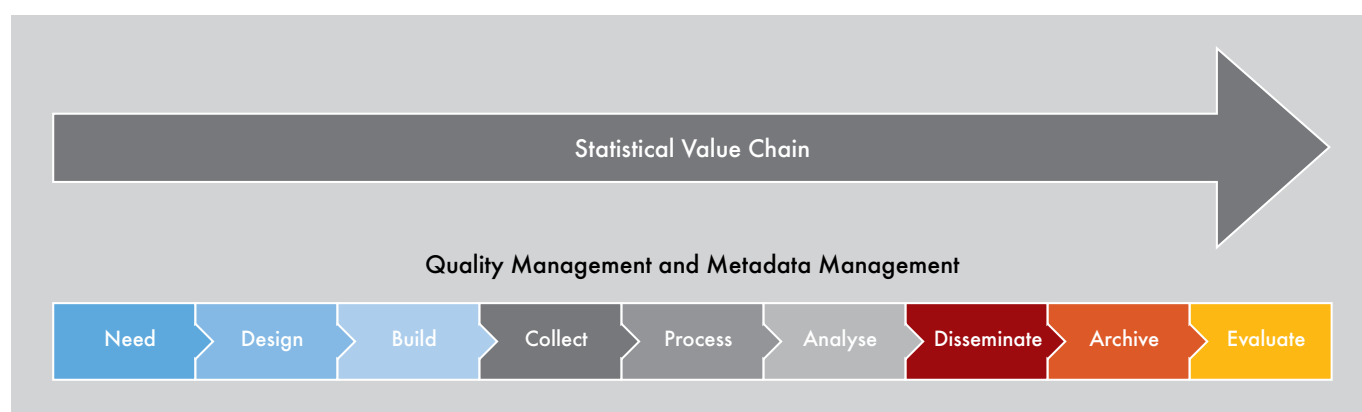
In the interests of coherence of its data with other South African economic survey data, the South African R&D Survey takes care to use standards and methods applied or recommended by Statistics South Africa (Stats SA). Concepts and definitions are aligned as far as possible with those in use by the National Statistical Organisation (NSO) (Stats SA, 2010a). Indicators that use external data are sourced from Stats SA surveys. Gross domestic product values are the values for the 2016 annual reference period taken from the quarterly Stats SA GDP statistical release P0441 (Stats SA, 2018a). Employment level is the value for the first quarter of 2016 obtained from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2018b). 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 project plan for the survey is 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 separate questionnaires were used in the survey. One questionnaire was designed for the business sector, another for the higher education sector, and a third one for the 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 2016/17. Table D.2 describes each of the sectors; the fieldwork period for each sector, and also provides their respective reference periods.

**Table D.2: Description of sectors, respective reference periods, sampling methods and fieldwork periods**

SECTOR	DESCRIPTION	REFERENCE PERIOD	METHOD OF SURVEYING	FIELDWORK AND FOLLOW-UP PERIOD
Business	Business enterprises, including state-owned enterprises.	Financial year 2016-2017 (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.	October 2017 - June 2018
Not-for-profit	Non-governmental and other organisations formally registered as NPOs.	1 April 2016 to 31 March 2017 (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.	13 November 2017 - 30 April 2018
Government	National and provincial departments, local government, museums, research institutes and other research councils with an R&D component.	Financial year 1 April 2016 to 31 March 2017 (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.	10 October 2017 - 31 May 2018
Science councils	The nine science councils established through Acts of Parliament.	Financial year 1 April 2016 to 31 March 2017 (or nearest complete financial year).	Seven statutory science councils were surveyed, using a census approach.	10 October 2017 - 31 May 2018
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 2016).	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.	10 October 2017 - 15 June 2018

### 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 10 October 2017 and 15 June 2018.

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 were made to the 2016/17 R&D Survey collection instrument. The most impactful changes were to the R&D personnel tables for all sectors. This was done in an effort to report on foreign employees that could not be categorised by population groups during previous surveys. The R&D personnel changes included an additional classification of population group of R&D personnel, as non-South African personnel. The full-time equivalent (FTE) value of the non-South African R&D personnel cannot be estimated with sufficient precision, due to the model that the R&D Survey employs for calculating labour costs from average costs of labour in terms of FTEs. However, the maximum effect on labour costs (and subsequently R&D expenditure) has been estimated by assuming a maximum value for the time spent on research by non-SA R&D personnel as indicated in Table D.3

The contribution of the non-South African researchers to the estimates of R&D personnel (as well as researchers) is 5.4%.

Another change was an additional classification of researchers as being emeritus professors, research fellows or honorary fellows. These changes did not contribute to the calculation of any of the statistics estimated in the R&D Survey, but merely provided an additional categorisation of researchers. More detail on this is provided in the higher education sector report below.

Furthermore, reporting units were asked whether they participate in space science. This addition is merely a classification and does not affect R&D expenditure, R&D personnel or other statistics estimated in 2016/17.

**Table D.3 Disaggregation of R&D personnel by non-South African personnel for all sectors (2016/17)**

SECTOR	SOUTH AFRICAN PERSONNEL ONLY		NON-SA PERSONNEL		TOTAL SA AND NON-SA PERSONNEL		ANNUAL LABOUR COST PER FULL-TIME PERSON	ESTIMATED AVERAGE MAXIMUM LABOUR COST OF NON-SA R&D PERSONNEL	R&D EXPENDITURE	CONTRIBUTION OF NON-SA PERSONNEL TO TOTAL		CONTRIBUTION OF NON-SA R&D PERSONNEL LABOUR COST TO R&D EXPENDITURE
	RESEARCHER HEADCOUNTS	R&D PERSONNEL HEADCOUNTS	RESEARCHER HEADCOUNTS	R&D PERSONNEL HEADCOUNTS	RESEARCHER HEADCOUNTS	R&D PERSONNEL HEADCOUNTS	R&D PERSONNEL (R'000)	R MILLION	R MILLION	RESEARCHERS %	R&D PERSONNEL %	
Business	6 343	17 689	121	309	6 464	17 998	676	209	14 781	1.9	1.7	1.4
Not-for-profit	370	1 552	34	64	404	1 616	344	22	1 018	8.4	4.0	2.2
Government	1 669	3 064	8	12	1 677	3 076	422	5	2 099	0.5	0.4	0.2
Science councils	2 023	4 722	166	233	2 189	4 955	529	123	6 136	7.6	4.7	2.0
Higher education*	43 319	48 461	2 709	3 923	46 028	52 384	196	767	11 659	5.9	7.5	6.6
<b>Total</b>	<b>53 724</b>	<b>75 488</b>	<b>3 038</b>	<b>4 541</b>	<b>56 762</b>	<b>80 029</b>		<b>1 127</b>	<b>35 694</b>	<b>5.4</b>	<b>5.7</b>	<b>3.2</b>

Contribution of non-SA R&D researchers to total R&D personnel, and R&D expenditure (2016/17). \*Higher Education researchers and R&D personnel includes non-SA post-doctoral fellows and PhD students. 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.





### 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 620 business sector units were selected for the 2016/17 survey period. Out of this sample, a cohort of 382 units was reported as in-scope units. The relatively high imputation rate of 74 can be attributed to the non-response from a small number of large R&D performers.

In some instances non-response is attributed to respondents declining participation in the survey due to the negative outcomes of their R&D Tax Incentive applications. These concerns have been reported to the DST.

### Science councils sector

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

### Not-for-profit sector

There is an ongoing process of substantial improvement in coverage of the not-for-profit sector by investigating a comprehensive list of 2 203 registered NPOs. A total of 452 units were investigated for the 2016/17 survey period, out of which only five units were identified as likely R&D performers. The NPO frame for the 2016/17 survey comprised a total of 74 units, after the removal of out-of-scopes at the end of the 2015/16 survey cycle, and with the addition of new units at the start of the 2016/17 survey period.

### Government sector

The government sector investigated a list of 164 units consisting of national and provincial departments, municipalities, research centres and museums, of which 104 units were selected for surveying.

### Higher education sector

In the 2016/17 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, while not explicitly delineated between respondents and collectors were 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 for reporting purposes.

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

In the 2016/17 survey, 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). These changes did not affect the calculation of R&D personnel in any way in 2016/17.

## 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.4 reflects an overall questionnaire response rate of 68.9%.

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*<sup>2</sup> 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. These include units stating nil in-house R&D expenditure for the 2016/17 survey period.

*In-scope units*<sup>3</sup> were defined as units performing in-house R&D or with likely in-house R&D activity.

*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:

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

*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.

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

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

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

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:

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

<sup>2</sup> Adapted from Sarndal, Swensson, & Wretman (1992).

<sup>3</sup> This is the HSRC-CeSTII operational definition.



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

SECTOR	NUMBER OF UNITS INVESTIGATED	NUMBER OF QUESTIONNAIRES RETURNED	NON-RESPONSE	OUT-OF-SCOPE	RESPONSES	QUESTIONNAIRE RESPONSE RATE	COLLECTION RATE	UNIT IMPUTATION RATE	CONFIRMED IN-SCOPE REPORTING UNITS
Business	620	430	232	122	308	73.7%	85.9%	17.7%	382
Not-for-profit	452	50	33	9	40	62.5%	67.1%	0.0%	40
Government	164	53	55	4	49	49.0%	71.2%	5.0%	54
Science councils	13	13	0	0	13	100.0%	100.0%	0.0%	13
Higher education (Public)	24	17	7	0	17	70.8%	70.8%	29.2%	24
Higher education (Private)	9	6	3	0	6	66.7%	77.8%	0.0%	6
<b>Total</b>	<b>1 282</b>	<b>569</b>	<b>330</b>	<b>135</b>	<b>433</b>	<b>68.9%</b>	<b>81.8%</b>	<b>13.7%</b>	<b>549</b>

## D.5. Imputation

Imputation is a procedure for entering a value for a specific data item where the response is missing or unusable. The R&D Survey strives to keep the rate of imputation as low as possible, while striving to include all likely sources of R&D activity in the final estimates. Since 2012/13, the rates of imputation employed have been reported, along with the age of the data used to impute (Table D.5). 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 adjusted by a GDP inflation factor of 7.140 in 2016/17.

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

AGE OF DATA	BUSINESS	NPO	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION
Imputed (data from current reference period)	0	0	0	0	0
Imputed (data from previous year)	0	0	0	0	0
Imputed (data more than one year old)	0	0	0	0	0
Commutated (data from previous year)	73	0	5	0	4
Commutated (data more than one year old)	1	0	0	0	3
<b>Total</b>	<b>74</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>7</b>

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

The data was manually entered on the R&D Survey Management System (RDSMS) after the individual responses to the questionnaires, including summation and percentage calculations, had been checked by the fieldworker. 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 DST. 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, and also taking into account the economic environment.

Sector experts selected known SOEs from the enterprises in the business sector to produce tables on the SOEs. CeSTII has developed this list of SOEs over several years, which has been checked against the treasury list (National Treasury, 2015).

## D.7. Dissemination of survey results

The 2016/17 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 DST. The report can be downloaded from the HSRC-CeSTII website (<http://www.hsrc.ac.za/en/departments/cestii/reports-cestii>) alternatively the DST website (<http://www.dst.gov.za/index.php/resource-center/rad-reports>).

Care is taken to ensure the confidentiality of respondent information, and the data presented in the report are therefore anonymised as far as possible.

## D.8. Storage and archiving of survey results

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

### STRICTLY CONFIDENTIAL

#### NATIONAL SURVEY OF RESEARCH & EXPERIMENTAL DEVELOPMENT INPUTS TO HIGHER EDUCATION [PUBLIC] 2016 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 2016.**

#### 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	<a href="mailto:nvlotman@hsrc.ac.za">nvlotman@hsrc.ac.za</a>
Mrs Janine Senekal	021 466 7814	<a href="mailto:jsenekal@hsrc.ac.za">jsenekal@hsrc.ac.za</a>

#### Dr. Neo Molotja

Senior Research Specialist

[nmolotja@hsrc.ac.za](mailto: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 2016 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 2015.

#### 4. HEADCOUNTS OF R&D PERSONNEL

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

Personnel Categories and Highest Qualification	African		Coloured		Indian		White		Sub-total		TOTAL
	M	F	M	F	M	F	M	F	M	F	
<b>Researchers</b>											
Doctorates											
Masters/Hons/Bachelors or equivalent											
Diplomas and other qualifications											
<b>Researcher total</b>											
<b>Technicians/Technologists</b>											
Doctorates											
Masters/Hons/Bachelors or equivalent											
Diplomas and other qualifications											
<b>Technician total</b>											
<b>Other personnel directly supporting R&amp;D</b>											
Doctorates											
Masters/Hons/Bachelors or equivalent											
Diplomas and other											
<b>Other direct support total</b>											
<b>Specific categories of R&amp;D personnel</b>											
Professors Emeritus, research fellows, honorary research associates or equivalent											
Volunteers											
<b>Specific R&amp;D personnel total</b>											

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 **NOTE B** on page 6 on how to calculate Research FTE's for technicians and support staff)

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

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

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

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

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

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

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

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

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

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

#### **CALCULATING RESEARCH FULL-TIME EQUIVALENTS:**

For the purpose of this survey, a person can work a maximum of 1 FTE in a year. This is why the Research FTE is not defined by specifying the maximum number of working hours in a month or year. The following equation can be used to calculate person years of effort on R&D: (Full time equivalent) x (Portion of the year the person spent on R&D) x (Portion of their job spent on R&D) = Person years of effort on R&D

#### **For example:**

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

$1 \times 1 \times 1 = 1$  person years on R&D

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

$1 \times 0.4 \text{ persons} \times 0.5 \text{ years} = 0.2$  person years of R&D effort

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

$0.4 \times 1 \times 1 = 0.4$  FTE to the R&D effort.

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

$20 \times 0.4 \times 1 = 8$

NOTE: please calculate FTEs for all R&D personnel

#### **Indirect Services:**

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



## 6. HEADCOUNT OF POSTGRADUATE STUDENTS

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

Postgraduate student categories	South African								Non-South African		Sub-total		TOTAL	
	African		Coloured		Indian		White		All Races		M	F		
	M	F	M	F	M	F	M	F	M	F				
Post-doctoral fellows														
Doctoral Students														
Masters Students (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)					
<b>TOTAL COST OF STUDENTS</b>					

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 2016. 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

Vehicles, plant, machinery and equipment  
Land, buildings and other structures

R'000 Excluding VAT

A

B

#### LABOUR COSTS OF R&D

Total cost of R&D personnel (carried over from Question 5)

Total cost of R&D postgraduate students (carried over from Question 7)

**TOTAL**

R'000 Excluding VAT

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)

Other Current Expenditure  
Specific categories of R&D personnel costs

R'000 Excluding VAT

D

**TOTAL R&D EXPENDITURE (A + B + C + D = E)**

R'000 Excluding VAT

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
- 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.

#### ***Excluding:***

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

### **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
- 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  $0.22 \times R1,700,000 = R374,000$ .

#### ***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

## 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
<b>National, Provincial and Local Government</b> excluding the HE Vote	
<b>Government Research Institutes</b> 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.	
<b>Agency Funding</b> 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 <b>your</b> institution	
<b>Science Council Funding</b> i.e. CSIR, HSRC, MRC (Non-agency), ARC, Geosciences, SABS, Mintek, Africa Institute of SA	
<b>Domestic Business</b> including industry funds for THRIP projects	
<b>Other South African Sources</b>	
• Other Higher Education Institutions	
• Not for Profit Organisations	
• Donations and bequests from Individuals	
<b>Foreign Sources</b>	
<b>SUB-TOTAL EXTERNAL SOURCES</b>	<b>F</b>

### 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.

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



## 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:

N/A ☐

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

\* 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  
Free State  
Gauteng  
KwaZulu-Natal  
Limpopo


Mpumalanga  
Northern Cape  
North-West  
Western Cape  
**TOTAL**


0%

## PART 4: CATEGORIES OF R&D EXPENDITURE

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

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

#### Basic Research

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

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

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

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

%



#### Applied Research

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

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

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

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

Applied research develops ideas into operational form.

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

%



#### Experimental Development

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

%



**TOTAL**

**0%**



### 13a. RESEARCH FIELDS (RF)

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

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

RF Codes		Percentage	RF Codes		Percentage
RF	<input type="text"/>	<input type="text"/>	RF	<input type="text"/>	<input type="text"/>
RF	<input type="text"/>	<input type="text"/>	RF	<input type="text"/>	<input type="text"/>
<b>TOTAL</b>			<b>0%</b>		

### 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	<input type="text"/>
Nanotechnology	<input type="text"/>

**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	
<b>No R&amp;D in these areas</b>	

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	
<b>TOTAL</b>			<b>0%</b>



## 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 2016/17

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@hsr.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'.

- |   |  |
|---|--|
| <input type="checkbox"/> Government                       | <input type="checkbox"/> International organisation  |
| <input type="checkbox"/> Private enterprise               | <input type="checkbox"/> Media                       |
| <input type="checkbox"/> Public enterprise                | <input type="checkbox"/> Not-for-profit organisation |
| <input type="checkbox"/> Academic or research institution | <input type="checkbox"/> Other, specify _____        |

\_\_\_\_\_

\_\_\_\_\_

#### 3. In which country do you work?

\_\_\_\_\_

#### 4. What is your assessment of the contents of this publication?

- |                                    |                               |                                  |                                       |                               |
|------------------------------------|-------------------------------|----------------------------------|---------------------------------------|-------------------------------|
| <input type="checkbox"/> Excellent | <input type="checkbox"/> Good | <input type="checkbox"/> Average | <input type="checkbox"/> Satisfactory | <input type="checkbox"/> 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.

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9. What did you like best about the publication?

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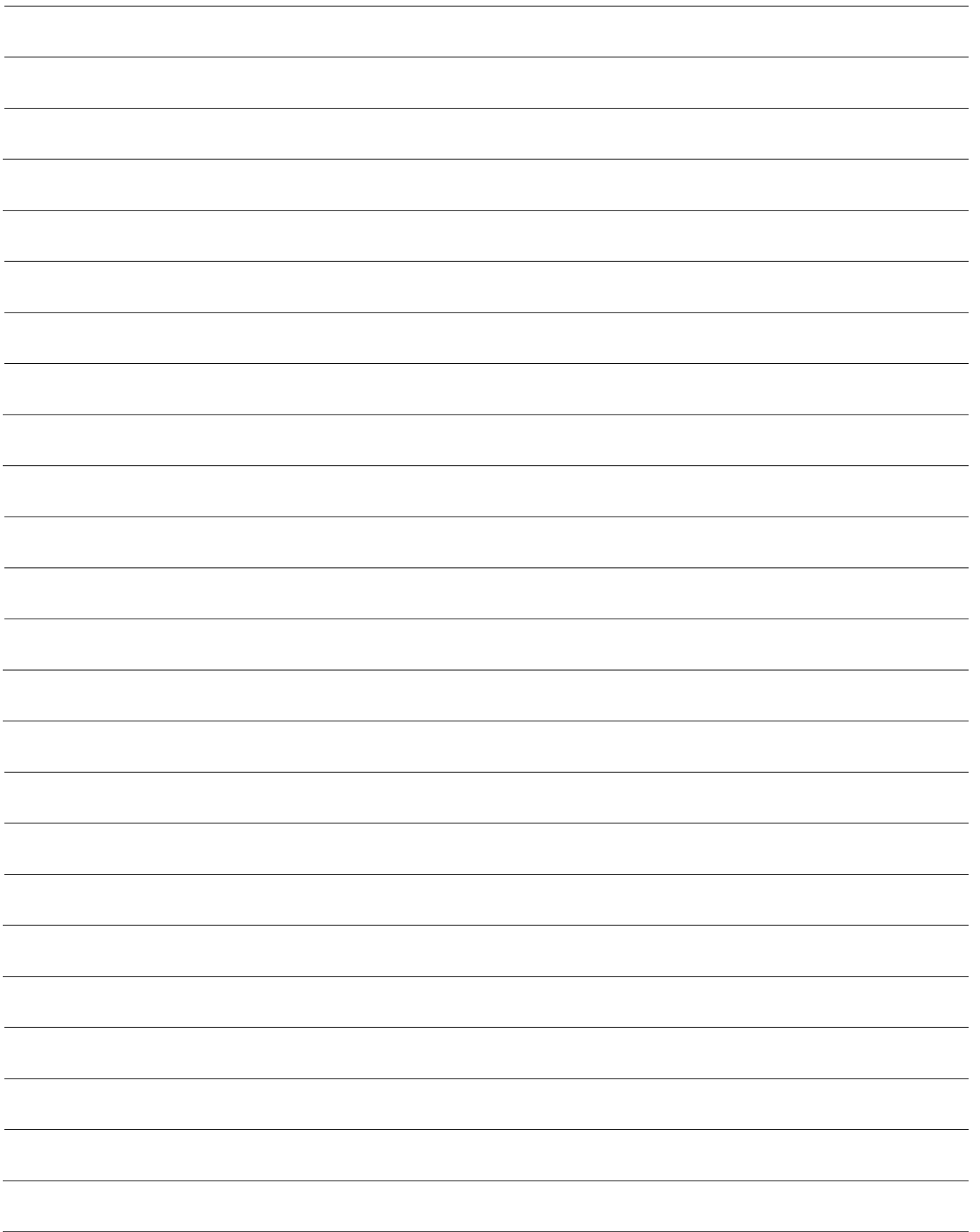
10. Provide any comments or recommendations for the improvement of the publication.

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**Thank you for completing the survey.**



▶ NOTES

[illegible]

▶ NOTES

[illegible]

▶ NOTES

[illegible]



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