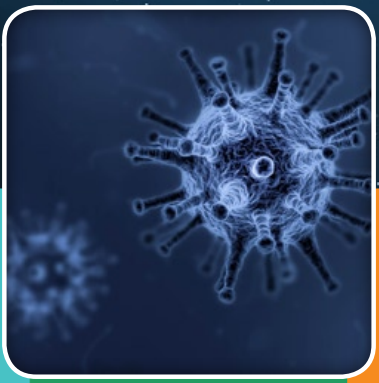
R&D SURVEY

Investment ▪ Insight ▪ Impact

SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT

STATISTICAL REPORT 2020/21



science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

HSRC
Human Sciences Research Council

stats sa
Department:
Statistics South Africa
REPUBLIC OF SOUTH AFRICA

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

First published: January 2023

DISSEMINATION

This report may be downloaded free of charge from the following links.

- https://www.dst.gov.za/index.php/resource-center/rad-reports/r-d-survey-reports
- https://hsrc.ac.za/divisions/centre-for-science-technology-and-innovation-indicators

Data extractions in response to users' special data requests are generally provided free of charge, unless substantial analytical work is required to meet any such request. Data extractions are done in accordance with the approved data access protocol, and requests should be sent to CeSTIIData@hsrc.ac.za.

User feedback

A User Satisfaction Survey (USS) questionnaire is included as **Annexure G** of this report. It would be appreciated if users could complete the questionnaire and return it by e-mail to CeSTIIData@hsrc.ac.za. The feedback is analysed following each survey cycle to ensure the continued improvement of the R&D survey.

Revisions

The Department of Science and Innovation (DSI), Statistics South Africa (Stats SA) and the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicators (HSRC-CeSTII) jointly reserve the right to revise the data and indicators in this report. Revisions may result from revisions by Stats SA of socio-economic indicators such as the gross domestic product (GDP) or population or employment numbers, or amendments in response to internal and external data quality and consistency monitoring such as that carried out by the Organisation for Economic Co-operation and Development (OECD), which conducts quality checks through global comparative analyses, time series analyses and other methods. Explanations of any revisions will be made available on the DSI and HSRC websites. The current R&D intensity series was revised to take into account the revision of the GDP series (Stats SA, 2021). The R&D expenditure in real terms was also rebased to 2015 constant prices.

FOREWORD

The Statistics Act (No. 6 of 1999) empowers the Statistician-General to lead and coordinate statistical production and usage in South Africa, beyond the confines of Statistics South Africa. This has enabled an arrangement whereby the Department of Science and Innovation (DSI) has spearheaded the production of the Research and Experimental Development (R&D) Survey as a member in the South African National Statistics System (NSS) for about two decades. The survey contributes to a body of official statistics that helps to report the country's progress in R&D as a critical aspect of development and growth, both in South Africa and within the global context.

The survey is subject to an ongoing process of quality assessment in line with the South African Statistical Quality Assessment Framework (SASQAF) to ensure that it remains credible and relevant. The 2020/21 is the eleventh series of the R&D Survey, started with the 2010/11 publication which was subjected to the clearance process as outlined in SASQAF. The process was led by the Statistician-General and the Director General of the DSI. The quality assessment processes undertaken for all survey periods prior to the actual publication of the R&D Survey since 2010 have recorded consistent improvements in key statistical quality indicators.

The Clearance Committee for the R&D Survey noted that the 2020/21 R&D Survey was conducted following good practices and achieved most of the set quality standards of the R&D Survey Assessment Tool. Notwithstanding the improvements in key quality indicators for the survey between 2017/18 and 2020/21, these indicators remained unchanged during the period 2018/19 from 2017/18. Indicators that have shown improvements over time include adherence to project plan, improved collection rate, sampling frame maintenance (i.e. duplication rate, out-of-scope units, misclassified units), improved Gross Domestic Expenditure on R&D (GERD) responses, improved Business Expenditure on R&D (BERD) responses. Furthermore, the 2020/21 R&D survey introduced an online data collection mode, which ran parallel with the traditional mode of data collection. This new mode of data collection improved survey operations.

Therefore, with all these improvements that have been recorded, the Clearance Committee recommended that the R&D Survey should undergo a second full Independent Quality Assessment (IQA) in the next financial year (2023/24) so that it can transition from National Statistics to Official Statistics. Moreover, a quality improvement plan will be produced based on key quality indicators that have been identified to require more attention. The IQA process will follow the operational standards and guidelines outlined in the SASQAF.

Given the aforementioned recommendations from the R&D Survey Clearance Committee, I endorse the 2020/21 R&D Survey results be published as National Statistics, with the caveats related to the challenges posed by the COVID-19 pandemic.

Risenga Maluleke
Statistician-General
Republic of South Africa

ACKNOWLEDGEMENTS

The project team extends its appreciation to Dr Phil Mjwara, Director-General of the DSI, Mr Risenga Maluleke, Statistician-General, and Prof. Leickness Simbayi, Acting CEO of the HSRC, for their support of the R&D survey. The support and contributions of Dr Glenda Kruss, Executive Director of CeSTII, Mr Imraan Patel, Dr Mmboneni Muofhe, Ms Tshidi Lekala, Ms Kgomotso Matjila and Mr Thabo Manyaka of the DSI are much appreciated.

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

The HSRC-CeSTII project team for the 2020/21 South African National Survey of Research and Experimental Development comprised: Lindiwe Binda, Mbali Bongoza, Isaac Cameron, Mario Clayford, Marco Davids, Nhlanhla Hlungwani, Atoko Kasongo, Jerry Mathekga, Audrey Mahlaela, Tlangelani Makamu, Sintu Mavi, Nokhetho Mhlanga, Nazeem Mustapha, Gerard Ralphs, Theodore Sass, Natasha Saunders, Kgabo Ramoroka, Viwe Sigenu, Moses Sithole, Natalie Vlotman, Darryn Whisgary, Nqobile Vundla and Luthando Zondi.

We further acknowledge the contributions and support of HSRC IT staff, copy editor Katharine McKenzie, graphic designer Tracey Watson, and the administrative staff Maria Maluleke, Bongiwe Ngqaqu and Zinziswa Hlakula.

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

ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
ARC	Agricultural Research Council
BERD	Business expenditure on R&D
CeSTII	Centre for Science, Technology and Innovation Indicators
DSI	Department of Science and Innovation
FTE	Full-time equivalent
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
GOVERD	Government intramural expenditure on R&D
HEMIS	Higher Education Management Information System
HERD	Expenditure on R&D in the higher education sector
HIV	Human immunodeficiency virus
HSRC	Human Sciences Research Council
ICT	Information and communication technologies
MRC	Medical Research Council
NESTI	National Experts on Science and Technology Indicators
NPO	Not-for-profit organisation
NRF	National Research Foundation
NSI	National system of innovation
NSO	National Statistical Organisation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and experimental development
RDI	Research, Development and Innovation
RDSMS	Research and Development Survey Management System
SA	South Africa
SASQAF	South African Statistical Quality Assessment Framework
SOE	State-owned enterprise
SEO	Socio-economic objective
SIC	Standard Industrial Classification
SNA	System of National Accounts
SPII	Support Programme for Industrial Innovation
Stats SA	Statistics South Africa
SVC	Statistical value chain
TB	Tuberculosis
VAT	Value added tax

DEFINITIONS AND DESCRIPTIONS

Applied research is original investigation undertaken 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 2015 Rands is the value of goods and services of a given year using the prices of a determined base reference year, which is 2010 in this case. These values were obtained by deflating with the GDP deflator using data published in the Statistics South Africa GDP survey P0441, 1st Quarter 2021 (Stats SA, 2021a).

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

Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

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

Gross domestic product (GDP) is the total market value of all final goods and services produced in a country in a given year, equal to total consumer, investment and government spending, plus the value of exports, minus the value of imports. This statistic is obtained from the Statistics South Africa GDP survey P0441, 1st Quarter 2021 (Stats SA, 2021a).

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

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

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

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

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

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

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

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

Other current expenditure 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.[1]

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

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

Socio-economic objective (SEO) classification provides an indication of the R&D activities by main purpose. The SEO classification used in this survey is consistent with the Nomenclature for the Analysis and Comparison of Scientific programs and Budgets (NABS) 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 to describe 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, 1st Quarter 2021 (Stats SA, 2021b) where employed persons were defined as those aged 15–64 years who, during the reference week, did any work for at least one hour, or had a job or business but were not at work (temporarily absent).

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

CONTENTS

LIST OF TABLES

LIST OF FIGURES

A. INTRODUCTION

This Statistical Report presents data tables from the 2020/21 South African National Survey of Research and Experimental Development (R&D Survey). The report provides key findings of the survey with commentary, standard summary tables of the overall findings from 2020/21 and time series from previous instances of the survey. The R&D Survey covers a 12-month period corresponding with the sectoral financial year. For the business, government, science councils and NPO sectors this is from 1 April to 31 March, or the nearest complete financial year. In the higher education sector the calendar year is surveyed, ending 31 December.

The Statistical Report is published annually and provides summary analysis of the survey data.

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

- **The business enterprise sector**, comprising large, medium and small enterprises, including state-owned enterprises.
- **The government sector**, comprising national, provincial and local government with an R&D component; government research institutions and museums.
- **The higher education sector**, comprising all public and private higher education institutions with an R&D component.
- **The not-for-profit sector**, comprising non-governmental and other organisations formally registered as not-for-profit institutions.
- **The science council sector**, comprising the seven science councils established through Acts of Parliament.

This approach is followed to maintain consistency with the institutional sector categorisation recommended by the Organisation for Economic Co-operation and Development (OECD) in *The Measurement of Scientific and Technological Activities: Proposed Standard Practice for Surveys on Research and Experimental Development*, known as the Frascati Manual (OECD, 2015). The split of government into two sectors – a government sector and a science council sector – is an adjustment for the South African situation.

This report presents R&D statistics in tables according to the following categories:

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

GDP values were obtained from the Stats SA GDP statistical release P0441 (Stats SA, 2021a) and the total employment level was taken from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2021b).

All financial quantities presented in this report are in current values, unless otherwise indicated. Constant 2015 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[2] series.

The classification of main institutional sectors recommended in the System of National Accounts (EC, IMF, OECD, UN and World Bank, 2009) is indicated in terms of those used in the Frascati Manual (OECD, 2002, 2015). This is only used indicatively in this report to assist users of data for R&D capitalisation purposes.

Since the 2014/15 R&D Survey, tables have been included to assess the R&D activities of SOEs.

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

Section B provides the main findings of the survey, including commentary on key developments. Section C contains a detailed set of tables describing the survey results for 2020/21 and the preceding nine years. The description of the survey methodology is contained in section D, and an example of the government/science council/not-for-profit questionnaire in section F.

[2] The R&D Survey has historically used the GDP series calculated according to the production method by Stats SA.

B. KEY FINDINGS FOR 2020/21

Gross domestic expenditure on R&D (GERD) declined in nominal and real terms for the third consecutive year (Table C.1 and C.2).

Gross domestic expenditure on research and development (GERD) for 2020/21 was R33.541 billion. GERD in constant 2015 prices fell from R28.140 billion in 2019/20 to R25.999 billion in 2020/21, which is a year-on-year change of -7.6%.

GERD as a percentage of gross domestic product (GDP) was 0.61% in 2020/21, which is one basis point lower than the 0.62% recorded in 2019/20.

Table B.1 shows the key R&D indicators for the 2018/19, 2019/20 and 2020/21 survey reference periods.

Table B.1: Summary of key statistics and indicators (2018/19 to 2020/21)

KEY INDICATOR	2018/19	2019/20	2020/21
Expenditure on R&D			
Gross domestic expenditure on R&D (GERD) (Rm)	36 784	34 485	33 541
Business enterprise expenditure on R&D (BERD) (Rm)	*14 448*	*10 704*	*10 047*
Not-for-profit (NPO) expenditure on R&D (Rm)	*1 486*	*1 510*	*1 568*
Government expenditure on R&D (GOVERD) (Rm)	*2 223*	*1 894*	*2 238*
Science council (SCI) expenditure on R&D (Rm)	*5 444*	*6 198*	*5 902*
Higher education (HE) expenditure on R&D (HERD) (Rm)	*13 183*	*14 179*	*13 786*
Gross domestic expenditure on R&D in constant 2015 prices (Rm)	31 367	28 140	25 999
Funding sources			
Government-funded* R&D (Rm)	17 475	19 417	18 872
Business-funded R&D (Rm)	14 534	9 359	9 034
Foreign funding of R&D (Rm)	3 999	4 662	4 462
Foreign funding of BERD (Rm)	*400*	*1 169*	*978*
Foreign funding of NPO R&D (Rm)	*899*	*941*	*1 018*
Foreign funding of GOVERD (Rm)	*297*	*134*	*56*
Foreign funding of SCI R&D (Rm)	*550*	*440*	*433*
Foreign funding of HERD (Rm)	*1 852*	*1 979*	*1 977*
R&D personnel			
Total R&D personnel (FTE**)	43 774.3	41 856.5	42 925.9
Total researchers# (FTE**)	29 110.8	28 358.6	27 697.6
Total researchers# (headcounts)	62 166	62 002	61 406
Female researchers# (headcounts)	28 401	28 623	28 597
Indicators computed from R&D Survey			
GERD as a percentage of GDP (%)	0.69	0.62	0.61
Civil GERD as a percentage of GDP (%)	0.66	0.58	0.58
BERD as a percentage of GERD (%)	39.3	31.0	30.0
Basic research (R millions)	10 364	11 043	9 856
Total R&D personnel (FTE**) per 1 000 in total employment	2.7	2.8	2.9
Total researchers# (FTE**) per 1 000 in total employment	1.8	1.9	1.8
Female researcher# headcounts as a percentage of total researcher headcounts (%)	45.7	42.0	43.9
Indicators obtained from external data sources			
Gross domestic product (GDP) level at current prices (Rm)	5 357 640	5 605 034	5 521 075
GDP (%)	1.5	0.1	-6.4
SA employment ('000)	16 420	15 024	14 995

*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 onwards).
Note: Headcounts include non-SA R&D personnel in 2016/17 onwards. Non-South African personnel are classified as those personnel that are not citizens of South Africa but are undertaking research in South Africa for a period exceeding six months.

Notable developments reflected in key indicators

South Africa's economy declined greatly

South Africa's GDP decreased by 6.4% in 2020 (Table B1, C.150). This may be ascribed mainly to the global COVID-19 pandemic and resulting national lockdown levels affecting most industries.

Declines in business, higher education and science councils

The business sector reported the largest decrease in nominal expenditure for 2020/21 by R657 million (-6.1%) followed by the higher education and science council sectors with R393 million (-2.8%) and R296 million (-4.8%) respectively (Table B.1).

Government remained the largest funder of R&D

Government funded 56.3% of R&D in South Africa while business funded 26.9%, with foreign funding contributing 13.3%. In nominal terms, funding decreased by R944 million (Table C.20). There was a R545 million (-2.8%) decrease in government funding (including science councils and university own funds) in 2020/21) and a R325 million decrease in business funding in 2020/21 (Table C.19). Funding from abroad decreased by R201 million while funding from other South African sources increased by R127 million.

The manufacturing, agriculture, and transport sectors recorded decreases in R&D expenditure while the financial and mining sectors recorded increases

Manufacturing and financial intermediation remain the two sectors with the highest R&D expenditure within the business sector, respectively contributing 28.8% (R2.895 billion) and 42.3% (R4.250 billion) (Table C.51). Nominally (Table C.50), the financial sector increased R&D expenditure by R218 million, while the mining and quarrying sector increased by R241 million to R927 million in 2020/21 (Table C.50). The manufacturing sector recorded the single largest sectoral decrease in R&D expenditure of R561 million from R3.456 billion to R2.895 billion. The agriculture and transport sectors reported decreases of R256 million and R229 million respectively.

The contribution of SOEs to R&D activity in the business sector decreased by 5.0 percentage points to 14.2% in 2020/21, a decrease of R394 million (Table C.56).

R&D continued to trend towards applied research

In 2020/21, 47.2% of R&D activity was devoted to applied research, which remains the dominant type of research. Most notably, the proportion of basic research decreased by 2.6 percentage points or R1.187 billion (Table C.5 and Table C.6). Experimental research increased by 2.0 percentages points to 23.4% of total GERD.

The proportion of R&D performed in Gauteng continued to decrease

Gauteng continues to perform most of the R&D, its share increasing by R332 million to R14.717 billion in 2020/21. The Western Cape (25.0%) and KwaZulu-Natal (9%) were the second and third largest contributors, respectively, but decreased by R71 million and R351 million in 2020/21. The Free State province decreased its expenditure by R469 million (1.3%) from R1.711 billion to R1.241 billion in 2020/21 (Table C.18).

The social sciences and medical and health sciences continued to dominate research areas

The medical and health sciences account for the majority of R&D (22.1%), followed by social sciences (19.7%) allocating R7.404 billion and R6.597 billion respectively. The engineering sciences (12.9%) is the field of research with the third-highest R&D expenditure with R4.332 billion (Table C.13 and C.14).

R&D in most priority policy areas continued to increase

Despite an overall economic decline, R&D in areas of policy priority has generally increased. These include increases in nanotechnology of R494 million to R1.349 billion and biotechnology increased by R200 million to R2.659 billion (Table C. 9). Similarly, research in environment-related areas continued to show gains, increasing by R471 million to R3.788 billion, whereas space science research increased R&D expenditure by R59 million to R1.041 billion. Research money spent on communicable diseases (TB, HIV/AIDS and malaria) increased by R42 million to R4.727 billion. The only decrease was in new materials, which decreased R&D expenditure by R268 million from R1.195 billion to R926 million (Table C.11).

Growth in R&D personnel was noticeable after a large decline in 2019/20

The business sector increased its personnel by a headcount of 1 429. A substantial component of this increase apparently came from R&D initiated in response to the COVID-19 pandemic with the majority of these being personnel directly supporting R&D. However, 131 researchers and 193 technicians (Table C.52) were shed in the business sector. Personnel in the government sector remained essentially unchanged. The higher education sector decreased its headcount by 666 R&D personnel (mainly researchers) while the not-for-profit sector shed 130 R&D personnel (Table C.3). Science council personnel decreased by 41 headcounts.

The number of FTE researchers per 1 000 in total employment was 1.8 in 2020/21, down by just 0.1 of a percentage point (Table C.28). The proportion of female researchers increased by 2.0 percentage points to 43.9% in 2020/21 (Table B.1).

C. TABLES

Notes:

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

C.1. General survey results

C.1.1. Expenditure on research and experimental development

Table C.1: R&D expenditure by sector (2011/12 to 2020/21)

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2011/12	**22 209 192**	1 235 669	3 729 680	6 609 216	10 464 022	170 605
2012/13	**23 871 219**	1 437 509	4 025 998	7 333 153	10 570 726	503 833
2013/14	**25 660 573**	1 697 151	4 304 556	7 292 853	11 782 848	583 165
2014/15	**29 344 977**	1 893 010	5 004 669	8 377 575	13 290 951	778 772
2015/16	**32 336 679**	2 013 021	5 740 897	9 876 623	13 814 995	891 142
2016/17	**35 692 973**	2 098 646	6 136 183	11 659 258	14 781 270	1 017 616
2017/18	**38 724 590**	2 325 875	6 313 344	13 009 876	15 859 185	1 216 310
2018/19	**36 783 968**	2 223 426	5 443 885	13 183 119	14 447 833	1 485 704
2019/20	**34 484 862**	1 893 543	6 198 363	14 178 960	10 704 481	1 509 515
2020/21	**33 541 332**	2 237 531	5 902 414	13 785 736	10 047 344	1 568 307

The NPO sector in 2012/13 improved coverage by R281 509 contributing 1.2% of GERD. In 2015/16 the NPO sector improved coverage by R185 302 contributing 0.6% of GERD.

Table C.2: R&D expenditure by sector, constant 2015 Rand values (2011/12 to 2020/21)

YEAR	GERD	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2011/12	**27 367 010**	1 522 638	4 595 853	8 144 127	12 894 165	210 226
2012/13	**28 098 548**	1 692 076	4 738 958	8 631 773	12 442 685	593 056
2013/14	**28 537 040**	1 887 396	4 787 083	8 110 358	13 103 667	648 536
2014/15	**30 972 311**	1 997 987	5 282 204	8 842 156	14 028 004	821 959
2015/16	**32 336 679**	2 013 021	5 740 897	9 876 623	13 814 995	891 142
2016/17	**33 372 836**	1 962 229	5 737 315	10 901 375	13 820 449	951 469
2017/18	**34 328 482**	2 061 836	5 596 638	11 532 964	14 058 812	1 078 231
2018/19	**31 367 131**	1 896 003	4 642 214	11 241 762	12 320 234	1 266 918
2019/20	**28 140 430**	1 545 174	5 058 005	11 570 353	8 735 099	1 231 799
2020/21	**25 999 475**	1 734 416	4 575 240	10 685 977	7 788 172	1 215 669

The NPO sector in 2012/13 improved coverage by R281 509 contributing 1.2% of GERD. In 2015/16 the NPO sector improved coverage by R185 302 contributing 0.6% of GERD.

Table C.3: R&D percentage expenditure composition by sector (2011/12 to 2020/21)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2011/12	5.6	16.8	29.8	47.1	0.8
2012/13	6.0	16.9	30.7	44.3	2.1
2013/14	6.6	16.8	28.4	45.9	2.3
2014/15	6.5	17.1	28.5	45.3	2.7
2015/16	6.2	17.8	30.5	42.7	2.8
2016/17	5.9	17.2	32.7	41.4	2.9
2017/18	6.0	16.3	33.6	41.0	3.1
2018/19	6.0	14.8	35.8	39.3	4.0
2019/20	5.5	18.0	41.1	31.0	4.4
2020/21	6.7	17.6	41.1	30.0	4.7

Table C.4: R&D expenditure as a percentage of GDP by sector (2011/12 to 2020/21)

YEAR	GERD/GDP	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%	%
2011/12	**0.67**	0.04	0.11	0.20	0.31	0.01
2012/13	**0.67**	0.04	0.11	0.21	0.30	0.01
2013/14	**0.66**	0.04	0.11	0.19	0.30	0.02
2014/15	**0.71**	0.05	0.12	0.20	0.32	0.02
2015/16	**0.73**	0.05	0.13	0.22	0.31	0.02
2016/17	**0.75**	0.04	0.13	0.24	0.31	0.02
2017/18	**0.76**	0.05	0.12	0.26	0.31	0.02
2018/19	**0.69**	0.04	0.10	0.25	0.27	0.03
2019/20	**0.62**	0.03	0.11	0.25	0.19	0.03
2020/21	**0.61**	0.04	0.11	0.25	0.18	0.03

The NPO sector in 2012/13 experienced improved coverage contributing 0.01 percentage points to NPO expenditure as a percentage of GDP. In 2015/16 the NPO sector improved coverage by R185 302 contributing a little less than 1 basis point to NPO expenditure as a percentage of GDP.

Table C.5: R&D expenditure by type of research (2011/12 to 2020/21)

YEAR	GERD	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	R'000	R'000	R'000	R'000
2011/12	**22 209 192**	5 439 561	9 388 273	7 381 358
2012/13	**23 871 219**	6 030 827	11 064 247	6 776 146
2013/14	**25 660 573**	6 102 085	12 132 211	7 426 277
2014/15	**29 344 977**	7 133 213	14 331 016	7 880 748
2015/16	**32 336 679**	8 209 662	15 349 070	8 777 948
2016/17	**35 692 973**	9 542 644	17 061 167	9 089 162
2017/18	**38 724 590**	10 223 956	20 623 856	7 876 778
2018/19	**36 783 968**	10 364 091	19 316 433	7 103 444
2019/20	**34 484 862**	11 043 171	16 074 948	7 366 744
2020/21	**33 541 332**	9 856 349	15 848 231	7 836 752

Table C.6: Proportional R&D expenditure by type of research (2011/12 to 2020/21)

YEAR	BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
	%	%	%
2011/12	24.5	42.3	33.2
2012/13	25.3	46.3	28.4
2013/14	23.8	47.3	28.9
2014/15	24.3	48.8	26.9
2015/16	25.4	47.5	27.1
2016/17	26.7	47.8	25.5
2017/18	26.4	53.3	20.3
2018/19	28.2	52.5	19.3
2019/20	32.0	46.6	21.4
2020/21	29.4	47.2	23.4

Table C.7: R&D expenditure by accounting category (2011/12 to 2020/21)

YEAR		CAPITAL EXPENDITURE ON R&D					CURRENT EXPENDITURE ON R&D			
	GERD	LAND: BUILDINGS AND OTHER STRUCTURES	VEHICLES, PLANT, MACHINERY, EQUIPMENT	#CAPITALISED COMPUTER SOFTWARE	TOTAL: VEHICLES, PLANT, MACHINERY, EQUIPMENT AND SOFTWARE	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	R'000	R'000
2011/12	**22 209 192**	454 321	2 215 416	0	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	0	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	0	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	0	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	0	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	0	2 822 229	4 096 967	16 505 080	1 928 108	13 162 819	31 596 007
2017/18	**38 724 590**	1 715 060	2 385 032	0	2 385 032	4 100 092	18 757 628	1 889 065	13 977 805	34 624 498
2018/19	**36 783 968**	879 489	2 393 110	0	2 393 110	3 272 599	18 112 670	1 938 984	13 459 715	33 511 369
2019/20	**34 484 862**	843 941	1 733 054	135 027	1 868 080	2 712 021	15 984 538	1 969 872	13 818 431	31 772 841
2020/21	**33 541 332**	500 532	1 552 588	433 636	1 986 224	2 486 756	15 743 599	1 895 876	13 415 100	31 054 575

*Includes specific categories of R&D personnel costs for 2017/18 to 2020/21. #Capitalised computer software collected from 2019/20.

Table C.8: Proportional R&D expenditure by accounting category (2011/12 to 2020/21)

YEAR	CAPITAL EXPENDITURE ON R&D					CURRENT EXPENDITURE ON R&D			
	LAND: BUILDINGS AND OTHER STRUCTURES	VEHICLES, PLANT, MACHINERY, EQUIPMENT	#CAPITALISED COMPUTER SOFTWARE	TOTAL: VEHICLES, PLANT, MACHINERY, EQUIPMENT AND SOFTWARE	SUBTOTAL: CAPITAL EXPENDITURE	LABOUR COSTS	TOTAL COST OF R&D POST-GRADUATE STUDENTS	OTHER CURRENT EXPENDITURE*	SUBTOTAL: CURRENT EXPENDITURE
	%	%	%	%	%	%	%	%	%
2011/12	2.0	10.0	0.0	10.0	12.0	42.9	4.8	40.2	88.0
2012/13	2.1	7.3	0.0	7.3	9.4	49.9	5.0	35.7	90.6
2013/14	2.1	7.2	0.0	7.2	9.3	51.8	4.8	34.1	90.7
2014/15	2.7	7.9	0.0	7.9	10.6	49.2	5.4	34.8	89.4
2015/16	2.2	9.3	0.0	9.3	11.5	45.7	6.0	36.8	88.5
2016/17	3.6	7.9	0.0	7.9	11.5	46.2	5.4	36.9	88.5
2017/18	4.4	6.2	0.0	6.2	10.6	48.4	4.9	36.1	89.4
2018/19	2.4	6.5	0.0	6.5	8.9	49.2	5.3	36.6	91.1
2019/20	2.4	5.0	0.4	5.4	7.9	46.4	5.7	40.1	92.1
2020/21	1.5	4.6	1.3	5.9	7.4	46.9	5.7	40.0	92.6

*Includes specific categories of R&D personnel costs for 2017/18 to 2020/21. #Capitalised computer software collected from 2019/20.

Table C.9: Expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

YEAR	GERD	BIOTECHNOLOGY	NANOTECHNOLOGY
	R'000	R'000	R'000
2011/12	**22 209 192**	1 065 286	596 072
2012/13	**23 871 219**	1 179 478	662 634
2013/14	**25 660 573**	1 266 325	664 139
2014/15	**29 344 977**	1 576 727	818 919
2015/16	**32 336 679**	1 843 363	871 426
2016/17	**35 692 973**	1 788 728	853 121
2017/18	**38 724 590**	1 797 013	718 527
2018/19	**36 783 968**	1 862 865	824 420
2019/20	**34 484 862**	2 459 421	855 790
2020/21	**33 541 332**	2 659 080	1 349 918

Table C.10: Proportional expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

YEAR	BIOTECHNOLOGY	NANOTECHNOLOGY
	%	%
2011/12	4.8	2.7
2012/13	4.9	2.8
2013/14	4.9	2.6
2014/15	5.4	2.8
2015/16	5.7	2.7
2016/17	5.0	2.4
2017/18	4.6	1.9
2018/19	5.1	2.2
2019/20	7.1	2.5
2020/21	7.9	4.0

Table C.11: R&D expenditure on selected areas of interest (2011/12 to 2020/21)

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
2011/12	**22 209 192**	181 320	2 006 625	1 215 855	783 232	N/A
2012/13	**23 871 219**	211 264	2 478 422	1 051 035	1 327 832	N/A
2013/14	**25 660 573**	339 065	2 867 954	1 088 094	794 016	N/A
2014/15	**29 344 977**	818 735	3 008 176	1 996 195	1 053 783	N/A
2015/16	**32 336 679**	1 145 590	3 462 704	2 056 659	1 146 470	N/A
2016/17	**35 692 973**	826 648	3 947 430	2 452 367	1 008 578	633 930
2017/18	**38 724 590**	1 233 636	4 621 859	2 815 269	850 606	300 763
2018/19	**36 783 968**	465 624	5 105 952	3 083 232	965 820	888 214
2019/20	**34 484 862**	629 995	4 684 747	3 317 882	1 195 028	982 824
2020/21	**33 541 332**	632 882	4 727 038	3 788 949	926 881	1 041 747

Note: 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 (2011/12 to 2020/21)

YEAR	OPEN-SOURCE SOFTWARE	TUBERCULOSIS (TB), HIV/AIDS, MALARIA	ENVIRONMENT / ENVIRONMENT-RELATED	NEW MATERIALS	SPACE SCIENCE
	%	%	%	%	%
2011/12	0.8	9.0	5.5	3.5	N/A
2012/13	0.9	10.4	4.4	5.6	N/A
2013/14	1.3	11.2	4.2	3.1	N/A
2014/15	2.8	10.3	6.8	3.6	N/A
2015/16	3.5	10.7	6.4	3.5	N/A
2016/17	2.3	11.1	6.9	2.8	1.8
2017/18	3.2	11.9	7.3	2.2	0.8
2018/19	1.3	13.9	8.4	2.6	2.4
2019/20	1.8	13.6	9.6	3.5	2.9
2020/21	1.9	14.1	11.3	2.8	3.1

Note: 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 (2011/12 to 2020/21

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	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	18 924 485	19 384 947	20 587 093	23 687 304	25 562 694	27 253 955	28 666 760	27 582 242	27 590 791	25 894 833
Mathematical sciences	636 153	634 658	627 017	636 084	646 870	713 360	879 045	934 136	969 234	799 796
Physical sciences	338 098	370 616	379 813	582 267	769 739	876 009	1 070 851	930 033	973 726	911 291
Chemical sciences	1 273 588	1 460 180	1 305 139	1 299 969	1 491 410	1 761 693	1 668 359	1 685 031	1 460 763	1 127 071
Earth sciences	409 212	499 210	498 427	690 040	635 291	780 402	766 556	826 869	1 020 560	1 061 388
Information, computer and communication technologies	2 852 251	2 000 453	1 994 502	2 946 625	3 877 852	4 494 987	4 006 992	3 636 363	3 560 762	3 640 261
Applied sciences and technologies	2 114 322	2 252 175	2 164 025	1 555 897	1 525 646	1 585 106	1 628 489	1 537 213	1 362 852	1 367 857
Engineering sciences	3 775 247	3 903 931	4 315 051	5 485 812	5 444 740	4 611 038	5 068 338	4 735 131	4 627 317	4 332 527
Biological sciences	1 350 716	1 555 035	1 578 516	1 398 611	1 452 763	1 416 454	1 562 103	1 579 782	1 685 936	1 530 697
Agricultural sciences	1 710 860	1 810 114	2 196 122	2 656 038	2 573 509	2 741 962	2 999 821	3 051 678	3 119 335	2 654 666
Medical and health sciences	3 819 180	4 107 641	4 668 417	5 459 721	6 389 455	6 868 131	7 540 190	7 793 148	7 407 626	7 404 019
Environmental sciences	439 719	587 113	611 007	533 065	375 455	992 281	1 125 709	435 578	602 065	440 186
Material sciences	166 411	155 379	192 199	368 315	299 069	287 507	206 687	190 551	545 685	328 498
Marine sciences	38 726	48 442	56 857	74 858	80 897	125 024	143 621	246 728	254 931	296 576
Division 2: Social sciences and humanities	3 284 707	4 486 272	5 073 480	5 657 674	6 773 985	8 439 018	10 057 830	9 201 726	6 894 071	7 646 499
Social sciences	2 790 339	3 999 853	4 489 054	5 000 339	6 043 806	7 495 167	9 168 767	8 238 808	5 836 521	6 597 460
Humanities	494 368	486 420	584 426	657 335	730 179	943 851	889 064	962 918	1 057 550	1 049 039
Total	22 209 192	23 871 219	25 660 573	29 344 977	32 336 679	35 692 973	38 724 590	36 783 968	34 484 862	33 541 332

Table C.14: Proportional R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	85.2	81.2	80.2	80.7	79.1	76.4	74.0	75.0	80.0	77.2
Mathematical sciences	2.9	2.7	2.4	2.2	2.0	2.0	2.3	2.5	2.8	2.4
Physical sciences	1.5	1.6	1.5	2.0	2.4	2.5	2.8	2.5	2.8	2.7
Chemical sciences	5.7	6.1	5.1	4.4	4.6	4.9	4.3	4.6	4.2	3.4
Earth sciences	1.8	2.1	1.9	2.4	2.0	2.2	2.0	2.2	3.0	3.2
Information, computer and communication technologies	12.8	8.4	7.8	10.0	12.0	12.6	10.3	9.9	10.3	10.9
Applied sciences and technologies	9.5	9.4	8.4	5.3	4.7	4.4	4.2	4.2	4.0	4.1
Engineering sciences	17.0	16.4	16.8	18.7	16.8	12.9	13.1	12.9	13.4	12.9
Biological sciences	6.1	6.5	6.2	4.8	4.5	4.0	4.0	4.3	4.9	4.6
Agricultural sciences	7.7	7.6	8.6	9.1	8.0	7.7	7.7	8.3	9.0	7.9
Medical and health sciences	17.2	17.2	18.2	18.6	19.8	19.2	19.5	21.2	21.5	22.1
Environmental sciences	2.0	2.5	2.4	1.8	1.2	2.8	2.9	1.2	1.7	1.3
Material sciences	0.7	0.7	0.7	1.3	0.9	0.8	0.5	0.5	1.6	1.0
Marine sciences	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.7	0.7	0.9
Division 2: Social sciences and humanities	14.8	18.8	19.8	19.3	20.9	23.6	26.0	25.0	20.0	22.8
Social sciences	12.6	16.8	17.5	17.0	18.7	21.0	23.7	22.4	16.9	19.7
Humanities	2.2	2.0	2.3	2.2	2.3	2.6	2.3	2.6	3.1	3.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.15: R&D expenditure by socio-economic objectives (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVES	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	1 069 289	1 351 337	1 386 428	1 826 784	1 814 789	1 629 650	2 124 098	1 571 796	1 747 323	1 594 793
Defence	1 069 289	1 351 337	1 386 428	1 826 784	1 814 789	1 629 650	2 124 098	1 571 796	1 747 323	1 594 793
Division 2: Economic development	12 174 897	12 223 017	14 166 615	15 359 534	16 644 668	18 357 187	19 528 226	17 902 898	14 919 363	14 081 873
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	1 137 706	1 218 852	1 739 038	1 364 018	1 426 609	1 920 246	1 701 055	1 746 483	1 879 578	1 379 102

SOCIO-ECONOMIC OBJECTIVES	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Animal production and animal primary products	565 729	598 602	803 403	694 423	655 059	746 579	794 314	748 145	764 501	707 826
Mineral resources (excluding energy)	1 065 384	1 143 762	1 351 239	1 779 068	1 759 268	1 328 413	1 256 826	1 321 249	1 259 257	1 401 816
Energy resources	273 390	294 820	288 314	197 072	178 434	556 147	546 831	605 311	265 828	303 671
Energy supply	676 491	509 128	590 980	778 805	636 596	730 849	853 099	927 403	1 008 795	932 553
Manufacturing	2 489 799	2 394 239	2 608 207	2 619 974	2 665 871	2 543 694	2 628 725	2 495 718	2 440 795	1 924 862
Construction	392 440	426 960	450 907	270 226	229 284	300 582	318 837	363 788	282 651	305 468
Transport	984 225	992 504	1 115 027	998 136	1 115 349	1 195 426	1 247 963	1 099 974	712 749	512 148
Information and communication services	1 271 591	1 159 823	1 124 614	1 661 660	2 347 021	2 694 355	2 129 740	1 768 149	1 559 066	1 522 190
Commercial services	1 866 449	1 895 734	2 443 529	2 701 523	2 789 611	3 134 235	4 448 419	3 492 749	1 269 391	1 532 397
Economic framework	611 868	715 759	689 386	1 331 844	1 797 751	1 997 933	2 343 788	2 147 239	2 248 020	2 262 348
Natural resources	839 825	872 835	961 971	962 787	1 043 816	1 208 728	1 258 630	1 186 690	1 228 735	1 297 494
Division 3: Society	3 861 889	4 473 657	4 585 825	5 885 267	6 815 987	7 558 386	8 517 207	8 323 617	8 721 748	8 732 871
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	2 301 764	2 942 262	2 859 623	3 638 036	4 154 557	4 733 478	5 118 330	5 675 740	5 128 170	5 397 930
Education and training	554 463	672 473	882 976	1 346 974	1 603 117	1 307 791	1 398 846	1 344 005	1 594 278	1 566 843
Social development and community services	1 005 662	858 922	843 226	900 257	1 058 313	1 517 117	2 000 031	1 303 872	1 999 300	1 768 099
Division 4: Environment	905 570	979 981	861 976	1 414 524	1 475 053	2 015 344	2 092 706	2 166 332	1 953 590	2 147 652
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	398 977	443 987	388 688	828 768	853 071	969 476	1 016 592	964 261	1 029 870	1 180 361
Environmental aspects of development	216 406	258 144	226 299	288 823	304 008	361 391	357 509	455 915	425 587	419 346
Environmental and other aspects	290 187	277 849	246 989	296 934	317 975	684 478	718 604	746 156	498 133	547 945
Division 5: Advancement of knowledge	4 197 547	4 843 227	4 659 729	4 858 868	5 586 182	6 132 406	6 462 352	6 819 325	7 142 838	6 984 142
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	3 025 841	3 497 129	3 407 325	3 445 842	3 891 834	4 424 024	4 771 950	5 022 207	5 258 091	5 075 189
Social sciences and humanities	1 171 706	1 346 098	1 252 404	1 413 026	1 694 348	1 708 382	1 690 403	1 797 118	1 884 747	1 908 953
Total	22 209 192	23 871 219	25 660 573	29 344 977	32 336 679	35 692 973	38 724 590	36 783 968	34 484 862	33 541 332

Table C.16: Proportional R&D expenditure by socio-economic objectives (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVES	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	4.8	5.7	5.4	6.2	5.6	4.6	5.5	4.3	5.1	4.8
Defence	4.8	5.7	5.4	6.2	5.6	4.6	5.5	4.3	5.1	4.8
Division 2: Economic development	54.8	51.2	55.2	52.3	51.5	51.4	50.4	48.7	43.3	42.0
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	5.1	5.1	6.8	4.6	4.4	5.4	4.4	4.7	5.5	4.1
Animal production and animal primary products	2.5	2.5	3.1	2.4	2.0	2.1	2.1	2.0	2.2	2.1
Mineral resources (excluding energy)	4.8	4.8	5.3	6.1	5.4	3.7	3.2	3.6	3.7	4.2
Energy resources	1.2	1.2	1.1	0.7	0.6	1.6	1.4	1.6	0.8	0.9
Energy supply	3.0	2.1	2.3	2.7	2.0	2.0	2.2	2.5	2.9	2.8
Manufacturing	11.2	10.0	10.2	8.9	8.2	7.1	6.8	6.8	7.1	5.7
Construction	1.8	1.8	1.8	0.9	0.7	0.8	0.8	1.0	0.8	0.9
Transport	4.4	4.2	4.3	3.4	3.4	3.3	3.2	3.0	2.1	1.5
Information and communication services	5.7	4.9	4.4	5.7	7.3	7.5	5.5	4.8	4.5	4.5
Commercial services	8.4	7.9	9.5	9.2	8.6	8.8	11.5	9.5	3.7	4.6
Economic framework	2.8	3.0	2.7	4.5	5.6	5.6	6.1	5.8	6.5	6.7
Natural resources	3.8	3.7	3.7	3.3	3.2	3.4	3.3	3.2	3.6	3.9
Division 3: Society	17.4	18.7	17.9	20.1	21.1	21.2	22.0	22.6	25.3	26.0
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	10.4	12.3	11.1	12.4	12.8	13.3	13.2	15.4	14.9	16.1
Education and training	2.5	2.8	3.4	4.6	5.0	3.7	3.6	3.7	4.6	4.7
Social development and community services	4.5	3.6	3.3	3.1	3.3	4.3	5.2	3.5	5.8	5.3
Division 4: Environment	4.1	4.1	3.4	4.8	4.6	5.6	5.4	5.9	5.7	6.4
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	1.8	1.9	1.5	2.8	2.6	2.7	2.6	2.6	3.0	3.5
Environmental aspects of development	1.0	1.1	0.9	1.0	0.9	1.0	0.9	1.2	1.2	1.3

SOCIO-ECONOMIC OBJECTIVES	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	1.3	1.2	1.0	1.0	1.0	1.9	1.9	2.0	1.4	1.6
Division 5: Advancement of knowledge	18.9	20.3	18.2	16.6	17.3	17.2	16.7	18.5	20.7	20.8
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	13.6	14.6	13.3	11.7	12.0	12.4	12.3	13.7	15.2	15.1
Social sciences and humanities	5.3	5.6	4.9	4.8	5.2	4.8	4.4	4.9	5.5	5.7
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 (2011/12 to 2020/21)

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
2011/12	**22 209 192**	1 278 870	1 718 602	10 391 272	2 515 736	583 857	522 963	341 136	732 363	4 124 394
2012/13	**23 871 219**	1 463 589	1 714 473	10 602 434	3 013 372	619 437	612 031	400 974	890 364	4 554 545
2013/14	**25 660 573**	1 478 850	1 943 131	11 975 916	2 752 543	444 015	615 773	473 722	1 027 448	4 949 174
2014/15	**29 344 977**	1 734 411	1 456 461	13 686 734	3 187 481	628 607	859 201	575 584	1 402 742	5 813 758
2015/16	**32 336 679**	2 142 919	1 778 469	14 666 111	3 335 141	627 125	791 248	660 963	1 209 434	7 125 269
2016/17	**35 692 973**	2 206 473	1 834 572	16 421 582	3 639 100	728 874	699 720	532 530	1 298 778	8 331 345
2017/18	**38 724 590**	2 300 631	2 149 267	17 319 635	4 172 713	854 885	715 616	576 963	1 306 478	9 328 402
2018/19	**36 783 968**	2 211 524	1 976 953	15 767 101	4 074 154	806 624	853 859	905 844	1 682 406	8 505 504
2019/20	**34 484 862**	2 091 071	1 711 039	14 385 849	3 629 403	772 074	841 877	900 545	1 700 184	8 452 820
2020/21	**33 541 332**	1 998 900	1 241 827	14 717 743	3 278 682	983 369	706 459	867 333	1 364 854	8 382 165

Table C.18: Proportional R&D expenditure by province (2011/12 to 2020/21)

YEAR	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMA-LANGA	NORTHERN CAPE	NORTH-WEST	WESTERN CAPE
	%	%	%	%	%	%	%	%	%
2011/12	5.8	7.7	46.8	11.3	2.6	2.4	1.5	3.3	18.6
2012/13	6.1	7.2	44.4	12.6	2.6	2.6	1.7	3.7	19.1
2013/14	5.8	7.6	46.7	10.7	1.7	2.4	1.8	4.0	19.3
2014/15	5.9	5.0	46.6	10.9	2.1	2.9	2.0	4.8	19.8
2015/16	6.6	5.5	45.4	10.3	1.9	2.4	2.0	3.7	22.0
2016/17	6.2	5.1	46.0	10.2	2.0	2.0	1.5	3.6	23.3
2017/18	5.9	5.6	44.7	10.8	2.2	1.8	1.5	3.4	24.1
2018/19	6.0	5.4	42.9	11.1	2.2	2.3	2.5	4.6	23.1
2019/20	6.1	5.0	41.7	10.5	2.2	2.4	2.6	4.9	24.5
2020/21	6.0	3.7	43.9	9.8	2.9	2.1	2.6	4.1	25.0

C.1.2. Source of R&D funds

Table C.19: Funding for R&D by source (2011/12 to 2020/21)

YEAR	TOTAL FUNDS	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	R'000	R'000	R'000	R'000	R'000
2011/12	**22 209 192**	9 561 917	8 663 105	653 674	3 330 496
2012/13	**23 871 219**	10 831 893	9 152 042	770 300	3 116 984
2013/14	**25 660 573**	11 007 083	10 615 902	722 361	3 315 227
2014/15	**29 344 977**	12 873 458	11 981 974	923 530	3 566 015
2015/16	**32 336 679**	14 425 992	12 578 499	1 122 328	4 209 861
2016/17	**35 692 973**	16 427 596	14 045 892	1 047 980	4 171 507
2017/18	**38 724 590**	18 082 182	16 066 846	638 858	3 936 705
2018/19	**36 783 968**	17 475 173	14 534 123	775 938	3 998 734
2019/20	**34 484 862**	19 416 933	9 358 770	1 046 861	4 662 299
2020/21	**33 541 332**	18 871 543	9 034 026	1 174 220	4 461 542

*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 (2011/12 to 2020/21)

YEAR	GOVERNMENT*	BUSINESS	OTHER SOUTH AFRICAN SOURCES**	FOREIGN SOURCES
	%	%	%	%
2011/12	43.1	39.0	2.9	15.0
2012/13	45.4	38.3	3.2	13.1
2013/14	42.9	41.4	2.8	12.9
2014/15	43.9	40.8	3.1	12.2
2015/16	44.6	38.9	3.5	13.0
2016/17	46.0	39.4	2.9	11.7
2017/18	46.7	41.5	1.6	10.2
2018/19	47.5	39.5	2.1	10.9
2019/20	56.3	27.1	3.0	13.5
2020/21	56.3	26.9	3.5	13.3

*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 (2020/21)

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	18 262 208	54.4	1 696 834	75.8	691 369	11.7	7 707 328	55.9	7 932 493	79.0	234 184	14.9
Internal sources	18 262 208	54.4	1 696 834	75.8	691 369	11.7	7 707 328	55.9	7 932 493	79.0	234 184	14.9
Government	8 776 012	26.2	428 386	19.1	4 334 556	73.4	3 226 294	23.4	592 551	5.9	194 225	12.4
Grants	3 401 747	10.1	358 863	16.0	2 536 289	43.0	N/A	N/A	387 231	3.9	119 365	7.6
Contracts	2 147 970	6.4	69 523	3.1	1 798 267	30.5	N/A	N/A	205 320	2.0	74 860	4.8
All other government source	3 226 294	9.6	N/A	N/A	N/A	N/A	3 226 294	23.4	N/A	N/A	N/A	N/A
National, provincial and local government	759 980	2.3	N/A	N/A	N/A	N/A	759 980	5.5	N/A	N/A	N/A	N/A
Government research institutes	255 506	0.8	N/A	N/A	N/A	N/A	255 506	1.9	N/A	N/A	N/A	N/A

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	%
Agency funding (e.g. NRF, MRC, ARC, etc.)	1 966 634	5.9	N/A	N/A	N/A	N/A	1 966 634	14.3	N/A	N/A	N/A	N/A
Science councils	244 174	0.7	N/A	N/A	N/A	N/A	244 174	1.8	N/A	N/A	N/A	N/A
Business	1 101 533	3.3	0	0.0	310 034	5.3	546 329	4.0	169 165	1.7	76 005	4.8
Local business	1 101 533	3.3	0	0.0	310 034	5.3	546 329	4.0	169 165	1.7	76 005	4.8
Other SA sources	940 037	2.8	56 523	2.5	133 764	2.3	329 275	2.4	374 875	3.7	45 599	2.9
Higher education	210 423	0.6	37 436	1.7	35 006	0.6	114 289	0.8	296	0.0	23 396	1.5
Not-for-profit	582 917	1.7	223	0.0	98 758	1.7	94 652	0.7	374 377	3.7	14 906	1.0
Individual donations	146 698	0.4	18 864	0.8	0	0.0	120 334	0.9	202	0.0	7 298	0.5
Foreign	4 461 542	13.3	55 787	2.5	432 691	7.3	1 976 510	14.3	978 260	9.7	1 018 294	64.9
*All sources	4 461 542	13.3	55 787	2.5	432 691	7.3	1 976 510	14.3	978 260	9.7	1 018 294	64.9
Total	33 541 332	100.0	2 237 531	100.0	5 902 414	100.0	13 785 736	100.0	10 047 344	100.0	1 568 307	100.0

Note: N/A indicates that data were not collected.
*Refers to all funds for R&D from outside South Africa.

Table C.22: Government-funded R&D by sector (2011/12 to 2020/21)

YEAR	TOTAL	GOVERNMENT*	SCIENCE COUNCILS*	HIGHER EDUCATION*	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2011/12	**9 561 917**	1 112 307	3 310 894	4 598 426	499 298	40 992
2012/13	**10 831 893**	1 269 337	3 368 555	5 395 871	683 669	114 461
2013/14	**11 007 083**	1 436 141	3 412 790	5 369 334	685 670	103 148
2014/15	**12 873 458**	1 711 809	4 319 393	6 020 572	690 396	131 288
2015/16	**14 425 992**	1 425 598	4 922 223	7 393 857	522 631	161 682
2016/17	**16 427 596**	1 530 964	5 076 805	9 222 246	453 958	143 623
2017/18	**18 082 182**	1 769 929	5 311 190	10 486 989	371 165	142 908
2018/19	**17 475 173**	1 898 230	4 644 414	10 501 066	214 541	216 922
2019/20	**19 416 933**	1 682 484	5 493 352	11 380 375	648 604	212 118
2020/21	**18 871 543**	2 125 220	5 025 925	10 933 622	592 551	194 225

*Includes science council and university own funds.

Table C.23: Proportional government-funded R&D by sector (2011/12 to 2020/21)

YEAR	GOVERNMENT*	SCIENCE COUNCILS*	HIGHER EDUCATION*	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2011/12	11.6	34.6	48.1	5.2	0.4
2012/13	11.7	31.1	49.8	6.3	1.1
2013/14	13.0	31.0	48.8	6.2	0.9
2014/15	13.3	33.6	46.8	5.4	1.0
2015/16	9.9	34.1	51.3	3.6	1.1
2016/17	9.3	30.9	56.1	2.8	0.9
2017/18	9.8	29.4	58.0	2.1	0.8
2018/19	10.9	26.6	60.1	1.2	1.2
2019/20	8.7	28.3	58.6	3.3	1.1
2020/21	11.3	26.6	57.9	3.1	1.0

*Includes science council and university own funds.

Table C.24: Business-funded R&D by sector (2011/12 to 2020/21)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2011/12	**8 663 105**	1 355	67 614	505 510	8 056 545	32 081
2012/13	**9 152 042**	11 552	135 729	577 527	8 402 340	24 894
2013/14	**10 615 902**	1 759	419 469	588 598	9 552 717	53 359
2014/15	**11 981 974**	290	222 892	885 280	10 810 428	63 084
2015/16	**12 578 499**	41 109	326 648	770 448	11 384 710	55 585
2016/17	**14 045 892**	1 261	483 166	906 651	12 586 109	68 705
2017/18	**16 066 846**	519	354 820	679 563	14 963 198	68 747
2018/19	**14 534 123**	4 614	206 648	463 413	13 787 512	71 937
2019/20	**9 358 770**	42 664	191 520	519 848	8 541 773	62 965
2020/21	**9 034 026**	0	310 034	546 329	8 101 658	76 005

Table C.25: Proportional business-funded R&D by sector (2011/12 to 2020/21)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2011/12	0.0	0.8	5.8	93.0	0.4
2012/13	0.1	1.5	6.3	91.8	0.3
2013/14	0.0	4.0	5.5	90.0	0.5
2014/15	0.0	1.9	7.4	90.2	0.5
2015/16	0.3	2.6	6.1	90.5	0.4
2016/17	0.0	3.4	6.5	89.6	0.5
2017/18	0.0	2.2	4.2	93.1	0.4
2018/19	0.0	1.4	3.2	94.9	0.5
2019/20	0.5	2.0	5.6	91.3	0.7
2020/21	0.0	3.4	6.0	89.7	0.8

Table C.26: Foreign-funded R&D by sector (2011/12 to 2020/21)

YEAR	TOTAL	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	R'000	R'000	R'000	R'000	R'000	R'000
2011/12	**3 330 496**	118 127	321 257	1 272 173	1 562 277	56 662
2012/13	**3 116 984**	143 994	510 846	1 010 244	1 189 865	262 035
2013/14	**3 315 227**	258 531	454 527	1 042 627	1 226 966	332 576
2014/15	**3 566 015**	179 473	431 215	1 079 732	1 418 823	456 772
2015/16	**4 209 861**	499 966	469 507	1 206 192	1 532 766	501 430
2016/17	**4 171 507**	512 090	537 503	1 143 451	1 338 662	639 801
2017/18	**3 936 705**	471 786	617 838	1 506 077	474 762	866 241
2018/19	**3 998 734**	296 918	550 456	1 851 900	400 462	898 998
2019/20	**4 662 299**	133 832	439 774	1 979 372	1 168 659	940 661
2020/21	**4 461 542**	55 787	432 691	1 976 510	978 260	1 018 294

Table C.27: Proportional foreign-funded R&D by sector (2011/12 to 2020/21)

YEAR	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
	%	%	%	%	%
2011/12	3.5	9.6	38.2	46.9	1.7
2012/13	4.6	16.4	32.4	38.2	8.4
2013/14	7.8	13.7	31.4	37.0	10.0
2014/15	5.0	12.1	30.3	39.8	12.8
2015/16	11.9	11.2	28.7	36.4	11.9
2016/17	12.3	12.9	27.4	32.1	15.3
2017/18	12.0	15.7	38.3	12.1	22.0
2018/19	7.4	13.8	46.3	10.0	22.5
2019/20	2.9	9.4	42.5	25.1	20.2
2020/21	1.3	9.7	44.3	21.9	22.8

C.1.3. R&D personnel

Table C.28: R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	R&D PERSONNEL			RESEARCHERS			TECHNICIANS		OTHER R&D PERSONNEL	
	(HEAD-COUNTS*)	(FTEs)	(FTEs) PER 1000 IN TOTAL EM-PLOYMENT	(HEAD-COUNTS*)	(FTEs)	(FTEs) PER 1000 IN TOTAL EM-PLOYMENT	(HEAD-COUNTS)	(FTEs) PER 1000 IN TOTAL EM-PLOYMENT	(HEAD-COUNTS)	(FTEs) PER 1000 IN TOTAL EM-PLOYMENT
2011/12	**59 487**	**30 978.4**	**2.3**	40 653	20 115.1	1.5	9 260	5 566.9	9 574	5 296.5
2012/13	**64 917**	**35 050.3**	**2.4**	42 828	21 382.4	1.5	10 790	6 582.3	11 299	7 085.5
2013/14	**68 838**	**37 956.5**	**2.5**	45 935	23 346.0	1.6	10 800	6 905.5	12 103	7 705.0
2014/15	**72 400**	**38 465.0**	**2.5**	48 479	23 571.9	1.5	12 183	7 731.3	11 738	7 161.9
2015/16	**74 931**	**41 054.5**	**2.6**	51 877	26 159.4	1.7	11 518	7 688.3	11 536	7 206.9
2016/17	**80 029**	**42 533.0**	**2.6**	56 761	27 656.2	1.7	11 346	7 563.1	11 922	7 313.6
2017/18	**84 262**	**44 259.3**	**2.7**	61 840	29 515.2	1.8	11 219	7 383.3	11 203	7 360.8
2018/19	**84 036**	**43 774.3**	**2.7**	62 166	29 110.8	1.8	10 545	7 069.0	11 325	7 594.5
2019/20	**82 068**	**41 856.5**	**2.8**	62 002	28 358.3	1.9	10 080	6 879.9	9 986	6 618.0
2020/21	**82 744**	**42 925.9**	**2.9**	61 406	27 697.6	1.8	9 870	6 846.5	11 468	8 381.7

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

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

Table C.29a: R&D personnel in headcounts and full-time equivalents by occupation and gender including students (2018/19 to 2020/21)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	62 166	33 765	28 401	29 110.8	16 005.1	13 105.8	46.8
Technicians directly supporting R&D	10 545	6 270	4 275	7 069.0	4 036.1	3 032.9	67.0
Other personnel directly supporting R&D	11 325	5 473	5 852	7 594.5	3 660.9	3 933.6	67.1
Total	84 036	45 508	38 528	43 774.3	23 702.0	20 072.3	52.1
2019/20	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	62 002	33 379	28 623	28 358.3	15 469.8	12 888.5	45.7
Technicians directly supporting R&D	10 080	5 710	4 370	6 879.9	3 641.2	3 238.7	68.3
Other personnel directly supporting R&D	9 986	4 152	5 834	6 618.0	2 779.5	3 838.5	66.3
Total	82 068	43 241	38 827	41 856.2	21 890.6	19 965.7	51.0
2020/21	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	61 406	32 809	28 597	27 697.6	14 820.1	12 877.5	45.1
Technicians directly supporting R&D	9 870	5 617	4 253	6 846.5	3 624.0	3 222.6	69.4
Other personnel directly supporting R&D	11 468	4 496	6 972	8 381.7	3 286.9	5 094.9	73.1
Total	82 744	42 922	39 822	42 925.9	21 731.0	21 195.0	51.9

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

Table C.29b: R&D personnel in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

YEAR	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	35 597	19 116	16 481	13 527.4	7 273.6	6 253.7	38.0
Technicians directly supporting R&D	10 545	6 270	4 275	7 069.0	4 036.1	3 032.9	67.0
Other personnel directly supporting R&D	11 325	5 473	5 852	7 594.5	3 660.9	3 933.6	67.1
Total	57 467	30 859	26 608	28 190.8	14 970.6	13 220.2	49.1
2019/20	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	34 358	18 547	15 811	12 370.9	6 712.9	5 658.0	36.0
Technicians directly supporting R&D	10 080	5 710	4 370	6 879.9	3 641.2	3 238.7	68.3
Other personnel directly supporting R&D	9 986	4 152	5 834	6 618.0	2 779.5	3 838.5	66.3
Total	54 424	28 409	26 015	25 868.8	13 133.7	12 735.1	47.5
2020/21	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers*	34 072	18 315	15 757	11 954.1	6 371.0	5 583.2	35.1
Technicians directly supporting R&D	9 870	5 617	4 253	6 846.5	3 624.0	3 222.6	69.4
Other personnel directly supporting R&D	11 468	4 496	6 972	8 381.7	3 286.9	5 094.9	73.1
Total	55 410	28 428	26 982	27 182.4	13 281.8	13 900.6	49.1

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

Table C.30: R&D personnel in headcounts by sector (2011/12 to 2020/21)

YEAR	TOTAL R&D PERSONNEL (HEADCOUNTS*)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2011/12	**59 487**	3 143	4 494	36 157	15 288	405
2012/13	**64 917**	3 252	5 399	38 205	17 155	906
2013/14	**68 838**	2 874	5 884	41 464	17 599	1 017
2014/15	**72 400**	2 893	4 836	44 457	18 743	1 471
2015/16	**74 931**	2 997	5 162	48 034	17 245	1 493
2016/17	**80 029**	3 076	4 955	52 384	17 998	1 616
2017/18	**84 262**	3 027	4 866	57 074	17 554	1 741
2018/19	**84 036**	2 910	4 514	57 799	16 876	1 937
2019/20	**82 068**	3 157	4 070	60 168	12 748	1 925
2020/21	**82 744**	3 159	4 111	59 502	14 177	1 795

Note: Includes doctoral students and post-doctoral fellows at higher education institutes.
Researchers includes specific categories of R&D for 2016/17 onwards.
Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.31: R&D personnel full-time equivalents by sector (2011/12 to 2020/21)

YEAR	TOTAL R&D PERSONNEL* (FTEs)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2011/12	**30 978.4**	2 404.5	3 803.5	14 563.4	9 894.9	312.1
2012/13	**35 050.3**	2 597.0	4 748.5	15 614.4	11 322.3	768.0
2013/14	**37 956.5**	2 245.5	5 164.5	17 777.7	11 877.4	891.4
2014/15	**38 465.0**	2 181.5	4 180.4	17 944.4	12 927.5	1 231.2
2015/16	**41 054.5**	2 056.2	4 361.2	20 812.0	12 457.8	1 367.3
2016/17	**42 533.0**	2 031.6	4 421.4	22 061.4	12 549.2	1 469.5
2017/18	**44 259.3**	2 000.4	4 294.9	23 415.1	12 952.9	1 596.0
2018/19	**43 774.3**	1 999.0	3 941.8	24 456.8	11 691.0	1 685.8
2019/20	**41 856.5**	2 173.1	3 562.8	25 109.7	9 300.8	1 710.1
2020/21	**42 925.9**	2 060.4	3 606.0	24 781.3	10 860.3	1 556.1

*Includes doctoral students and post-doctoral fellows. Also includes specific categories of R&D personnel for 2016/17 onwards.
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 (2011/12 to 2020/21)

YEAR	TOTAL RESEARCHERS (HEADCOUNTS*)	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION	BUSINESS	NOT-FOR-PROFIT
2011/12	**40 653**	1 411	1 803	30 993	6 192	254
2012/13	**42 828**	1 409	1 879	32 955	6 191	394
2013/14	**45 935**	1 229	1 956	36 133	6 182	435
2014/15	**48 479**	1 343	1 988	38 381	6 261	506
2015/16	**51 877**	1 573	2 072	41 639	6 128	465
2016/17	**56 761**	1 677	2 189	46 028	6 463	404
2017/18	**61 840**	1 671	2 053	50 549	7 142	425
2018/19	**62 166**	1 662	1 951	51 187	6 942	424
2019/20	**62 002**	1 742	1 858	53 371	4 641	390
2020/21	**61 406**	1 706	1 774	52 985	4 510	431

*Includes doctoral students and post-doctoral fellows. Researchers includes specific categories of R&D personnel (from 2016/17).
Note: Headcounts include non-SA R&D personnel (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 (2011/12 to 2020/21)

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	MALE	FEMALE
2011/12	**25 954**	15 065	10 889
2012/13	**27 314**	15 378	11 936
2013/14	**28 014**	15 520	12 494
2014/15	**28 723**	15 824	12 899
2015/16	**29 455**	16 150	13 305
2016/17	**33 035**	17 957	15 078
2017/18	**36 233**	19 800	16 433
2018/19	**35 597**	19 116	16 481
2019/20	**34 358**	18 547	15 811
2020/21	**34 072**	18 315	15 757

*Excludes doctoral students and post-doctoral fellows. Researchers include specific categories of R&D personnel (from 2016/17).
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 (2011/12 to 2020/21)

YEAR	TOTAL RESEARCHERS* (HEADCOUNTS)	AFRICAN	COLOURED	INDIAN/ASIAN	WHITE	NON-SA
2011/12	**25 954**	7 201	1 438	2 202	15 113	N/A
2012/13	**27 314**	8 101	1 591	2 514	15 108	N/A
2013/14	**28 014**	8 024	1 685	2 530	15 775	N/A
2014/15	**28 723**	8 468	1 815	2 522	15 919	N/A
2015/16	**29 454**	9 548	1 881	2 629	15 396	N/A
2016/17	**33 035**	9 968	1 957	2 921	15 151	3 038
2017/18	**36 233**	10 815	2 209	3 352	15 795	4 062
2018/19	**35 597**	10 572	2 099	3 370	14 890	4 667
2019/20	**34 358**	10 724	1 968	3 191	14 224	4 251
2020/21	**34 072**	10 950	2 077	3 145	13 450	4 450

*Excludes doctoral students and post-doctoral fellows. Researchers includes specific categories of R&D personnel (from 2016/17).
Note: Headcounts include non-SA R&D personnel (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.35a: R&D personnel (*including doctoral and post-doctoral students) in headcounts

OCCUPATION AND QUALIFICATION	TOTAL R&D PERSONNEL (HEADCOUNTS)	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers*	61 406	32 809	28 597	10 449	9 557	1 431	1 892	1 869	2 645	9 163	9 468	9 897	5 035
Doctoral degree or equivalent	42 615	23 205	19 410	6 795	5 842	909	1 167	983	1 587	5 426	6 209	9 092	4 605
Master's, honours, bachelor or equivalent	16 255	8 269	7 986	3 211	3 233	456	625	750	896	3 191	2 871	661	361
Diplomas	2 536	1 335	1 201	443	482	66	100	136	162	546	388	144	69
Technicians directly supporting R&D	9 870	5 617	4 253	2 331	2 481	633	457	403	277	2 090	930	160	108
Doctoral degree or equivalent	305	172	133	45	35	7	8	4	11	84	69	32	10
Master's, honours, bachelor or equivalent	3 921	2 123	1 798	874	909	171	214	136	140	870	482	72	53
Diplomas	5 644	3 322	2 322	1 412	1 537	455	235	263	126	1 136	379	56	45
Other personnel directly supporting R&D	11 468	4 496	6 972	2 733	4 153	576	1 053	160	253	798	1 312	229	201
Doctoral degree or equivalent	316	146	170	40	42	9	26	15	12	59	78	23	12
Master's, honours, bachelor or equivalent	2 878	1 042	1 836	475	825	111	255	52	99	307	575	97	82
Diplomas	8 274	3 308	4 966	2 218	3 286	456	772	93	142	432	659	109	107
Total	82 744	42 922	39 822	15 513	16 191	2 640	3 402	2 432	3 175	12 051	11 710	10 286	5 344

*Researchers includes specific categories of R&D personnel (from 2016/17). To enable comparison, the table below excludes doctoral students and post-doctoral fellows from the Researchers indicator, and provides a total for this modified Researchers value, including Technicians directly supporting R&D (unchanged) and Other personnel directly supporting R&D (unchanged). Note: Non-SA student data are not collected by population group. Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but are undertaking research in South Africa for a period exceeding six months. They can be temporary or permanent residents as described by the SNA. **Total may vary due to extrapolations.

Table C.35b: R&D personnel (*excluding doctoral and post-doctoral students) in headcounts

OCCUPATION AND QUALIFICATION	TOTAL R&D PERSONNEL (HEADCOUNTS)	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers*	34 072	18 315	15 757	5 793	5 157	932	1 145	1 437	1 708	7 007	6 443	3 146	1 304
Doctoral degree or equivalent	15 281	8 711	6 570	2 139	1 442	410	420	551	650	3 270	3 184	2 341	874
Master's, honours, bachelor or equivalent	16 255	8 269	7 986	3 211	3 233	456	625	750	896	3 191	2 871	661	361
Diplomas	2 536	1 335	1 201	443	482	66	100	136	162	546	388	144	69
Technicians directly supporting R&D	9 870	5 617	4 253	2 331	2 481	633	457	403	277	2 090	930	160	108
Doctoral degree or equivalent	305	172	133	45	35	7	8	4	11	84	69	32	10
Master's, honours, bachelor or equivalent	3 921	2 123	1 798	874	909	171	214	136	140	870	482	72	53
Diplomas	5 644	3 322	2 322	1 412	1 537	455	235	263	126	1 136	379	56	45
Other personnel directly supporting R&D	11 468	4 496	6 972	2 733	4 153	576	1 053	160	253	798	1 312	229	201
Doctoral degree or equivalent	316	146	170	40	42	9	26	15	12	59	78	23	12
Master's, honours, bachelor or equivalent	2 878	1 042	1 836	475	825	111	255	52	99	307	575	97	82
Diplomas	8 274	3 308	4 966	2 218	3 286	456	772	93	142	432	659	109	107
Total	55 410	28 428	26 982	10 857	11 791	2 141	2 655	2 000	2 238	9 895	8 685	3 535	1 613

C.2. Sector tables

C.2.1. Business sector

Table C.36: Business sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Basic research	922 888	802 753	968 504	845 527	906 730	909 278	1 021 152	948 319	758 971	788 740
Applied research	4 461 770	5 569 024	6 087 791	7 541 596	7 492 229	8 389 888	10 551 512	9 819 344	6 218 563	6 014 078
Experimental development research	5 079 364	4 198 949	4 726 553	4 903 827	5 416 037	5 482 104	4 286 521	3 680 170	3 726 947	3 244 526
Total	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

Table C.37: Proportional business sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Basic research	8.8	7.6	8.2	6.4	6.6	6.2	6.4	6.6	7.1	7.9
Applied research	42.6	52.7	51.7	56.7	54.2	56.8	66.5	68.0	58.1	59.9
Experimental development research	48.5	39.7	40.1	36.9	39.2	37.1	27.0	25.5	34.8	32.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.38: Business sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Capital expenditure	1 650 541	1 072 556	1 132 520	1 397 243	1 289 228	1 727 929	1 421 699	1 545 944	984 728	969 093
Land: buildings & other structures	217 126	140 053	159 162	117 656	186 396	288 957	270 191	370 231	343 953	183 111
TOTAL: Vehicles, plant, machinery, equipment and software	1 433 415	932 503	973 358	1 279 587	1 102 833	1 438 972	1 151 508	1 175 713	640 776	785 982
Vehicles, plant, machinery, equipment	1 433 415	932 503	973 358	1 279 587	1 102 833	1 438 972	1 151 508	1 175 713	584 324	559 525
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	56 452	226 457
Current expenditure	8 813 481	9 498 170	10 650 328	11 893 708	12 525 767	13 053 341	14 437 485	12 901 890	9 719 752	9 078 252
Labour costs	4 723 488	5 821 884	6 768 527	7 659 365	7 821 865	8 486 640	9 747 037	8 612 310	5 992 573	5 387 961
Other current expenditure	4 089 993	3 676 286	3 881 801	4 234 343	4 703 901	4 566 701	4 690 449	4 289 579	3 727 179	3 690 290
Total	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

*Capitalised computer software collected from 2019/20.

Table C.39: Proportional business sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Capital expenditure	10.1	9.6	10.5	9.3	11.7	9.0	10.7	9.2	9.2	9.6
Land: buildings & other structures	1.3	1.4	0.9	1.3	2.0	1.7	2.6	3.2	3.2	1.8
TOTAL: Vehicles, plant, machinery, equipment and software	8.8	8.3	9.6	8.0	9.7	7.3	8.1	6.0	6.0	7.8
Vehicles, plant, machinery, equipment	8.8	8.3	9.6	8.0	9.7	7.3	8.1	5.5	5.5	5.6
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1	2.3
Current expenditure	89.9	90.4	89.5	90.7	88.3	91.0	89.3	90.8	90.8	90.4
Labour costs	55.1	57.4	57.6	56.6	57.4	61.5	59.6	56.0	56.0	53.6
Other current expenditure	34.8	32.9	31.9	34.0	30.9	29.6	29.7	34.8	34.8	36.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Capitalised computer software collected from 2019/20.

Table C.40: Business sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Biotechnology	422 121	499 589	556 275	578 747	729 299	685 170	721 698	702 168	992 682	901 293
Nanotechnology	171 808	225 557	170 479	217 216	134 063	268 320	113 260	155 956	77 163	73 309
Total	593 929	725 145	726 754	795 963	863 362	953 490	834 958	858 124	1 069 845	974 603
Business expenditure on R&D	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

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

Table C.41: Proportional business sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Biotechnology	4.0	4.7	4.7	4.4	5.3	4.6	4.6	4.9	9.3	9.0
Nanotechnology	1.6	2.1	1.4	1.6	1.0	1.8	0.7	1.1	0.7	0.7
Total	5.7	6.9	6.2	6.0	6.2	6.5	5.3	5.9	10.0	9.7

Table C.42: Business sector R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Environment-related	31 349	183 921	228 905	176 463	173 356	280 651	377 030	472 759	532 424	591 414
Open-source software	85 787	87 200	233 576	241 710	326 856	207 849	193 239	154 894	176 450	219 128
New materials	277 152	225 897	151 890	245 752	224 433	179 108	186 858	268 298	447 596	354 411
Tuberculosis, HIV/AIDS, malaria	812 580	929 121	992 538	1 082 646	1 176 149	1 153 668	1 332 248	1 801 869	1 347 208	1 316 084
Space science	N/A	N/A	N/A	N/A	N/A	33 099	42 291	47 018	19 990	4 659
Total	1 206 869	1 426 139	1 606 909	1 746 571	1 900 794	1 854 375	2 131 666	2 744 839	2 523 667	2 485 695
Business expenditure on R&D	**10 464 022**	**10 570 726**	**11 782 848**	**13 290 951**	**13 814 995**	**14 781 270**	**15 859 185**	**14 447 833**	**10 704 481**	**10 047 344**

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

Table C.43: Proportional business sector R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Environment-related	0.3	1.7	1.9	1.3	1.3	1.9	2.4	3.3	5.0	5.9
Open-source software	0.8	0.8	2.0	1.8	2.4	1.4	1.2	1.1	1.6	2.2
New materials	2.6	2.1	1.3	1.8	1.6	1.2	1.2	1.9	4.2	3.5
Tuberculosis, HIV/AIDS, malaria	7.8	8.8	8.4	8.1	8.5	7.8	8.4	12.5	12.6	13.1
Space science	N/A	N/A	N/A	N/A	N/A	0.2	0.3	0.3	0.2	0.0
Total	11.5	13.5	13.6	13.1	13.8	12.5	13.4	19.0	23.6	24.7

Note: Data on these selected areas of R&D were collected for the first time in the 2005/06 R&D Survey.
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 (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Division 1: Natural sciences, technology and engineering	9 992 916	9 127 446	9 765 859	10 977 250	11 447 693	11 918 539	11 793 445	11 719 001	10 552 496	9 533 861
Mathematical sciences	204 594	149 220	209 344	211 324	119 900	138 858	188 550	196 143	181 438	184 125
Physical sciences	28 490	47 672	50 708	56 997	35 616	45 816	90 281	87 440	108 895	123 589
Chemical sciences	934 005	980 021	979 760	847 321	972 398	1 153 685	1 154 404	1 102 373	800 201	628 780
Earth sciences	92 439	102 892	109 665	118 539	93 302	104 072	160 745	156 112	285 180	197 020
Information, computer and communication technologies	2 481 028	1 576 163	1 610 718	1 908 985	2 572 364	3 111 146	2 584 726	2 295 683	2 074 429	2 119 285
Applied sciences and technologies	902 425	872 014	808 899	955 119	903 958	915 101	1 143 251	942 480	608 833	539 767
Engineering sciences	2 751 145	2 827 677	3 093 088	3 548 019	3 429 786	2 651 327	2 971 162	2 786 664	2 332 755	2 231 703

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biological sciences	212 633	210 627	213 124	248 838	254 071	250 356	220 193	154 696	175 572	245 176
Agricultural sciences	471 529	444 593	593 315	665 703	671 194	686 697	778 583	1 008 216	1 070 593	666 564
Medical and health sciences	1 843 005	1 812 411	1 974 213	2 170 317	2 300 587	2 283 200	2 384 920	2 855 116	2 395 653	2 289 175
Environmental sciences	2 206	44 563	50 909	85 932	21 920	480 612	60 379	69 676	130 311	101 190
Material sciences	65 092	53 855	64 090	154 500	71 967	97 670	56 253	63 653	388 110	206 974
Marine sciences	4 324	5 738	8 026	5 655	630	0	0	750	526	512
Division 2: Social sciences and humanities	471 106	1 443 280	2 016 989	2 313 701	2 367 302	2 862 731	4 065 740	2 728 832	151 985	513 483
Social sciences	471 106	1 443 280	2 016 989	2 313 701	2 367 302	2 858 585	4 065 740	2 727 641	151 985	513 483
Humanities	0	0	0	0	0	4 146	0	1 191	0	0
Total	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

Table C.45: Proportional business sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	95.5	86.3	82.9	82.6	82.9	80.6	74.4	81.1	98.6	94.9
Mathematical sciences	2.0	1.4	1.8	1.6	0.9	0.9	1.2	1.4	1.7	1.8
Physical sciences	0.3	0.5	0.4	0.4	0.3	0.3	0.6	0.6	1.0	1.2
Chemical sciences	8.9	9.3	8.3	6.4	7.0	7.8	7.3	7.6	7.5	6.3
Earth sciences	0.9	1.0	0.9	0.9	0.7	0.7	1.0	1.1	2.7	2.0
Information, computer and communication technologies	23.7	14.9	13.7	14.4	18.6	21.0	16.3	15.9	19.4	21.1
Applied sciences and technologies	8.6	8.2	6.9	7.2	6.5	6.2	7.2	6.5	5.7	5.4
Engineering sciences	26.3	26.8	26.3	26.7	24.8	17.9	18.7	19.3	21.8	22.2
Biological sciences	2.0	2.0	1.8	1.9	1.8	1.7	1.4	1.1	1.6	2.4
Agricultural sciences	4.5	4.2	5.0	5.0	4.9	4.6	4.9	7.0	10.0	6.6
Medical and health sciences	17.6	17.1	16.8	16.3	16.7	15.4	15.0	19.8	22.4	22.8
Environmental sciences	0.0	0.4	0.4	0.6	0.2	3.3	0.4	0.5	1.2	1.0
Material sciences	0.6	0.5	0.5	1.2	0.5	0.7	0.4	0.4	3.6	2.1
Marine sciences	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Division 2: Social sciences and humanities	4.5	13.7	17.1	17.4	17.1	19.4	25.6	18.9	1.4	5.1
Social sciences	4.5	13.7	17.1	17.4	17.1	19.3	25.6	18.9	1.4	5.1
Humanities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.46: Business sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	813 259	1 040 025	1 096 986	1 034 893	937 964	830 331	1 187 443	975 765	985 893	923 205
Defence	813 259	1 040 025	1 096 986	1 034 893	937 964	830 331	1 187 443	975 765	985 893	923 205
Division 2: Economic development	7 381 289	7 234 533	8 308 177	9 663 402	10 362 668	11 554 708	11 730 578	10 197 220	6 944 128	6 471 578
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	315 806	374 327	454 990	593 610	622 367	1 026 707	628 123	791 508	919 470	529 292
Animal production and animal primary products	46 316	38 484	69 916	74 045	74 267	66 547	41 588	55 615	45 062	50 273
Mineral resources (excluding energy)	733 280	853 544	977 365	1 405 074	1 348 618	947 258	812 439	867 249	787 924	973 275
Energy resources	90 377	90 975	95 375	100 061	79 210	470 860	431 681	488 026	116 459	209 543
Energy supply	490 490	321 456	349 710	503 222	362 656	461 804	555 067	574 180	674 663	659 620
Manufacturing	1 863 289	1 639 077	1 869 926	2 096 271	2 106 255	1 924 020	1 965 446	1 788 564	1 758 500	1 281 713
Construction	46 158	96 071	125 059	138 237	55 625	54 328	22 942	32 416	22 651	53 209
Transport	920 081	951 435	1 080 427	935 483	1 046 235	1 098 281	1 124 099	1 045 650	630 950	437 619
Information and communication services	978 187	908 640	842 341	1 097 649	1 685 124	2 085 856	1 403 512	1 011 167	690 243	712 864
Commercial services	1 739 933	1 755 506	2 255 642	2 555 783	2 643 503	2 929 445	4 196 652	3 154 500	897 099	1 197 714
Economic framework	57 474	103 240	91 464	79 065	273 497	422 742	476 032	302 938	326 180	304 383
Natural resources	99 898	101 778	95 962	84 901	65 312	66 859	72 996	85 409	74 926	62 073
Division 3: Society	1 232 867	1 242 066	1 303 321	1 435 870	1 433 935	1 498 255	2 027 742	2 476 255	2 106 630	2 100 049
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	1 054 182	1 045 048	1 097 446	1 212 844	1 216 127	1 289 142	1 364 830	2 419 773	1 459 043	1 460 434
Education and training	32 767	29 566	33 913	35 728	33 707	21 076	23 586	16 021	27 515	24 891
Social development and community services	145 918	167 452	171 962	187 298	184 102	188 036	639 326	40 461	620 072	614 724
Division 4: Environment	220 698	173 535	171 747	219 212	196 802	201 177	283 454	207 806	195 663	198 780
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	58 565	46 213	43 935	55 885	62 471	45 213	116 313	50 017	57 772	42 158
Environmental aspects of development	42 226	17 957	14 344	38 437	18 915	48 553	52 852	52 754	16 820	32 251

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environmental and other aspects	119 907	109 365	113 468	124 889	115 415	107 410	114 289	105 035	121 070	124 371
Division 5: Advancement of knowledge	815 909	880 567	902 617	937 575	883 626	696 800	629 967	590 788	472 168	353 733
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	813 150	877 557	899 840	932 030	880 474	696 770	629 967	590 788	472 168	353 733
Social sciences and humanities	2 758	3 010	2 776	5 545	3 152	30	0	0	0	0
Total	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

Table C.47: Proportional business sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	7.8	9.8	9.3	7.8	6.8	5.6	7.5	6.8	9.2	9.2
Defence	7.8	9.8	9.3	7.8	6.8	5.6	7.5	6.8	9.2	9.2
Division 2: Economic development	70.5	68.4	70.5	72.7	75.0	78.2	74.0	70.6	64.9	64.4
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	3.0	3.5	3.9	4.5	4.5	6.9	4.0	5.5	8.6	5.3
Animal production and animal primary products	0.4	0.4	0.6	0.6	0.5	0.5	0.3	0.4	0.4	0.5
Mineral resources (excluding energy)	7.0	8.1	8.3	10.6	9.8	6.4	5.1	6.0	7.4	9.7
Energy resources	0.9	0.9	0.8	0.8	0.6	3.2	2.7	3.4	1.1	2.1
Energy supply	4.7	3.0	3.0	3.8	2.6	3.1	3.5	4.0	6.3	6.6
Manufacturing	17.8	15.5	15.9	15.8	15.2	13.0	12.4	12.4	16.4	12.8
Construction	0.4	0.9	1.1	1.0	0.4	0.4	0.1	0.2	0.2	0.5
Transport	8.8	9.0	9.2	7.0	7.6	7.4	7.1	7.2	5.9	4.4
Information and communication services	9.3	8.6	7.1	8.3	12.2	14.1	8.8	7.0	6.4	7.1
Commercial services	16.6	16.6	19.1	19.2	19.1	19.8	26.5	21.8	8.4	11.9
Economic framework	0.5	1.0	0.8	0.6	2.0	2.9	3.0	2.1	3.0	3.0
Natural resources	1.0	1.0	0.8	0.6	0.5	0.5	0.5	0.6	0.7	0.6

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 3: Society	11.8	11.8	11.1	10.8	10.4	10.1	12.8	17.1	19.7	20.9
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	10.1	9.9	9.3	9.1	8.8	8.7	8.6	16.7	13.6	14.5
Education and training	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.3	0.2
Social development and community services	1.4	1.6	1.5	1.4	1.3	1.3	4.0	0.3	5.8	6.1
Division 4: Environment	2.1	1.6	1.5	1.6	1.4	1.4	1.8	1.4	1.8	2.0
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.6	0.4	0.4	0.4	0.5	0.3	0.7	0.3	0.5	0.4
Environmental aspects of development	0.4	0.2	0.1	0.3	0.1	0.3	0.3	0.4	0.2	0.3
Environmental and other aspects	1.1	1.0	1.0	0.9	0.8	0.7	0.7	0.7	1.1	1.2
Division 5: Advancement of knowledge	7.8	8.3	7.7	7.1	6.4	4.7	4.0	4.1	4.4	3.5
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	7.8	8.3	7.6	7.0	6.4	4.7	4.0	4.1	4.4	3.5
Social sciences and 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.48: Business sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	354 553	468 197	646 497	608 398	651 533	690 478	707 348	674 516	439 537	214 755
Free State	1 308 833	1 265 285	1 374 960	831 575	1 124 042	1 060 177	1 105 873	991 206	694 454	470 355
Gauteng	5 558 409	5 356 550	5 813 673	7 160 280	7 183 557	7 876 139	8 285 425	7 617 873	5 447 407	5 577 133
KwaZulu-Natal	1 160 507	1 237 563	1 434 084	1 501 659	1 436 737	1 553 130	1 679 718	1 446 281	1 193 914	821 492
Limpopo	62 728	127 451	140 026	161 331	145 736	171 567	223 014	184 199	78 484	199 637
Mpumalanga	157 158	222 974	301 831	435 770	339 985	284 655	304 990	392 986	370 695	258 575
North West	45 267	380 144	435 849	681 634	451 891	526 962	565 486	601 653	566 308	526 476
Northern Cape	302 164	78 471	124 150	226 303	206 786	49 508	60 007	50 561	39 576	29 084
Western Cape	1 514 404	1 434 090	1 511 778	1 684 001	2 274 728	2 568 653	2 927 324	2 488 558	1 874 107	1 949 835
Total	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

Table C.49: Proportional business sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	3.4	4.4	5.5	4.6	4.7	4.7	4.5	4.7	4.1	2.1
Free State	12.5	12.0	11.7	6.3	8.1	7.2	7.0	6.9	6.5	4.7
Gauteng	53.1	50.7	49.3	53.9	52.0	53.3	52.2	52.7	50.9	55.5
KwaZulu-Natal	11.1	11.7	12.2	11.3	10.4	10.5	10.6	10.0	11.2	8.2
Limpopo	0.6	1.2	1.2	1.2	1.1	1.2	1.4	1.3	0.7	2.0
Mpumalanga	1.5	2.1	2.6	3.3	2.5	1.9	1.9	2.7	3.5	2.6
North West	2.9	3.6	3.7	5.1	3.3	3.6	3.6	4.2	5.3	5.2
Northern Cape	0.4	0.7	1.1	1.7	1.5	0.3	0.4	0.3	0.4	0.3
Western Cape	14.5	13.6	12.8	12.7	16.5	17.4	18.5	17.2	17.5	19.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.50: Business sector R&D expenditure by Standard Industrial Classification code (2011/12 to 2020/21)

STANDARD INDUSTRIAL CLASSIFICATION	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	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	211 132	286 832	364 424	460 464	484 384	472 472	395 011	560 631	707 251	451 499
Mining and quarrying	1 352 877	1 554 284	1 675 153	1 340 103	1 220 985	1 069 826	1 101 202	1 748 437	686 064	927 055
Manufacturing	3 551 234	3 476 647	3 793 066	4 501 146	4 442 466	4 107 936	4 473 167	3 166 486	3 456 739	2 895 406
Manufacture of food products, beverages and tobacco products	283 262	319 143	340 427	364 178	376 884	328 832	455 335	498 001	452 243	273 509
Manufacture of textiles, clothing and leather goods	0	2 073	32090,5	34 609	9 335	8 932	21 968	11 129	11 306	16 547
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	80 255	50 531	60 437	72 870	95 555	87 814	91 005	76 413	79 627	77 126
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	1 381 001	1 139 617	1 256 313	1 835 837	1 800 420	1 696 770	1 692 447	802 217	1 165 107	1 096 348
Manufacture of non-metallic mineral products	72 039	49 974	52 263	51 097	28 095	37 531	24 657	43 350	19 376	36 079
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	392 800	585 635	620 923	607 574	660 205	519 108	581 073	525 937	548 762	422 697
Manufacture of electrical machinery and apparatus	310 599	312 102	254 042	302 575	381 971	455 378	635 655	374 509	250 907	300 913

STANDARD INDUSTRIAL CLASSIFICATION	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Manufacture of radio, television and communication equipment & apparatus; Manufacture of medical, precision and optical instruments, watches & clocks	639 217	656 639	742 033	706 308	569 127	629 240	625 773	486 808	538 682	567 514
Manufacture of transport equipment	310 145	267 788	334 276	408 448	402 772	321 638	316 503	315 433	381 531	96 840
Manufacture of furniture; Recycling; Manufacturing not elsewhere classified	81 914	93 145	100 261	117 649	118 102	22 692	28 752	32 689	9 198	7 833
Electricity, gas and water supply	494 745	385 770	355 720	548 015	439 157	544 850	639 298	708 166	762 345	708 350
Construction	6 495	9 051	8 037	6 637	5 613	4 297	3 562	9 408	5 065	4 762
Wholesale and retail	547 194	179 383	100 176	85 491	42 977	54 553	84 403	102 393	89 487	64 403
Transport, storage & communication	484 222	467 411	451 336	632 243	897 359	1 543 763	978 548	1 111 760	503 415	274 353
Financial intermediation, real estate and business services	3 645 625	3 914 543	4 724 439	5 357 151	5 910 332	6 555 245	7 744 370	6 402 099	4 032 237	4 250 465
Community, social and personal services	170 499	296 805	310 498	359 701	371 723	428 328	439 625	638 452	461 877	471 053
Total	10 464 022	10 570 726	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344

Table C.51: Proportional business sector R&D expenditure by Standard Industrial Classification Code (SIC) (2011/12 to 2020/21)

STANDARD INDUSTRIAL CLASSIFICATION	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Agriculture, hunting, forestry and fishing	2.7	3.1	3.5	3.5	3.2	2.5	3.9	6.6	6.6	4.5
Mining and quarrying	14.7	14.2	10.1	8.8	7.2	6.9	12.1	6.4	6.4	9.2
Manufacturing	32.9	32.2	33.9	32.2	27.8	28.2	21.9	32.3	32.3	28.8
Manufacture of food products, beverages and tobacco products	3.0	2.9	2.7	2.7	2.2	2.9	3.4	4.2	4.2	2.7
Manufacture of textiles, clothing and leather goods	0.0	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Manufacture of wood and products of wood and cork, except furniture; Manufacture of articles of straw and plaiting materials; Manufacture of paper and paper products; Manufacture of publishing, printing and reproduction of recorded material	0.5	0.5	0.5	0.7	0.6	0.6	0.5	0.7	0.7	0.8
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	10.8	10.7	13.8	13.0	11.5	10.7	5.6	10.9	10.9	10.9
Manufacture of non-metallic mineral products	0.5	0.4	0.4	0.2	0.3	0.2	0.3	0.2	0.2	0.4
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	5.5	5.3	4.6	4.8	3.5	3.7	3.6	5.1	5.1	4.2

STANDARD INDUSTRIAL CLASSIFICATION	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Manufacture of electrical machinery and apparatus	3.0	2.2	2.3	2.8	3.1	4.0	2.6	2.3	2.3	3.0
Manufacture of radio, television and communication equipment & apparatus; Manufacture of medical, precision and optical instruments, watches & clocks	6.2	6.3	5.3	4.1	4.3	3.9	3.4	5.0	5.0	5.6
Manufacture of transport equipment	2.5	2.8	3.1	2.9	2.2	2.0	2.2	3.6	3.6	1.0
Manufacture of furniture; Recycling; Manufacturing not elsewhere classified	0.9	0.9	0.9	0.9	0.2	0.2	0.2	0.1	0.1	0.1
Electricity, gas and water supply	3.6	3.0	4.1	3.2	3.7	4.0	4.9	7.1	7.1	7.1
Construction	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Wholesale and retail	1.7	0.9	0.6	0.3	0.4	0.5	0.7	0.8	0.8	0.6
Transport, storage & communication	4.4	3.8	4.8	6.5	10.4	6.2	7.7	4.7	4.7	2.7
Financial intermediation, real estate and business services	37.0	40.1	40.3	42.8	44.3	48.8	44.3	37.7	37.7	42.3
Community, social and personal services	2.8	2.6	2.7	2.7	2.9	2.8	4.4	4.3	4.3	4.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.52: Business sector R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	HEADCOUNTS				FULL-TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2011/12	**15 288**	6 192	5 095	4 001	**9 894.9**	4 451.9	3 343.5	2 099.5
2012/13	**17 155**	6 191	6 394	4 570	**11 322.3**	4 555.9	4 065.5	2 700.9
2013/14	**17 599**	6 182	6 397	5 020	**11 877.4**	4 530.1	4 253.1	3 094.2
2014/15	**18 743**	6 261	6 912	5 570	**12 927.5**	4 636.2	4 494.4	3 796.9
2015/16	**17 245**	6 128	6 090	5 027	**12 457.8**	4 626.8	4 227.4	3 603.6
2016/17	**17 998**	6 463	6 156	5 379	**12 549.2**	4 777.3	4 149.4	3 622.5
2017/18	**17 554**	7 142	5 655	4 757	**12 952.9**	5 481.7	3 807.5	3 663.8
2018/19	**16 876**	6 942	5 286	4 648	**11 691.0**	4 535.1	3 546.9	3 609.0
2019/20	**12 748**	4 641	4 989	3 118	**9 300.8**	3 227.8	3 486.8	2 586.3
2020/21	**14 177**	4 510	4 796	4 871	**10 860.3**	3 055.5	3 454.5	4 350.3

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

Table C.53: Business sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**6 942**	4 323	2 619	**4 535.1**	2 577.4	1 957.7	65.3
Technicians directly supporting R&D	**5 286**	3 508	1 778	**3 546.9**	2 199.3	1 347.6	67.1
Other personnel directly supporting R&D	**4 648**	2 823	1 825	**3 609.0**	2 034.5	1 574.5	77.6
Total	16 876	10 654	6 222	11 691.0	6 811.1	4 879.8	69.3
2019/20	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**4 641**	3 076	1 565	**3 227.8**	1 973.7	1 254.0	69.5
Technicians directly supporting R&D	**4 989**	3 023	1 966	**3 486.8**	1 885.1	1 601.7	69.9
Other personnel directly supporting R&D	**3 118**	1 432	1 686	**2 586.3**	1 114.1	1 472.2	82.9
Total	12 748	7 531	5 217	9 300.8	4 973.0	4 327.9	73.0
2020/21	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers	**4 510**	2 954	1 556	**3 055.5**	1 799.7	1 255.8	67.7
Technicians directly supporting R&D	**4 796**	2 925	1 871	**3 454.5**	1 865.8	1 588.8	72.0
Other personnel directly supporting R&D	**4 871**	1 998	2 873	**4 350.3**	1 681.8	2 668.6	89.3
Total	14 177	7 877	6 300	10 860.3	5 347.2	5 513.1	76.6

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

Table C.54: Business sector R&D personnel in headcounts by occupation, qualification, population group and gender (2020/21)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	4 510	2 954	1 556	588	407	108	120	316	230	1 869	753	73	46
Doctoral degree or equivalent	570	296	274	55	27	19	17	14	20	189	202	19	8
Master's, honours, bachelor or equivalent	3 088	2 125	963	409	284	73	77	253	163	1 349	412	41	27
Diplomas	852	533	319	124	96	16	26	49	47	331	139	13	11
Technicians directly supporting R&D	4 796	2 925	1 871	950	1 096	240	201	270	125	1 414	394	51	55
Doctoral degree or equivalent	63	33	30	5	12	1	2	2	1	18	10	7	5
Master's, honours, bachelor or equivalent	1 404	928	476	235	181	60	75	72	42	543	162	18	16
Diplomas	3 329	1 964	1 365	710	903	179	124	196	82	853	222	26	34
Other personnel directly supporting R&D	4 871	1 998	2 873	1 268	2 199	179	204	75	55	446	375	30	40
Doctoral degree or equivalent	28	12	16	2	2	0	0	0	2	9	12	1	0
Master's, honours, bachelor or equivalent	642	314	328	94	155	26	18	19	18	169	130	6	7
Diplomas	4 201	1 672	2 529	1 172	2 042	153	186	56	35	268	233	23	33
Total	14 177	7 877	6 300	2 806	3 702	527	525	661	410	3 729	1 522	154	141

Note: Headcounts include non-SA R&D staff.

Table C.55: Number of foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2018/19 to 2020/21)

COLLABORATION PARTNERS	2018/19		2019/20		2020/21	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	27	12	24	7	21	9
Higher education institutions	81	25	84	24	82	22
Members of own company	34	16	37	15	36	18
Not-for-profit organisations	12	3	11	2	12	5
Other companies	60	34	70	33	71	33
Science councils	61	10	61	11	53	11
Total number of R&D collaborations	275	100	287	92	275	98
No collaboration	N/A	N/A	N/A	N/A	N/A	N/A
R&D EXPENDITURE	R'000	R'000	R'000	R'000	R'000	R'000
Total in-house plus outsourced R&D collaboration expenditure (excl. VAT)	N/A	N/A	N/A	N/A	N/A	N/A

Note: Collaborative R&D entails partnerships. alliances and collaborations.
N/A: The indicator 'No collaboration' was not assessed from 2016/17 onwards.

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 (2011/12 to 2020/21)

YEAR	NUMBER OF R&D PERFORMERS	R&D EXPENDITURE	PROPORTION OF BERD
		R'000	%
2011/12	18	1 318 492	12.6
2012/13	19	1 512 021	14.3
2013/14	19	1 609 771	13.7
2014/15	19	2 019 919	15.2
2015/16	18	1 973 416	14.3
2016/17	16	2 621 883	17.7
2017/18	16	2 536 374	16.0
2018/19	16	2 492 520	17.3
2019/20	16	2 053 331	19.2
2020/21	15	1 659 038	14.2

Note: The list of SOEs was revised from 2014/15.

Table C.57: Business sector: SOEs – R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	55 107	59 187	263 523	65 489	65 556	110 249	140 989	153 137	132 998	87 580
Applied research	832 505	805 106	641 358	1 216 953	860 904	1 588 222	1 886 756	1 970 733	1 406 439	1 312 496
Experimental development research	430 880	647 728	704 890	737 477	1 046 956	923 413	508 629	368 650	513 895	258 961
Total	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

Table C.58: Business sector: SOEs – Proportional R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Basic research	4.2	3.9	16.4	3.2	3.3	4.2	5.6	6.1	6.5	5.3
Applied research	63.1	53.2	39.8	60.2	43.6	60.6	74.4	79.1	68.5	79.1
Experimental development research	32.7	42.8	43.8	36.5	53.1	35.2	20.1	14.8	25.0	15.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.59: Business sector: SOEs – R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Capital expenditure	333 325	179 959	245 077	355 725	122 272	726 071	702 156	768 912	368 628	131 658
Land: buildings & other structures	14 032	11 195	12 920	16 307	31 884	183 145	173 025	193 483	204 147	30 276
TOTAL: Vehicles, plant, machinery, equipment and software	319 293	168 764	232 157	339 418	90 388	542 926	529 131	575 429	164 481	101 382
Vehicles, plant, machinery, equipment	319 293	168 764	232 157	339 418	90 388	542 926	529 131	575 429	164 331	100 716
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	150	666
Current expenditure	985 167	1 332 062	1 364 694	1 664 194	1 851 145	1 895 812	1 834 218	1 723 607	1 684 703	1 527 380
Labour costs	658 509	795 414	849 371	922 321	976 713	1 040 703	968 562	892 376	842 680	721 809
Other current expenditure	326 658	536 648	515 323	741 873	874 432	855 109	865 656	831 231	842 023	805 571
Total	1 318 492	1 512 021	1 609 771	2 019 919	1 973 417	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

*Capitalised computer software collected from 2019/20.

Table C.60: Business sector: SOEs – Proportional R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Capital expenditure	25.3	11.9	15.2	17.6	6.2	27.7	27.7	30.8	18.0	7.9
Land: buildings & other structures	1.1	0.7	0.8	0.8	1.6	7.0	6.8	7.8	9.9	1.8
TOTAL: Vehicles, plant, machinery, equipment and software	24.2	11.2	14.4	16.8	4.6	20.7	20.9	23.1	8.0	6.1
Vehicles, plant, machinery, equipment	24.2	11.2	14.4	16.8	4.6	20.7	20.9	23.1	8.0	6.1
*Capitalised computer software	NA	NA	NA	NA	NA	NA	NA	NA	0	0.04
Current expenditure	74.7	88.1	84.8	82.4	93.8	72.3	72.3	69.2	82.0	92.1
Labour costs	49.9	52.6	52.8	45.7	49.5	39.7	38.2	35.8	41.0	43.5
Other current expenditure	24.8	35.5	32.0	36.7	44.3	32.6	34.1	33.3	41.0	48.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Capitalised computer software collected from 2019/20.

Table C.61: Business sector: SOEs – R&D expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Biotechnology	14 615	23 479	21 845	16 591	12 278	16 457	18 514	8 116	9 352	9 705
Nanotechnology	7 103	3 768	654	700	144	0	0	0	369	384
Total	21 717	27 247	22 499	17 290	12 422	16 457	18 514	8 116	9 721	10 089
Business expenditure on R&D	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

Table C.62: Business sector: SOEs – Proportional expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Biotechnology	1.1	1.6	1.4	0.8	0.6	0.6	0.7	0.3	0.5	0.6
Nanotechnology	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.6	1.8	1.4	0.9	0.6	0.6	0.7	0.3	0.5	0.6

Note: Data on these selected areas of R&D were collected for the first time in the 2005/06 R&D Survey.
N/A: Environment-related data was collected from the 2011/12 R&D Survey onward.

Table C.63: Business sector: SOEs – R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Environment-related	N/A	10 029	15 284	22 448	51 522	30 864	136 523	150 811	171 166	187 339
Open-source software	9 087	8 736	7 599	4 124	0	50 589	0	0	0	19 769
New materials	14 598	14 872	12 082	12 233	11 111	64 021	15 353	21 144	23 841	32 115
Tuberculosis, HIV/AIDS, malaria	0	0	0	0	0	0	0	0	0	943
Space science	N/A	N/A	N/A	N/A	N/A	N/A	32 571.42	33 063	34 998	9 462
Total	23 684	33 636	34 965	38 806	62 633	145 474	184 446	205 018	230 005	249 628
Business expenditure on R&D	1 685 520	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331

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 (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Environment-related	0.8	1.0	1.4	2.6	1.6	5.2	5.9	6.9	9.1	9.2
Open-source software	0.7	0.5	0.3	0.0	2.6	0.0	0.0	0.0	1.0	0.1
New materials	1.1	0.8	0.8	0.6	3.2	0.6	0.8	1.0	1.6	1.9
Tuberculosis, 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	1.2	1.3	1.4	0.5	0.1
Total	2.6	2.3	2.4	3.1	7.4	7.0	8.1	9.2	12.2	11.3

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

Table C.65: Business sector: SOEs – R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	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	1 318 492	1 512 021	1 609 771	1 963 779	1 963 821	2 524 169	2 437 185	2 387 524	2 043 870	1 658 091
Mathematical sciences	142 930	86 576	93 820	137 076	87 387	85 055	134 335	142 171	143 412	143 414
Physical sciences	14 992	40 742	44 460	46 559	32 100	42 210	81 896	86 032	83 931	106 613
Chemical sciences	80 556	133 867	132 399	86 408	64 230	68 251	55 705	50 406	56 752	58 973
Earth sciences	0	44 006	48 671	24 356	12 254	17 750	17 522	9 297	27 651	26 227
Information, computer and communication technologies	126 456	155 601	168 174	304 806	541 009	935 325	483 015	511 409	219 824	142 888
Applied sciences and technologies	151 475	176 600	176 391	165 214	133 687	277 702	446 635	363 768	274 949	124 361
Engineering sciences	768 675	781 073	824 057	1 034 900	981 683	971 414	1 059 843	1 040 397	924 156	877 692
Biological sciences	0	13 496	30 701	29 183	33 874	13 112	12 338	26 520	27 002	24 903
Agricultural sciences	8137	5 343	11 711	12 507	12 665	9 079	9 282	5 857	16 669	12 927
Medical and health sciences	17 491	18 012	18 316	49 357	36 548	23 990	76 571	80 711	153 719	81 265
Environmental sciences	0	42 440	45 772	59 270	16 310	47 674	51 225	58 605	67 425	40 162
Material sciences	7 780	8 605	9 198	9 849	12 073	32 605	8 818	12 352	48 380	18 666
Marine sciences	0	5 659	6 103	4 294	0	0	0	0	0	0
Division 2: Social sciences and humanities	0	0	0	56 140	9 595	97 714	99 189	104 995	9 462	947
Social sciences	0	0	0	56 140	9 595	97 714	99 189	104 995	9 462	947
Humanities	0	0	0	0	0	0	0	0	0	0
Total	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

Table C.66: Business sector: SOEs – Proportional R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	100.0	100.0	100.0	97.2	99.5	96.3	96.1	95.8	99.5	99.9
Mathematical sciences	10.8	5.7	5.8	6.8	4.4	3.2	5.3	5.7	7.0	8.6
Physical sciences	1.1	2.7	2.8	2.3	1.6	1.6	3.2	3.5	4.1	6.4
Chemical sciences	6.1	8.9	8.2	4.3	3.3	2.6	2.2	2.0	2.8	3.6
Earth sciences	0.0	2.9	3.0	1.2	0.6	0.7	0.7	0.4	1.3	1.6

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Information, computer and communication technologies	9.6	10.3	10.4	15.1	27.4	35.7	19.0	20.5	10.7	8.6
Applied sciences and technologies	11.5	11.7	11.0	8.2	6.8	10.6	17.6	14.6	13.4	7.5
Engineering sciences	58.3	51.7	51.2	51.2	49.7	37.1	41.8	41.7	45.0	52.9
Biological sciences	0.0	0.9	1.9	1.4	1.7	0.5	0.5	1.1	1.3	1.5
Agricultural sciences	0.6	0.4	0.7	0.6	0.6	0.3	0.4	0.2	0.8	0.8
Medical and health sciences	1.3	1.2	1.1	2.4	1.9	0.9	3.0	3.2	7.5	4.9
Environmental sciences	0.0	2.8	2.8	2.9	0.8	1.8	2.0	2.4	3.3	2.4
Material sciences	0.6	0.6	0.6	0.5	0.6	1.2	0.3	0.5	2.4	1.1
Marine sciences	0.0	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Division 2: Social sciences and humanities	0.0	0.0	0.0	2.8	0.5	3.7	3.9	4.2	0.5	0.1
Social sciences	0.0	0.0	0.0	2.8	0.5	3.7	3.9	4.2	0.5	0.1
Humanities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.67: Business sector: SOEs – R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	356 627	485 487	512 440	563 927	399 183	304 302	676 595	497 808	524 278	398 046
Defence	356 627	485 487	512 440	563 927	399 183	304 302	676 595	497 808	524 278	398 046
Division 2: Economic development	770 791	831 597	887 024	1 187 718	1 360 120	1 901 235	1 424 957	1 522 995	1 257 352	1 075 905
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	0	9 030	9 380	10 076	10 203	8 610	8 610	9 287	10 302	9 241
Animal production and animal primary products	4 069	0	0	0	0	0	0	0	0	0
Mineral resources (excluding energy)	6 247	6 433	6 541	6 996	7 743	8 500	8 818	9 236	0	0
Energy resources	22 488	23 158	23 549	25 185	27 874	30 602	12 479	13 070	71 813	54 254
Energy supply	367 866	249 963	253 757	419 084	316 868	410 091	516 908	546 952	614 824	584 239
Manufacturing	57 794	77 574	105 372	178 376	103 757	110 104	112 307	114 695	103 465	95 463
Construction	26 433	70 899	99 484	81 944	0	0	0	0	0	0
Transport	60 839	125 965	122 633	126 069	253 742	333 284	335 410	357 608	222 975	177 757

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Information and communication services	179 318	193 815	191 811	270 175	609 251	873 600	302 316	319 210	72 508	15 498
Commercial services	1 504	9 893	10 644	11 434	16 235	16 878	18 002	19 049	16 898	640
Economic framework	17 049	36 408	40 833	37 065	14 447	109 566	110 107	115 191	120 014	118 203
Natural resources	27 185	28 459	23 019	21 316	0	0	0	18 697	24 554	20 611
Division 3: Society	57 479	46 872	59 171	67 371	54 784	51 876	70 963	87 496	188 813	109 720
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	22 992	19 743	29 360	26 193	19 804	25 631	39 533	54 213	150 830	75 259
Education and training	11 496	10 862	13 281	14 266	14 447	0	0	0	0	0
Social development and community services	22 992	16 268	16 530	26 912	20 533	26 246	31 431	33 282	37 984	34 461
Division 4: Environment	47 487	31 245	31 720	68 425	56 760	86 865	94 694	100 236	82 888	75 367
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	23 368	15 623	15 860	26 193	33 494	28 662	30 816	32 619	39 060	34 101
Environmental aspects of development	0	0	0	16 040	2 741	32 571	33 063	34 998	0	0
Environmental and other aspects	24 119	15 623	15 860	26 193	20 525	25 631	30 816	32 619	43 828	41 265
Division 5: Advancement of knowledge	86 108	116 819	119 417	132 476	102 570	277 605	269 165	283 984	0	0
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	83 349	113 836	116 668	129 393	99 448	277 605	269 165	283 984	0	0
Social sciences and humanities	2 758	2 983	2 750	3 083	3 122	0	0	0	0	0
Total	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

Table C.68: Business sector: SOEs – Proportional R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	27.0	32.1	31.8	27.9	20.2	11.6	26.7	20.0	25.5	24.0
Defence	27.0	32.1	31.8	27.9	20.2	11.6	26.7	20.0	25.5	24.0
Division 2: Economic development	58.5	55.0	55.1	58.8	68.9	72.5	56.2	61.1	61.2	64.9
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	0.0	0.6	0.6	0.5	0.5	0.3	0.3	0.4	0.5	0.6
Animal production and animal primary products	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mineral resources (excluding energy)	0.5	0.4	0.4	0.3	0.4	0.3	0.3	0.4	0.0	0.0
Energy resources	1.7	1.5	1.5	1.2	1.4	1.2	0.5	0.5	3.5	3.3
Energy supply	27.9	16.5	15.8	20.7	16.1	15.6	20.4	21.9	29.9	35.2
Manufacturing	4.4	5.1	6.5	8.8	5.3	4.2	4.4	4.6	5.0	5.8
Construction	2.0	4.7	6.2	4.1	0.0	0.0	0.0	0.0	0.0	0.0
Transport	4.6	8.3	7.6	6.2	12.9	12.7	13.2	14.3	10.9	10.7
Information and communication services	13.6	12.8	11.9	13.4	30.9	33.3	11.9	12.8	3.5	0.9
Commercial services	0.1	0.7	0.7	0.6	0.8	0.6	0.7	0.8	0.8	0.0
Economic framework	1.3	2.4	2.5	1.8	0.7	4.2	4.3	4.6	5.8	7.1
Natural resources	2.1	1.9	1.4	1.1	0.0	0.0	0.0	0.8	1.2	1.2
Division 3: Society	4.4	3.1	3.7	3.3	2.8	2.0	2.8	3.5	9.2	6.6
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	1.7	1.3	1.8	1.3	1.0	1.0	1.6	2.2	7.3	4.5
Education and training	0.9	0.7	0.8	0.7	0.7	0.0	0.0	0.0	0.0	0.0
Social development and community services	1.7	1.1	1.0	1.3	1.0	1.0	1.2	1.3	1.8	2.1
Division 4: Environment	3.6	2.1	2.0	3.4	2.9	3.3	3.7	4.0	4.0	4.5
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	1.8	1.0	1.0	1.3	1.7	1.1	1.2	1.3	1.9	2.1
Environmental aspects of development	0.0	0.0	0.0	0.8	0.1	1.2	1.3	1.4	0.0	0.0

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	1.8	1.0	1.0	1.3	1.0	1.0	1.2	1.3	2.1	2.5
Division 5: Advancement of knowledge	6.5	7.7	7.4	6.6	5.2	10.6	10.6	11.4	0.0	0.0
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	6.3	7.5	7.2	6.4	5.0	10.6	10.6	11.4	0.0	0.0
Social sciences and humanities	0.2	0.2	0.2	0.2	0.2	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.69: Business sector: SOEs – R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	21 897	33 436	38 634	37 244	10 854	45 081	52 404	50 850	27 532	18 658
Free State	31 842	28 367	26 428	25 193	10 854	42 824	45 798	48 477	34 521	17 170
Gauteng	915 824	1 014 194	1 012 556	1 448 092	1 558 538	1 937 851	1 682 598	1 715 224	1 306 669	1 037 875
KwaZulu-Natal	61 139	66 477	91 406	45 588	86 565	188 606	197 355	242 371	222 198	219 340
Limpopo	15 917	19 724	19 596	18 612	3 019	615	1 024	1 094	2 619	2 613
Mpumalanga	15 917	27 038	28 976	33 927	13 222	9 594	9 594	10 348	19 056	10 931
North West	140 853	151 514	160 739	289 990	170 118	180 261	214 709	189 393	245 578	175 388
Northern Cape	17 446	18 630	52 104	17 998	2 397	0	409	431	11 465	2 919
Western Cape	97 655	152 641	179 332	103 275	117 850	217 052	332 484	234 330	183 695	174 142
Total	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

Table C.70: Business sector: SOEs – Proportional R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	1.7	2.2	2.4	1.8	0.5	1.7	2.1	2.0	1.3	1.1
Free State	2.4	1.9	1.6	1.2	0.5	1.6	1.8	1.9	1.7	1.0
Gauteng	69.5	67.1	62.9	71.7	79.0	73.9	66.3	68.8	63.6	62.6
KwaZulu-Natal	4.6	4.4	5.7	2.3	4.4	7.2	7.8	9.7	10.8	13.2
Limpopo	1.2	1.3	1.2	0.9	0.2	0.0	0.0	0.0	0.1	0.2
Mpumalanga	1.2	1.8	1.8	1.7	0.7	0.4	0.4	0.4	0.9	0.7
North West	10.7	10.0	10.0	14.4	8.6	6.9	8.5	7.6	12.0	10.6
Northern Cape	1.3	1.2	3.2	0.9	0.1	0.0	0.0	0.0	0.6	0.2
Western Cape	7.4	10.1	11.1	5.1	6.0	8.3	13.1	9.4	8.9	10.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.71: Business sector: SOEs – R&D expenditure by Standard Industrial Classification code (2011/12 to 2020/21)

STANDARD INDUSTRIAL CLASSIFICATION	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Agriculture, hunting, forestry and fishing	0	12 592	17 187	18 413	18 646	20 052	20 390	21 702	24 242	25 263
Mining and quarrying	0	0	0	0	0	0	0	0	0	0
Manufacturing	248 309	444 185	475 294	480 601	370 407	161 096	461 776	270 718	284 344	157 561
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	1 290	1 340	1 439	1 458	1 230	1 230	1 327	1 230	1 280
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	58 362	69 607	72 216	77 350	8 616	14 489	24 007	14 343	14 950	15 185
Manufacture of non-metallic mineral products	7 496	7 719	7 850	8 395	0	0	0	0	0	0
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	84 285	224 661	272 253	293 575	297 289	75 855	146 953	74 588	212 512	86 276
Manufacture of electrical machinery and apparatus	88 159	76 590	63 824	52 760	20 430	21 690	242 822	127 036	0	0
Manufacture of radio, television and communication equipment & apparatus; Manufacture of medical, precision and optical instruments, watches & clocks	0	0	0	0	0	0	0	0	0	0
Manufacture of transport equipment	10 007	64 318	57 812	47 081	42 614	47 833	46 764	53 425	55 652	54 820
Manufacture of furniture; Recycling; Manufacturing not elsewhere classified	0	0	0	0	0	0	0	0	0	0
Electricity, gas and water supply	463 592	325 822	340 670	534 569	424 561	531 606	633 700	698 810	725 835	697 653
Construction	0	0	0	0	0	0	0	0	0	0
Wholesale and retail	0	0	0	0	0	0	0	0	0	0
Transport, storage and communication	304 346	371 495	397 326	565 363	826 532	1 516 160	952 348	1 004 572	396 000	260 144
Financial intermediation, real estate and business services	302 245	137 898	158 060	150 347	196 661	174 576	176 127	184 533	288 975	201 458
Community, social and personal services	0	220 029	221 233	270 626	136 609	218 393	292 033	312 183	333 936	316 958
Total	1 318 492	1 512 021	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038

Table C.72: Business sector: SOEs – Proportional R&D expenditure by Standard Industrial Classification code (2011/12 to 2020/21)

STANDARD INDUSTRIAL CLASSIFICATION	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Agriculture, hunting, forestry and fishing	0.0	0.8	1.1	0.9	0.9	0.8	0.8	0.9	1.2	1.5
Mining and quarrying	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacturing	18.8	29.4	29.5	23.8	18.8	6.1	18.2	10.9	13.8	9.5
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	0.1	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	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.7	0.1
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	4.4	4.6	4.5	3.8	0.4	0.6	0.9	0.6	0.0	0.9
Manufacture of non-metallic mineral products	0.6	0.5	0.5	0.4	0.0	0.0	0.0	0.0	10.3	0.0
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	6.4	14.9	16.9	14.5	15.1	2.9	5.8	3.0	0.0	5.2
Manufacture of electrical machinery and apparatus	6.7	5.1	4.0	2.6	1.0	0.8	9.6	5.1	0.0	0.0
Manufacture of radio, television and communication equipment & apparatus; Manufacture of medical, precision and optical instruments, watches & clocks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0
Manufacture of transport equipment	0.8	4.3	3.6	2.3	2.2	1.8	1.8	2.1	0.0	3.3
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 and water supply	35.2	21.5	21.2	26.5	21.5	20.3	25.0	28.0	35.3	42.1
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wholesale and retail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport, storage and communication	23.1	24.6	24.7	28.0	41.9	57.8	37.5	40.3	19.3	15.7
Financial intermediation, real estate and business services	22.9	9.1	9.8	7.4	10.0	6.7	6.9	7.4	14.1	12.1
Community, social and personal services	0.0	14.6	13.7	13.4	6.9	8.3	11.5	12.5	16.3	19.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.73: Business sector: SOEs – R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	HEADCOUNTS				FULL-TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2011/12	**2 336**	841	1 018	477	**1 068.6**	458.2	431.0	179.4
2012/13	**2 699**	890	1 351	458	**1 307.1**	548.4	563.8	194.9
2013/14	**2 674**	892	1 334	448	**1 301.1**	541.8	573.0	186.3
2014/15	**2 760**	918	1 479	363	**1 335.3**	541.5	593.2	200.7
2015/16	**2 476**	959	1 163	354	**1 150.1**	477.7	587.9	84.5
2016/17	**2 983**	1 113	1 437	433	**1 213.8**	415.2	688.2	110.4
2017/18	**2 853**	1 509	1 021	323	**1 182.5**	668.6	394.4	119.6
2018/19	**2 738**	1 445	992	301	**984.3**	555.0	316.9	112.5
2019/20	**2 327**	1 146	864	317	**932.8**	472.3	322.5	138.0
2020/21	**2 279**	1 082	878	319	**771.7**	374.7	270.0	127.0

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but 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 (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 445**	1 173	272	**555.0**	424.5	130.6	38.4
Technicians directly supporting R&D	**992**	732	260	**316.9**	235.9	81.0	31.9
Other personnel directly supporting R&D	**301**	131	170	**112.5**	45.2	67.3	37.4
Total	2 738	2 036	702	984.3	705.5	278.8	36.0
2019/20	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 146**	904	242	**472.3**	357.5	114.8	41.2
Technicians directly supporting R&D	**864**	643	221	**322.5**	225.6	96.9	37.3
Other personnel directly supporting R&D	**317**	132	185	**138.0**	52.4	85.7	43.5
Total	2 327	1 679	648	932.8	635.4	297.4	40.1
2020/21	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 082**	873	209	**374.7**	286.0	88.8	34.6
Technicians directly supporting R&D	**878**	648	230	**270.0**	181.6	88.4	30.8
Other personnel directly supporting R&D	**319**	131	188	**127.0**	43.2	83.8	39.8
Total	2 279	1 652	627	771.7	510.7	261.0	33.9

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but 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 (2020/21)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	1 082	873	209	242	95	34	9	112	28	471	74	14	3
Doctoral degree or equivalent	86	73	13	20	9	2	0	6	2	36	1	9	1
Master's, honours, bachelor or equivalent	892	719	173	205	72	30	9	98	24	381	66	5	2
Diplomas	104	81	23	17	14	2	0	8	2	54	7	0	0
Technicians directly supporting R&D	878	648	230	284	151	20	20	25	8	319	51	0	0
Doctoral degree or equivalent	1	1	0	0	0	0	0	0	0	1	0	0	0
Master's, honours, bachelor or equivalent	179	117	62	52	41	2	2	10	6	53	13	0	0
Diplomas	698	530	168	232	110	18	18	15	2	265	38	0	0
Other personnel directly supporting R&D	319	131	188	68	103	8	9	4	3	51	73	0	0
Doctoral degree or equivalent	4	2	2	0	1	0	0	0	0	2	1	0	0
Master's, honours, bachelor or equivalent	48	17	31	9	24	0	3	4	0	4	4	0	0
Diplomas	267	112	155	59	78	8	6	0	3	45	68	0	0
Total	2 279	1 652	627	594	349	62	38	141	39	841	198	14	3

Note: Headcounts include non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as those that are not from South Africa but 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 (2018/19 to 2020/21)

COLLABORATION PARTNERS	2018/19		2019/20		2020/21	
	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA	WITHIN SOUTH AFRICA	OUTSIDE SOUTH AFRICA
Government research institutes	3	3	5	3	5	3
Higher education institutions	11	4	11	4	11	5
Members of own company	5	3	5	2	5	0
Not-for-profit organisations	3	1	4	1	4	1
Other companies	3	1	3	1	4	1
Science councils	10	2	9	2	11	2
Total number of R&D collaborations	35	14	37	13	40	12
No collaboration	N/A	N/A	N/A	N/A	N/A	N/A
R&D EXPENDITURE	R'000	R'000	R'000	R'000	R'000	R'000
Total in-house plus outsourced R&D collaboration expenditure (excl. VAT)	N/A	N/A	N/A	N/A	N/A	N/A

Note: Collaborative R&D entails partnerships, alliances and collaborations.
N/A: The indicator 'No collaboration' was not assessed from 2016/17 onwards. Collaboration expenditure was not calculated for 2016/17 onwards.

C.2.2. Not-for-profit sector

Table C.77: Not-for-profit sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Basic research	62 134	114 755	132 478	181 492	200 040	232 304	280 032	291 509	349 219	381 683
Applied research	79 105	346 179	322 295	426 132	508 738	558 059	661 575	841 861	779 943	805 222
Experimental development research	29 366	42 898	128 391	171 149	182 365	227 254	274 703	352 334	380 353	381 402
Total	170 605	503 833	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307

Table C.78: Proportional not-for-profit sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Basic research	36.4	22.8	22.7	23.3	22.4	22.8	23.0	19.6	23.1	24.3
Applied research	46.4	68.7	55.3	54.7	57.1	54.8	54.4	56.7	51.7	51.3
Experimental development research	17.2	8.5	22.0	22.0	20.5	22.3	22.6	23.7	25.2	24.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.79: Not-for-profit sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Capital expenditure	18 702	37 564	39 983	49 647	53 800	91 083	75 522	103 851	57 865	65 031
Land: buildings & other structures	6 905	11 152	19 047	18 794	18 391	20 765	23 962	41 676	15 201	17 132
TOTAL: Vehicles, plant, machinery, equipment and software	11 797	26 412	20 936	30 853	35 409	70 318	51 560	62 175	42 664	47 899
Vehicles, plant, machinery, equipment	11 797	26 412	20 936	30 853	35 409	70 318	51 560	62 175	38 076	39 173
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4 588	8 726
Current expenditure	151 903	466 269	543 182	729 125	837 342	926 534	1 140 787	1 381 853	1 451 650	1 503 276
Labour costs	100 176	243 871	303 644	420 462	468 883	506 181	634 168	648 726	681 740	742 825
Other current expenditure	51 727	222 398	239 538	308 663	368 459	420 353	506 620	733 127	769 910	760 451
Total	170 605	503 833	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307

*Capitalised computer software collected from 2019/20.

Table C.80: Proportional not-for-profit sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Capital expenditure	11.0	7.5	6.9	6.4	6.0	9.0	6.2	7.0	3.8	4.1
Land: buildings & other structures	4.0	2.2	3.3	2.4	2.1	2.0	2.0	2.8	1.0	1.1
TOTAL: Vehicles, plant, machinery, equipment and software	6.9	5.2	3.6	4.0	4.0	6.9	4.2	4.2	2.8	3.1
Vehicles, plant, machinery, equipment	6.9	5.2	3.6	4.0	4.0	6.9	4.2	4.2	2.5	2.5
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0.6
Current expenditure	89.0	92.5	93.1	93.6	94.0	91.0	93.8	93.0	96.2	95.9
Labour costs	58.7	48.4	52.1	54.0	52.6	49.7	52.1	43.7	45.2	47.4
Other current expenditure	30.3	44.1	41.1	39.6	41.3	41.3	41.7	49.3	51.0	48.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Capitalised computer software collected from 2019/20.

Table C.81: Not-for-profit sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Biotechnology	8 667	29 062	62 082	128 964	159 045	123 879	160 846	261 324	339 841	305 702
Nanotechnology	0	10 187	4915	70 348	81 103	841	543	569	0	0
Total	8 667	39 249	66 997	199 312	240 148	124 720	161 389	261 892	339 841	305 702
NPO expenditure on R&D	170 605	503 833	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307

Table C.82: Proportional not-for-profit sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Biotechnology	5.1	5.8	10.6	16.6	17.8	12.2	13.2	17.6	22.5	19.5
Nanotechnology	0	2.0	0.8	9.0	9.1	0.1	0.0	0.0	0	0
Total	5.1	7.8	11.5	25.6	26.9	12.3	13.3	17.6	22.5	19.5

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

Table C.83: Not-for-profit sector R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Environment-related	15 133	18 022	27 142	50 364	52 156	54 904	56 218	70 733	85 245	148 730
Open-source software	20	419	481	69 509	756	824	952	930	1 335	3 065
New materials	395	178	191	634	79 322	223	1 814	0	20 594	27 149
Tuberculosis, HIV/AIDS, malaria	5 034	246 760	301 086	374 460	482 298	689 315	876 132	1 118 507	1 147 804	1 142 974
Space science	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0
Total	20 581	265 379	328 901	494 966	614 532	745 265	935 117	1 190 170	1 254 979	1 321 918
NPO expenditure on R&D	**170 605**	**503 833**	**583 165**	**778 772**	**891 142**	**1 017 616**	**1 216 310**	**1 485 704**	**1 509 515**	**1 509 515**

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 (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Environment-related	8.9	3.6	4.7	6.5	5.9	5.4	4.6	4.8	5.6	9.9
Open-source software	0.0	0.1	0.1	8.9	0.1	0.1	0.1	0.1	0.1	0.2
New materials	0.2	0.0	0.0	0.1	8.9	0.0	0.1	0.0	1.4	1.8
Tuberculosis, HIV/AIDS, malaria	3.0	49.0	51.6	48.1	54.1	67.7	72.0	75.3	76.0	75.7
Space science	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0
Total	12.1	52.7	56.4	63.6	69.0	73.2	76.9	80.1	83.1	87.6

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 (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Division 1: Natural sciences, technology and engineering	64 042	346 961	427 237	647 068	766 355	909 337	1 096 247	1 374 844	1 402 157	1 452 887
Mathematical sciences	0	8 223	9 674	14 613	14 293	13 540	14 797	16 009	16 684	14 497
Physical sciences	0	765	802	989	1 191	1 300	1 504	1 551	1 616	1 284
Chemical sciences	0	0	1 309	0	0	0	0	0	0	0
Earth sciences	2 407	2 598	5 907	8 371	8 356	8 727	8 008	8 594	7 532	9 157
Information, computer and communication technologies	595	2 919	39	197	528	0	1 925	0	365	2 350
Applied sciences and technologies	1 487	4 317	4 666	19 123	30 565	29 946	29 379	30 941	31 097	32 863
Engineering sciences	0	4 075	4 915	4 638	4 005	3 393	1 572	1 645	1 746	30
Biological sciences	7 978	15 475	23 435	23 338	11 400	42 787	44 312	62 027	64 866	67 468

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	25 819	33 105	34 165	53 777	60 727	62 269	63 037	52 807	52 884	56 448
Medical and health sciences	17 423	265 031	329 293	497 588	614 889	719 902	905 867	1 174 074	1 200 011	1 244 118
Environmental sciences	7 553	10 122	12 238	23 548	19 552	25 746	24 150	25 335	23 586	21 949
Material sciences	0	0	0	0	0	0	0	0	0	0
Marine sciences	781	331	794	886	848	1 725	1 697	1 860	1 770	1 634
Division 2: Social sciences and humanities	106 563	156 872	155 928	131 705	124 787	108 280	120 063	110 860	107 358	115 420
Social sciences	104 842	142 525	147 029	122 105	117 549	98 355	109 068	99 304	87 132	94 871
Humanities	1 720	14 348	8 898	9 599	7 238	9 925	10 995	11 556	20 226	21 639
Total	170 605	503 833	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307

Table C.86: Proportional not-for-profit sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	37.5	68.9	73.3	83.1	86.0	89.4	90.1	92.5	92.9	92.6
Mathematical sciences	0.0	1.6	1.7	1.9	1.6	1.3	1.2	1.1	1.1	0.9
Physical sciences	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chemical sciences	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Earth sciences	1.4	0.5	1.0	1.1	0.9	0.9	0.7	0.6	0.5	0.6
Information, computer and communication technologies	0.3	0.6	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.1
Applied sciences and technologies	0.9	0.9	0.8	2.5	3.4	2.9	2.4	2.1	2.1	2.1
Engineering sciences	0.0	0.8	0.8	0.6	0.4	0.3	0.1	0.1	0.1	0.0
Biological sciences	4.7	3.1	4.0	3.0	1.3	4.2	3.6	4.2	4.3	4.3
Agricultural sciences	15.1	6.6	5.9	6.9	6.8	6.1	5.2	3.6	3.5	3.6
Medical and health sciences	10.2	52.6	56.5	63.9	69.0	70.7	74.5	79.0	79.5	79.3
Environmental sciences	4.4	2.0	2.1	3.0	2.2	2.5	2.0	1.7	1.6	1.4
Material sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marine sciences	0.5	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Division 2: Social sciences and humanities	62.5	31.1	26.7	16.9	14.0	10.6	9.9	7.5	7.1	7.4
Social sciences	61.5	28.3	25.2	15.7	13.2	9.7	9.0	6.7	5.8	6.0
Humanities	1.0	2.8	1.5	1.2	0.8	1.0	0.9	0.8	1.3	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.87: Not-for-profit sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	0	0	0	690	0	0	0	0	0	0
Defence	0	0	0	690	0	0	0	0	0	0
Division 2: Economic development	60 758	110 866	113 991	152 573	157 608	129 359	118 415	103 702	92 455	108 865
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	24 850	36 127	35 511	28 974	32 936	35 240	35 197	26 579	23 124	22 599
Animal production and animal primary products	828	2 538	3 083	4 000	7 628	9 856	2 635	2 858	2 378	3 084
Mineral resources (excluding energy)	0	8 150	9 831	9 242	7 955	7 708	0	0	0	0
Energy resources	969	2 538	3 083	3 993	4 008	3 278	4 022	4 875	4 508	5 307
Energy supply	3 430	4 363	8 690	7 663	6 242	10 628	7 994	8 852	7 102	8 177
Manufacturing	2 197	3 896	2 955	26 291	31 646	230	0	308	321	316
Construction	0	0	0	0	0	0	0	0	0	0
Transport	137	465	424	0	0	0	0	0	0	0
Information and communication services	1 480	2 031	1 823	316	2 411	327	2 513	0	365	0
Commercial services	0	0	0	0	1 135	1 962	1 675	0	0	0
Economic framework	22 228	45 252	42 423	54 435	53 406	47 465	57 125	53 099	47 407	52 747
Natural resources	4 640	5 507	6 167	17 659	10 242	12 665	7 253	7 131	7 251	16 635
Division 3: Society	75 597	360 333	415 093	555 151	632 030	767 620	941 505	1 058 928	1 079 921	1 218 236
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	13 496	260 712	303 535	449 619	527 783	667 371	835 603	955 738	962 721	1 074 859
Education and training	23 762	58 894	63 833	61 150	59 917	59 123	61 652	60 123	80 287	102 542
Social development and community services	38 339	40 726	47 725	44 382	44 330	41 126	44 250	43 066	36 913	40 835
Division 4: Environment	13 356	12 841	15 044	16 135	17 503	19 734	38 078	39 974	37 194	45 433
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	7 233	4 716	7 845	8 697	9 949	9 712	23 780	23 201	22 225	30 236
Environmental aspects of development	3 746	5 771	4 545	4 569	4 494	6 269	6 559	7 544	6 393	7 294

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environmental and other aspects	2 377	2 355	2 654	2 869	3 060	3 753	7 739	9 229	8 576	7 903
Division 5: Advancement of knowledge	20 895	19 793	39 036	54 223	84 002	100 903	118 312	283 100	299 945	195 773
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	13 166	7 754	31 450	42 017	69 845	90 114	107 310	272 540	286 464	186 060
Social sciences and humanities	7 729	12 039	7 586	12 206	14 157	10 789	11 001	10 561	13 481	9 713
Total	170 605	503 833	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307

Table C.88: Proportional not-for-profit sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Defence	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Division 2: Economic development	35.6	22.0	19.5	19.6	17.7	12.7	9.7	7.0	6.1	6.9
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	14.6	7.2	6.1	3.7	3.7	3.5	2.9	1.8	1.5	1.4
Animal production and animal primary products	0.5	0.5	0.5	0.5	0.9	1.0	0.2	0.2	0.2	0.2
Mineral resources (excluding energy)	0.0	1.6	1.7	1.2	0.9	0.8	0.0	0.0	0.0	0.0
Energy resources	0.6	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3
Energy supply	2.0	0.9	1.5	1.0	0.7	1.0	0.7	0.6	0.5	0.5
Manufacturing	1.3	0.8	0.5	3.4	3.6	0.0	0.0	0.0	0.0	0.0
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Information and communication services	0.9	0.4	0.3	0.0	0.3	0.0	0.2	0.0	0.0	0.0
Commercial services	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0
Economic framework	13.0	9.0	7.3	7.0	6.0	4.7	4.7	3.6	3.1	3.4
Natural resources	2.7	1.1	1.1	2.3	1.1	1.2	0.6	0.5	0.5	1.1

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 3: Society	44.3	71.5	71.2	71.3	70.9	75.4	77.4	71.3	71.5	77.7
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	7.9	51.7	52.0	57.7	59.2	65.6	68.7	64.3	63.8	68.5
Education and training	13.9	11.7	10.9	7.9	6.7	5.8	5.1	4.0	5.3	6.5
Social development and community services	22.5	8.1	8.2	5.7	5.0	4.0	3.6	2.9	2.4	2.6
Division 4: Environment	7.8	2.5	2.6	2.1	2.0	1.9	3.1	2.7	2.5	2.9
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	4.2	0.9	1.3	1.1	1.1	1.0	2.0	1.6	1.5	1.9
Environmental aspects of development	2.2	1.1	0.8	0.6	0.5	0.6	0.5	0.5	0.4	0.5
Environmental and other aspects	1.4	0.5	0.5	0.4	0.3	0.4	0.6	0.6	0.6	0.5
Division 5: Advancement of knowledge	12.2	3.9	6.7	7.0	9.4	9.9	9.7	19.1	19.9	12.5
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	7.7	1.5	5.4	5.4	7.8	8.9	8.8	18.3	19.0	11.9
Social sciences and humanities	4.5	2.4	1.3	1.6	1.6	1.1	0.9	0.7	0.9	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.89: Not-for-profit sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	9 493	25 610	25 478	27 219	21 026	17 053	15 150	19 452	19 676	20 462
Free State	5 096	15 297	15 953	14 214	8 890	6 643	8 086	11 332	29 633	9 743
Gauteng	69 321	162 866	175 651	287 783	345 937	333 359	440 863	528 725	543 971	572 423
KwaZulu-Natal	33 740	163 221	166 603	181 052	232 636	277 770	317 706	316 771	267 615	357 192
Limpopo	7 449	11 779	13 719	49 971	56 143	64 105	78 996	67 940	79 897	92 664
Mpumalanga	16 027	23 195	26 979	30 594	25 944	29 964	32 775	29 863	25 003	18 360
North West	6 353	42 960	72 446	105 904	97 918	136 641	133 473	136 626	162 503	171 737
Northern Cape	1 889	3 867	3 583	1 546	2 200	4 782	4 868	3 238	3 837	2 389
Western Cape	21 236	55 038	82 753	80 489	100 448	147 299	184 392	371 758	377 380	323 336
Total	170 605	503 833	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307

Table C.90: Proportional not-for-profit sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	5.6	5.1	4.4	3.5	2.4	1.7	1.2	1.3	1.3	1.3
Free State	3.0	3.0	2.7	1.8	1.0	0.7	0.7	0.8	2.0	0.6
Gauteng	40.6	32.3	30.1	37.0	38.8	32.8	36.2	35.6	36.0	36.5
KwaZulu-Natal	19.8	32.4	28.6	23.2	26.1	27.3	26.1	21.3	17.7	22.8
Limpopo	4.4	2.3	2.4	6.4	6.3	6.3	6.5	4.6	5.3	5.9
Mpumalanga	9.4	4.6	4.6	3.9	2.9	2.9	2.7	2.0	1.7	1.2
North West	1.1	8.5	12.4	13.6	11.0	13.4	11.0	9.2	10.8	11.0
Northern Cape	3.7	0.8	0.6	0.2	0.2	0.5	0.4	0.2	0.3	0.2
Western Cape	12.4	10.9	14.2	10.3	11.3	14.5	15.2	25.0	25.0	20.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.91: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	HEADCOUNTS				FULL-TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2011/12	**405**	254	56	95	**312.1**	190.8	47.2	74.1
2012/13	**906**	394	132	380	**768.0**	294.5	114.2	359.4
2013/14	**1 017**	435	205	377	**891.4**	338.4	195.1	357.9
2014/15	**1 471**	506	368	597	**1 231.2**	396.0	355.5	479.8
2015/16	**1 493**	465	436	592	**1 367.3**	384.8	411.2	571.2
2016/17	**1 616**	404	607	605	**1 469.5**	340.5	575.6	553.4
2017/18	**1 741**	425	678	638	**1 596.0**	346.1	644.7	605.2
2018/19	**1 937**	424	843	670	**1 685.8**	367.3	693.2	625.4
2019/20	**1 925**	390	878	657	**1 710.1**	330.9	766.0	613.3
2020/21	**1 795**	431	718	646	**1556.1**	352.0	595.7	608.4

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

Table C.92: Not-for-profit sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**424**	165	259	**367.3**	142.6	224.7	86.6
Technicians directly supporting R&D	**843**	231	612	**693.2**	192.0	501.2	82.2
Other personnel directly supporting R&D	**670**	182	488	**625.4**	167.8	457.5	93.3
Total	1 937	578	1 359	1 685.8	502.4	1 183.4	87.0
2019/20	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**390**	162	228	**330.9**	132.7	198.2	84.8
Technicians directly supporting R&D	**878**	214	664	**766.0**	195.3	570.7	87.2
Other personnel directly supporting R&D	**657**	189	468	**613.3**	175.0	438.3	93.3
Total	1 925	565	1 360	1 710.1	502.9	1 207.1	88.8
2020/21	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**431**	179	252	**352.0**	148.2	203.8	81.7
Technicians directly supporting R&D	**718**	193	525	**595.7**	152.6	443.1	83.0
Other personnel directly supporting R&D	**646**	188	458	**608.4**	177.3	431.1	94.2
Total	1 795	560	1 235	1 556.1	478.2	1 077.9	86.7

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

Table C.93: Not-for-profit sector R&D personnel in headcounts by occupation, qualification, population group and gender (2020/21)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	431	179	252	64	82	4	19	16	42	84	90	11	19
Doctoral degree or equivalent	115	54	61	9	10	1	3	4	16	36	27	4	5
Master's, honours, bachelor or equivalent	277	110	167	47	62	3	14	8	20	45	57	7	14
Diplomas	39	15	24	8	10	0	2	4	6	3	6	0	0
Technicians directly supporting R&D	718	189	509	136	364	16	53	4	35	28	51	5	6
Doctoral degree or equivalent	9	3	6	2	0	0	0	0	3	1	3	0	0
Master's, honours, bachelor or equivalent	265	64	201	29	95	7	34	4	32	21	36	3	4
Diplomas	444	126	318	105	269	4	16	9	19	6	12	2	2
Other personnel directly supporting R&D	646	188	458	157	338	6	29	6	38	12	46	7	7
Doctoral degree or equivalent	10	4	6	1	3	0	2	1	0	0	1	2	0
Master's, honours, bachelor or equivalent	115	29	86	19	35	1	8	2	24	6	16	1	3
Diplomas	521	155	366	137	300	5	19	3	14	6	29	4	4
Total	1 795	556	1 219	357	784	26	101	26	115	124	187	23	32

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

C.2.3. Government sector

Table C.94: Government sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Basic research	263 380	331 587	245 167	338 250	358 666	348 775	329 263	416 131	400 775	411 837
Applied research	812 067	873 469	1 194 866	1 292 421	1 390 221	1 444 821	1 685 367	1 495 783	1 241 999	1 572 122
Experimental development research	160 223	232 453	257 118	262 339	264 134	305 051	311 246	311 513	250 769	253 572
Total	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531

Table C.95: Proportional government sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Basic research	21.3	23.1	14.4	17.9	17.8	16.6	14.2	18.7	21.2	18.4
Applied research	65.7	60.8	70.4	68.3	69.1	68.8	72.5	67.3	65.6	70.3
Experimental development research	13.0	16.2	15.1	13.9	13.1	14.5	13.4	14.0	13.2	11.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.96: Government sector R&D expenditure by spheres and institutes of government and accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Municipalities	14 959	65 541	59 418	62 485	61 703	76 493	59 114	84 160	99 754	106 207
Capital expenditure	144	18 605	23 033	12 921	13 059	20 271	13 265	30 048	20 120	24 170
Land: buildings and other structures	0	5 400	10 000	6 537	6 598	9 575	7 065	13 305	8 500	8 750
TOTAL: Vehicles, plant, machinery, equipment and software	144	13 205	13 033	6 384	6 461	10 696	6 200	16 743	11 620	15 420
Vehicles, plant, machinery, equipment	144	13 205	13 033	6 384	6 461	10 696	6 200	16 743	7 900	9 600
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3 720	5 820
Current expenditure	14 815	46 936	36 385	49 564	48 644	56 222	45 849	54 112	79 634	82 037
Labour costs	12 715	30 131	27 513	39 314	38 687	41 407	38 279	42 316	70 310	74 527
Other current expenditure	2 100	16 805	8 872	10 250	9 957	14 815	7 570	11 796	9 324	7 510
Provincial departments	335 607	372 231	390 301	421 126	401 512	405 760	411 195	410 454	412 428	427 623
Capital expenditure	42 895	45 895	45 930	39 325	43 918	48 084	35 517	27 502	44 238	42 072
Land: buildings and other structures	10 674	7 255	6 348	5 500	7 900	12 264	14 864	12 130	14 035	13 506
TOTAL: Vehicles, plant, machinery, equipment and software	32 221	38 640	39 582	33 825	36 018	35 820	20 653	15 372	30 203	28 566
Vehicles, plant, machinery, equipment	32 221	38 640	39 582	33 825	36 018	35 820	20 653	15 372	25 056	25 763
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 147	2 803
Current expenditure	292 712	326 336	344 371	381 801	357 594	357 676	375 678	382 951	368 190	385 551
Labour costs	206 583	236 367	233 321	248 823	225 621	252 286	264 285	252 129	265 436	278 148
Other current expenditure	86 129	89 969	111 050	132 978	131 973	105 390	111 393	130 823	102 754	107 403
National departments	280 005	321 632	249 705	248 041	356 575	408 803	512 743	546 432	453 849	668 116
Capital expenditure	31 879	32 669	17 540	4 406	57 905	56 999	71 632	77 174	66 915	78 421
Land: buildings and other structures	11 820	12 783	2 122	811	18 037	6 424	6 920	16 143	18 321	17 861
TOTAL: Vehicles, plant, machinery, equipment and software	20 059	19 886	15 418	3 595	39 868	50 575	64 712	61 031	48 594	60 560
Vehicles, plant, machinery, equipment	20 059	19 886	15 418	3 595	39 868	50 575	64 712	61 031	46 705	58 950
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1 889	1 610
Current expenditure	248 126	288 963	232 165	243 635	298 670	351 804	441 111	469 258	386 934	589 695
Labour costs	140 146	158 808	198 440	150 921	171 849	216 103	228 761	194 471	204 110	181 989
Other current expenditure	107 980	130 155	33 725	92 714	126 821	135 701	212 350	274 787	182 824	407 706
Government research institutes	573 698	644 360	973 807	1 134 875	1 165 161	1 179 994	1 326 427	1 161 197	885 825	996 858
Capital expenditure	35 071	157 221	98 010	233 386	202 878	199 952	271 029	342 078	254 023	236 377
Land: buildings and other structures	2 487	58 280	4 542	93 477	112 710	107 971	131 824	105 507	116 115	132 749
TOTAL: Vehicles, plant, machinery, equipment and software	32 584	98 941	93 468	139 909	90 168	91 981	139 205	236 571	137 908	103 628
Vehicles, plant, machinery, equipment	32 584	98 941	93 468	139 909	90 168	91 981	139 205	236 571	132 565	93 433
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 343	10 195
Current expenditure	538 627	487 139	875 797	901 489	962 283	980 042	1 055 398	819 119	631 802	760 482
Labour costs	316 835	355 503	316 256	375 939	311 876	323 121	328 656	394 182	425 678	459 866
Other current expenditure	221 792	131 636	559 541	525 550	650 407	656 921	726 741	424 937	206 124	300 616
Museums	31 400	33 745	23 920	26 484	28 070	27 596	16 396	21 184	41 688	38 727
Capital expenditure	3 256	649	946	1 996	2 005	2 704	796	2 106	5 574	6 679
Land: buildings and other structures	2 337	30	638	687	663	774	0	0	1 346	50
TOTAL: Vehicles, plant, machinery, equipment and software	919	619	308	1 309	1 342	1 930	796	2 106	4 228	6 629
Vehicles, plant, machinery, equipment	919	619	308	1 309	1 342	1 930	796	2 106	2 626	6 349
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1 602	280
Current expenditure	28 144	33 096	22 974	24 488	26 065	24 892	15 600	19 078	36 114	32 048
Labour costs	21 413	25 471	20 769	22 429	23 751	24 004	14 775	17 610	29 837	30 059
Other current expenditure	6 731	7 625	2 205	2 059	2 314	888	825	1 468	6 277	1 989
Government sector	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531
Capital expenditure	113 245	255 039	185 459	292 034	319 765	328 010	392 239	478 908	390 870	387 719
Land: buildings and other structures	27 318	83 748	23 650	107 012	145 908	137 008	160 673	147 085	158 317	172 916
TOTAL: Vehicles, plant, machinery, equipment and software	85 927	171 291	161 809	185 022	173 857	191 002	231 566	331 823	232 553	214 803
Vehicles, plant, machinery, equipment	85 927	171 291	161 809	185 022	173 857	191 002	231 566	331 823	214 852	194 095
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17 701	20 708
Current expenditure	1 122 424	1 182 470	1 511 692	1 600 976	1 693 256	1 770 636	1 933 636	1 744 518	1 502 673	1 849 812
Labour costs	697 692	806 280	796 299	837 425	771 784	856 921	874 757	900 707	995 370	1 024 588
Other current expenditure	424 732	376 190	715 393	763 551	921 472	913 715	1 058 879	843 811	507 303	825 224

N/A: Municipal data were collected from the 2011/12 R&D Survey onwards. *Capitalised computer software collected from 2019/20.

Table C.97: Proportional government sector R&D expenditure by spheres and institutes of government and accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Municipalities	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	1.0	28.4	38.8	20.7	21.2	26.5	22.4	35.7	20.2	22.8
Land: buildings and other structures	0.0	8.2	16.8	10.5	10.7	12.5	12.0	15.8	8.5	8.2
TOTAL: Vehicles, plant, machinery, equipment and software	1.0	20.1	21.9	10.2	10.5	14.0	10.5	19.9	11.6	14.5
Vehicles, plant, machinery, equipment	1.0	20.1	21.9	10.2	10.5	14.0	10.5	19.9	7.9	9.0
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	5.5
Current expenditure	99.0	71.6	61.2	79.3	78.8	73.5	77.6	64.3	79.8	77.2
Labour costs	85.0	46.0	46.3	62.9	62.7	54.1	64.8	50.3	70.5	70.2
Other current expenditure	14.0	25.6	14.9	16.4	16.1	19.4	12.8	14.0	9.3	7.1
Provincial departments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	12.8	12.3	11.8	9.3	10.9	11.9	8.6	6.7	10.7	9.8
Land: buildings and other structures	3.2	1.9	1.6	1.3	2.0	3.0	3.6	3.0	3.4	3.2
TOTAL: Vehicles, plant, machinery, equipment and software	9.6	10.4	10.1	8.0	9.0	8.8	5.0	3.7	7.3	6.7
Vehicles, plant, machinery, equipment	9.6	10.4	10.1	8.0	9.0	8.8	5.0	3.7	6.1	6.0
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	0.7
Current expenditure	87.2	87.7	88.2	90.7	89.1	88.1	91.4	93.3	89.3	90.2
Labour costs	61.6	63.5	59.8	59.1	56.2	62.2	64.3	61.4	64.4	65.0
Other current expenditure	25.7	24.2	28.5	31.6	32.9	26.0	27.1	31.9	24.9	25.1
National departments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	11.4	10.2	7.0	1.8	16.2	13.9	14.0	14.1	14.7	11.7
Land: buildings and other structures	4.2	4.0	0.8	0.3	5.1	1.6	1.3	3.0	4.0	2.7
TOTAL: Vehicles, plant, machinery, equipment and software	7.2	6.2	6.2	1.4	11.2	12.4	12.6	11.2	10.7	9.1
Vehicles, plant, machinery, equipment	7.2	6.2	6.2	1.4	11.2	12.4	12.6	11.2	10.3	8.8
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0.2
Current expenditure	88.6	89.8	93.0	98.2	83.8	86.1	86.0	85.9	85.3	88.3
Labour costs	50.1	49.4	79.5	60.8	48.2	52.9	44.6	35.6	45.0	27.2
Other current expenditure	38.6	40.5	13.5	37.4	35.6	33.2	41.4	50.3	40.3	61.0
Government research institutes	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	6.1	24.4	10.1	20.6	17.4	16.9	20.4	29.5	28.7	23.7
Land: buildings and other structures	0.4	9.0	0.5	8.2	9.7	9.2	9.9	9.1	13.1	13.3
TOTAL: Vehicles, plant, machinery, equipment and software	5.7	15.4	9.6	12.3	7.7	7.8	10.5	20.4	15.6	10.4
Vehicles, plant, machinery, equipment	5.7	15.4	9.6	12.3	7.7	7.8	10.5	20.4	15.0	9.4
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1.0
Current expenditure	93.9	75.6	89.9	79.4	82.6	83.1	79.6	70.5	71.3	76.3
Labour costs	55.2	55.2	32.5	33.1	26.8	27.4	24.8	33.9	48.1	46.1
Other current expenditure	38.7	20.4	57.5	46.3	55.8	55.7	54.8	36.6	23.3	30.2
Museums	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	10.4	1.9	4.0	7.5	7.1	9.8	4.9	9.9	13.4	17.2
Land: buildings and other structures	7.4	0.1	2.7	2.6	2.4	2.8	0.0	0.0	3.2	0.1
TOTAL: Vehicles, plant, machinery, equipment and software	2.9	1.8	1.3	4.9	4.8	7.0	4.9	9.9	10.1	17.1
Vehicles, plant, machinery, equipment	2.9	1.8	1.3	4.9	4.8	7.0	4.9	9.9	6.3	16.4
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	0.7
Current expenditure	89.6	98.1	96.0	92.5	92.9	90.2	95.1	90.1	86.6	82.8
Labour costs	68.2	75.5	86.8	84.7	84.6	87.0	90.1	83.1	71.6	77.6
Other current expenditure	21.4	22.6	9.2	7.8	8.2	3.2	5.0	6.9	15.1	5.1
Government sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	9.2	17.7	10.9	15.4	15.9	15.6	16.9	21.5	20.6	17.3
Land: buildings and other structures	2.2	5.8	1.4	5.7	7.2	6.5	6.9	6.6	8.4	7.7
TOTAL: Vehicles, plant, machinery, equipment and software	7.0	11.9	9.5	9.8	8.6	9.1	10.0	14.9	12.3	9.6
Vehicles, plant, machinery, equipment	7.0	11.9	9.5	9.8	8.6	9.1	10.0	14.9	11.3	8.7
*Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	0.9
Current expenditure	90.8	82.3	89.1	84.6	84.1	84.4	83.1	78.5	79.4	82.7
Labour costs	56.5	56.1	46.9	44.2	38.3	40.8	37.6	40.5	52.6	45.8
Other current expenditure	34.4	26.2	42.2	40.3	45.8	43.5	45.5	38.0	26.8	36.9

N/A: Municipal data were collected from the 2011/12 R&D Survey onwards. *Capitalised computer software collected from 2019/20.

Table C.98: Government sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Biotechnology	81 993	124 429	97 816	85 385	81 409	87 557	84 738	89 293	100 237	104 270
Nanotechnology	4 609	15 035	16 929	13 112	11 774	12 620	12 741	24 732	10 784	13 115
Total	86 602	139 464	114 745	98 497	93 183	100 176	97 479	114 025	111 021	117 385
Government expenditure on R&D	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531

Table C.99: Proportional government sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Biotechnology	6.6	8.7	5.8	4.5	4.0	4.2	3.6	4.0	5.3	4.7
Nanotechnology	0.4	1.0	1.0	0.7	0.6	0.6	0.5	1.1	0.6	0.6
Total	7.0	9.7	6.8	5.2	4.6	4.8	4.2	5.1	5.9	5.2

Table C.100: Government sector R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Environment-related	109 774	170 304	194 564	232 090	192 774	202 351	316 188	339 012	314 713	552 121
Open-source software	1 345	1 501	0	0	0	0	597	711	5 553	43 034
New materials	4 107	28 708	30 945	12 062	5 291	6 143	7 599	13 172	8 594	15 866
Tuberculosis, HIV/AIDS, malaria	167 522	132 264	380 640	359 074	389 279	395 996	435 045	237 974	114 727	190 057
Space science	N/A	N/A	N/A	N/A	N/A	39 882	0	0	51 887	52 566
Total	282 748	332 777	606 149	603 226	587 343	644 372	759 430	590 869	495 475	853 644
Government expenditure on R&D	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531

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 (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Environment-related	8.9	11.8	11.5	12.3	9.6	9.6	13.6	15.2	16.6	24.7
Open-source software	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.9
New materials	0.3	2.0	1.8	0.6	0.3	0.3	0.3	0.6	0.5	0.7
Tuberculosis, HIV/AIDS, malaria	13.6	9.2	22.4	19.0	19.3	18.9	18.7	10.7	6.1	8.5
Space science	N/A	N/A	N/A	N/A	N/A	1.9	0.0	0.0	2.7	2.3
Total	22.9	23.1	24.3	19.6	29.2	30.7	32.7	26.6	26.2	38.2

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

Table C.102: Government sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	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	863 949	1 045 006	1 359 179	1 558 094	1 520 894	1 560 315	1 722 617	1 592 766	1 401 551	1 739 342
Mathematical sciences	2 349	1 076	1 525	28 302	397	539	85	1 855	11 408	8 075
Physical sciences	0	5064	0	30 154	26 454	28 529	49 051	54 017	8 725	5 105
Chemical sciences	1 223	21 823	19 394	61 881	61 688	68 937	73 898	81 603	45 405	32 280
Earth sciences	39 303	90 571	65 501	139 388	79 942	85 550	50 110	103 767	163 319	359 200
Information, computer and communication technologies	15 642	7 760	8 431	12 141	4 662	5 540	398	0	0	35 986
Applied sciences and technologies	10 183	32 467	23 216	29 723	22 531	25 444	23 016	38 562	49 438	45 394
Engineering sciences	4 515	10 430	11 853	13 176	12 129	13 572	17 076	14 574	14 071	27 752
Biological sciences	94 662	111 871	138 000	152 735	196 053	195 922	215 624	254 654	246 541	187 733
Agricultural sciences	362 241	460 921	397 687	506 445	471 798	485 417	523 343	557 157	591 668	566 999
Medical and health sciences	270 312	211 840	594 684	553 534	608 530	615 067	673 437	370 294	167 039	307 108
Environmental sciences	34 231	54 394	55 245	14 353	14 478	13 921	13 085	17 270	29 249	30 808
Material sciences	4107	9771	10 537	0	0	0	0	0	0	3 244
Marine sciences	25 182	27 019	33 106	16 262	22 232	21 877	83 495	99 013	74 686	129 657
Division 2: Social sciences and humanities	371 720	392 503	337 972	334 916	492 127	538 331	603 258	630 660	491 992	498 188
Social sciences	358 892	383 172	326 603	328 522	479 316	529 080	591 813	620 433	476 565	485 014
Humanities	12 828	9 331	11 369	6 394	12 811	9 251	11 445	10 227	15 427	13 174
Total	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531

Table C.103: Proportional government sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	69.9	72.7	80.1	82.3	75.6	74.3	74.1	71.6	74.0	77.7
Mathematical sciences	0.2	0.1	0.1	1.5	0.0	0.0	0.0	0.1	0.6	0.4
Physical sciences	0.0	0.4	0.0	1.6	1.3	1.4	2.1	2.4	0.5	0.2
Chemical sciences	0.1	1.5	1.1	3.3	3.1	3.3	3.2	3.7	2.4	1.4
Earth sciences	3.2	6.3	3.9	7.4	4.0	4.1	2.2	4.7	8.6	16.1

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Information, computer and communication technologies	1.3	0.5	0.5	0.6	0.2	0.3	0.0	0.0	0.0	1.6
Applied sciences and technologies	0.8	2.3	1.4	1.6	1.1	1.2	1.0	1.7	2.6	2.0
Engineering sciences	0.4	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	1.2
Biological sciences	7.7	7.8	8.1	8.1	9.7	9.3	9.3	11.5	13.0	8.4
Agricultural sciences	29.3	32.1	23.4	26.8	23.4	23.1	22.5	25.1	31.2	25.3
Medical and health sciences	21.9	14.7	35.0	29.2	30.2	29.3	29.0	16.7	8.8	13.7
Environmental sciences	2.8	3.8	3.3	0.8	0.7	0.7	0.6	0.8	1.5	1.4
Material sciences	0.3	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Marine sciences	2.0	1.9	2.0	0.9	1.1	1.0	3.6	4.5	3.9	5.8
Division 2: Social sciences and humanities	30.1	27.3	19.9	17.7	24.4	25.7	25.9	28.4	26.0	22.3
Social sciences	29.0	26.7	19.2	17.4	23.8	25.2	25.4	27.9	25.2	21.7
Humanities	1.0	0.6	0.7	0.3	0.6	0.4	0.5	0.5	0.8	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.104: Government sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	2 736	19 314	21 118	21 472	42 233	34 213	7 582	46 886	31 484	26 989
Defence	2 736	19 314	21 118	21 472	42 233	34 213	7 582	46 886	31 484	26 989
Division 2: Economic development	469 129	480 373	510 688	763 932	745 129	826 860	1 009 575	1 117 257	1 045 765	1 068 644
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	70 754	100 956	89 446	107 672	92 506	103 212	117 664	115 406	127 551	117 715
Animal production and animal primary products	86 710	93 504	137 279	156 437	125 737	134 227	129 024	135 755	141 189	131 528
Mineral resources (excluding energy)	0	0	311	5403	6 547	2 854	12 395	5 508	5 729	4 829
Energy resources	0	0	1023	12062	5 291	5 716	5 706	6 413	2 446	1 312
Energy supply	10 552	7 193	8 482	34 845	29 705	32 772	40 959	53 254	15 204	11 714
Manufacturing	1 005	1 557	1 544	79 583	1 318	5 201	5 433	10 794	15 855	28 956
Construction	9545	543	741	4312	1 394	1 501	1 584	8 501	6 112	5 935
Transport	10 964	8 774	1 672	24 105	21 537	24 896	21 926	7 268	9 686	7 231

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Information and communication services	20 590	5 678	5 515	14 397	7 977	6 071	19 938	18 583	13 385	5 220
Commercial services	4 708	3 587	12 162	15 532	13 531	12 616	47 515	72 388	55 141	53 609
Economic framework	157 364	161 541	116 604	167 690	262 289	343 537	394 216	404 073	381 306	388 478
Natural resources	96 938	97 042	135 909	141 895	177 298	154 258	213 214	279 313	272 162	312 117
Division 3: Society	538 749	592 285	872 096	912 216	952 108	951 859	1 029 316	746 234	529 902	669 831
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	221 435	171 741	487 130	475 983	482 472	511 031	554 746	303 831	137 831	253 419
Education and training	69 185	116 788	165 906	174 540	209 544	169 499	173 547	139 984	96 114	116 193
Social development and community services	248 129	303 756	219 061	261 693	260 092	271 328	301 023	302 419	295 956	300 218
Division 4: Environment	130 742	199 677	172 006	127 394	191 334	204 573	208 704	237 373	191 622	374 408
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	83 089	137 679	124 445	91 677	107 265	116 996	100 339	117 228	123 194	340 111
Environmental aspects of development	38 467	51 795	38 877	27 206	53 541	55 508	50 936	64 148	48 503	23 399
Environmental and other aspects	9 186	10 204	8 684	8 511	30 528	32 069	57 429	55 997	19 924	10 898
Division 5: Advancement of knowledge	94 314	145 860	121 243	67 996	82 217	81 141	70 698	75 676	94 771	97 658
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	61 357	120 173	96 381	43 170	58 401	57 655	57 473	61 475	78 751	77 069
Social sciences and humanities	32 956	25 687	24 862	24 825	23 816	23 486	13 225	14 201	16 019	20 590
Total	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531

Table C.105: Proportional government sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	0.2	1.3	1.2	1.1	2.1	1.6	0.3	2.1	1.7	1.2
Defence	0.2	1.3	1.2	1.1	2.1	1.6	0.3	2.1	1.7	1.2
Division 2: Economic development	38.0	33.4	30.1	40.4	37.0	39.4	43.4	50.2	55.2	47.8
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	5.7	7.0	5.3	5.7	4.6	4.9	5.1	5.2	6.7	5.3
Animal production and animal primary products	7.0	6.5	8.1	8.3	6.2	6.4	5.5	6.1	7.5	5.9
Mineral resources (excluding energy)	0.0	0.0	0.0	0.3	0.3	0.1	0.5	0.2	0.3	0.2
Energy resources	0.0	0.0	0.1	0.6	0.3	0.3	0.2	0.3	0.1	0.1
Energy supply	0.9	0.5	0.5	1.8	1.5	1.6	1.8	2.4	0.8	0.5
Manufacturing	0.1	0.1	0.1	4.2	0.1	0.2	0.2	0.5	0.8	1.3
Construction	0.8	0.0	0.0	0.2	0.1	0.1	0.1	0.4	0.3	0.3
Transport	0.9	0.6	0.1	1.3	1.1	1.2	0.9	0.3	0.5	0.3
Information and communication services	1.7	0.4	0.3	0.8	0.4	0.3	0.9	0.8	0.7	0.2
Commercial services	0.4	0.2	0.7	0.8	0.7	0.6	2.0	3.3	2.9	2.4
Economic framework	12.7	11.2	6.9	8.9	13.0	16.4	16.9	18.2	20.1	17.4
Natural resources	7.8	6.8	8.0	7.5	8.8	7.4	9.2	12.6	14.4	13.9
Division 3: Society	43.6	41.2	51.4	48.2	47.3	45.4	44.3	33.6	28.0	29.9
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	17.9	11.9	28.7	25.1	24.0	24.4	23.9	13.7	7.3	11.3
Education and training	5.6	8.1	9.8	9.2	10.4	8.1	7.5	6.3	5.1	5.2
Social development and community services	20.1	21.1	12.9	13.8	12.9	12.9	12.9	13.6	15.6	13.4
Division 4: Environment	10.6	13.9	10.1	6.7	9.5	9.7	9.0	10.7	10.1	16.7
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	6.7	9.6	7.3	4.8	5.3	5.6	4.3	5.3	6.5	15.2
Environmental aspects of development	3.1	3.6	2.3	1.4	2.7	2.6	2.2	2.9	2.6	1.0

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.7	0.7	0.5	0.4	1.5	1.5	2.5	2.5	1.1	0.5
Division 5: Advancement of knowledge	7.6	10.1	7.1	3.6	4.1	3.9	3.0	3.4	5.0	4.4
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	5.0	8.4	5.7	2.3	2.9	2.7	2.5	2.8	4.2	3.4
Social sciences and humanities	2.7	1.8	1.5	1.3	1.2	1.1	0.6	0.6	0.8	0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.106: Government sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	127 415	194 258	133 657	227 427	225 603	222 456	281 201	305 629	301 816	383 648
Free State	44 200	38 659	55 095	60 860	61 802	81 957	81 890	59 694	45 660	51 714
Gauteng	447 635	427 173	689 915	760 199	832 397	885 142	974 192	836 827	581 945	626 239
KwaZulu-Natal	126 857	168 029	161 962	177 517	187 088	172 655	206 551	236 602	205 503	284 898
Limpopo	65 017	74 621	95 668	83 683	84 232	76 541	86 876	89 889	81 308	90 390
Mpumalanga	78 335	80 201	77 479	93 566	112 173	107 237	104 154	88 922	83 648	74 233
North West	44 618	45 573	73 576	56 719	61 815	57 994	60 594	66 727	57 423	60 752
Northern Cape	63 556	75 440	61 932	52 579	69 174	66 200	94 659	88 575	52 399	131 729
Western Cape	238 035	333 555	347 869	380 461	378 737	428 465	435 757	450 560	483 841	533 926
Total	1 235 669	1 437 509	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531

Table C.107: Proportional government sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	10.3	13.5	7.9	12.0	11.2	10.6	12.1	13.7	15.9	17.1
Free State	3.6	2.7	3.2	3.2	3.1	3.9	3.5	2.7	2.4	2.3
Gauteng	36.2	29.7	40.7	40.2	41.4	42.2	41.9	37.6	30.7	28.0
KwaZulu-Natal	10.3	11.7	9.5	9.4	9.3	8.2	8.9	10.6	10.9	12.7
Limpopo	5.3	5.2	5.6	4.4	4.2	3.6	3.7	4.0	4.3	4.0
Mpumalanga	6.3	5.6	4.6	4.9	5.6	5.1	4.5	4.0	4.4	3.3
North West	3.6	3.2	4.3	3.0	3.1	2.8	2.6	3.0	3.0	2.7
Northern Cape	5.1	5.2	3.6	2.8	3.4	3.2	4.1	4.0	2.8	5.9
Western Cape	19.3	23.2	20.5	20.1	18.8	20.4	18.7	20.3	25.6	23.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.108: Government sector R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	HEADCOUNTS				FULL-TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
2011/12	**3 143**	1 411	432	1 300	**2 404.5**	1 009.8	330.4	1 064.3
2012/13	**3 252**	1 409	517	1 326	**2 597.0**	1 091.4	385.8	1 119.9
2013/14	**2 874**	1 229	518	1 127	**2 245.5**	923.7	366.3	955.4
2014/15	**2 893**	1 343	550	1 000	**2 181.5**	970.0	337.9	873.5
2015/16	**2 997**	1 573	537	887	**2 056.2**	953.9	365.7	736.7
2016/17	**3 076**	1 677	538	861	**2 031.6**	969.1	357.9	704.6
2017/18	**3 027**	1 671	517	839	**2 000.4**	899.1	347.7	753.7
2018/19	**2 910**	1 662	416	832	**1 999.0**	920.8	324.9	753.3
2019/20	**3 157**	1 742	548	867	**2 173.1**	1 027.3	374.3	771.6
2020/21	**3 159**	1 706	534	919	**2 060.4**	963.3	334.6	762.5

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

Table C.109: Government sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 662**	757	905	**920.8**	435.7	485.2	55.4
Technicians directly supporting R&D	**416**	226	190	**324.9**	179.6	145.3	78.1
Other personnel directly supporting R&D	**832**	573	259	**753.3**	533.7	219.6	90.5
Total	2 910	1 556	1 354	1 999.0	1 148.9	850.1	68.7
2019/20	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 742**	819	923	**1 027.3**	480.6	546.7	59.0
Technicians directly supporting R&D	**548**	304	244	**374.3**	214.7	159.6	68.3
Other personnel directly supporting R&D	**867**	603	264	**771.6**	549.8	221.8	89.0
Total	3 157	1 726	1 431	2 173.1	1 245.0	928.1	68.8
2020/21	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 706**	764	942	**963.3**	431.9	531.4	56.5
Technicians directly supporting R&D	**534**	291	243	**334.6**	190.2	144.4	62.7
Other personnel directly supporting R&D	**919**	592	327	**762.5**	539.9	222.6	83.0
Total	3 159	1 647	1 512	2 060.4	1 162.0	898.4	65.2

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

Table C.110: Government sector R&D personnel in headcounts by occupation, qualification, population group and gender (2020/21)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	1 706	764	942	443	557	49	76	50	90	211	218	11	1
Doctoral degree or equivalent	339	163	176	60	47	10	17	15	19	71	92	7	1
Master's, honours, bachelor or equivalent	1 195	533	662	340	436	36	53	28	60	125	113	4	0
Diplomas	172	68	104	43	74	3	6	7	11	15	13	0	0
Technicians directly supporting R&D	534	291	243	172	147	47	35	8	7	60	53	4	1
Doctoral degree or equivalent	16	12	4	4	2	1	0	0	0	5	2	2	0
Master's, honours, bachelor or equivalent	345	168	177	98	103	30	27	4	7	35	39	1	1
Diplomas	173	111	62	70	42	16	8	4	0	20	12	1	0
Other personnel directly supporting R&D	919	592	327	386	228	149	50	2	4	33	44	22	1
Doctoral degree or equivalent	12	8	4	0	1	0	0	0	0	4	2	4	1
Master's, honours, bachelor or equivalent	115	51	64	15	41	9	8	1	1	8	14	18	0
Diplomas	792	533	259	371	186	140	42	1	3	21	28	0	0
Total	3 159	1 647	1 512	1 001	932	245	161	60	101	304	315	37	3

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

C.2.4. Science councils sector

Table C.111: Science councils sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Basic research	900 830	937 826	970 785	1 166 491	1 348 533	1 372 702	1 349 946	1 244 253	1 388 847	1 294 844
Applied research	1 756 157	1 885 484	2 114 943	2 421 309	2 781 198	3 202 019	3 460 650	2 855 564	3 337 342	3 033 375
Experimental development research	1 072 693	1 202 689	1 218 827	1 416 869	1 611 166	1 561 462	1 502 748	1 344 068	1 472 175	1 574 195
Total	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

Table C.112: Proportional science councils sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Basic research	24.2	23.3	22.6	23.3	23.5	22.4	21.4	22.9	22.4	21.9
Applied research	47.1	46.8	49.1	48.4	48.4	52.2	54.8	52.5	53.8	51.4
Experimental development research	28.8	29.9	28.3	28.3	28.1	25.4	23.8	24.7	23.8	26.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.113: Science councils sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Capital expenditure	323 070	275 750	323 190	598 429	916 480	857 241	823 937	460 304	571 628	499 152
Land: buildings & other structures	65 442	68 565	71 602	362 246	162 904	211 246	386 063	62 598	105 660	37 189
TOTAL: Vehicles, plant, machinery, equipment and software	257 628	207 185	251 588	236 183	753 576	645 995	437 874	397 706	465 968	461 963
Vehicles, plant, machinery, equipment	257 628	207 185	251 588	236 183	753 576	645 995	437 874	397 706	430 090	424 749
*Capitalised computer software	NA	NA	NA	NA	NA	NA	NA	NA	35 878	37 214
Current expenditure	3 406 610	3 750 248	3 981 366	4 406 240	4 824 418	5 278 942	5 489 407	4 983 581	5 626 735	5 403 262
Labour costs	1 531 460	2 053 204	2 187 401	1 986 918	2 142 875	2 339 348	2 421 297	2 371 273	2 260 207	2 264 933
Other current expenditure	1 875 150	1 697 044	1 793 965	2 419 322	2 681 543	2 939 594	3 068 110	2 612 308	3 366 528	3 138 329
Total	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

*Capitalised computer software collected from 2019/20.

Table C.114: Proportional science councils sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Capital expenditure	8.1	8.7	6.8	7.5	12.0	16.0	14.0	13.1	9.2	8.5
Land: buildings & other structures	1.6	1.8	1.7	1.7	7.2	2.8	3.4	6.1	1.7	0.6
TOTAL: Vehicles, plant, machinery, equipment and software	6.6	6.9	5.1	5.8	4.7	13.1	10.5	6.9	7.5	7.8
Vehicles, plant, machinery, equipment	6.6	6.9	5.1	5.8	4.7	13.1	10.5	6.9	6.9	7.2
*Capitalised computer software	NA	NA	NA	NA	NA	NA	NA	NA	0.6	0.6
Current expenditure	91.9	91.3	93.2	92.5	88.0	84.0	86.0	86.9	90.8	91.5
Labour costs	36.0	41.1	51.0	50.8	39.7	37.3	38.1	38.4	36.5	38.4
Other current expenditure	55.9	50.3	42.2	41.7	48.3	46.7	47.9	48.6	54.3	53.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Capitalised computer software collected from 2019/20.

Table C.115: Science councils sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Biotechnology	208 466	145 671	143 868	312 793	320 048	360 163	299 783	257 498	325 251	296 543
Nanotechnology	102 007	118 555	114 990	125 107	139 107	139 783	272 372	222 662	289 934	95 110
Total	310 473	264 226	258 857	437 900	459 154	499 946	572 155	480 160	615 186	391 652
Science councils expenditure on R&D	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

Table C.116: Proportional science councils sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Biotechnology	5.6	3.6	3.3	6.3	5.6	5.9	4.7	4.7	5.2	5.0
Nanotechnology	2.7	2.9	2.7	2.5	2.4	2.3	4.3	4.1	4.7	1.6
Total	8.3	6.6	6.0	8.7	8.0	8.1	9.1	8.8	9.9	6.6

Table C.117: Science councils sector R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Environment-related	770 339	378 782	297 097	1 037 320	1 054 651	1 031 393	953 077	831 377	881 520	802 772
Open-source software	15 982	36 636	0	389 871	692 095	453 879	842 548	107 063	226 090	56 908
New materials	197 430	751 305	229 854	358 361	374 463	373 768	401 995	329 199	297 042	225 040
Tuberculosis, HIV/AIDS, malaria	399 070	455 311	398 880	346 751	470 488	625 806	670 209	572 650	492 341	519 670
Space science	N/A	N/A	N/A	N/A	N/A	296 236	0	593 920	614 780	635 906
Total	1 382 821	1 622 034	925 831	2 132 304	2 591 697	2 781 082	2 867 828	2 434 208	2 511 774	2 240 296
Science councils expenditure on R&D	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

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 (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Environment-related	20.7	9.4	6.9	20.7	18.4	16.8	15.1	15.3	14.2	13.6
Open-source software	0.4	0.9	0.0	7.8	12.1	7.4	13.3	2.0	3.6	1.0
New materials	5.3	18.7	5.3	7.2	6.5	6.1	6.4	6.0	4.8	3.8
Tuberculosis, HIV/AIDS, malaria	10.7	11.3	9.3	6.9	8.2	10.2	10.6	10.5	7.9	8.8
Space science	N/A	N/A	N/A	N/A	N/A	4.8	0.0	10.9	9.9	10.8
Total	37.1	40.3	21.5	42.6	45.1	45.3	45.4	44.7	40.5	38.0

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

Table C.119: Science councils sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	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	3 517 520	3 819 642	4 109 105	4 800 742	5 486 847	5 889 463	6 112 974	5 314 694	6 062 356	5 801 859
Mathematical sciences	117 637	134 046	128 291	48 258	54 212	47 890	61 223	180 075	154 147	44 050
Physical sciences	120 267	123 267	129 568	263 302	418 648	444 274	502 615	410 797	457 042	423 591
Chemical sciences	20 972	14 078	18 166	63 775	71 024	66 188	77 952	48 685	94 308	59 447
Earth sciences	100 921	112 406	110 092	162 880	181 876	254 414	198 140	202 037	231 490	214 568
Information, computer and communication technologies	168 115	181 521	182 402	780 044	977 891	999 538	1 124 366	852 856	996 778	977 489
Applied sciences and technologies	954 616	1 092 098	1 046 934	277 649	296 162	475 568	356 409	369 603	474 058	538 072
Engineering sciences	278 125	292 940	349 666	1 001 486	1 107 289	1 016 283	1 171 287	849 940	1 171 031	1 176 104
Biological sciences	425 036	485 673	482 728	148 268	144 341	138 673	169 717	87 630	138 416	113 597
Agricultural sciences	582 438	594 638	859 600	1 075 165	1 043 494	1 067 146	989 974	898 199	886 212	790 931
Medical and health sciences	443 156	426 520	430 472	596 600	775 858	836 967	1 021 905	984 580	885 544	1 048 315
Environmental sciences	284 116	330 667	326 122	228 909	240 075	343 218	267 495	212 887	283 782	181 584
Material sciences	15 462	22 905	35 093	113 457	133 231	122 130	143 684	114 491	151 654	111 190
Marine sciences	6 656	8 885	9 970	40 949	42 747	77 173	28 207	102 913	137 894	122 922
Division 2: Social sciences and humanities	212 160	206 356	195 452	203 927	254 050	246 721	200 370	129 191	136 007	100 554
Social sciences	190 845	186 132	173 407	179 456	223 966	239 011	192 200	123 414	136 007	100 554
Humanities	21 315	20 224	22 044	24 471	30 084	7 710	8 170	5 777	0	0
Total	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

Table C.120: Proportional science councils sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	94.3	94.9	95.5	95.9	95.6	96.0	96.8	97.6	97.8	98.3
Mathematical sciences	3.2	3.3	3.0	1.0	0.9	0.8	1.0	3.3	2.5	0.7
Physical sciences	3.2	3.1	3.0	5.3	7.3	7.2	8.0	7.5	7.4	7.2
Chemical sciences	0.6	0.3	0.4	1.3	1.2	1.1	1.2	0.9	1.5	1.0
Earth sciences	2.7	2.8	2.6	3.3	3.2	4.1	3.1	3.7	3.7	3.6

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Information, computer and communication technologies	4.5	4.5	4.2	15.6	17.0	16.3	17.8	15.7	16.1	16.6
Applied sciences and technologies	25.6	27.1	24.3	5.5	5.2	7.8	5.6	6.8	7.6	9.1
Engineering sciences	7.5	7.3	8.1	20.0	19.3	16.6	18.6	15.6	18.9	19.9
Biological sciences	11.4	12.1	11.2	3.0	2.5	2.3	2.7	1.6	2.2	1.9
Agricultural sciences	15.6	14.8	20.0	21.5	18.2	17.4	15.7	16.5	14.3	13.4
Medical and health sciences	11.9	10.6	10.0	11.9	13.5	13.6	16.2	18.1	14.3	17.8
Environmental sciences	7.6	8.2	7.6	4.6	4.2	5.6	4.2	3.9	4.6	3.1
Material sciences	0.4	0.6	0.8	2.3	2.3	2.0	2.3	2.1	2.4	1.9
Marine sciences	0.2	0.2	0.2	0.8	0.7	1.3	0.4	1.9	2.2	2.1
Division 2: Social sciences and humanities	5.7	5.1	4.5	4.1	4.4	4.0	3.2	2.4	2.2	1.7
Social sciences	5.1	4.6	4.0	3.6	3.9	3.9	3.0	2.3	2.2	1.7
Humanities	0.6	0.5	0.5	0.5	0.5	0.1	0.1	0.1	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.121: Science councils sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	243 083	279 989	262 203	762 464	826 261	754 207	915 281	536 553	715 553	630 997
Defence	243 083	279 989	262 203	762 464	826 261	754 207	915 281	536 553	715 553	630 997
Division 2: Economic development	2 191 098	2 400 747	2 686 504	2 306 795	2 529 244	2 471 163	2 625 282	2 140 026	2 419 541	2 178 829
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	448 531	473 133	624 675	413 737	396 612	396 536	368 829	339 896	290 267	258 061
Animal production and animal primary products	280 542	287 431	419 259	269 519	247 883	247 835	230 518	212 435	207 333	184 329
Mineral resources (excluding energy)	202 919	213 007	234 273	232 114	265 006	255 226	274 778	287 423	303 480	294 486
Energy resources	94 385	108 360	106 823	5 590	5 063	8 108	6 682	5 568	21 334	20 002
Energy supply	14 715	13 237	2 937	0	0	0	1 468	1 499	4 072	4 065
Manufacturing	351 021	400 864	393 152	88 746	146 395	170 040	179 215	138 141	147 634	147 455
Construction	220 595	256 024	245 333	31 034	60 828	67 003	70 943	65 389	69 621	71 721
Transport	0	0	0	0	0	0	0	0	0	0

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Information and communication services	127 021	141 495	135 629	396 310	419 252	410 724	462 785	386 839	499 564	455 370
Commercial services	15 522	25 053	19 724	5 236	5 671	7 756	2 937	2 998	0	0
Economic framework	72 109	70 509	75 411	537 499	664 440	571 815	713 045	419 073	559 622	467 458
Natural resources	363 738	411 634	429 288	327 009	318 094	336 119	314 082	280 766	316 614	275 882
Division 3: Society	430 876	413 060	425 943	801 370	977 159	1 074 539	978 471	1 053 871	1 254 643	1 041 731
Society unclassified	0	0	0	0	0	0	0	0	0	
Health	326 500	314 412	316 987	424 639	552 314	613 932	632 851	722 673	653 443	727 194
Education and training	68 852	64 941	72 216	335 946	374 704	145 215	98 348	70 575	93 081	50 329
Social development and community services	35 525	33 707	36 741	40 785	50 141	315 392	247 273	260 622	508 119	264 208
Division 4: Environment	31 241	39 169	46 559	422 650	455 404	852 597	782 034	610 761	423 727	389 939
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	19 956	22 939	28 295	402 820	426 582	466 312	434 251	304 725	373 973	344 017
Environmental aspects of development	8 623	13 665	14 071	15 824	14 179	17 451	13 215	13 493	0	0
Environmental and other aspects	2 662	2 565	4 194	4 006	14 644	368 834	334 567	292 543	49 754	45 922
Division 5: Advancement of knowledge	833 382	893 033	883 346	711 390	952 830	983 677	1 012 276	1 102 675	1 384 899	1 660 917
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	694 254	760 107	746 397	422 429	620 283	692 258	708 020	723 871	1 074 410	1 260 670
Social sciences and humanities	139 127	132 926	136 949	288 961	332 547	291 419	304 256	378 804	310 489	400 247
Total	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

Table C.122: Proportional science councils sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	6.5	7.0	6.1	15.2	14.4	12.3	14.5	9.9	11.5	10.7
Defence	6.5	7.0	6.1	15.2	14.4	12.3	14.5	9.9	11.5	10.7
Division 2: Economic development	58.7	59.6	62.4	46.1	44.1	40.3	41.6	39.3	39.0	36.9
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	12.0	11.8	14.5	8.3	6.9	6.5	5.8	6.2	4.7	4.4
Animal production and animal primary products	7.5	7.1	9.7	5.4	4.3	4.0	3.7	3.9	3.3	3.1
Mineral resources (excluding energy)	5.4	5.3	5.4	4.6	4.6	4.2	4.4	5.3	4.9	5.0
Energy resources	2.5	2.7	2.5	0.1	0.1	0.1	0.1	0.1	0.3	0.3
Energy supply	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Manufacturing	9.4	10.0	9.1	1.8	2.6	2.8	2.8	2.5	2.4	2.5
Construction	5.9	6.4	5.7	0.6	1.1	1.1	1.1	1.2	1.1	1.2
Transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Information and communication services	3.4	3.5	3.2	7.9	7.3	6.7	7.3	7.1	8.1	7.7
Commercial services	0.4	0.6	0.5	0.1	0.1	0.1	0.0	0.1	0.0	0.0
Economic framework	1.9	1.8	1.8	10.7	11.6	9.3	11.3	7.7	9.0	7.9
Natural resources	9.8	10.2	10.0	6.5	5.5	5.5	5.0	5.2	5.1	4.7
Division 3: Society	11.6	10.3	9.9	16.0	17.0	17.5	15.5	19.4	20.2	17.6
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	8.8	7.8	7.4	8.5	9.6	10.0	10.0	13.3	10.5	12.3
Education and training	1.8	1.6	1.7	6.7	6.5	2.4	1.6	1.3	1.5	0.9
Social development and community services	1.0	0.8	0.9	0.8	0.9	5.1	3.9	4.8	8.2	4.5
Division 4: Environment	0.8	1.0	1.1	8.4	7.9	13.9	12.4	11.2	6.8	6.6
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	0.7	8.0	7.4	7.6	6.9	5.6	6.0	5.8
Environmental aspects of development	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.0	0.0

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Environmental and other aspects	0.1	0.1	0.1	0.1	0.3	6.0	5.3	5.4	0.8	0.8
Division 5: Advancement of knowledge	22.3	22.2	20.5	14.2	16.6	16.0	16.0	20.3	22.3	28.1
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	18.6	18.9	17.3	8.4	10.8	11.3	11.2	13.3	17.3	21.4
Social sciences and humanities	3.7	3.3	3.2	5.8	5.8	4.7	4.8	7.0	5.0	6.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.123: Science councils sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	178 594	182 664	115 925	259 128	269 658	273 509	279 550	183 931	206 142	189 604
Free State	37 138	39 054	47 271	58 608	59 953	60 149	59 300	110 995	94 188	85 089
Gauteng	2 287 762	2 537 028	3 062 983	2 745 142	2 998 643	3 221 705	3 350 135	3 053 440	3 624 098	3 467 734
KwaZulu-Natal	292 246	307 302	239 387	484 142	575 016	477 823	540 084	427 585	448 070	437 452
Limpopo	99 104	105 150	7 286	117 270	111 649	114 852	107 457	80 249	65 682	59 687
Mpumalanga	100 476	103 468	62 349	124 613	122 432	128 883	118 267	171 535	148 618	134 637
North West	104 139	110 361	39 615	153 911	153 676	108 010	97 730	43 764	57 117	50 771
Northern Cape	81 998	78 714	122 454	148 387	218 317	223 524	236 797	601 757	634 734	651 793
Western Cape	548 223	562 256	607 285	913 468	1 231 555	1 527 729	1 524 025	770 631	919 714	825 647
Total	3 729 680	4 025 998	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414

Table C.124: Proportional science councils sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	4.8	4.5	2.7	5.2	4.7	4.5	4.4	3.4	3.3	3.2
Free State	1.0	1.0	1.1	1.2	1.0	1.0	0.9	2.0	1.5	1.4
Gauteng	61.3	63.0	71.2	54.9	52.2	52.5	53.1	56.1	58.5	58.8
KwaZulu-Natal	7.8	7.6	5.6	9.7	10.0	7.8	8.6	7.9	7.2	7.4
Limpopo	2.7	2.6	0.2	2.3	1.9	1.9	1.7	1.5	1.1	1.0
Mpumalanga	2.7	2.6	1.4	2.5	2.1	2.1	1.9	3.2	2.4	2.3
North West	2.8	2.7	0.9	3.1	2.7	1.8	1.5	0.8	0.9	0.9
Northern Cape	2.2	2.0	2.8	3.0	3.8	3.6	3.8	11.1	10.2	11.0
Western Cape	14.7	14.0	14.1	18.3	21.5	24.9	24.1	14.2	14.8	14.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.125: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	HEADCOUNTS				FULL-TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS	TECHNICIANS	OTHER R&D PERSONNEL
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
2017/18	**4 866**	2 053	1 885	928	**4 294.9**	1 792.1	1 745.4	757.4
2018/19	**4 514**	1 951	1 728	835	**3 941.8**	1 697.0	1 579.6	665.2
2019/20	**4 070**	1 858	1 505	707	**3 562.8**	1 619.4	1 403.7	539.7
2020/21	**4 111**	1 774	1 555	782	**3 606.0**	1 549.2	1 440.3	616.5

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

Table C.126: Science councils sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 951**	1 059	892	**1 697.0**	911.9	785.1	87.0
Technicians directly supporting R&D	**1 728**	998	730	**1 579.6**	895.4	684.2	91.4
Other personnel directly supporting R&D	**835**	426	409	**665.2**	309.4	355.8	79.7
Total	4 514	2 483	2 031	3 941.8	2 116.7	1 825.1	87.3
2019/20	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 858**	1 009	849	**1 619.4**	870.6	748.8	87.2
Technicians directly supporting R&D	**1 505**	886	619	**1 403.7**	815.9	587.8	93.3
Other personnel directly supporting R&D	**707**	380	327	**539.7**	263.3	276.4	76.3
Total	4 070	2 275	1 795	3 562.8	1 949.8	1 613.0	87.5
2020/21	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	FTEs AS % OF HEADCOUNTS
Researchers	**1 774**	966	808	**1 549.2**	831.4	717.8	87.3
Technicians directly supporting R&D	**1 555**	894	661	**1 440.3**	816.5	623.8	92.6
Other personnel directly supporting R&D	**782**	416	366	**616.5**	302.0	314.5	78.8
Total	4 111	2 276	1 835	3 606.0	1 949.9	1 656.1	87.7

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

Table C.127: Science councils sector R&D personnel in headcounts by occupation, qualification, population group and gender (2020/21)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers	1 774	966	808	373	344	50	55	67	87	330	257	146	65
Doctoral degree or equivalent	830	476	354	140	102	25	30	30	35	164	137	117	50
Master's, honours, bachelor or equivalent	885	457	428	223	227	18	25	37	48	151	114	28	14
Diplomas	59	33	26	10	15	7	0	0	4	15	6	1	1
Technicians directly supporting R&D	1 555	894	661	497	449	84	35	47	45	242	130	24	2
Doctoral degree or equivalent	67	50	17	11	2	0	1	2	3	30	10	7	1
Master's, honours, bachelor or equivalent	902	470	432	259	296	35	18	37	36	126	82	13	0
Diplomas	586	374	212	227	151	49	16	8	6	86	38	4	1
Other personnel directly supporting R&D	782	416	366	289	232	56	61	19	23	38	42	14	8
Doctoral degree or equivalent	20	16	4	5	1	2	1	0	1	6	0	3	1
Master's, honours, bachelor or equivalent	304	136	168	83	116	17	10	12	16	19	26	5	0
Diplomas	458	264	194	201	115	37	50	7	6	13	16	6	7
Total	4 111	2 276	1 835	1 159	1 025	190	151	133	155	610	429	184	75

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

Table C.128: Science councils sector overview (2019/20 to 2020/21)

SCIENCE COUNCILS	2019/20				2020/21			
	R&D EXPENDITURE	RESEARCHERS	BASIC RESEARCH	CAPITAL EXPENDITURE	R&D EXPENDITURE	RESEARCHERS	BASIC RESEARCH	CAPITAL EXPENDITURE
	R'000	FTEs	R'000	R'000	R'000	FTEs	R'000	R'000
Agricultural Research Council	829 333	439.0	165 867	90 056	737 316	415.0	147 463	36 367
Council for Scientific and Industrial Research	2 739 257	458.0	206 266	44 009	2 496 675	471.0	113 599	36 193
Council for Geoscience	203 586	97.8	30 538	88 830	203 263	97.8	30 489	88 755
Human Sciences Research Council	231 581	144.0	34 737	1 353	230 801	109.0	34 620	5 693
Medical Research Council	859 223	218.0	515 534	12 672	942 641	201.0	565 585	40 325
Mintek	396 052	150.4	79 210	56 110	383 601	150.4	76 720	46 104
National Research Foundation	939 331	112.2	356 695	278 598	908 116	105.0	326 368	245 715
Total	6 198 363	1 619	1 388 847	571 628	5 902 414	1 549	1 294 844	499 152

C.2.5. Higher education sector

Table C.129: Higher education sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Basic research	3 290 328	3 843 906	3 785 149	4 601 453	5 395 693	6 679 585	7 243 562	7 463 879	8 145 359	6 979 245
Applied research	2 279 175	2 390 090	2 412 316	2 649 558	3 176 685	3 466 381	4 264 753	4 303 881	4 497 102	4 423 435
Experimental development research	1 039 712	1 099 157	1 095 388	1 126 565	1 304 245	1 513 291	1 501 561	1 415 358	1 536 500	2 383 056
Total	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

Table C.130: Proportional higher education sector R&D expenditure by type of research (2011/12 to 2020/21)

TYPE OF RESEARCH	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Basic research	49.8	52.4	51.9	54.9	54.6	57.3	55.7	56.6	57.4	50.6
Applied research	34.5	32.6	33.1	31.6	32.2	29.7	32.8	32.6	31.7	32.1
Experimental development research	15.7	15.0	15.0	13.4	13.2	13.0	11.5	10.7	10.8	17.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.131: Higher education sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Capital expenditure	564 179	602 116	706 336	779 789	1 141 349	1 092 704	1 386 695	683 592	706 929	565 762
Land: buildings & other structures	137 530	192 324	256 114	200 253	198 032	616 761	874 171	257 899	220 810	90 184
TOTAL: Vehicles, plant, machinery, equipment and software	426 649	409 792	450 222	579 536	943 317	475 943	512 524	425 693	486 119	475 578
Vehicles, plant, machinery, equipment	426 649	409 792	450 222	579 536	943 317	475 943	512 524	425 693	465 711	335 047
#Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20 408	140 531
Current expenditure	6 045 037	6 731 037	6 586 517	7 597 786	8 735 274	10 566 554	11 623 181	12 499 527	13 472 031	13 219 974
Labour costs	2 481 322	2 996 929	3 248 542	3 539 733	3 576 140	4 315 989	5 080 369	5 579 653	6 054 648	6 323 292
Total cost of R&D postgraduate students	1 074 207	1 186 653	1 224 611	1 579 088	1 926 301	1 928 108	1 889 065	1 938 984	1 969 872	1 895 876
Other current expenditure*	2 489 508	2 547 455	2 113 364	2 478 965	3 232 833	4 322 457	4 653 747	4 980 889	5 447 511	5 000 806
Total	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

*Includes specific categories of R&D personnel costs from 2016/17.
#Capitalised computer software collected from 2019/20.

Table C.132: Proportional higher education sector R&D expenditure by accounting category (2011/12 to 2020/21)

TYPE OF EXPENDITURE	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Capital expenditure	8.5	8.2	9.7	9.3	11.6	9.4	10.7	5.2	5.0	4.1
Land: buildings & other structures	2.1	2.6	3.5	2.4	2.0	5.3	6.7	2.0	1.6	0.7
TOTAL: Vehicles, plant, machinery, equipment and software	6.5	5.6	6.2	6.9	9.6	4.1	3.9	3.2	3.4	3.4
Vehicles, plant, machinery, equipment	6.5	5.6	6.2	6.9	9.6	4.1	3.9	3.2	3.3	2.4
#Capitalised computer software	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1	1.0
Current expenditure	91.5	91.8	90.3	90.7	88.4	90.6	89.3	94.8	95.0	95.9
Labour costs	37.5	40.9	44.5	42.3	36.2	37.0	39.1	42.3	42.7	45.9
Total cost of R&D postgraduate students	16.3	16.2	16.8	18.8	19.5	16.5	14.5	14.7	13.9	13.8
Other current expenditure*	37.7	34.7	29.0	29.6	32.7	37.1	35.8	37.8	38.4	36.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Includes specific categories of R&D personnel costs from 2016/17.
#Capitalised computer software collected from 2019/20.

Table C.133: Higher education sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Biotechnology	344 039	380 727	406 285	470 837	553 562	531 958	529 948	552 583	701 411	1 051 272
Nanotechnology	317 649	293 300	356 826	393 137	505 380	431 558	319 610	420 500	477 909	1 168 384
Total	661 688	674 028	763 111	863 974	1 058 942	963 516	849 558	973 083	1 179 319	2 219 656
Higher education expenditure on R&D	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

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

Table C.134: Proportional higher education sector expenditure on multidisciplinary areas of R&D (2011/12 to 2020/21)

MULTI-DISCIPLINARY AREA OF R&D	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Biotechnology	5.2	5.2	5.6	5.6	5.6	4.6	4.1	4.2	4.9	7.6
Nanotechnology	4.8	4.0	4.9	4.7	5.1	3.7	2.5	3.2	3.4	8.5
Total	10.0	9.2	10.5	10.3	10.7	8.3	6.5	7.4	8.3	16.1

Table C.135: Higher education sector R&D expenditure on selected areas of interest (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Environment-related	770 339	300 006	340 386	499 958	583 723	883 069	1 112 755	1 369 351	1 503 980	1 693 912
Open-source software	15 982	85 508	105 008	117 646	125 883	164 097	196 300	202 026	220 567	310 748
New materials	197 430	321 744	381 136	436 975	462 962	449 336	252 340	355 152	421 202	304 415
Tuberculosis, HIV/AIDS, malaria	399 070	714 966	794 810	845 245	944 490	1 082 645	1 308 224	1 374 952	1 582 666	1 558 253
Space science	N/A	N/A	N/A	N/A	N/A	264 712	258 472	247 276	296 166	348 616
Total	1 382 821	1 422 224	1 621 339	1 899 823	2 117 058	2 843 859	3 128 090	3 548 757	4 024 580	4 215 944
Higher education expenditure on R&D	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

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 (2011/12 to 2020/21)

AREA OF INTEREST	2011/12 %	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %
Environment-related	11.7	4.1	4.7	6.0	5.9	7.6	8.6	10.4	10.6	12.3
Open-source software	0.2	1.2	1.4	1.4	1.3	1.4	1.5	1.5	1.6	2.3
New materials	3.0	4.4	5.2	5.2	4.7	3.9	1.9	2.7	3.0	2.2
Tuberculosis, HIV/AIDS, malaria	6.0	9.7	10.9	10.1	9.6	9.3	10.1	10.4	11.2	11.3
Space science	N/A	N/A	N/A	N/A	N/A	2.3	2.0	1.9	2.1	2.5
Total	20.9	19.4	22.2	22.7	21.4	24.4	24.0	26.9	28.4	30.6

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 (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12 R'000	2012/13 R'000	2013/14 R'000	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000	2019/20 R'000	2020/21 R'000
Division 1: Natural sciences, technology and engineering	4 486 057	5 045 892	4 925 713	5 704 150	6 340 905	6 976 302	7 941 477	7 580 936	8 172 232	7 366 884
Mathematical sciences	311 572	342 093	278 183	333 587	458 068	512 534	614 391	540 054	605 557	549 049
Physical sciences	189 341	193 849	198 735	230 826	287 830	356 090	427 400	376 229	397 447	357 722
Chemical sciences	317 389	444 258	286 511	326 992	386 300	472 883	362 105	452 369	520 849	406 563
Earth sciences	174 141	190 744	207 261	260 862	271 814	327 638	349 553	356 360	333 039	281 443
Information, computer and communication technologies	186 870	232 090	192 911	245 257	322 406	378 763	295 577	487 825	489 190	505 675
Applied sciences and technologies	245 611	251 278	280 310	274 283	272 429	139 046	76 434	155 627	199 427	211 761
Engineering sciences	741 462	768 810	855 529	918 494	891 532	926 463	907 241	1 082 308	1 107 713	896 415
Biological sciences	610 408	731 389	721 229	825 432	846 897	788 716	912 256	1 020 774	1 060 541	916 723

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	268 834	276 857	311 355	354 949	326 296	440 433	644 885	535 299	517 978	573 725
Medical and health sciences	1 245 284	1 391 838	1 339 755	1 641 683	2 089 591	2 412 996	2 554 061	2 409 084	2 759 378	2 515 304
Environmental sciences	111 612	147 367	166 493	180 324	79 430	128 784	760 600	110 409	135 137	104 655
Material sciences	81 749	68 849	82 479	100 358	93 871	67 707	6 751	12 407	5 921	6 000
Marine sciences	1 783	6 469	4 961	11 105	14 441	24 249	30 223	42 192	40 056	41 851
Division 2: Social sciences and humanities	2 123 159	2 287 261	2 367 140	2 673 425	3 535 718	4 682 956	5 068 399	5 602 183	6 006 728	6 418 852
Social sciences	1 664 653	1 844 744	1 825 026	2 056 555	2 855 673	3 770 136	4 209 945	4 668 015	4 984 831	5 404 627
Humanities	458 505	442 517	542 114	616 870	680 046	912 820	858 454	934 167	1 021 897	1 014 225
Total	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

Table C.138: Proportional higher education sector R&D expenditure by research field (2011/12 to 2020/21)

MAIN RESEARCH FIELD	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	67.9	68.8	67.5	68.1	64.2	59.8	61.0	57.5	57.6	53.4
Mathematical sciences	4.7	4.7	3.8	4.0	4.6	4.4	4.7	4.1	4.3	4.0
Physical sciences	2.9	2.6	2.7	2.8	2.9	3.1	3.3	2.9	2.8	2.6
Chemical sciences	4.8	6.1	3.9	3.9	3.9	4.1	2.8	3.4	3.7	2.9
Earth sciences	2.6	2.6	2.8	3.1	2.8	2.8	2.7	2.7	2.3	2.0
Information, computer and communication technologies	2.8	3.2	2.6	2.9	3.3	3.2	2.3	3.7	3.5	3.7
Applied sciences and technologies	3.7	3.4	3.8	3.3	2.8	1.2	0.6	1.2	1.4	1.5
Engineering sciences	11.2	10.5	11.7	11.0	9.0	7.9	7.0	8.2	7.8	6.5
Biological sciences	9.2	10.0	9.9	9.9	8.6	6.8	7.0	7.7	7.5	6.6
Agricultural sciences	4.1	3.8	4.3	4.2	3.3	3.8	5.0	4.1	3.7	4.2
Medical and health sciences	18.8	19.0	18.4	19.6	21.2	20.7	19.6	18.3	19.5	18.2
Environmental sciences	1.7	2.0	2.3	2.2	0.8	1.1	5.8	0.8	1.0	0.8
Material sciences	1.2	0.9	1.1	1.2	1.0	0.6	0.1	0.1	0.0	0.04
Marine sciences	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3
Division 2: Social sciences and humanities	32.1	31.2	32.5	31.9	35.8	40.2	39.0	42.5	42.4	46.6
Social sciences	25.2	25.2	25.0	24.5	28.9	32.3	32.4	35.4	35.2	39.2
Humanities	6.9	6.0	7.4	7.4	6.9	7.8	6.6	7.1	7.2	7.4
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 (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	10 211	12 009	6 121	7 266	8 330	10 899	13 792	12 592	14 392	13 602
Defence	10 211	12 009	6 121	7 266	8 330	10 899	13 792	12 592	14 392	13 602
Division 2: Economic development	2 072 624	1 996 497	2 547 254	2 472 831	2 850 018	3 375 098	4 044 376	4 344 693	4 417 475	4 253 957
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	277 764	234 309	534 417	220 024	282 188	358 551	551 241	473 094	519 167	451 434
Animal production and animal primary products	151 334	176 645	173 865	190 421	199 545	288 114	390 549	341 481	368 539	338 612
Mineral resources (excluding energy)	129 185	69 062	129 459	127 236	131 141	115 367	157 215	161 069	162 124	129 226
Energy resources	87 659	92 947	82 011	75 367	84 862	68 184	98 739	100 429	121 081	67 507
Energy supply	157 304	162 879	221 160	233 075	237 993	225 645	247 610	289 618	307 754	248 977
Manufacturing	272 287	348 845	340 630	329 083	380 258	444 203	478 631	557 911	518 485	466 422
Construction	116 141	74 322	79 775	96 642	111 437	177 750	223 367	257 483	184 267	174 602
Transport	53 043	31 830	32 503	38 549	47 577	72 250	101 938	47 056	72 113	67 299
Information and communication services	144 313	101 980	139 305	152 987	232 257	191 378	240 992	351 560	355 508	348 737
Commercial services	106 287	111 587	156 001	124 971	125 771	182 456	199 639	262 863	317 151	281 074
Economic framework	302 693	335 217	363 483	493 154	544 118	612 373	703 369	968 057	933 506	1 049 281
Natural resources	274 612	256 874	294 645	391 322	472 871	638 827	651 085	534 072	557 782	630 786
Division 3: Society	1 583 800	1 865 914	1 569 371	2 180 662	2 820 755	3 266 113	3 540 172	2 988 330	3 750 653	3 703 025
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	686 152	1 150 349	654 525	1 074 951	1 375 861	1 652 001	1 730 300	1 273 726	1 915 131	1 882 024
Education and training	359 897	402 285	547 108	739 611	925 245	912 877	1 041 714	1 057 301	1 297 282	1 272 888
Social development and community services	537 752	313 280	367 738	366 099	519 649	701 234	768 158	657 303	538 240	548 113
Division 4: Environment	509 533	554 758	456 619	629 133	614 011	737 262	780 436	1 070 418	1 105 385	1 139 091
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	230 135	232 440	184 169	269 688	246 804	331 243	341 909	469 090	452 706	423 839
Environmental aspects of development	123 344	168 956	154 462	202 787	212 879	233 609	233 947	317 976	353 870	356 402

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environmental and other aspects	156 054	153 362	117 989	156 658	154 328	172 411	204 580	283 352	298 809	358 850
Division 5: Advancement of knowledge	2 433 048	2 903 975	2 713 487	3 087 684	3 583 508	4 269 886	4 631 099	4 767 086	4 891 055	4 676 061
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	1 443 913	1 731 540	1 633 257	2 006 195	2 262 831	2 887 227	3 269 179	3 373 533	3 346 297	3 197 657
Social sciences and humanities	989 135	1 172 435	1 080 231	1 081 488	1 320 677	1 382 659	1 361 920	1 393 552	1 544 758	1 478 404
Total	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

Table C.140: Proportional higher education sector R&D expenditure by socio-economic objective (2011/12 to 2020/21)

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Defence	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Division 2: Economic development	31.4	27.2	34.9	29.5	28.9	28.9	31.1	33.0	31.2	30.9
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	4.2	3.2	7.3	2.6	2.9	3.1	4.2	3.6	3.7	3.3
Animal production and animal primary products	2.3	2.4	2.4	2.3	2.0	2.5	3.0	2.6	2.6	2.5
Mineral resources (excluding energy)	2.0	0.9	1.8	1.5	1.3	1.0	1.2	1.2	1.1	0.9
Energy resources	1.3	1.3	1.1	0.9	0.9	0.6	0.8	0.8	0.9	0.5
Energy supply	2.4	2.2	3.0	2.8	2.4	1.9	1.9	2.2	2.2	1.8
Manufacturing	4.1	4.8	4.7	3.9	3.9	3.8	3.7	4.2	3.7	3.4
Construction	1.8	1.0	1.1	1.2	1.1	1.5	1.7	2.0	1.3	1.3
Transport	0.8	0.4	0.4	0.5	0.5	0.6	0.8	0.4	0.5	0.5
Information and communication services	2.2	1.4	1.9	1.8	2.4	1.6	1.9	2.7	2.5	2.5
Commercial services	1.6	1.5	2.1	1.5	1.3	1.6	1.5	2.0	2.2	2.0
Economic framework	4.6	4.6	5.0	5.9	5.5	5.3	5.4	7.3	6.6	7.6
Natural resources	4.2	3.5	4.0	4.7	4.8	5.5	5.0	4.1	3.9	4.6

SOCIO-ECONOMIC OBJECTIVE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Division 3: Society	24.0	25.4	21.5	26.0	28.6	28.0	27.2	22.7	26.5	26.9
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	10.4	15.7	9.0	12.8	13.9	14.2	13.3	9.7	13.5	13.7
Education and training	5.4	5.5	7.5	8.8	9.4	7.8	8.0	8.0	9.1	9.2
Social development and community services	8.1	4.3	5.0	4.4	5.3	6.0	5.9	5.0	3.8	4.0
Division 4: Environment	7.7	7.6	6.3	7.5	6.2	6.3	6.0	8.1	7.8	8.3
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	3.5	3.2	2.5	3.2	2.5	2.8	2.6	3.6	3.2	3.1
Environmental aspects of development	1.9	2.3	2.1	2.4	2.2	2.0	1.8	2.4	2.5	2.6
Environmental and other aspects	2.4	2.1	1.6	1.9	1.6	1.5	1.6	2.1	2.1	2.6
Division 5: Advancement of knowledge	36.8	39.6	37.2	36.9	36.3	36.6	35.6	36.2	34.5	33.9
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	21.8	23.6	22.4	23.9	22.9	24.8	25.1	25.6	23.6	23.2
Social sciences and humanities	15.0	16.0	14.8	12.9	13.4	11.9	10.5	10.6	10.9	10.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.141: Higher education sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	608 815	592 861	557 292	612 239	975 099	1 002 978	1 017 383	1 027 996	1 123 901	1 190 432
Free State	323 335	356 177	449 852	491 203	523 782	625 646	894 118	803 727	847 104	624 925
Gauteng	2 028 145	2 118 817	2 233 696	2 733 330	3 305 576	4 105 237	4 269 020	3 730 236	4 188 428	4 474 214
KwaZulu-Natal	902 386	1 137 258	750 507	843 111	903 664	1 157 722	1 428 653	1 646 915	1 514 301	1 377 646
Limpopo	349 559	300 435	187 317	216 352	229 364	301 809	358 543	384 346	466 703	540 991
Mpumalanga	170 966	182 192	147 134	174 657	190 716	148 981	155 430	170 553	213 914	220 654
North West	275 088	311 325	405 963	404 575	444 135	469 171	449 196	833 635	856 833	555 118
Northern Cape	148 425	164 483	161 603	146 769	164 487	188 515	180 632	161 714	169 999	52 337
Western Cape	1 802 496	2 169 606	2 399 489	2 755 339	3 139 800	3 659 198	4 256 902	4 423 997	4 797 779	4 749 419
Total	6 609 216	7 333 153	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736

Table C.142: Proportional higher education sector R&D expenditure by province (2011/12 to 2020/21)

PROVINCE	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	9.2	8.1	7.6	7.3	9.9	8.6	7.8	7.8	7.9	8.6
Free State	4.9	4.9	6.2	5.9	5.3	5.4	6.9	6.1	6.0	4.5
Gauteng	30.7	28.9	30.6	32.6	33.5	35.2	32.8	28.3	29.5	32.5
KwaZulu-Natal	13.7	15.5	10.3	10.1	9.1	9.9	11.0	12.5	10.7	10.0
Limpopo	5.3	4.1	2.6	2.6	2.3	2.6	2.8	2.9	3.3	3.9
Mpumalanga	2.6	2.5	2.0	2.1	1.9	1.3	1.2	1.3	1.5	1.6
North West	4.2	4.2	5.6	4.8	4.5	4.0	3.5	6.3	6.0	4.0
Northern Cape	2.2	2.2	2.2	1.8	1.7	1.6	1.4	1.2	1.2	0.4
Western Cape	27.3	29.6	32.9	32.9	31.8	31.4	32.7	33.6	33.8	34.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.143: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation (2011/12 to 2020/21)

YEAR	HEADCOUNTS				FULL-TME EQUIVALENTS (FTEs)			
	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL	TOTAL	RESEARCHERS*	TECHNICIANS	OTHER R&D PERSONNEL
2011/12	**21 458**	16 294	2 344	2 820	**6 091.2**	4 355.3	673.4	1 062.5
2012/13	**22 691**	17 441	2 344	2 906	**6 571.5**	4 700.6	737.3	1 133.5
2013/14	**23 543**	18 212	2 284	3 047	**7 005.7**	5 000.5	843.7	1 161.5
2014/15	**24 701**	18 625	2 496	3 580	**7 237.8**	5 097.7	857.3	1 282.8
2015/16	**25 612**	19 217	2 616	3 779	**7 147.1**	4 701.9	1 000.3	1 445.0
2016/17	**28 658**	22 302	2 227	4 129	**7 652.9**	5 220.4	804.2	1 628.3
2017/18	**31 467**	24 942	2 484	4 041	**8 459.4**	6 040.6	838.0	1 580.8
2018/19	**31 230**	24 618	2 272	4 340	**8 873.3**	6 007.2	924.5	1 941.6
2019/20	**32 524**	25 727	2 160	4 637	**9 122.3**	6 165.9	849.2	2 107.2
2020/21	**32 168**	25 651	2 267	4 250	**9 037.8**	5 972.3	1 021.5	2 044.0

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

Table C.144a: Higher education sector R&D personnel (including doctoral students and post-doctoral fellows) in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**51 187**	27 461	23 726	**21 590.6**	11 937.5	9 653.1	42.2
Technicians directly supporting R&D	**2 272**	1 307	965	**924.5**	569.9	354.7	40.7
Other personnel directly supporting R&D	**4 340**	1 469	2 871	**1 941.6**	615.5	1 326.2	44.7
Total	57 799	30 237	27 562	24 456.8	13 122.8	11 334.0	42.3
2019/20	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**53 371**	28 313	25 058	**22 153.0**	12 012.2	10 140.8	41.5
Technicians directly supporting R&D	**2 160**	1 283	877	**849.2**	530.3	318.9	39.3
Other personnel directly supporting R&D	**4 637**	1 548	3 089	**2 107.2**	677.4	1 429.9	45.4
Total	60 168	31 144	29 024	25 109.4	13 219.9	11 889.5	41.7
2020/21	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**52 985**	27 946	25 039	**21 715.9**	11 562.3	10 153.5	41.0
Technicians directly supporting R&D	**2 267**	1 314	953	**1 021.5**	598.9	422.5	45.1
Other personnel directly supporting R&D	**4 250**	1 302	2 948	**2 044.0**	585.9	1 458.1	48.1
Total	59 502	30 562	28 940	24 781.3	12 747.2	12 034.2	134.1

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

Table C.144b: Higher education sector R&D personnel (excluding doctoral students and post-doctoral fellows) in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)			
2018/19	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers**	**24 618**	12 812	11 806	**6 007.2**	3 206.1	2 801.1	24.4
Technicians directly supporting R&D	**2 272**	1 307	965	**924.5**	569.9	354.7	40.7
Other personnel directly supporting R&D	**4 340**	1 469	2 871	**1 941.6**	615.5	1 326.2	44.7
Total	31 230	15 588	15 642	8 873.3	4 391.4	4 481.9	28.4
2019/20	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers**	**25 727**	13 481	12 246	**6 165.6**	3 255.4	2 910.2	24.0
Technicians directly supporting R&D	**2 160**	1 283	877	**849.2**	530.3	318.9	39.3
Other personnel directly supporting R&D	**4 637**	1 548	3 089	**2 107.2**	677.4	1 429.9	45.4
Total	32 524	16 312	16 212	9 122.0	4 463.0	4 659.0	28.0
2020/21	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**MALE**	**FEMALE**	**FTEs AS % OF HEADCOUNTS**
Researchers**	**25 651**	13 452	12 199	**5 972.3**	3 113.2	2 859.1	23.3
Technicians directly supporting R&D	**2 267**	1 314	953	**1 021.5**	598.9	422.5	45.1
Other personnel directly supporting R&D	**4 250**	1 302	2 948	**2 044.0**	585.9	1 458.1	48.1
Total	32 168	16 068	16 100	9 037.8	4 298.0	4 739.8	28.1

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

Table C.145: Higher education sector R&D personnel in headcounts and full-time equivalents by occupation and gender (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
2018/19	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**24 618**	12 812	11 806	**6 007.2**	24.4
Technicians directly supporting R&D	**2 272**	1 307	965	**924.5**	40.7
Other personnel directly supporting R&D	**4 340**	1 469	2 871	**1 941.6**	44.7
Total	31 230	15 588	15 642	8 873.3	28.4
2019/20	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**25 727**	13 481	12 246	**6 165.6**	24.0
Technicians directly supporting R&D	**2 160**	1 283	877	**849.2**	39.3
Other personnel directly supporting R&D	**4 637**	1 548	3 089	**2 107.2**	45.4
Total	32 524	16 312	16 212	9 122.0	28.0
2020/21	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Researchers*	**25 651**	13 452	12 199	**5 972.3**	23.3
Technicians directly supporting R&D	**2 267**	1 314	953	**1 021.5**	45.1
Other personnel directly supporting R&D	**4 250**	1 302	2 948	**2 044.0**	48.1
Total	32 168	16 068	16 100	9 037.8	28.1

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

Table C.146: Higher education sector R&D postgraduates in headcounts by qualification and gender, and full-time equivalents by qualification (2018/19 to 2020/21)

OCCUPATION	HEADCOUNTS			FULL-TIME EQUIVALENTS (FTEs)	
2018/19	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Post-doctoral fellows	**2 727**	1 577	1 150	**2 564.9**	94.1
Doctoral students	**23 842**	13 072	10 770	**13 018.6**	54.6
Master's students (full research master's)	**29 554**	13 689	15 865	**15 075.1**	51.0
Master's students (coursework plus thesis with research component)	**30 272**	14 037	16 235	**10 262.9**	33.9
Total	86 395	42 375	44 020	40 921.4	47.4
2019/20	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Post-doctoral fellows	**2 867**	1 693	1 174	**2 717.6**	94.8
Doctoral students	**24 777**	13 139	11 638	**13 269.7**	53.6
Master's students (full research master's)	**29 578**	13 507	16 071	**14 593.6**	49.3
Master's students (coursework plus thesis with research component)	**29 924**	14 019	15 905	**9 758.2**	32.6
Total	87 146	42 358	44 788	40 339.2	46.3
2020/21	**TOTAL**	**MALE**	**FEMALE**	**TOTAL**	**FTEs AS % OF HEADCOUNTS**
Post-doctoral fellows	**2 978**	1 745	1 233	**2 817.3**	94.6
Doctoral students	**24 356**	12 749	11 607	**12 926.2**	53.1
Master's students (full research master's)	**28 558**	12 674	15 884	**13 429.1**	47.0
Master's students (coursework plus thesis with research component)	**31 411**	14 170	17 241	**8 671.3**	27.6
Total	87 303	41 338	45 965	37 844.9	43.3

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

Table C.147: Higher education sector R&D personnel in headcounts by occupation, qualification, population group and gender (2020/21)

OCCUPATION AND QUALIFICATION	TOTAL	SUBTOTAL		AFRICAN		COLOURED		INDIAN/ASIAN		WHITE		NON-SA	
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Researchers*	25 651	13 452	12 199	4 325	3 767	721	875	988	1 259	4 513	5 125	2 905	1 173
Doctoral degree or equivalent	13 427	7 722	5 705	1 875	1 256	355	353	488	560	2 810	2 726	2 194	810
Master's, honours, bachelor or equivalent	10 810	5 044	5 766	2 192	2 224	326	456	424	605	1 521	2 175	581	306
Diplomas	1 414	686	728	258	287	40	66	76	94	182	224	130	57
Technicians directly supporting R&D	2 267	1 314	953	576	425	246	133	70	49	346	302	76	44
Doctoral degree or equivalent	150	74	76	23	19	5	5	0	4	30	44	16	4
Master's, honours, bachelor or equivalent	1 005	493	512	253	234	39	60	19	23	145	163	37	32
Diplomas	1 112	747	365	300	172	202	68	51	22	171	95	23	8
Other personnel directly supporting R&D	4 250	1 302	2 948	633	1 156	186	709	58	133	269	805	156	145
Doctoral degree or equivalent	246	106	140	32	35	7	23	14	9	40	63	13	10
Master's, honours, bachelor or equivalent	1 702	512	1 190	264	478	58	211	18	40	105	389	67	72
Diplomas	2 302	684	1 618	337	643	121	475	26	84	124	353	76	63
Total	32 168	16 068	16 100	5 534	5 348	1 153	1 717	1 116	1 441	5 128	6 232	3 137	1 362

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

Table C.148: Higher education sector overview (2019/20 to 2020/21)

HIGHER EDUCATION OVERVIEW	2019/20					2020/21				
	R&D EXPENDITURE	RESEARCHER HEADCOUNT*	RESEARCHER FTE*	POSTGRAD HEADCOUNT	POSTGRAD FTE	R&D EXPENDITURE	RESEARCHER HEADCOUNT*	RESEARCHER FTE*	POSTGRAD HEADCOUNT	POSTGRAD FTE
	R' 000					R' 000				
Private universities	63 701	160	70.0	358	111.6	86 064	165	73.4	371	118.9
Public universities	12 621 707	21 877	5 228.8	25 027	14 461.7	12 177 813	21 044	4 986.2	24 707	14 335.5
Nelson Mandela Metropolitan University	446 406	773	126.0	704	342.4	401 472	868	145.4	662	321.4
North-West University	699 286	1 575	472.5	2 209	1 234.5	498 343	875	262.5	1 711	1 127.8
Rhodes University	362 523	433	153.7	687	687.0	306 532	443	175.4	685	679.5
Sefako Makgatho Health Sciences University	198 937	641	127.4	102	72.9	199 141	645	127.4	90	64.5
University of Cape Town	2 011 826	1 115	416.7	2 608	1 645.5	1 871 443	1 041	410.5	2 561	1 610.4
University of Fort Hare	172 342	354	70.8	706	450.0	181 585	347	104.1	582	341.6
University of Johannesburg	695 414	1 445	273.3	1 601	1 240.9	687 668	1 672	218.5	1 805	1 228.5
University of KwaZulu-Natal	902 454	2 355	503.9	3 655	1 644.7	822 415	2 314	532.1	3 243	1 460.3
University of Limpopo	289 652	602	257.9	361	196.6	327 328	693	258.5	310	173.5
University of Pretoria	1 427 785	2 466	566.0	2592	1 452.4	1 374 844	2 464	492.8	2 673	1 589.8
University of South Africa	923 437	1866	373.2	2 588	1 833.0	1 350 722	1 982	366.0	2 649	1 864.7
University of Stellenbosch	1 944 876	1 740	523.7	2 034	1 131.2	1 838 086	1 789	529.8	2 009	1 149.3
University of the Free State	436 578	966	188.6	1 162	593.1	350 027	677	187.7	1 435	578.4
University of the Western Cape	734 983	990	302.5	1 069	555.1	782 888	1 040	312.0	1 261	564.8
University of the Witwatersrand	1 192 541	4 237	713.1	2 575	1 116.1	1 012 628	3 875	704.1	2 712	1 419.5
University of Zululand	182 667	319	159.5	374	266.3	172 690	319	159.5	319	161.5

HIGHER EDUCATION OVERVIEW	2019/20					2020/21				
	R&D EXP-ENDITURE	RESEARCHER HEADCOUNT*	RESEARCHER FTE*	POSTGRAD HEADCOUNT	POSTGRAD FTE	R&D EXP-ENDITURE	RESEARCHER HEADCOUNT*	RESEARCHER FTE*	POSTGRAD HEADCOUNT	POSTGRAD FTE
	R' 000					R' 000				
Universities of (science) and technology	1 493 552	3 690	867.2	2 259	1 414.1	1 521 859	4442	912.8	2 256	1 289.1
Cape Peninsula University of Technology	279 500	551	96.3	318	113.9	237 193	787	124.6	393	200.0
Walter Sisulu University of Technology and Science	97 453	616	92.4	94	65.8	279 321	714	142.8	88	64.9
Central University of Technology	252 933	316	273.6	236	169.0	212 552	323	195.8	215	99.7
Durban University of Technology	217 262	738	118.2	548	319.5	175 143	704	131.1	567	323.9
Mangosuthu University of Technology	34 558	209	36.5	14	12.0	33 515	209	32.6	17	17.0
Tshwane University of Technology	403 472	483	152.8	542	390.8	381 466	922	193.6	574	314.0
University of Venda for Science and Technology	104 923	431	43.1	374	261.8	105 208	433	43.3	253	177.1
Vaal University of Technology	103 452	346	54.3	133	81.3	97 462	350	49.1	149	92.6
TOTAL	14 178 960	25 727	6 165.9	27 644	15 987.4	13 785 736	25 651	5 972.3	27 334	14 335.5

**Missing personnel data were supplemented from the HEMIS database. Collected personnel data may differ from HEMIS data in some cases due to definitional differences in personnel categories. Where no data was provided, a statistically generated estimate was created.
*Excludes post-doctoral and doctoral students. Includes specific categories of R&D personnel.
Note: Headcounts include non-SA R&D staff from 2016/17. Non-South African personnel are classified as those that are not from South Africa but undertaking research for a period exceeding six months. They can be temporary or permanent residents as described by the SNA.

Table C.149: Gross Domestic Product (1993/94 – 2020/21)

YEAR	GDP LEVEL (CURRENT VALUES)	GDP LEVEL (CONSTANT 2015 VALUES)
	R MILLIONS	R MILLIONS
1993/94	480 994	2 315 156
1994/95	545 093	2 389 241
1995/96	622 901	2 463 307
1996/97	701 804	2 569 229
1997/98	778 644	2 636 029
1998/99	845 733	2 649 210
1999/00	925 690	2 712 791
2000/01	1 053 138	2 826 728
2001/02	1 165 941	2 903 049
2002/03	1 360 679	3 010 473
2003/04	1 490 399	3 099 254
2004/05	1 652 434	3 240 412
2005/06	1 837 001	3 411 410
2006/07	2 057 594	3 602 579
2007/08	2 346 650	3 795 694
2008/09	2 611 631	3 916 816
2009/10	2 794 228	3 856 572
2010/11	3 055 613	3 973 802
2011/12	3 327 047	4 099 714
2012/13	3 566 385	4 197 952
2013/14	3 868 630	4 302 291
2014/15	4 133 873	4 363 118
2015/16	4 420 793	4 420 793
2016/17	4 759 555	4 450 171
2017/18	5 078 190	4 501 702
2018/19	5 357 640	4 568 670
2019/20	5 605 034	4 573 835
2020/21	5 521 075	4 279 647

Data source: Stats SA (2021a)

Table C.150: South African employment (2008/09 – 2020/21)

REFERENCE YEAR	SURVEY YEAR	EMPLOYMENT (000)	CORRESPONDING QLFS QUARTER
2008	2008/09	14 438	QLFS Q1 2009
2009	2009/10	14 616	QLFS Q1 2010
2010	2010/11	13 797	QLFS Q1 2011
2011	2011/12	13 904	QLFS Q1 2012
2012	2012/13	14 284	QLFS Q1 2013
2013	2013/14	15 055	QLFS Q1 2014
2014	2014/15	15 459	QLFS Q1 2015
2015	2015/16	15 675	QLFS Q1 2016
2016	2016/17	16 212	QLFS Q1 2017
2017	2017/18	16 378	QLFS Q1 2018
2018	2018/19*	16 291	QLFS Q1 2019
2019	2019/20*	16 383	QLFS Q1 2020
2020	2020/21	14 995	QLFS Q1 2021

*Note: Values rectified for 2018/19 and 2019/20.
Data source: Stats SA (2021b).

D. DESCRIPTION OF SURVEY METHODOLOGY

D.1. Survey design and planning

The South African National Survey of Research and Experimental Development (R&D Survey) forms part of the tools used to monitor and evaluate 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 OECD's Frascati Manual: business enterprise, government, private not-for-profit and higher education sectors. In South Africa, the science councils are extracted from the government sector and are reported separately, thus comprising a fifth South African sector.

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

The survey collects data in accordance with the guidelines recommended by the OECD in the Frascati Manual (OECD, 2002; 2015). This helps to maintain coherence and international comparability. The System of National Accounts (EC, IMF, OECD, UN and the World Bank, 2009) and the national system of innovation differ on the identification of target units and definitions.

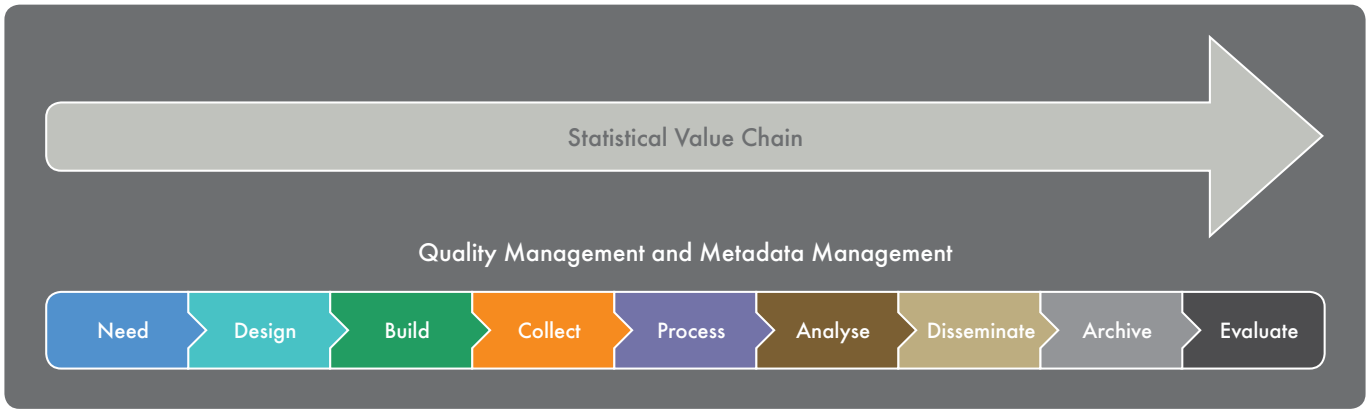
In the interests of coherence of data with other South African economic survey data, the South African R&D survey uses standards and methods applied or recommended by Statistics South Africa. Concepts and definitions are aligned as far as possible with those in use by the National Statistical Organisation (NSO) (Stats SA, 2010a). Indicators that use external data are sourced from Stats SA surveys. These are:

- Gross domestic product values for the 2020 annual reference period taken from the quarterly Stats SA GDP statistical release P0441 (Stats SA, 2021a); and
- Employment level value for the first quarter of 2021 obtained from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2021b).

The survey also uses the Standard Industrial Classification (Stats SA, 2004) codes for business sector industrial classifications employed by Stats SA.

Overall, HSRC-CeSTII performs quality management in line with practices recommended by Stats SA in the South African Statistical Quality Assessment Framework (SASQAF) (Stats SA, 2010b). The survey is conducted according to a project plan aligned with the phases of the Statistical Value Chain (SVC) illustrated in Figure D1, which is modelled on practice at Statistics SA.

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



D.2. Frame, sample selection and fieldwork

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

R&D performers in sectors were taken to be any units that had R&D expenditure or were likely to have had R&D expenditure in 2020/21. Table D.1 describes each of the fieldwork periods employed by sector and provides their respective reference periods. All sectors were surveyed as a census.

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

SECTOR	DESCRIPTION	REFERENCE PERIOD	METHOD OF SURVEYING	FIELDWORK AND FOLLOW-UP PERIOD
Business	Large, medium and small (micro) business enterprises, including state-owned enterprises.	1 April 2020 to 31 March 2021 or nearest complete financial year	A purposive design was used for the register 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 including those that were on the current frame.	01 February 2022 to 31 August 2022
Not-for-profit	Non-governmental and not-for-profit entities. Those registered as section 21 companies.	1 April 2020 to 31 March 2021 or nearest complete financial year	All known and likely R&D performers were surveyed following an investigation of a list of registered non-governmental and not-for-profit organisations including those that were on the current frame.	01 February 2022 to 31 August 2022
Government	National and provincial departments, local government, museums, research institutes and other research units with an R&D component.	1 April 2020 to 31 March 2021 or nearest complete financial year	Government departments were surveyed using a census approach. All government departments, associated research institutions and museums performing R&D at national, provincial, and local levels were included in the government sector.	01 February 2022 to 31 August 2022
Science councils	The nine science councils established through Acts of Parliament.	1 April 2020 to 31 March 2021 or nearest complete financial year	Seven statutory science councils were surveyed.	01 February 2022 to 31 October 2022
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 2020)	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.	3 March 2022 to 12 October 2022

D.3. Fieldwork

The R&D data were collected through questionnaires that were sent to the units in each sector by electronic mail or by use of an online submission system piloted this year. All five sectors were surveyed between 1 February 2022 and 31 October 2022.

A unit was considered as a response if:

- The unit 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 as a minimum were reported by the respondent without a fully completed questionnaire, or,
- If data were confirmed by the respondent after being imputed based on secondary data sources.

The data sources used for imputation included previous R&D survey responses as well as other private and public data sources such as the Higher Education Management Information System (HEMIS) and Support Programme for Industrial Innovation (SPII).

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

Changes made to the 2016/17 R&D Survey collection instruments on the R&D personnel tables for all sectors were maintained in the 2020/21 R&D Survey and include explanatory footnotes. This was done to report on foreign employees that could not be categorised by population group during previous surveys. The R&D personnel changes included an additional classification of the population group of R&D personnel as non-South African personnel.

Business sector

CeSTII has developed a register of known or likely R&D performers in the business sector from several information sources, including the JSE Top 100 Companies, Technology Top 100, Support Programme for Industrial Innovation (SPII) and Technology and Human Resources for Industry Programme (THRIP). A list of 571 companies was investigated. A total of 543 business sector units were selected for the 2020/21 survey period. Of this cohort, 242 units were reported as in-scope units and 58 as out-of-scope. A total of 69 units were imputed to account for non-response of in-scope units.

Non-response during the 2020/21 survey was attributed to several issues including resistance from respondents to participate in the survey and newly appointed individuals assigned to R&D activities within their companies. Negative outcomes of R&D tax incentives were also indicated as a contributor to resistance to participation in the survey.

The impact of COVID-19 and the resulting national lockdowns implemented from March 2020 resulted in CeSTII adopting specialised strategies to collect data. A large proportion of these included virtual meetings with respondents who were working remotely. This strategy was continued for the 2020/21 survey cycle. A total of ten virtual meetings and nine face-to-face meetings were conducted with individual companies and the representatives for each entity. Companies showed greater resistance to participating in this survey round due to the after-effects of the pandemic and the challenging economic climate. Through dialogue with respondents, some companies stated they were struggling to get back to pre-COVID operations which impacted their R&D and led to organisations reprioritising their R&D activities. A strategy of combined virtual and face-to-face meetings was implemented to overcome resistance to participation in the survey.

Science councils sector

Seven R&D-active science councils responded to the survey questionnaire. One was surveyed at the level of its constituent units, resulting in a total of 11 reporting units for the 2020/21 financial period.

Not-for-profit sector

A list of 354 units was investigated for the not-for-profit sector which consisted of known and likely R&D performers. Fourteen units were removed from the 2019/20 frame and 14 more units were included in 2020/21. Finalisation of the frame maintenance process identified 62 units as known and likely R&D performers for the 2020/21 survey period.

Government sector

The government sector team investigated a list of 164 units consisting of national and provincial departments, municipalities, research centres and museums. Eighty possible R&D performing units were selected for surveying in 2020/21.

Higher education sector

In the 2020/21 R&D Survey, the survey frame for the higher education sector was 32, which consisted of six private universities and 26 public universities.

The funding of research chairs is 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. Such persons do not incur a salary at the university but there are time and costs associated with them. The Frascati guidelines classify specific categories of R&D personnel as researchers and recommend they be included in reporting R&D activity. Costs incurred by the specific categories of R&D personnel are included as "specific categories of R&D personnel costs" and are included in the other current expenditure (Q7 of the GOV/SCI/NPO questionnaire; see section F). From the 2016/17 Survey onwards in the higher education questionnaire, the master's student category was split into two types: master's students (full research master's) and master's students (coursework plus thesis with research component).

D.4. Methodological note on the impact of COVID-19 on the R&D survey 2020/21

Due to the significant impacts of the COVID-19 pandemic a revised strategy was devised to complete data collection during the hard 'lock-down' period the country experienced from March 2020. Although the national restrictions have ended, certain strategies implemented during the state of national disaster were still applied in this survey period. These are highlighted below.

1. **Extending fieldwork:** The period of fieldwork for the R&D Survey 2020/21 commenced much later as a result of extensions in the previous survey due to the COVID-19 pandemic. After consulting with various stakeholders, a decision was made to extend the fieldwork period by three months to accommodate this knock-on effect.

2. **Target top 200 firms:** The Frascati Manual (2015, Chapter 7) recommends that all size classes be covered in an R&D survey. However, considering that large firms contribute significantly to R&D, every effort must be made to ensure coverage of large firms. In addition to the units already in the field, a list of the top 200 South African firms was identified to guide more focused fieldwork efforts in the business sector.

3. **Sectorising firms in the business sector:** The business sector consists of 10 industrial sectors based on Standard Industrial Classification codes. Researcher expertise based on industrial sectors was identified and was required to focus solely on these units based on the business frame of responding units. This ensured a higher quality of R&D frame maintenance, inclusion of R&D performing entities and quality checking of data received based on sectorised expertise.

4. **Prepopulated estimates:** In cases of some new respondents or respondents who were not able to complete the survey, historical data submissions involving the use of a mathematically generated GDP inflation factor and annual reports were used by researchers to compile questionnaires. The respondents were sent the questionnaire and allowed to amend or edit where necessary and then approve and sign off the questionnaire. This strategy was implemented for all sectors with outstanding units. However, if no response or adjustment was received, this was recorded as a unit imputation.

5. **Digital meetings:** Face-to-face interviews due to the termination of the state of disaster and lockdown levels were implemented where possible in different provinces. Furthermore, virtual meetings were scheduled with respondents to improve response rates. Virtual meetings required no travel and were convenient for respondents' busy schedules. These meetings were conducted frequently with respondents where senior CeSTII staff members could interact with respondents, which improved response rates and the quality of data received.

6. **Workshops:** A virtual workshop was held with the higher education respondents to help onboard them using the new online web-based platform for data collection.

7. **New web based online data collection tool:** A new digital data collection system was developed and integrated with the R&D Survey Management System (RDSMS) in preparation for the 2020/21 survey fieldwork. Additionally, respondents were prepared for the transition to a digital survey and active participation in new survey tools through a dedicated advocacy process. This new online data collection system would result in faster data processing thereby reducing survey timelines because of fieldwork extensions.

D.5. Quality indicators of survey coverage, fieldwork and analysis

Questionnaire response rates for 2020/21 improved to 54.5%, compared to 53.9% in 2019/20, according to Table D.2.

In addition, the 2020/21 survey period returned a lower rate of out-of-scopes. 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 in any given year. 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 collection phase of the SVC.

Non-response[3] was defined as failure to obtain a measurement on one or more variables for one or more units selected for the survey. These include out-of-scope units. *Out-of-scope units* are defined as units that should not be included in the survey frame because they did not belong to the target population in the reference period. Entities that returned a questionnaire stating nil in-house R&D expenditure for the survey reference period were counted as out-of-scope for the 2020/21 R&D survey.

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

In-scope units[4] 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:

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

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

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

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

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

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

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

Table D.2: Quality indicators of survey coverage by sector (2020/21)

SECTOR	NUMBER OF UNITS INVESTI-GATED	NUMBER OF UNITS SELECTED TO COMPILE STATISTICS	NON-RESPONSE	OUT-OF-SCOPE	RESPONSES	QUESTION-NAIRE RESPONSE RATE	COLLECTION RATE	UNIT IMPUTATION RATE	WEIGHTED RESPONSE RATE
Business	571	543	292	58	242	49.9%	55.4%	14.2%	71.5%
Not-for-profit	354	62	40	3	37	62.7%	67.7%	6.8%	98.6%
Government	164	80	34	3	46	59.7%	70.0%	3.9%	95.2%
Science councils	11	11	1	0	10	90.9%	90.9%	9.1%	93.5%
Higher education	32	32	5	0	27	84.4%	84.4%	9.4%	97.8%
HE: Public	26	26	4	0	22	84.6%	86.6%	7.7%	97.8%
HE: Private	6	6	1	0	5	83.3%	83.3%	16.7%	96.5%
Total	1 132	728	366	64	362	54.5%	59.9%	12.0%	89.0%

Table D.3: Quality indicators of survey coverage by sector (2019/20)

SECTOR	NUMBER OF UNITS INVESTI-GATED	NUMBER OF UNITS SELECTED TO COMPILE STATISTICS	NON-RESPONSE	OUT-OF-SCOPE	RESPONSES	QUESTION-NAIRE RESPONSE RATE	COLLECTION RATE	UNIT IMPUTATION RATE	WEIGHTED RESPONSE RATE
Business	581	571	308	67	263	52.2%	70.2%	10.9%	68.7%
Not-for-profit	115	56	27	3	29	54.7%	62.5%	15.1%	94.6%
Government	164	94	48	5	46	51.7%	68.1%	6.7%	93.0%
Science councils	11	11	0	0	11	100.0%	100.0%	0.0%	100.0%
Higher education	30	30	9	0	21	70.0%	70.0%	26.7%	87.0%
HE: Public	24	24	6	0	18	75.0%	75.0%	25.0%	86.9%
HE: Private	6	6	3	0	3	50.0%	50.0%	33.3%	93.8%
Total	901	762	392	75	370	53.9%	69.8%	12.4%	84.3%

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

An improvement in the questionnaire response between 2019/20 and 2020/21 was evident (See D.2.). The collection rate declined by 9.9 percentage points largely driven by low responses in the business sector and a science council being imputed. The 2020/21 R&D survey reduced the number of out-of-scope units in the business and government sectors, while the not-for-profit, science council and higher education sectors remained unchanged.

D.6. 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 have been reported, along with the age of the data used to impute (Table D.4). Imputations are only used upon verification from respondents or where available information confirms continued R&D activity. The survey mostly employs an estimation procedure that uses data from a previous return adjusted by a GDP inflation factor. 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 were used. Lastly, an 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 decreased by a GDP inflation value of -1.498% in 2020/21. Under most economic circumstances, this would be a positive inflation factor, but due to the GDP contraction in 2020/21, this resulted in decreased estimates of R&D expenditure used in item or unit imputations.

The unit imputation rate decreased for all sectors except the science council sector, which recorded a rate of 9.1% for 2020/21 due to one unit imputation. The business, government, not-for-profit and public higher education sectors all reported lower imputation rates compared to those obtained in the 2019/20 survey.

Table D.4: Number of units and age of data used in the imputation models by sector

AGE OF DATA	BUSINESS	NPO	GOVERNMENT	SCIENCE COUNCILS	HIGHER EDUCATION
Imputed (data from current reference period)	0	0	0	0	0
Imputed (data from previous year)	0	0	0	0	0
Imputed (data more than one year old)	0	0	0	0	0
Commuted (data from previous year)	19	0	1	0	1
Commuted (data more than one year old)	50	4	2	1	2
Total	69	4	3	1	3

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.7. Data processing and analysis

Data collection happened via two modalities: the online web-based data collection Research, Development and Innovation (RDI) tool and PDF and excel questionnaires, with built-in validations.

Once the individual responses to the questionnaires, including summation and percentage calculations, had been checked by the relevant fieldworker, the data were manually entered into the RDSMS. The same quality checks were applied to data submitted via the online platform. Summary data were drawn from the system, and anomalies were identified by cross-checking results and returned to sector leaders for verification and correction.

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

Tables on the state-owned enterprises (SOEs) were produced by selecting known SOEs from the enterprises in the business sector.

D.8. Dissemination

The 2020/21 R&D Survey reports will be disseminated to all respondents as well as to other users of the R&D statistics. This report is available on request from HSRC-CeSTII and the DSI.

The report can be downloaded from the HSRC-CeSTII website https://hsrc.ac.za/divisions/centre-for-science-technology-and-innovation-indicators/ or the DSI website https://www.dst.gov.za/index.php/resource-center/rad-reports/r-d-survey-reports. The survey ensures the confidentiality of respondent information and organisation, and the data presented in the report are therefore anonymised.

D.9. Storage and archiving

The data from the R&D survey series is 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

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

National Treasury. (2022). Public Institutions Listed in PFMA Schedule 1, 2, 3A, 3B, 3C and 3D as at 14 October 2022. Pretoria, Gauteng, South Africa. Retrieved October 17, 2022, from http://www.treasury.gov.za/legislation/pfma/public%20entities/2022-10-14%20Public%20institutions%20Sch%201-3D.pdf

OECD. 2015. Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development. Paris: Organisation for Economic Cooperation and Development.

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

Stats SA. 2004. *Standard Industrial Classification*. Retrieved August 1, 2013, from StatsOnline: http://www.statssa.gov.za/additional_services/sic/sic.htm

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

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

Stats SA. 2021a. *Gross domestic product: P0441, First quarter 2021*, Pretoria: Statistics South Africa.

Stats SA. 2021b. *Quarterly Labour Force Survey: P0211, First quarter 2021*, Pretoria: Statistics South Africa.

F. R&D SURVEY QUESTIONNAIRE

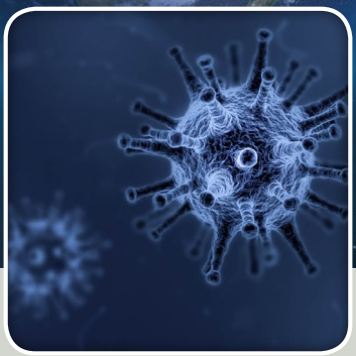
(Science Councils/Government/Not-for-Profit Sectors)

R&D SURVEY

Investment ▪ Insight ▪ Impact

National Survey of Research and Experimental Development (R&D) Inputs 2020/21 Financial Year

Science Councils/Government/Not-for-Profit



Organisation contact details

Organisation name

Address line 1

Address line 2

Province

Postal code

Strictly confidential

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

HSRC
Human Sciences Research Council

stats sa
Department:
Statistics South Africa
REPUBLIC OF SOUTH AFRICA

Mandate

The Centre for Science, Technology and Innovation Indicators (CeSTII), within the Human Sciences Research Council (HSRC), conducts the National Survey of Research & Experimental Development (R&D) Inputs 2020/21 Financial Year on behalf of the Department of Science and Innovation (DSI). **The Survey is conducted in terms of the Statistics Act No. 6 of 1999**. Organisations are therefore legally required to respond by providing accurate data on R&D performance. All data gathered for this survey are confidential. Only the survey team have access to individual organisation data. The HSRC and DSI will not disseminate any information identifiable with an organisation without their consent.

Purpose and scope

The R&D survey collects data on the inputs into **intramural** R&D activities performed 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 that strengthen South Africa's competitiveness. Previous survey results may be viewed at http://www.hsrc.ac.za/en/departments/cestii. This survey covers the **financial year 1 April 2020 to 31 March 2021 (or your nearest complete financial year)**.

Due date

Kindly complete and return this questionnaire via email by _____ . Should you wish to post your questionnaire to us, please address your consignment to **R&D Survey, Private Bag X9182, Cape Town, 8000**.

Record keeping

PLEASE KEEP A COPY OF THIS QUESTIONNAIRE FOR YOUR RECORDS.

Assistance and feedback

If you need assistance please contact one of the survey team:

Sector	Name	Contact Number	E-mail
Government	Dr Mario Clayford (Sector Leader)	021 466 7829	mclayford@hsrc.ac.za
Government	Ms Audrey Mahlaela	021 466 7925	amahlaela@hsrc.ac.za
Government	Mr Theodore Sass	061 470 6983	tsass@hsrc.ac.za
Not-For-Profit	Ms Natasha Saunders (Sector Leader)	021 466 7886	nsaunders@hsrc.ac.za
Not-For-Profit	Ms Nokhetho Mhlanga	021 466 8045	nomhlanga@hsrc.ac.za
Science Councils	Dr Mario Clayford (Sector Leader)	021 466 7829	mclayford@hsrc.ac.za

A feedback section is located on the back page of this questionnaire. We welcome your comments and suggestions.

National R&D Survey Project Leader
Dr Nazeem Mustapha, Chief Research Specialist
nmustapha@hsrc.ac.za | Tel: 021 466 7887

Key

Definition Instruction

Details of person completing the questionnaire (please print):

Name (with title)		Tel	( )
Designation		Cell	( )
Date		E-mail	
Signature			

2

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:

"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."

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 commonly used knowledge and techniques in the area concerned.

The R&D activity must be:

- Novel
- Creative
- Uncertain
- Systematic
- Transferable and/or reproducible.

All five criteria are to be met, at least in principle, every time an R&D activity is undertaken whether on a continuous or occasional basis.

Examples

- Investigating electrical conduction in crystals is basic research; application of crystallography to the properties of alloys is applied research.
- New chip designs involve development.
- Investigating the limiting factors in chip element placement lies at the border between basic and applied research, and increasingly involves nanotechnology.
- Much services R&D involves software development where the completion of the project is dependent on a scientific or technological advance and the aim of the project is the systematic resolution of a scientific or technological uncertainty.

Scope of survey

- The survey requests data on **intramural** R&D performed by your organisation on the national territory of South Africa.
- Intramural (or in-house) R&D expenditures are all current expenditures (including labour and other costs) plus gross fixed capital expenditures (such as for land, buildings, machinery and equipment) for R&D performed within a reporting unit during a specific reference period, whatever the source of funds. A reporting unit is a unit that supplies the data for a given survey instance.
- Part 5 asks some questions on **extramural** R&D. Extramural (or outsourced) R&D are the amounts of money spent on R&D that is performed outside a reporting unit.

R&D includes – but is not limited to activities of personnel who are obviously engaged in R&D.
In addition it includes:

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

R&D excludes:
The following routine activities are excluded, except where they are an essential part of in-house R&D activity:

- 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, IT systems work or software maintenance where there are no technological uncertainties to be resolved
- Market research
- Feasibility studies and pilot projects.

3

Part 1: General Information

1. **Parent organisation/department**

2. **Name of organisation/unit**

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

3b. **Total number of employees working on contract for six months or less**

3c. **Estimate percentage of time spent on R&D per employee** (working on contract for six months or less) %

4. **Intramural R&D in South Africa during the 2020/21 financial year**

Definition

- Intramural R&D refers to R&D performed by the reporting unit on its own behalf or on behalf of others.
- Intramural R&D expenditures are all current expenditures (including labour and other costs) plus gross fixed capital expenditures (such as for land, buildings, machinery and equipment) for R&D performed within a reporting unit during a specific reference period, whatever the source of funds.
- It excludes R&D projects funded by this organisation but carried out by others using their own facilities.

Instruction

- Intramural R&D must be distinguished from extramural R&D which should be reported under Part 5.
- Only R&D performed within the borders of South Africa should be recorded.

4a. **Did the organisation/unit perform any intramural R&D in South Africa during the 2020/21 financial year?**

Yes ☐ No ☐

Do you think your organisation/unit will perform intramural R&D in the future?

Please tick	2021/22	2022/23	2023/24
Yes	☐	☐	☐
No	☐	☐	☐

4

4b. Did the organisation have extramural (outsourced) R&D expenditures during the 2020/21 financial year?

Yes ☐ No ☐

Instruction

- If you have conducted intramural (or in-house) R&D in the 2020/21 financial year please continue to Part 2.
- If you have conducted only extramural (or outsourced) R&D in the 2020/21 financial year, please continue to Part 5.
- If you have indicated **no intramural R&D** or **extramural R&D** in Questions 4a and 4b above, please tick below and return the questionnaire via post or email.

No **intramural** or **extramural R&D** – **Nil** return ☐

5

Part 2: Intramural R&D Personnel

Instruction

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

Internal R&D personnel
Persons employed by the reporting unit who contribute to the unit's intramural R&D activities.

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. This category must include **Research Managers** and other **Research Executives**.

Technicians directly supporting R&D
Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, the physical and life sciences, or the social sciences, humanities and the arts.
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.

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.

Note: All foreign headcounts should be recorded in the non-South African category

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

6

5. Headcount of R&D Personnel

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

Researchers (incl. Research Executives and Research Managers)

Personnel Categories & Highest Qualification	African		Coloured		Indian/Asian		White		Non-SA		Subtotal		Total
	M	F	M	F	M	F	M	F	M	F	M	F	
Doctorates													
Master's/Hons/Bachelor's or equivalent													
Diplomas and other qualifications													
Researcher Total													

Technicians and equivalent staff directly supporting R&D

Personnel Categories & Highest Qualification	African		Coloured		Indian/Asian		White		Non-SA		Subtotal		Total
	M	F	M	F	M	F	M	F	M	F	M	F	
Doctorates													
Master's/Hons/Bachelor's or equivalent													
Diplomas and other qualifications													
Technician Total													

Other personnel directly supporting R&D

Personnel Categories & Highest Qualification	African		Coloured		Indian/Asian		White		Non-SA		Subtotal		Total
	M	F	M	F	M	F	M	F	M	F	M	F	
Doctorates													
Master's/Hons/Bachelor's or equivalent													
Diplomas and other qualifications													
Other Personnel Total													

Carry subtotals over to Question 6

6. Full-Time Equivalents (FTEs) and Labour Costs of R&D Personnel

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

Instruction

CALCULATING FULL-TIME EQUIVALENT (FTE)

NOTE: For the purpose of this survey, an employee can work a maximum of 1 FTE in a year.

The following equation can be used to calculate FTE/effort on R&D:
(Person/s employed) x (Portion of their job spent on R&D) x (Portion of the year employed) = FTE on R&D

For example:

- a full-time employee who devotes 100% of their time to R&D:
  1 x 1 x 1 = 1 FTE on R&D
- a full-time employee spending 40% of his/her time on R&D during half of the survey year:
  1 x 0.4 persons x 0.5 years = 0.2 FTE on R&D
- a part-time employee working 40% of a full time year doing only R&D:
  1 x 0.4 x 1 = 0.4 FTE on R&D
- 20 full-time researchers spending 40% of their time on R&D during the survey year:
  20 x 0.4 x 1 = 8 FTE on R&D

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

R&D Personnel Categories	Headcounts (from Q5)			Total Full-Time Equivalents (FTEs)			Average annual labour cost per person	Calculated labour cost of R&D
	M	F	Total	M	F	Total **(A)**	R'000 (excl. VAT) **(B)**	R'000 (excl. VAT) **(A x B)**
Researchers (incl. Research Executives & Research Managers)								
Technicians directly supporting R&D								
Other personnel directly supporting R&D								
							Total Labour Cost of R&D	

Carry over total calculated labour cost to Question 7C

8

Part 3: Intramural R&D Expenditure

7. Allocation of Intramural R&D Expenditure

CAPITAL EXPENDITURE ON R&D

Definition

- Capital R&D expenditures are the annual gross amount paid for the acquisition of fixed assets that are used repeatedly or continuously in the performance of R&D for more than one year.
- The full value of capital expenditure must be reported in the year of purchase (do not depreciate).
- If the asset has been/will be used for more than one activity, include an estimate of the portion used for R&D.

Including - but not limited to:

- Expenditure on fixed assets used in the R&D projects of your business.
- Capitalised software includes acquisition of software for R&D, including fees, rights and licences expected to be used for more than one year, or separately identifiable software (systems or applications) and their descriptions and supporting materials.
- Purchase of databases expected to be used for more than one year.
- Major repairs and improvements on land and buildings used for R&D.

Excluding:

- Other repairs and maintenance expenses not used for R&D.
- Depreciation provisions.
- Proceeds from the sale of R&D assets.

		R'000 (excl. VAT)
Vehicles, plant, machinery and equipment		
Capitalised computer software		
Total: Vehicles, plant, machinery and equipment and software	A	
Land, buildings and other structures	B	

LABOUR COSTS OF R&D

		R'000 (excl. VAT)
Labour Costs of R&D (to match Question 6)	C	

OTHER CURRENT EXPENDITURE ON R&D

Definition

- Current expenditures are composed of labour costs of R&D personnel and other current costs used in R&D.
- Services and items (including equipment) used and consumed within one year are current expenditures.
- Annual fees or rents for the use of fixed assets should be included in current expenditures.

Including - but not limited to:

- Materials, fuels, water, electricity and other inputs (i.e. all overheads/ running costs).
- Repair and maintenance expenses.
- Rents for research facilities: all fees and rents associated with R&D.
- Payments to outside organisations for use of specialised testing facilities.
- Payments to outside organisations for analytical work, engineering or other specialised services in support of R&D performed by your business.
- Commission/consultant expenses for research projects carried out by your business.
- Other R&D expenses and indirect costs not specified in 11 A, B or C.

Excluding:

- R&D activities where research is outsourced.
- Payments for purchases of technical know-how.
- Payments for patent searches.
- Depreciation provisions.

		R'000 (excl. VAT)
Other Current Expenditure	D	

		R'000 (excl. VAT)
Total R&D Expenditure (A + B + C + D = E)	E	

9

8. Sources of Funds for Intramural R&D

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

INTERNAL SOURCE OF FUNDS

Organisation	R'000 (excl. VAT)
Own funds	

EXTERNAL SOURCE OF FUNDS

Government (includes Science Councils e.g. CSIR, Departments and Institutes)	
Government support programmes for R&D (including Grants, SPII, Innovation Fund etc)	
Contracts to perform R&D	
Other Local Businesses (including Trade Associations)	
Contracts to perform R&D	
Other South African Sources	
Higher Education	
Not-for-Profit Organisations*/NGOs/Trusts/Foundations (contracts for research)	
Individual donations/NGOs/Trusts/Foundations (donations for research without the obligation for a product or service)	
Rest of the world	
All sources (complete Question 9)	
	R'000 (excl. VAT)
Total R&D Expenditure (should match Question 7E)	

*Not-for-Profit organisations primarily serving households. Funding from non-profit organisations primarily serving Business, Higher Education or Government should be allocated to these sectors.

10

9. Sources of Funds from the rest of the World (in R'000s) for Intramural R&D

If your organisation received R&D funding from the rest of the world, provide percentage contribution by sector and region.

Funding of R&D from the rest of the world	Percentage of Expenditure								
Category	DATA CHECK	Africa (outside SA)	Middle East	Europe	USA/ Canada	Central & South America	China	Rest of Asia	Other
Business*	%	%	%	%	%	%	%	%	%
Not-for-Profit Organisations**	%	%	%	%	%	%	%	%	%
Foundations	%	%	%	%	%	%	%	%	%
Government	%	%	%	%	%	%	%	%	%
Higher Education	%	%	%	%	%	%	%	%	%
Total	%	TOTAL must sum to 100% (of total funding from rest of the world Q8)							

* Including affiliated company, trade associations (affiliated denotes parent or subsidiary organisation)

** NPOs serving households only. Funding from non-profit organisations primarily serving Business, Higher Education or Government should be allocated to these sectors. Donations from individuals should be recorded under this category.

10. Provincial Expenditure on R&D

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

Instruction

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

Eastern Cape	%	Mpumalanga	%
Free State	%	Northern Cape	%
Gauteng	%	North West	%
KwaZulu-Natal	%	Western Cape	%
Limpopo	%	**Total** (must sum to 100%)	%

11

Part 4: Categories of Intramural R&D Expenditure

11. Intramural Total R&D Expenditure by Type of R&D

Specify the percentage of total **intramural R&D expenditure** by **type of R&D**.

Basic Research

Definition

- Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.
- The analysis of properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws.
- The results of basic research are usually published in peer-reviewed scientific journals.

Percentage

%

Applied Research

Definition

- Applied research is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective.
- Activities that determine the possible uses for the findings of basic research.
- The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems.
- Applied research develops ideas into operational form and may be published in peer-reviewed journals or subjected to other forms of intellectual property protection.

Percentage

%

Experimental Development

Definition

- Experimental development is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

Percentage

%

Total (must sum to 100%) %

12

12. Research Fields (RF)

Classify R&D according to Research Fields (see Appendix A in Codes book) and provide the associated percentage of the **total** R&D expenditure per research field.

Definition

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

	RF Codes	Percentage			RF Codes	Percentage	
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
RF			%	RF			%
Total			(must sum to 100%)				**%**

13

13a. Multi-disciplinary Areas of R&D

Please estimate the percentage of R&D expenditure allocated to biotechnology and nanotechnology.

Instruction

Multi-disciplinary R&D combines several research fields or disciplines. If your organisation performs R&D, as described below, please provide the applicable percentage of total R&D expenditure.

Note that the percentages will most likely not total 100%.

Definition

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.

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

No R&D in these areas ☐ ← **Tick** if no such R&D is done

13b. Specific Areas of R&D

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

Definition

Open source software – computer software with its source code made in which the copyright holder provides the rights to study, change, and distribute the software to anyone and for any purpose

Space science – any of several scientific disciplines, such as communications, transport, engineering or health that specifically studies phenomena occurring in the upper atmosphere, in space, or on celestial bodies other than Earth

Environment / sustainability R&D – any of several fields wherein research focuses on human, economic and societal impact on the environment investigating its contemporary and future impact on society

New materials – materials science and engineering, involves the discovery and design of new materials, with an emphasis on solids.

Specific Areas of Interest	% of R&D expenditure
Open source software	%
Space science	%
Tuberculosis (TB), HIV/AIDS, Malaria	%
Environment and sustainability R&D	%
New materials	%

No R&D in these areas ☐ ← **Tick** if no such R&D is done

14

14. Socio-Economic Objectives (SEO)

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

Definition

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

	SEO Codes	Percentage			SEO Codes	Percentage	
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
S			%	S			%
	Total				(must sum to 100%)		**%**

15

15. Collaborative R&D

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

Yes ☐ Continue with Question 15b No ☐ Go to Question 16

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

Instruction

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 intramural or extramural. R&D collaboration can occur without expenditure – please note zero expenditure in such cases.

			Rest of the world consisting of... (tick as appropriate)							
Tick as appropriate	South Africa	Foreign	Africa (outside SA)	Middle East	Europe	USA/ Canada	Central & South America	China	Rest of Asia	Other
Higher Education Institutions										
Science Councils (e.g. CSIR, Mintek, MRC, ARC etc.)										
Government Research Institutes										
Members of own organisation / Affiliated* organisations										
Other Companies (including specialist consultants, business and trade associations)										
Not-for-Profit Organisations**										

* Affiliated denotes parent or subsidiary organisation.

** NPOs serving households only. Funding from non-profit organisations primarily serving Business, Higher Education or Government should be allocated to these sectors.

16

Part 5: Extramural R&D (Outsourced/Contracted Out)

Definition

Extramural 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.

R'000 (excl. VAT)

16a. State value of extramural R&D inside South Africa

16b. Please indicate the name of the organisation(s) that conducted the extramural R&D with the associated expenditure inside South Africa

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

R'000 (excl. VAT)

17a. State value of extramural R&D outside South Africa

17b. If you have indicated extramural R&D outside South Africa in Question 17a, kindly provide the approximate percentage by sector and geographic location

	Percentage Extramural R&D Outside South Africa								
Category	DATA CHECK	Africa (outside SA)	Middle East	Europe	USA/ Canada	Central & South America	China	Rest of Asia	Other
Business*	%	%	%	%	%	%	%	%	%
Not-for-Profit Organisations**	%	%	%	%	%	%	%	%	%
Foundations	%	%	%	%	%	%	%	%	%
Government	%	%	%	%	%	%	%	%	%
Higher Education	%	%	%	%	%	%	%	%	%
Total	%	TOTAL must sum to 100% of total extramural R&D outside SA R&D (Q17a)							

* Including affiliated company, trade associations (affiliated denotes parent or subsidiary organisation)

** NPOs serving households only. Funding from non-profit organisations primarily serving Business, Higher Education or Government should be allocated to these sectors.

17

Your feedback matters

Please use this section to provide general feedback or data notes to the Survey Team

Thank you for your time and effort

R&D SURVEY

Investment ▪ Insight ▪ Impact

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

HSRC
Human Sciences Research Council

stats sa
Department:
Statistics South Africa
REPUBLIC OF SOUTH AFRICA

G. USER SATISFACTION SURVEY:

SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT: STATISTICAL REPORT 2020/21

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 e-mail to RnDSurvey@hsrc.ac.za.

1. Name and address of respondent:

Name and title _____

Designation/occupation _____

Name and address of organisation or enterprise _____

_____

_____

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

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

_____

_____

3. In which country do you work?

_____

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

☐ Excellent ☐ Good ☐ Average ☐ Satisfactory ☐ Poor

5. How useful is this publication for your work?

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

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

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

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

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

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

9. What did you like best about the publication?

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

Thank you for completing the survey.

R&D SURVEY

Investment ▪ Insight ▪ Impact

Department of Science and Innovation (DSI)
Private Bag X894, Pretoria, 0001
Republic of South Africa
www.dst.gov.za

Dr Phil Mjwara
Director-General: DSI
Phil.Mjwara@dst.gov.za

Dr Mmboneni Muofhe
Deputy Director-General: Technology Innovation, DSI
Mmboneni.Muofhe@dst.gov.za

Ms Tshidi Lekala
Director: Science and Technology Indicators, DSI
Tshidi.Lekala@dst.gov.za

Centre for Science, Technology and Innovation Indicators (CeSTII)
Human Sciences Research Council
P O Box 15200, Vlaeberg, Cape Town, 8018
www.hsrc.ac.za

Prof Leickness Simbayi
Acting Chief Executive Officer: Human Sciences Research Council
LSimbayi@hsrc.ac.za

Dr Nazeem Mustapha
Chief Research Specialist: CeSTII
nmustapha@hsrc.ac.za

Dr Moses Sithole
Research Director: CeSTII
msithole@hsrc.ac.za

Dr Glenda Kruss
Executive Head: CeSTII
gkruss@hsrc.ac.za

ISBN: 978-0-621-50805-5

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

HSRC
Human Sciences
Research Council

stats sa
Department:
Statistics South Africa
REPUBLIC OF SOUTH AFRICA