

South African National Survey of Research and Experimental Development



Investment ■ Insight ■ Impact



STATISTICAL REPORT 2022/23



Science, Technology
and Innovation
Statistics South Africa



HSRC
Human Sciences
Research Council

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

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DISSEMINATION

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- <https://www.dsti.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 fairly 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 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, Technology and Innovation (DSTI), 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. Such revisions may result from revisions by Stats SA of socio-economic indicators such as the gross domestic product (GDP) or population or employment numbers, or amendments in response to internal and external data quality and consistency monitoring such as that carried out by the Organisation for Economic Co-operation and Development (OECD), which conducts quality checks through global comparative analyses, time series analyses and other methods. Explanations of any revisions will be made available and accessible on the DSTI and HSRC websites. The R&D Survey calculates real GERD levels using 2015 Rand values. The most recent GDP series (Stats SA, 2024) has been used to calculate the headline indicator of GERD/GDP.

FOREWORD



The 2022/23 National Survey of Research and Experimental Development (R&D Survey) is the thirteenth of the R&D survey series, starting with the 2010/11 publication, subjected to the clearance process formulated by the Statistician-General in 2010. The Department of Science Technology and Innovation (DSTI) has provided full support by annually producing the R&D Survey over two decades under the auspices of the National Statistics System (NSS), thereby contributing to the body of official statistics. The optimal functioning of the National System of Innovation (NSI) relies on accurate and reliable statistics about its inputs, actors, activities, and outputs, and the interrelationships among these.

According to the Statistics Act (No. 6 of 1999), the Statistician-General (SG) is mandated to coordinate statistical production beyond the scope of Statistics South Africa (Stats SA). To this effect, in order to organise the production of statistics in the National Statistics System (NSS), the Statistician-General has developed tools to drive this process. The South African Statistical Quality Assessment Framework (SASQAF) is among the tools that the SG has developed to effect statistical coordination and is in line with the United Nations Fundamental Principles of Official Statistics.

Each R&D survey is subjected to a quality assessment process which is undertaken by a Clearance Committee, prior to its publication. This is done in accordance with SASQAF, to ensure the survey remains credible in terms of producing quality statistics. To validate the quality of the survey, independent verification was done by a Technical Committee. In brief, the Clearance Committee for the R&D survey noted that the 2022/23 R&D Survey was conducted following good practices and achieved 66.7% of quality indicators set in the quality standards of the R&D Survey Assessment Tool. Continuing efforts to enhance survey quality are applied across the statistical value chain (SVC) to refine the survey methodology, and these have been reflected in consistent improvements in key statistical quality indicators.

In 2023/24, the R&D Survey concluded the second independent quality assessment review, which determines the survey status. The assessment process also resulted in a quality improvement plan for the areas where the statistical product was found to be deficient.

Based on my evaluation and the evident dedication displayed by the DSTI in implementing continuous quality improvements, I endorse the outcomes of the 2022/23 R&D Survey. I encourage stakeholders to utilise these results for informed decision-making and strategic planning.

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

Risenga Maluleke
Statistician-General
Republic of South Africa

ACKNOWLEDGEMENTS

The project team extends its appreciation to Ms Gugulethu Zwane, Acting Director-General of the DSTI, Mr Risenga Maluleke, Statistician-General, and Prof. Sarah Mosoetsa, CEO of the HSRC, for their support of the R&D Survey. The support and contributions of Dr Glenda Kruss, Executive Director of CeSTII, Dr Mmboneni Muofhe, Ms Kgomotso Matjila, Ms Tshidi Lekala, and Mr Thabo Manyaka of the DSTI are much appreciated.

Technical inputs and advice by the DSTI 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 the results.

The HSRC-CeSTII project team for the 2022/23 South African National Survey of Research and Experimental Development comprised: Lindiwe Binda, Mbali Bongoza, Jacqueline Borel-Saladin, Isaac Cameron, Mario Clayford, Marco Davids, Shanice Eksteen, Atoko Kasongo, Jerry Mathekga, Tlangelani Makamu, Tshifhiwa Manenzhe, Rory Liedeman, Sintu Mavi, Nazeem Mustapha, Wendy Neer, Litha Phika, Gerard Ralphs, Theodore Sass, Natasha Saunders, Kgabo Ramoroka, Viwe Sigenu, Moses Sithole, Natalie Vlotman, Darryn Whisgary, and Luthando Zondi.

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

ABBREVIATIONS

BERD	Business expenditure on R&D
CeSTII	Centre for Science, Technology and Innovation Indicators
DSTI	Department of Science, Technology 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
HSRC	Human Sciences Research Council
ICT	Information and communication technologies
IMF	International Monetary Fund
Mintek	Council for Mineral Technology
NESTI	National Experts on Science and Technology Indicators
NPO	Not-for-profit organisation
NSI	National system of innovation
NSO	National Statistical Organisation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and experimental development
RDI	Research, development and innovation
RDSMS	Research and Development Survey Management System
SASQAF	South African Statistical Quality Assessment Framework
SEO	Socio-economic objective
SOE	State-owned enterprise
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
THRIP	Technology and Human Resources for Industry Programme
UN	United Nations
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 2015 in this case. These values were obtained by deflating with the GDP deflator using data published in the Statistics South Africa GDP survey P0441, 2nd Quarter 2023 (Stats SA, 2024).

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, 2nd Quarter 2024 (Stats SA, 2024).

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.

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

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

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

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

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

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

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order 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 2023 (Stats SA, 2023) 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 measured comprised only South African researchers, technicians and other R&D personnel. Also, emeritus professors, honorary fellows and research fellows were not explicitly included in the estimates of R&D personnel.

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A. INTRODUCTION

This Statistical Report presents data tables from the 2022/23 South African National Survey of Research and Experimental Development (R&D Survey). It provides key findings from the survey with commentary, standard summary tables of the overall findings from 2022/23 and comparative time series data 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 survey covers these sectors that perform R&D in South Africa:

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

This approach is followed for 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*, also 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 context.

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

- Gross domestic expenditure on R&D
- 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
- R&D expenditure by industrial sector in the business sector
- R&D expenditure in selected areas of policy interest, namely: biotechnology, nanotechnology, space science, environment-related, open-source software, new materials, and tuberculosis, HIV/AIDS and malaria research.
- R&D personnel

GDP values were obtained from the Stats SA GDP statistical release P0441 (Stats SA, 2024) and the total employment level was taken from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2023).

The financial quantities presented in the 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 series. The R&D Survey uses the GDP series calculated according to the production method by Stats SA.

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). Since 2009/10, further work has been done with Statistics South Africa to enhance the SASQAF aspects of the R&D Survey. Based on quality requirements, SASQAF offers transparent procedures and precise criteria for assessing the standard of data and statistics. The framework outlines the eight quality dimension evaluations of the collected data, quality criteria for assessing the statistics, self-assessment standards for data producers to evaluate their own products, and the prerequisite parameters that impact data quality.

Since the 2014/15 R&D Survey, tables have been included to assess the R&D activities of state-owned enterprises.

From the 2016/17 R&D Survey onward, the master's student category has been split into two types: students doing a research master's degree and those doing a master's degree with coursework and a dissertation component. Further, non-South African 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 the 2022/23 survey and the preceding nine years, from 2013/14. The survey methodology is described in section D, and the government/science council/not-for-profit sector questionnaire for the 2022/23 R&D Survey is reproduced in section F.

B. KEY FINDINGS FOR 2022/23

Gross domestic expenditure on R&D increased in real terms

In 2015 prices, GERD grew by a reassuring 2.1% year-on-year in 2022/23, from R27.712 billion in 2021/22 to R28.282 billion in 2022/23. However, GERD as a percentage of gross domestic product (GDP) was 0.61% in 2022/23, which is unchanged from 2021/22.

The R&D survey incorporates revisions of GDP from Statistics South Africa (Stats SA, 2024), updating the headline GERD/GDP indicator with the latest revised GDP series.

Table B.1 summarises key R&D indicators for the 2020/21, 2021/22, and 2022/23 reference periods.

Table B.1: Summary of key statistics and indicators (2020/21 to 2022/23)

Key indicator	2020/21	2021/22	2022/23
Expenditure on R&D (Rm)			
Gross domestic expenditure on R&D (GERD)	33 541	38 186	40 918
<i>Business enterprise expenditure on R&D (BERD)</i>	10 047	13 527	14 507
<i>Not-for-profit expenditure on R&D</i>	1 568	1 600	1 770
<i>Government expenditure on R&D (GOVERD)</i>	2 238	2 472	2 720
<i>Science council expenditure on R&D</i>	5 902	6 354	7 023
<i>Higher education expenditure on R&D (HERD)</i>	13 786	14 232	14 898
Gross domestic expenditure on R&D in constant 2015 prices	25 965	27 756	28 282
Funding sources (Rm)			
Government-funded R&D (includes science council and university own funds)	18 872	20 049	20 664
Business-funded R&D	9 034	11 081	11 754
Foreign funding of R&D	4 462	5 539	7 060
<i>Foreign funding of BERD</i>	978	2 003	2 347
<i>Foreign funding of NPO R&D</i>	1 018	845	1 166
<i>Foreign funding of GOVERD</i>	56	55	73
<i>Foreign funding of SCI R&D</i>	433	629	884
<i>Foreign funding of HERD</i>	1 977	2 006	2 591
R&D personnel			
Total R&D personnel (**FTE)	42 925.9	44 355.4	44 420.2
Total researchers (**FTE)	27 697.6	27 763.3	27 520.3
Total researchers (headcount)	61 406	63 122	61 547
Female researchers (headcount)	28 597	29 658	29 303
Indicators computed from R&D Survey			
GERD as % of GDP	0.60	0.61	0.61
Civil GERD as % of GDP	0.57	0.59	0.58
BERD as % of GERD	30.0	35.4	35.5
Basic research (Rm)	9 856	11 148	11 528
Total R&D personnel (**FTE) per 1 000 in total employment	2.9	3.0	2.7
Total researchers# (**FTE) per 1 000 in total employment	1.8	1.9	1.7
Female researcher# headcount as % of total researcher headcount	46.6	47.0	47.6
Indicators obtained from external data sources			
GDP level at current prices (Rm)	5 562 760	6 220 152	6 655 524
GDP (%)	-6.2	5.0	1.9
SA employment ('000)	14 995	14 914	16 192

**FTE: Full-time equivalent

Highlights of the 2022/23 R&D Survey

South Africa's economy grew in 2022/23

South Africa's real growth in GERD of 2.1% was comparable to the growth in domestic product of 1.9% in 2022 (Stats SA, 2024).

Business sector R&D expenditure drove an increase in GERD

Total nominal GERD increased by R2.732 billion to R40.918 billion. As in 2021/22, the business sector was the primary contributor to the nominal increase, contributing R980 million (Table C.1). Further significant contributions were from the science councils (R669 million) and higher education (R665 million) sectors (Table C.1).

Foreign funding is trending upward

Government-funded R&D amounted to R20.664 billion (50.5%), while business-funded R&D totalled R11.754 billion (28.7%), and foreign-funded R&D reached R7.060 billion (17.3%) (Table C.20). The largest increase in funding for 2022/23 came from foreign sources, contributing R1.521 billion more than 2021/22 (Table C.19). Foreign investment has generally maintained an upward trend over the past decade, with the majority directed to the higher education and business sectors.

Business sector increases came from the manufacturing and mining and quarrying sectors

The increase in business sector R&D expenditure of R980 million was primarily driven by higher spending in the manufacturing sector (R480 million) and the mining and quarrying sector (R433 million).

The financial intermediation, real estate, and business services sectors, along with the manufacturing sector, continue to account for the majority of R&D expenditure, contributing 43.9% (R6.373 billion) and 31.2% (R4.530 billion) of total expenditure, respectively (Tables C.50 and C.51). The largest individual contributor to manufacturing R&D expenditure was the subsector involved in the manufacture of refined petroleum, coke, and nuclear fuel; chemicals and chemical products (including pharmaceuticals); and rubber and plastic products, which contributed R1.735 billion (12.0%) in 2022/23.

Applied research remained the most prevalent

Applied research, which remained the most prevalent type of research, was spread out across sectors, and accounted for half of all R&D activity, totalling R20.449 billion in 2022/23 (Table C.5). Expenditure on basic research totalled R11.528 billion, with the majority (64.4%) conducted within the higher education sector. In comparison to basic research, expenditure on experimental development was lower, at R8.941 billion, with most (51.8%) carried out in the business sector.

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

Gauteng remained the leader in research and development activity in South Africa, contributing 39.0% (R15.963 billion) to gross domestic expenditure on R&D (GERD) in 2022/23. However, this reflects a decrease of 2.1 percentage points from a 41.1% (R15.690 billion) contribution in 2021/22, indicating a slowing in the province's growth. Mpumalanga, the province contributing the least to GERD, saw a reduction in expenditure by R154 million in 2022/23 (Table C.17).

Social sciences and medical and health sciences remain the largest research areas

The largest share of R&D expenditure in 2022/23 was in the medical and health sciences, accounting for 24.4% (R10.001 billion) of total R&D, followed by the social sciences at 16.5%. However, the social sciences, which showed stagnating growth in recent years, began to decline in 2022/23. Other significant areas of research include the engineering sciences at 12.3% (R5.018 billion), information, computer, and communication technology sciences at 12.2% (R4.982 billion), and agricultural sciences at 8.0% (R3.268 billion). Notably, South Africa allocates the lowest proportion of GERD to marine sciences, amounting to R174 million (0.4%) (Table C.13, C.14).

R&D in priority policy areas showed mixed results

Biotechnology and nanotechnology, as convergent technologies, followed similar growth trajectories over a ten-year span (Table C.9), both generally trending upward. The two primary areas of national focus—communicable diseases (tuberculosis, HIV/AIDS, malaria) and environment-related research—experienced nominal increases of R964 million (19.1%) and R132 million (3.1%), respectively (Table C.11). In contrast, all other research areas of policy interest experienced declines in R&D expenditure, with the most significant decrease occurring in new materials research, amounting to R444 million.

R&D personnel growth was stagnant

R&D personnel went up by 64.8 FTEs (an increase of 0.1%) to 44 420.2 in 2022/23. Researchers accounted for 27 520.3 of R&D personnel (a decrease of 0.9%) year-on-year (Table C.28).

In 2022/23, there were 1.7 full-time equivalent researchers employed for every 1 000 R&D workers, a decrease from the 1.9 reported in 2021/22 (Table B.1). The ratio of female researchers as a percentage of total researchers rose by 0.6 percentage points to 47.6%.

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 <https://hsrc.ac.za/about-cestii/accessing-cestii-data/>

C.1. General survey results

C.1.1. Expenditure on research and experimental development

Table C.1: R&D expenditure by sector (2013/14 to 2022/23)

Year	GERD R'000	Government R'000	Science councils R'000	Higher education R'000	Business R'000	Not-for-profit R'000
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
2021/22	38 185 599	2 472 434	6 354 298	14 232 128	13 527 182	1 599 557
2022/23	40 917 649	2 719 866	7 023 307	14 897 549	14 506 774	1 770 153

Table C.2: R&D expenditure by sector, constant 2015 Rand values (2013/14 to 2022/23)

Year	GERD R'000	Government R'000	Science councils R'000	Higher education R'000	Business R'000	Not-for-profit R'000
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	31 356 025	1 895 331	4 640 571	11 237 782	12 315 872	1 266 470
2019/20	28 099 791	1 542 943	5 050 700	11 553 644	8 722 484	1 230 020
2020/21	25 965 298	1 732 136	4 569 226	10 671 930	7 777 935	1 214 071
2021/22	27 756 358	1 797 164	4 618 814	10 345 053	9 832 641	1 162 686
2022/23	28 282 292	1 879 972	4 854 512	10 297 191	10 027 087	1 223 531

Table C.3: R&D percentage expenditure composition by sector (2013/14 to 2022/23)

Year	Government	Science councils	Higher education	Business	Not-for-profit
	%	%	%	%	%
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
2021/22	6.5	16.6	37.3	35.4	4.2
2022/23	6.6	17.2	36.4	35.5	4.3

Table C.4: R&D expenditure as a percentage of GDP by sector (2013/14 to 2022/23)

Year	GERD/GDP	Government	Science councils	Higher education	Business	Not-for-profit
	%	%	%	%	%	%
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	0.61	0.03	0.11	0.25	0.19	0.03
2020/21	0.60	0.04	0.11	0.25	0.18	0.03
2021/22	0.61	0.04	0.10	0.23	0.22	0.03
2022/23	0.61	0.04	0.11	0.22	0.22	0.03

Table C.5: R&D expenditure by type of research (2013/14 to 2022/23)

Year	GERD	Basic research	Applied research	Experimental development
	R'000	R'000	R'000	R'000
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
2021/22	38 185 599	11 148 327	18 380 000	8 657 271
2022/23	40 917 649	11 527 937	20 449 158	8 940 554

Table C.6: Proportional R&D expenditure by type of research (2013/14 to 2022/23)

Year	Basic research		Applied research		Experimental development	
	%		%		%	
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
2021/22		29.2		48.1		22.7
2022/23		28.2		50.0		21.9

Table C.7: R&D expenditure by accounting category (2013/14 to 2022/23)

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 postgraduate 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
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
2021/22	38 185 599	800 666	2 426 402	377 722	2 804 124	3 604 791	17 638 424	1 989 659	14 952 725	34 580 808
2022/23	40 917 649	858 386	2 164 191	486 651	2 650 842	3 509 228	18 223 464	2 048 469	17 136 488	37 408 421

*Includes specific categories of R&D personnel costs for 2017/18 to 2022/23.

#Capitalised computer software collected from 2019/20.

Table C.8: Proportional R&D expenditure by accounting category (2013/14 to 2022/23)

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 postgraduate students	Other current expenditure*	Subtotal: current expenditure	
	%	%	%	%	%	%	%	%	%	
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	
2021/22	2.1	7.3	1.0	7.3	9.4	46.2	5.2	39.2	90.6	
2022/23	2.1	5.3	1.2	6.5	8.6	44.5	5.0	41.9	91.4	

*Includes specific categories of R&D personnel costs for 2017/18 to 2022/23.

#Capitalised computer software collected from 2019/20.

Table C.9: Expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Year	GERD	Biotechnology	Nanotechnology
	R'000	R'000	R'000
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
2021/22	38 185 599	2 985 191	1 284 063
2022/23	40 917 649	3 316 372	1 347 891

Table C.10: Proportional expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Year	Biotechnology	Nanotechnology
	%	%
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
2021/22	7.8	3.4
2022/23	8.1	3.3

Table C.11: R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Year	GERD	Open source software	Tuberculosis, HIV/AIDS, malaria	Environment / environment-related	New materials	Space science
	R'000	R'000	R'000	R'000	R'000	R'000
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
2021/22	38 185 599	860 999	5 056 305	4 263 513	1 477 114	1 654 313
2022/23	40 917 649	790 802	6 019 989	4 396 010	1 033 040	1 273 205

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 (2013/14 to 2022/23)

Year	Open source software	Tuberculosis, HIV/AIDS, malaria	Environment / environment-related	New materials	Space science
	%	%	%	%	%
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
2021/22	2.3	13.2	11.2	3.9	4.3
2022/23	1.9	14.7	10.7	2.5	3.1

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 (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	20 587 093	23 687 304	25 562 694	27 253 955	28 666 760	27 582 242	27 590 791	25 894 833	30 105 115	33 072 629
Mathematical sciences	627 017	636 084	646 870	713 360	879 045	934 136	969 234	799 796	888 597	912 662
Physical sciences	379 813	582 267	769 739	876 009	1 070 851	930 033	973 726	911 291	834 297	974 388
Chemical sciences	1 305 139	1 299 969	1 491 410	1 761 693	1 668 359	1 685 031	1 460 763	1 127 071	1 231 637	1 458 920
Earth sciences	498 427	690 040	635 291	780 402	766 556	826 869	1 020 560	1 061 388	1 143 310	1 282 548
Information, computer and communication technologies	1 994 502	2 946 625	3 877 852	4 494 987	4 006 992	3 636 363	3 560 762	3 640 261	5 007 507	4 981 582
Applied sciences and technologies	2 164 025	1 555 897	1 525 646	1 585 106	1 628 489	1 537 213	1 362 852	1 367 857	1 545 204	1 489 934
Engineering sciences	4 315 051	5 485 812	5 444 740	4 611 038	5 068 338	4 735 131	4 627 317	4 332 527	4 462 856	5 018 357
Biological sciences	1 578 516	1 398 611	1 452 763	1 416 454	1 562 103	1 579 782	1 685 936	1 530 697	1 682 135	1 777 658
Agricultural sciences	2 196 122	2 656 038	2 573 509	2 741 962	2 999 821	3 051 678	3 119 335	2 654 666	2 942 151	3 268 295
Medical and health sciences	4 668 417	5 459 721	6 389 455	6 868 131	7 540 190	7 793 148	7 407 626	7 404 019	8 717 753	10 000 846
Environmental sciences	611 007	533 065	375 455	992 281	1 125 709	435 578	602 065	440 186	701 600	799 140
Material sciences	192 199	368 315	299 069	287 507	206 687	190 551	545 685	328 498	735 472	934 561
Marine sciences	56 857	74 858	80 897	125 024	143 621	246 728	254 931	296 576	212 597	173 739
Division 2: Social sciences and humanities	5 073 480	5 657 674	6 773 985	8 439 018	10 057 830	9 201 726	6 894 071	7 646 499	8 080 484	7 845 020
Social sciences	4 489 054	5 000 339	6 043 806	7 495 167	9 168 767	8 238 808	5 836 521	6 597 460	7 040 864	6 759 856
Humanities	584 426	657 335	730 179	943 851	889 064	962 918	1 057 550	1 049 039	1 039 620	1 085 163
Total	25 660 573	29 344 977	32 336 679	35 692 973	38 724 590	36 783 968	34 484 862	33 541 332	38 185 599	40 917 649

Table C.14: Proportional R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	80.2	80.7	79.1	76.4	74.0	75.0	80.0	77.2	78.8	80.8
Mathematical sciences	2.4	2.2	2.0	2.0	2.3	2.5	2.8	2.4	2.3	2.2
Physical sciences	1.5	2.0	2.4	2.5	2.8	2.5	2.8	2.7	2.2	2.4
Chemical sciences	5.1	4.4	4.6	4.9	4.3	4.6	4.2	3.4	3.2	3.6
Earth sciences	1.9	2.4	2.0	2.2	2.0	2.2	3.0	3.2	3.0	3.1
Information, computer and communication technologies	7.8	10.0	12.0	12.6	10.3	9.9	10.3	10.9	13.1	12.2
Applied sciences and technologies	8.4	5.3	4.7	4.4	4.2	4.2	4.0	4.1	4.0	3.6
Engineering sciences	16.8	18.7	16.8	12.9	13.1	12.9	13.4	12.9	11.7	12.3
Biological sciences	6.2	4.8	4.5	4.0	4.0	4.3	4.9	4.6	4.4	4.3
Agricultural sciences	8.6	9.1	8.0	7.7	7.7	8.3	9.0	7.9	7.7	8.0
Medical and health sciences	18.2	18.6	19.8	19.2	19.5	21.2	21.5	22.1	22.8	24.4
Environmental sciences	2.4	1.8	1.2	2.8	2.9	1.2	1.7	1.3	1.8	2.0
Material sciences	0.7	1.3	0.9	0.8	0.5	0.5	1.6	1.0	1.9	2.3
Marine sciences	0.2	0.3	0.3	0.4	0.4	0.7	0.7	0.9	0.6	0.4
Division 2: Social sciences and humanities	19.8	19.3	20.9	23.6	26.0	25.0	20.0	22.8	21.2	19.2
Social sciences	17.5	17.0	18.7	21.0	23.7	22.4	16.9	19.7	18.4	16.5
Humanities	2.3	2.2	2.3	2.6	2.3	2.6	3.1	3.1	2.7	2.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.15: R&D expenditure by socio-economic objectives (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	1 386 428	1 826 784	1 814 789	1 629 650	2 124 098	1 571 796	1 747 323	1 594 793	1 672 596	2 054 509
Defence	1 386 428	1 826 784	1 814 789	1 629 650	2 124 098	1 571 796	1 747 323	1 594 793	1 672 596	2 054 509
Division 2: Economic development	14 166 615	15 359 534	16 644 668	18 357 187	19 528 226	17 902 898	14 919 363	14 081 873	16 420 497	17 195 685
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	1 739 038	1 364 018	1 426 609	1 920 246	1 701 055	1 746 483	1 879 578	1 379 102	1 555 544	1 932 734
Animal production and animal primary products	803 403	694 423	655 059	746 579	794 314	748 145	764 501	707 826	778 689	798 137

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Mineral resources (excluding energy)	1 351 239	1 779 068	1 759 268	1 328 413	1 256 826	1 321 249	1 259 257	1 401 816	1 518 802	1 876 008
Energy resources	288 314	197 072	178 434	556 147	546 831	605 311	265 828	303 671	451 002	432 031
Energy supply	590 980	778 805	636 596	730 849	853 099	927 403	1 008 795	932 553	978 400	877 669
Manufacturing	2 608 207	2 619 974	2 665 871	2 543 694	2 628 725	2 495 718	2 440 795	1 924 862	2 391 995	2 488 613
Construction	450 907	270 226	229 284	300 582	318 837	363 788	282 651	305 468	393 604	446 697
Transport	1 115 027	998 136	1 115 349	1 195 426	1 247 963	1 099 974	712 749	512 148	715 539	587 553
Information and communication services	1 124 614	1 661 660	2 347 021	2 694 355	2 129 740	1 768 149	1 559 066	1 522 190	2 134 145	2 329 765
Commercial services	2 443 529	2 701 523	2 789 611	3 134 235	4 448 419	3 492 749	1 269 391	1 532 397	1 581 135	1 186 092
Economic framework	689 386	1 331 844	1 797 751	1 997 933	2 343 788	2 147 239	2 248 020	2 262 348	2 589 298	2 847 726
Natural resources	961 971	962 787	1 043 816	1 208 728	1 258 630	1 186 690	1 228 735	1 297 494	1 332 345	1 392 660
Division 3: Society	4 585 825	5 885 267	6 815 987	7 558 386	8 517 207	8 323 617	8 721 748	8 732 871	10 358 127	10 954 001
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	2 859 623	3 638 036	4 154 557	4 733 478	5 118 330	5 675 740	5 128 170	5 397 930	6 281 588	7 001 510
Education and training	882 976	1 346 974	1 603 117	1 307 791	1 398 846	1 344 005	1 594 278	1 566 843	1 629 780	1 657 150
Social development and community services	843 226	900 257	1 058 313	1 517 117	2 000 031	1 303 872	1 999 300	1 768 099	2 446 759	2 295 341
Division 4: Environment	861 976	1 414 524	1 475 053	2 015 344	2 092 706	2 166 332	1 953 590	2 147 652	2 156 591	2 503 764
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	388 688	828 768	853 071	969 476	1 016 592	964 261	1 029 870	1 180 361	1 060 660	1 388 753
Environmental aspects of development	226 299	288 823	304 008	361 391	357 509	455 915	425 587	419 346	504 860	546 831
Environmental and other aspects	246 989	296 934	317 975	684 478	718 604	746 156	498 133	547 945	591 071	568 180
Division 5: Advancement of knowledge	4 659 729	4 858 868	5 586 182	6 132 406	6 462 352	6 819 325	7 142 838	6 984 142	7 577 788	8 209 691
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	3 407 325	3 445 842	3 891 834	4 424 024	4 771 950	5 022 207	5 258 091	5 075 189	5 661 980	6 210 744
Social sciences and humanities	1 252 404	1 413 026	1 694 348	1 708 382	1 690 403	1 797 118	1 884 747	1 908 953	1 915 809	1 998 947
Total	25 660 573	29 344 977	32 336 679	35 692 973	38 724 590	36 783 968	34 484 862	33 541 332	38 185 599	40 917 649

Table C.16: Proportional R&D expenditure by socio-economic objectives (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence										
Defence	5.4	6.2	5.6	4.6	5.5	4.3	5.1	4.8	4.4	5.0
Division 2: Economic development										
Economic development unclassified	55.2	52.3	51.5	51.4	50.4	48.7	43.3	42.0	43.0	42.0
Plant production and plant primary products	6.8	4.6	4.4	5.4	4.4	4.7	5.5	4.1	4.1	4.7
Animal production and animal primary products	3.1	2.4	2.0	2.1	2.1	2.0	2.2	2.1	2.0	2.0
Mineral resources (excluding energy)	5.3	6.1	5.4	3.7	3.2	3.6	3.7	4.2	4.0	4.6
Energy resources	1.1	0.7	0.6	1.6	1.4	1.6	0.8	0.9	1.2	1.1
Energy supply	2.3	2.7	2.0	2.0	2.2	2.5	2.9	2.8	2.6	2.1
Manufacturing	10.2	8.9	8.2	7.1	6.8	6.8	7.1	5.7	6.3	6.1
Construction	1.8	0.9	0.7	0.8	0.8	1.0	0.8	0.9	1.0	1.1
Transport	4.3	3.4	3.4	3.3	3.2	3.0	2.1	1.5	1.9	1.4
Information and communication services	4.4	5.7	7.3	7.5	5.5	4.8	4.5	4.5	5.6	5.7
Commercial services	9.5	9.2	8.6	8.8	11.5	9.5	3.7	4.6	4.1	2.9
Economic framework	2.7	4.5	5.6	5.6	6.1	5.8	6.5	6.7	6.8	7.0
Natural resources	3.7	3.3	3.2	3.4	3.3	3.2	3.6	3.9	3.5	3.4
Division 3: Society										
Society unclassified	17.9	20.1	21.1	21.2	22.0	22.6	25.3	26.0	27.1	26.8
Health	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Education and training	11.1	12.4	12.8	13.3	13.2	15.4	14.9	16.1	16.5	17.1
Social development and community services	3.4	4.6	5.0	3.7	3.6	3.7	4.6	4.7	4.3	4.0
Division 4: Environment										
Environment unclassified	3.4	4.8	4.6	5.6	5.4	5.9	5.7	6.4	5.6	6.1
Environmental knowledge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental aspects of development	1.5	2.8	2.6	2.7	2.6	2.6	3.0	3.5	2.8	3.4
Environmental and other aspects	0.9	1.0	0.9	1.0	0.9	1.2	1.2	1.3	1.3	1.3

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 5: Advancement of knowledge	18.2	16.6	17.3	17.2	16.7	18.5	20.7	20.8	19.8	20.1
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	13.3	11.7	12.0	12.4	12.3	13.7	15.2	15.1	14.8	15.2
Social sciences and humanities	4.9	4.8	5.2	4.8	4.4	4.9	5.5	5.7	5.0	4.9
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 (2013/14 to 2022/23)

Year	GERD	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	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
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
2021/22	38 185 599	2 010 947	1 732 973	15 689 758	3 716 120	1 016 496	1 263 082	1 086 102	1 499 418	10 170 702
2022/23	40 917 649	2 153 716	2 055 196	15 963 272	4 090 416	1 257 112	1 108 706	1 325 497	1 811 975	11 151 759

Table C.18: Proportional R&D expenditure by province (2013/14 to 2022/23)

Year	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	Northern Cape	North West	Western Cape
	%	%	%	%	%	%	%	%	%
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
2021/22	5.3	4.5	41.1	9.7	2.7	3.3	2.8	3.9	26.6
2022/23	5.3	5.0	39.0	10.0	3.1	2.7	3.2	4.4	27.3

C.1.2. Source of R&D funds

Table C.19: Funding for R&D by source (2013/14 to 2022/23)

Year	Total funds	Government*	Business	Other South African**	Foreign
	R'000	R'000	R'000	R'000	R'000
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
2021/22	38 185 599	20 049 283	11 080 806	1 516 441	5 539 069
2022/23	40 917 649	20 664 276	11 754 450	1 439 107	7 059 815

*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 (2013/14 to 2022/23)

Year	Government*	Business	Other South African**	Foreign
	%	%	%	%
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
2021/22	52.5	29.0	4.0	14.5
2022/23	50.5	28.7	3.5	17.3

*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 (2022/23)

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	22 128 705	54.1	1 951 035	71.7	820 155	11.7	8 328 159	55.9	10 748 811	74.1	280 545	15.8
Internal sources	22 128 705	54.1	1 951 035	71.7	820 155	11.7	8 328 159	55.9	10 748 811	74.1	280 545	15.8
Government	9 564 927	23.4	622 676	22.9	4 995 408	71.1	3 144 638	21.1	622 555	4.3	179 651	10.1
Grants	4 188 292	10.2	580 566	21.3	3 082 562	43.9	N/A	N/A	424 723	2.9	100 442	5.7
Contracts	2 231 997	5.5	42 110	1.5	1 912 846	27.2	N/A	N/A	197 832	1.4	79 209	4.5
All other government source	3 144 638	7.7	N/A	N/A	N/A	N/A	3 144 638	21.1	N/A	N/A	N/A	N/A
National, provincial and local government	659 896	1.6	N/A	N/A	N/A	N/A	643 279	4.3	N/A	N/A	N/A	N/A
Government research institutes	89 036	0.2	N/A	N/A	N/A	N/A	109 856	0.7	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.)	2 345 875	5.7	N/A	N/A	N/A	N/A	2 139 547	14.4	N/A	N/A	N/A	N/A
Science councils	233 877	0.6	N/A	N/A	N/A	N/A	251 956	1.7	N/A	N/A	N/A	N/A
Business	1 005 639	2.5	10 397	0.4	291 424	4.1	424 463	2.8	175 668	1.2	103 687	5.9
Local business	1 005 639	2.5	10 397	0.4	291 424	4.1	424 463	2.8	175 668	1.2	103 687	5.9
Other SA sources	1 158 562	2.8	62 793	2.3	32 788	0.5	409 161	2.7	613 207	4.2	40 613	2.3
Higher education	189 669	0.5	38 130	1.4	24 154	0.3	109 744	0.7	11 000	0.1	6 641	0.4
Not-for-profit	776 615	1.9	2 445	0.1	8 634	0.1	150 315	1.0	595 502	4.1	19 719	1.1
Individual donations	192 278	0.5	22 218	0.8	0	0.0	149 102	1.0	6 705	0.0	14 253	0.8
Foreign	7 059 815	17.3	72 964	2.7	883 533	12.6	2 591 128	17.4	2 346 533	16.2	1 165 657	65.9
All sources*	7 059 815	17.3	72 964	2.7	883 533	12.6	2 591 128	17.4	2 346 533	16.2	1 165 657	65.9
Total	40 917 649	100.0	2 719 866	100.0	7 023 307	100.0	14 897 549	100.0	14 506 774	100.0	1 770 153	100.0

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 (2013/14 to 2022/23)

Year	Total	Government*	Science councils*	Higher education*	Business	Not-for-profit
	R'000	R'000	R'000	R'000	R'000	R'000
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
2021/22	20 049 283	2 348 152	5 392 693	11 353 867	773 672	180 899
2022/23	20 664 276	2 573 711	5 815 562	11 472 797	622 555	179 651

*Includes science council and university own funds.

Table C.23: Proportional government-funded R&D by sector (2013/14 to 2022/23)

Year	Government*	Science councils*	Higher education*	Business	Not-for-profit
	%	%	%	%	%
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
2021/22	11.7	26.9	56.6	3.9	0.9
2022/23	12.5	28.1	55.5	3.0	0.9

*Includes science council and university own funds.

Table C.24: Business-funded R&D by sector (2013/14 to 2022/23)

Year	Total	Government	Science councils	Higher education	Business	Not-for-profit
	R'000	R'000	R'000	R'000	R'000	R'000
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
2021/22	11 080 806	10 296	238 561	564 157	10 176 993	90 799
2022/23	11 754 450	10 397	291 424	424 463	10 924 479	103 687

Table C.25: Proportional business-funded R&D by sector (2013/14 to 2022/23)

Year	Government	Science councils	Higher education	Business	Not-for-profit
	%	%	%	%	%
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
2021/22	0.1	2.2	5.1	91.8	0.8
2022/23	0.1	2.5	3.6	92.9	0.9

Table C.26: Foreign-funded R&D by sector (2013/14 to 2022/23)

Year	Total	Government	Science councils	Higher education	Business	Not-for-profit
	R'000	R'000	R'000	R'000	R'000	R'000
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
2021/22	5 539 069	55 349	629 492	2 006 272	2 002 607	845 349
2022/23	7 059 815	72 964	883 533	2 591 128	2 346 533	1 165 657

Table C.27: Proportional foreign-funded R&D by sector (2013/14 to 2022/23)

Year	Government	Science councils	Higher education	Business	Not-for-profit
	%	%	%	%	%
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
2021/22	1.0	11.4	36.2	36.2	15.3
2022/23	1.0	12.5	36.7	33.2	16.5

C.1.3. R&D personnel

Table C.28: R&D personnel headcount and full-time equivalents by occupation (2013/14 to 2022/23)

Year	R&D personnel			Researchers			Technicians		Other R&D personnel	
	Headcount*	FTEs	FTEs per 1000 in total employment	Headcount*	FTEs	FTEs per 1000 in total employment	Headcount	FTEs per 1000 in total employment	Headcount	FTEs per 1000 in total employment
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	41 856.2	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
2021/22	85 601	44 355.4	3.0	63 122	27 763.3	1.9	10 221	7 657.1	12 258	8 935.0
2022/23	84 275	44 420.2	2.7	61 547	27 520.3	1.7	9 619	7 193.4	13 109	9 706.6

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

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

Table C.29: R&D personnel headcount and full-time equivalents by occupation and gender including and excluding students (2020/21 to 2022/23)

Year	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
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
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
2021/22							
Researchers*	63 122	33 464	29 658	27 763.3	14 799.6	12 963.7	44.0
Technicians directly supporting R&D	10 221	5 434	4 787	7 657.1	3 789.3	3 867.9	74.9
Other personnel directly supporting R&D	12 258	4 823	7 435	8 935.0	3 500.4	5 434.7	72.9
Total	85 601	43 721	41 880	44 355.4	22 089.2	22 266.2	51.8
Researchers**	35 097	18 770	16 327	11 798.1	6 317.6	5 480.5	33.6
Technicians directly supporting R&D	10 221	5 434	4 787	7 657.1	3 789.3	3 867.9	74.9
Other personnel directly supporting R&D	12 258	4 823	7 435	8 935.0	3 500.4	5 434.7	72.9
Total	57 576	29 027	28 549	28 390.2	13 607.3	14 783.0	49.3
2022/23							
Researchers*	61 547	32 244	29 303	27 520.3	14 390.6	13 129.7	44.7
Technicians directly supporting R&D	9 619	5 031	4 588	7 193.4	3 519.2	3 674.1	70.5
Other personnel directly supporting R&D	13 109	5 073	8 036	9 706.6	3 762.5	5 944.1	74.0
Total	84 275	42 348	41 927	44 420.2	21 672.4	22 747.9	52.3
Researchers**	34 136	18 073	16 063	11 782.1	6 194.8	5 587.3	34.5
Technicians directly supporting R&D	9 619	5 031	4 588	7 193.4	3 519.2	3 674.1	70.5
Other personnel directly supporting R&D	13 109	5 073	8 036	9 706.6	3 762.5	5 944.1	74.0
Total	56 864	28 177	28 687	28 682.0	13 476.6	15 205.5	49.9

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

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

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.30: R&D personnel headcount by sector (2013/14 to 2022/23)

Year	Total R&D personnel headcount	Government	Science councils	Higher education	Business	Not-for-profit
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
2021/22	85 601	3 314	4 190	61 159	15 094	1 844
2022/23	84 275	3 374	4 117	59 511	15 364	1 909

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

Researchers includes specific categories of R&D for 2016/17 onwards.

Headcount includes non-SA R&D personnel (from 2016/17) that are not South African 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 (2013/14 to 2022/23)

Year	Total R&D personnel headcount	Government	Science councils	Higher education	Business	Not-for-profit
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	25 109.4	9 300.8	1 710.1
2020/21	42 925.9	2 060.4	3 606.0	24 843.1	10 860.3	1 556.1
2021/22	44 355.4	2 095.5	3 838.5	24 789.8	12 054.6	1 577.1
2022/23	44 420.2	2 100.2	3 784.1	24 406.1	12 507.7	1 622.1

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

From 2016/17 headcounts include personnel who are not from South Africa, but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.32: Researcher headcount by sector (2013/14 to 2022/23)

Year	Total researchers (headcount)	Government	Science councils	Higher education	Business	Not-for-profit
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
2021/22	63 122	1 789	1 735	54 784	4 370	444
2022/23	61 547	1 872	1 749	53 059	4 395	472

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

From 2016/17 headcount includes personnel not from South Africa, but undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.33: Researcher headcount by gender (2013/14 to 2022/23)

Year	Total researchers (headcount)*	Male	Female
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
2021/22	35 097	18 770	16 327
2022/23	34 136	18 073	16 063

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

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel 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 headcount by race (2013/14 to 2022/23)

Year	Total researchers (headcount)*	African	Coloured	Indian/Asian	White	Non-SA
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
2021/22	35 097	11 880	2 066	3 285	13 091	4 775
2022/23	34 136	12 405	1 933	3 160	12 057	4 581

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

Headcount includes non-SA R&D personnel from 2016/17, classified as 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.35: R&D personnel headcount (including doctoral and excluding post-doctoral students) in (2022/23)

Occupation and qualification	Total R&D personnel (headcount)	Subtotal		African		Coloured		Indian/Asian		White		Non-SA	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Researchers*	61 547	32 244	29 303	11 346	11 045	1 352	1 885	2 072	2 497	8 125	8 641	9 349	5 235
Doctoral degree or equivalent	43 609	23 316	20 293	7 527	6 846	926	1 239	1 245	1 519	4 955	5 829	8 663	4 860
Master's, honours, bachelor or equivalent	15 499	7 693	7 806	3 416	3 655	342	548	741	853	2 645	2 449	549	301
Diplomas	2 439	1 235	1 204	403	544	84	98	86	125	525	363	137	74
Technicians directly supporting R&D	9 619	5 031	4 588	2 274	2 412	622	428	295	319	1 674	1 327	166	102
Doctoral degree or equivalent	329	161	168	36	38	8	15	5	21	72	77	40	17
Master's, honours, bachelor or equivalent	4 487	2 226	2 261	1 011	1 091	183	212	157	201	787	694	88	63
Diplomas	4 803	2 644	2 159	1 227	1 283	431	201	133	97	815	556	38	22
Other personnel directly supporting R&D	13 109	5 073	8 036	3 122	5 092	593	1 055	218	317	936	1 363	204	209
Doctoral degree or equivalent	599	296	303	119	80	16	40	18	33	94	113	49	37
Master's, honours, bachelor or equivalent	3 575	1 398	2 177	673	1 005	127	290	109	157	400	624	89	101
Diplomas	8 935	3 379	5 556	2 330	4 007	450	725	91	127	442	626	66	71
Total	84 275	42 348	41 927	16 742	18 549	2 567	3 368	2 585	3 133	10 735	11 331	9 719	5 546

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

Occupation and qualification	Total R&D personnel (headcount)	Subtotal		African		Coloured		Indian/Asian		White		Non-SA	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Researchers**	34 136	18 073	16 063	6 317	6 088	824	1 109	1 450	1 710	6 206	5 851	3 276	1 305
Doctoral degree or equivalent	16 198	9 145	7 053	2 498	1 889	398	463	623	732	3 036	3 039	2 590	930
Master's, honours, bachelor or equivalent	15 499	7 693	7 806	3 416	3 655	342	548	741	853	2 645	2 449	549	301
Diplomas	2 439	1 235	1 204	403	544	84	98	86	125	525	363	137	74
Technicians directly supporting R&D	9 619	5 031	4 588	2 274	2 412	622	428	295	319	1 674	1 327	166	102
Other personnel directly supporting R&D	13 109	5 073	8 036	3 122	5 092	593	1 055	218	317	936	1 363	204	209
Total	56 864	28 177	28 687	11 713	13 592	2 039	2 592	1 963	2 346	8 816	8 541	3 646	1 616

C.2. Sector tables

C.2.1. Business sector

Table C.36: Business sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	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	2021/22 R'000	2022/23 R'000
Basic research	968 504	845 527	906 730	909 278	1 021 152	948 319	758 971	788 740	1 567 352	1 358 442
Applied research	6 087 791	7 541 596	7 492 229	8 389 888	10 551 512	9 819 344	6 218 563	6 014 078	7 834 505	8 517 075
Experimental development research	4 726 553	4 903 827	5 416 037	5 482 104	4 286 521	3 680 170	3 726 947	3 244 526	4 125 325	4 631 257
Total	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Table C.37: Proportional business sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2019/20 %	2020/21 %	2021/22 %	2022/23 %
Basic research	8.2	6.4	6.6	6.2	6.4	6.6	7.1	7.9	11.6	9.4
Applied research	51.7	56.7	54.2	56.8	66.5	68.0	58.1	59.9	57.9	58.7
Experimental development research	40.1	36.9	39.2	37.1	27.0	25.5	34.8	32.3	30.5	31.9
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 (2013/14 to 2022/23)

Type of expenditure	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	2021/22 R'000	2022/23 R'000
Capital expenditure	1 132 520	1 397 243	1 289 228	1 727 929	1 421 699	1 545 944	984 728	969 093	1 851 120	1 687 624
Land: buildings & other structures	159 162	117 656	186 396	288 957	270 191	370 231	343 953	183 111	451 832	365 550
Total: Vehicles, plant, machinery, equipment and software	973 358	1 279 587	1 102 833	1 438 972	1 151 508	1 175 713	640 776	785 982	1 399 288	1 322 074
Vehicles, plant, machinery, equipment	973 358	1 279 587	1 102 833	1 438 972	1 151 508	1 175 713	584 324	559 525	1 118 884	977 554
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	56 452	226 457	280 404	344 520
Current expenditure	10 650 328	11 893 708	12 525 767	13 053 341	14 437 485	12 901 890	9 719 752	9 078 252	11 676 062	12 819 150
Labour costs	6 768 527	7 659 365	7 821 865	8 486 640	9 747 037	8 612 310	5 992 573	5 387 961	6 793 891	7 046 654
Other current expenditure	3 881 801	4 234 343	4 703 901	4 566 701	4 690 449	4 289 579	3 727 179	3 690 290	4 882 170	5 772 496
Total	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

*Capitalised computer software collected from 2019/20.

Table C.39: Proportional business sector R&D expenditure by accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Capital expenditure	10.5	9.3	11.7	9.0	10.7	9.2	9.2	9.6	13.7	11.6
Land: buildings & other structures	0.9	1.3	2.0	1.7	2.6	3.2	3.2	1.8	3.3	2.5
Total: Vehicles, plant, machinery, equipment and software	9.6	8.0	9.7	7.3	8.1	6.0	6.0	7.8	10.3	9.1
Vehicles, plant, machinery, equipment	9.6	8.0	9.7	7.3	8.1	5.5	5.5	5.6	8.3	6.7
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	0.5	0.5	2.3	2.1	2.4
Current expenditure	89.5	90.7	88.3	91.0	89.3	90.8	90.8	90.4	86.3	88.4
Labour costs	57.6	56.6	57.4	61.5	59.6	56.0	56.0	53.6	50.2	48.6
Other current expenditure	31.9	34.0	30.9	29.6	29.7	34.8	34.8	36.7	36.1	39.8
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 (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	556 275	578 747	729 299	685 170	721 698	702 168	992 682	901 293	993 533	1 257 517
Nanotechnology	170 479	217 216	134 063	268 320	113 260	155 956	77 163	73 309	102 815	127 105
Total	726 754	795 963	863 362	953 490	834 958	858 124	1 069 845	974 603	1 096 348	1 384 623
Business expenditure on R&D	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Table C.41: Proportional business sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biotechnology	4.7	4.4	5.3	4.6	4.6	4.9	9.3	9.0	7.3	8.7
Nanotechnology	1.4	1.6	1.0	1.8	0.7	1.1	0.7	0.7	0.8	0.9
Total	6.2	6.0	6.2	6.5	5.3	5.9	10.0	9.7	8.1	9.5

Table C.42: Business sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment-related	228 905	176 463	173 356	280 651	377 030	472 759	532 424	591 414	1 008 487	804 676
Open-source software	233 576	241 710	326 856	207 849	193 239	154 894	176 450	219 128	453 683	215 700
New materials	151 890	245 752	224 433	179 108	186 858	268 298	447 596	354 411	569 008	664 568
Tuberculosis, HIV/AIDS, malaria	992 538	1 082 646	1 176 149	1 153 668	1 332 248	1 801 869	1 347 208	1 316 084	1 687 720	2 260 472
Space science	N/A	N/A	N/A	33 099	42 291	47 018	19 990	4 659	498 372	66 746
Total	1 606 909	1 746 571	1 900 794	1 854 375	2 131 666	2 744 839	2 523 667	2 485 695	4 217 269	4 012 161
Business expenditure on R&D	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Space science data collected from 2016/17.

Table C.43: Proportional business sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Environment-related	1.9	1.3	1.3	1.9	2.4	3.3	5.0	5.9	7.5	5.5
Open-source software	2.0	1.8	2.4	1.4	1.2	1.1	1.6	2.2	3.4	1.5
New materials	1.3	1.8	1.6	1.2	1.2	1.9	4.2	3.5	4.2	4.6
Tuberculosis, HIV/AIDS, malaria	8.4	8.1	8.5	7.8	8.4	12.5	12.6	13.1	12.5	15.6
Space science	N/A	N/A	N/A	0.2	0.3	0.3	0.2	0.0	3.7	0.5
Total	13.6	13.1	13.8	12.5	13.4	19.0	23.6	24.7	31.2	27.7

Space science data collected from 2016/17.

Table C.44: Business sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	9 765 859	10 977 250	11 447 693	11 918 539	11 793 445	11 719 001	10 552 496	9 533 861	12 883 090	14 451 444
Mathematical sciences	209 344	211 324	119 900	138 858	188 550	196 143	181 438	184 125	188 752	166 662
Physical sciences	50 708	56 997	35 616	45 816	90 281	87 440	108 895	123 589	78 346	156 312
Chemical sciences	979 760	847 321	972 398	1 153 685	1 154 404	1 102 373	800 201	628 780	714 191	977 837
Earth sciences	109 665	118 539	93 302	104 072	160 745	156 112	285 180	197 020	219 212	217 394
Information, computer and communication technologies	1 610 718	1 908 985	2 572 364	3 111 146	2 584 726	2 295 683	2 074 429	2 118 762	3 442 168	3 022 290
Applied sciences and technologies	808 899	955 119	903 958	915 101	1 143 251	942 480	608 833	539 767	773 565	774 657
Engineering sciences	3 093 088	3 548 019	3 429 786	2 651 327	2 971 162	2 786 664	2 332 755	2 232 226	2 339 006	2 903 433
Biological sciences	213 124	248 838	254 071	250 356	220 193	154 696	175 572	245 176	250 139	245 558

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	593 315	665 703	671 194	686 697	778 583	1 008 216	1 070 593	666 564	742 632	903 056
Medical and health sciences	1 974 213	2 170 317	2 300 587	2 283 200	2 384 920	2 855 116	2 395 653	2 289 175	3 238 019	3 934 739
Environmental sciences	50 909	85 932	21 920	480 612	60 379	69 676	130 311	101 190	295 153	367 824
Material sciences	64 090	154 500	71 967	97 670	56 253	63 653	388 110	206 974	601 417	780 961
Marine sciences	8 026	5 655	630	0	0	750	526	512	489	721
Division 2: Social sciences and humanities										
Social sciences	2 016 989	2 313 701	2 367 302	2 862 731	4 065 740	2 728 832	151 985	513 483	644 092	55 330
Humanities	0	0	0	4 146	0	1 191	0	0	0	0
Total	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Table C.45: Proportional business sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering										
Mathematical sciences	1.8	1.6	0.9	0.9	1.2	1.4	1.7	1.8	1.4	1.1
Physical sciences	0.4	0.4	0.3	0.3	0.6	0.6	1.0	1.2	0.6	1.1
Chemical sciences	8.3	6.4	7.0	7.8	7.3	7.6	7.5	6.3	5.3	6.7
Earth sciences	0.9	0.9	0.7	0.7	1.0	1.1	2.7	2.0	1.6	1.5
Information, computer and communication technologies	13.7	14.4	18.6	21.0	16.3	15.9	19.4	21.1	25.4	20.8
Applied sciences and technologies	6.9	7.2	6.5	6.2	7.2	6.5	5.7	5.4	5.7	5.3
Engineering sciences	26.3	26.7	24.8	17.9	18.7	19.3	21.8	22.2	17.3	20.0
Biological sciences	1.8	1.9	1.8	1.7	1.4	1.1	1.6	2.4	1.8	1.7
Agricultural sciences	5.0	5.0	4.9	4.6	4.9	7.0	10.0	6.6	5.5	6.2
Medical and health sciences	16.8	16.3	16.7	15.4	15.0	19.8	22.4	22.8	23.9	27.1
Environmental sciences	0.4	0.6	0.2	3.3	0.4	0.5	1.2	1.0	2.2	2.5
Material sciences	0.5	1.2	0.5	0.7	0.4	0.4	3.6	2.1	4.4	5.4
Marine sciences	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Division 2: Social sciences and humanities										
Social sciences	17.1	17.4	17.1	19.4	25.6	18.9	1.4	5.1	4.8	0.4
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 (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence										
Defence	1 096 986	1 034 893	937 964	830 331	1 187 443	975 765	985 893	923 205	1 082 978	1 335 553
Division 2: Economic development										
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	454 990	593 610	622 367	1 026 707	628 123	791 508	919 470	529 292	590 356	913 047
Animal production and animal primary products	69 916	74 045	74 267	66 547	41 588	55 615	45 062	50 273	62 704	72 791
Mineral resources (excluding energy)	977 365	1 405 074	1 348 618	947 258	812 439	867 249	787 924	973 275	1 048 406	1 407 422
Energy resources	95 375	100 061	79 210	470 860	431 681	488 026	116 459	209 543	301 461	286 466
Energy supply	349 710	503 222	362 656	461 804	555 067	574 180	674 663	659 620	689 021	553 975
Manufacturing	1 869 926	2 096 271	2 106 255	1 924 020	1 965 446	1 788 564	1 758 500	1 281 713	1 770 822	1 822 868
Construction	125 059	138 237	55 625	54 328	22 942	32 416	22 651	53 209	100 008	135 931
Transport	1 080 427	935 483	1 046 235	1 098 281	1 124 099	1 045 650	630 950	437 619	618 080	486 848
Information and communication services	842 341	1 097 649	1 685 124	2 085 856	1 403 512	1 011 167	690 243	712 864	1 223 477	1 028 818
Commercial services	2 255 642	2 555 783	2 643 503	2 929 445	4 196 652	3 154 500	897 099	1 197 714	1 272 773	879 072
Economic framework	91 464	79 065	273 497	422 742	476 032	302 938	326 180	304 383	639 142	536 783
Natural resources	95 962	84 901	65 312	66 859	72 996	85 409	74 926	62 073	97 468	97 648
Division 3: Society										
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	1 097 446	1 212 844	1 216 127	1 289 142	1 364 830	2 419 773	1 459 043	1 460 434	2 125 198	2 476 032
Education and training	33 913	35 728	33 707	21 076	23 586	16 021	27 515	24 891	32 722	38 524
Social development and community services	171 962	187 298	184 102	188 036	639 326	40 461	620 072	614 724	833 436	1 041 119
Division 4: Environment										
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	43 935	55 885	62 471	45 213	116 313	50 017	57 772	42 158	35 094	53 902
Environmental aspects of development	14 344	38 437	18 915	48 553	52 852	52 754	16 820	32 251	96 362	129 747
Environmental and other aspects	113 468	124 889	115 415	107 410	114 289	105 035	121 070	124 371	201 110	224 429

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 5: Advancement of knowledge	902 617	937 575	883 626	696 800	629 967	590 788	472 168	353 733	706 564	985 799
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	899 840	932 030	880 474	696 770	629 967	590 788	472 168	353 733	706 564	985 799
Social sciences and humanities	2 776	5 545	3 152	30	0	0	0	0	0	0
Total	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Table C.47: Proportional business sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	9.3	7.8	6.8	5.6	7.5	6.8	9.2	9.2	8.0	9.2
Defence	9.3	7.8	6.8	5.6	7.5	6.8	9.2	9.2	8.0	9.2
Division 2: Economic development	70.5	72.7	75.0	78.2	74.0	70.6	64.9	64.4	62.2	56.7
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	3.9	4.5	4.5	6.9	4.0	5.5	8.6	5.3	4.4	6.3
Animal production and animal primary products	0.6	0.6	0.5	0.5	0.3	0.4	0.4	0.5	0.5	0.5
Mineral resources (excluding energy)	8.3	10.6	9.8	6.4	5.1	6.0	7.4	9.7	7.8	9.7
Energy resources	0.8	0.8	0.6	3.2	2.7	3.4	1.1	2.1	2.2	2.0
Energy supply	3.0	3.8	2.6	3.1	3.5	4.0	6.3	6.6	5.1	3.8
Manufacturing	15.9	15.8	15.2	13.0	12.4	12.4	16.4	12.8	13.1	12.6
Construction	1.1	1.0	0.4	0.4	0.1	0.2	0.2	0.5	0.7	0.9
Transport	9.2	7.0	7.6	7.4	7.1	7.2	5.9	4.4	4.6	3.4
Information and communication services	7.1	8.3	12.2	14.1	8.8	7.0	6.4	7.1	9.0	7.1
Commercial services	19.1	19.2	19.1	19.8	26.5	21.8	8.4	11.9	9.4	6.1
Economic framework	0.8	0.6	2.0	2.9	3.0	2.1	3.0	3.0	4.7	3.7
Natural resources	0.8	0.6	0.5	0.5	0.5	0.6	0.7	0.6	0.7	0.7
Division 3: Society	11.1	10.8	10.4	10.1	12.8	17.1	19.7	20.9	22.1	24.5
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	9.3	9.1	8.8	8.7	8.6	16.7	13.6	14.5	15.7	17.1
Education and training	0.3	0.3	0.2	0.1	0.1	0.1	0.3	0.2	0.2	0.3

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Social development and community services	1.5	1.4	1.3	1.3	4.0	0.3	5.8	6.1	6.2	7.2
Division 4: Environment	1.5	1.6	1.4	1.4	1.8	1.4	1.8	2.0	2.5	2.8
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.4	0.4	0.5	0.3	0.7	0.3	0.5	0.4	0.3	0.4
Environmental aspects of development	0.1	0.3	0.1	0.3	0.3	0.4	0.2	0.3	0.7	0.9
Environmental and other aspects	1.0	0.9	0.8	0.7	0.7	0.7	1.1	1.2	1.5	1.5
Division 5: Advancement of knowledge	7.7	7.1	6.4	4.7	4.0	4.1	4.4	3.5	5.2	6.8
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	7.6	7.0	6.4	4.7	4.0	4.1	4.4	3.5	5.2	6.8
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 (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	646 497	608 398	651 533	690 478	707 348	674 516	439 537	214 755	241 315	252 981
Free State	1 374 960	831 575	1 124 042	1 060 177	1 105 873	991 206	694 454	470 355	998 559	1 186 428
Gauteng	5 813 673	7 160 280	7 183 557	7 876 139	8 285 425	7 617 873	5 447 407	5 577 133	6 785 927	6 477 267
KwaZulu-Natal	1 434 084	1 501 659	1 436 737	1 553 130	1 679 718	1 446 281	1 193 914	821 492	1 061 049	1 252 446
Limpopo	140 026	161 331	145 736	171 567	223 014	184 199	78 484	199 637	136 397	393 755
Mpumalanga	301 831	435 770	339 985	284 655	304 990	392 986	370 695	258 575	438 496	452 041
North West	435 849	681 634	451 891	526 962	565 486	601 653	566 308	526 476	581 045	714 383
Northern Cape	124 150	226 303	206 786	49 508	60 007	50 561	39 576	29 084	112 703	308 237
Western Cape	1 511 778	1 684 001	2 274 728	2 568 653	2 927 324	2 488 558	1 874 107	1 949 835	3 171 691	3 469 236
Total	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Table C.49: Proportional business sector R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	5.5	4.6	4.7	4.7	4.5	4.7	4.1	2.1	1.8	1.7
Free State	11.7	6.3	8.1	7.2	7.0	6.9	6.5	4.7	7.4	8.2
Gauteng	49.3	53.9	52.0	53.3	52.2	52.7	50.9	55.5	50.2	44.6
KwaZulu-Natal	12.2	11.3	10.4	10.5	10.6	10.0	11.2	8.2	7.8	8.6
Limpopo	1.2	1.2	1.1	1.2	1.4	1.3	0.7	2.0	1.0	2.7
Mpumalanga	2.6	3.3	2.5	1.9	1.9	2.7	3.5	2.6	3.2	3.1
North West	3.7	5.1	3.3	3.6	3.6	4.2	5.3	5.2	4.3	4.9
Northern Cape	1.1	1.7	1.5	0.3	0.4	0.3	0.4	0.3	0.8	2.1
Western Cape	12.8	12.7	16.5	17.4	18.5	17.2	17.5	19.4	23.4	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.50: Business sector R&D expenditure by Standard Industrial Classification (2013/14 to 2022/23)

Standard Industrial Classification	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	364 424	460 464	484 384	472 472	395 011	560 631	707 251	451 499	454 235	717 014
Mining and quarrying	1 675 153	1 340 103	1 220 985	1 069 826	1 101 202	1 748 437	686 064	927 055	888 716	1 321 976
Manufacturing	3 793 066	4 501 146	4 442 466	4 107 936	4 473 167	3 166 486	3 456 739	2 895 406	4 049 490	4 529 566
Manufacture of food products, beverages and tobacco products	340 427	364 178	376 884	328 832	455 335	498 001	452 243	273 509	240 474	254 102
Manufacture of textiles, clothing and leather goods	32 091	34 609	9 335	8 932	21 968	11 129	11 306	16 547	26 709	27 015
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	60 437	72 870	95 555	87 814	91 005	76 413	79 627	77 126	103 141	124 422
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	1 256 313	1 835 837	1 800 420	1 696 770	1 692 447	802 217	1 165 107	1 096 348	1 704 714	1 734 600
Manufacture of non-metallic mineral products	52 263	51 097	28 095	37 531	24 657	43 350	19 376	36 079	24 095	89 733
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	620 923	607 574	660 205	519 108	581 073	525 937	548 762	422 697	695 090	716 307
Manufacture of electrical machinery and apparatus	254 042	302 575	381 971	455 378	635 655	374 509	250 907	300 913	423 722	614 154
Manufacture of radio, television and communication equipment & apparatus; Manufacture of medical, precision and optical instruments, watches & clocks	742 033	706 308	569 127	629 240	625 773	486 808	538 682	567 514	552 318	742 645
Manufacture of transport equipment	334 276	408 448	402 772	321 638	316 503	315 433	381 531	96 840	236 450	175 198
Manufacture of furniture; Recycling; Manufacturing not elsewhere classified	100 261	117 649	118 102	22 692	28 752	32 689	9 198	7 833	42 778	51 390
Electricity, gas and water supply	355 720	548 015	439 157	544 850	639 298	708 166	762 345	708 350	412 425	382 874
Construction	8 037	6 637	5 613	4 297	3 562	9 408	5 065	4 762	9 700	80 580
Wholesale and retail	100 176	85 491	42 977	54 553	84 403	102 393	89 487	64 403	21 638	74 712
Transport, storage & communication	451 336	632 243	897 359	1 543 763	978 548	1 111 760	503 415	274 353	805 449	384 936
Financial intermediation, real estate and business services	4 724 439	5 357 151	5 910 332	6 555 245	7 744 370	6 402 099	4 032 237	4 250 465	6 187 437	6 372 521
Community, social and personal services	310 498	359 701	371 723	428 328	439 625	638 452	461 877	471 053	698 091	642 595
Total	11 782 848	13 290 951	13 814 995	14 781 270	15 859 185	14 447 833	10 704 481	10 047 344	13 527 182	14 506 774

Table C.51: Proportional business sector R&D expenditure by Standard Industrial Classification (2013/14 to 2022/23)

Standard Industrial Classification	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Agriculture, hunting, forestry and fishing	3.5	3.5	3.2	2.5	3.9	6.6	6.6	4.5	3.4	4.9
Mining and quarrying	10.1	8.8	7.2	6.9	12.1	6.4	6.4	9.2	6.6	9.1
Manufacturing	33.9	32.2	27.8	28.2	21.9	32.3	32.3	28.8	29.9	31.2
Manufacture of food products, beverages and tobacco products	2.7	2.7	2.2	2.9	3.4	4.2	4.2	2.7	1.8	1.8
Manufacture of textiles, clothing and leather goods	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	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	0.7	0.6	0.6	0.5	0.7	0.7	0.8	0.8	0.9
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	13.8	13.0	11.5	10.7	5.6	10.9	10.9	10.9	12.6	12.0
Manufacture of non-metallic mineral products	0.4	0.2	0.3	0.2	0.3	0.2	0.2	0.4	0.2	0.6
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	4.6	4.8	3.5	3.7	3.6	5.1	5.1	4.2	5.1	4.9
Manufacture of electrical machinery and apparatus	2.3	2.8	3.1	4.0	2.6	2.3	2.3	3.0	3.1	4.2
Manufacture of radio, television and communication equipment & apparatus; Manufacture of medical, precision and optical instruments, watches & clocks	5.3	4.1	4.3	3.9	3.4	5.0	5.0	5.6	4.1	5.1
Manufacture of transport equipment	3.1	2.9	2.2	2.0	2.2	3.6	3.6	1.0	1.7	1.2
Manufacture of furniture; Recycling; Manufacturing not elsewhere classified	0.9	0.9	0.2	0.2	0.2	0.1	0.1	0.1	0.3	0.4
Electricity, gas and water supply	4.1	3.2	3.7	4.0	4.9	7.1	7.1	7.1	3.0	2.6
Construction	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.6
Wholesale and retail	0.6	0.3	0.4	0.5	0.7	0.8	0.8	0.6	0.2	0.5
Transport, storage & communication	4.8	6.5	10.4	6.2	7.7	4.7	4.7	2.7	6.0	2.7
Financial intermediation, real estate and business services	40.3	42.8	44.3	48.8	44.3	37.7	37.7	42.3	45.7	43.9
Community, social and personal services	2.7	2.7	2.9	2.8	4.4	4.3	4.3	4.7	5.2	4.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.52: Business sector R&D personnel headcount and full-time equivalents by occupation (2013/14 to 2022/23)

Year	Headcount				Full-time equivalents (FTEs)			
	Total	Researchers	Technicians	Other R&D personnel	Total	Researchers	Technicians	Other R&D personnel
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
2021/22	15 094	4 370	5 347	5 377	12 054.6	2 927.7	4 435.4	4 691.6
2022/23	15 364	4 395	4 702	6 267	12 507.7	3 121.9	3 885.4	5 500.4

Headcount includes non-SA R&D personnel (from 2016/17).

Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.53: Business sector R&D personnel headcount and full-time equivalents by occupation and gender (2020/21 to 2022/23)

Occupation	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
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
2021/22							
Researchers	4 370	2 859	1 511	2 927.7	1 795.9	1 131.8	67.0
Technicians directly supporting R&D	5 347	2 882	2 465	4 435.4	2 159.2	2 276.1	83.0
Other personnel directly supporting R&D	5 377	2 225	3 152	4 691.6	1 799.4	2 892.2	87.3
Total	15 094	7 966	7 128	12 054.6	5 754.5	6 300.1	79.9
2022/23							
Researchers	4 395	2 749	1 646	3 121.9	1 829.6	1 292.3	71.0
Technicians directly supporting R&D	4 702	2 506	2 196	3 885.4	1 892.3	1 993.1	82.6
Other personnel directly supporting R&D	6 267	2 538	3 729	5 500.4	2 068.3	3 432.2	87.8
Total	15 364	7 793	7 571	12 507.7	5 790.2	6 717.6	81.4

Headcount includes non-SA R&D personnel (from 2016/17).

Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.54: Business sector R&D personnel headcount by occupation, qualification, population group and gender (2022/23)

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	4 395	2 749	1 646	599	570	130	138	286	218	1 671	683	63	37
Doctoral degree or equivalent	479	288	191	73	34	19	13	21	27	158	105	17	12
Master's, honours, bachelor or equivalent	2 979	1 918	1 061	405	369	71	77	233	162	1 176	433	33	20
Diplomas	937	543	394	121	167	40	48	32	29	337	145	13	5
Technicians directly supporting R&D	4 702	2 506	2 196	907	963	263	159	151	145	1 121	872	64	57
Doctoral degree or equivalent	101	42	59	8	13	0	6	3	7	17	23	14	10
Master's, honours, bachelor or equivalent	1 778	927	851	251	280	75	56	62	72	503	412	36	31
Diplomas	2 823	1 537	1 286	648	670	188	97	86	66	601	437	14	16
Other personnel directly supporting R&D	6 267	2 538	3 729	1 621	2 962	212	208	129	77	545	435	31	47
Doctoral degree or equivalent	56	32	24	3	2	1	0	0	0	21	16	7	6
Master's, honours, bachelor or equivalent	968	559	409	221	167	41	32	67	32	225	164	5	14
Diplomas	5 243	1 947	3 296	1 397	2 793	170	176	62	45	299	255	19	27
Total	15 364	7 793	7 571	3 127	4 495	605	505	566	440	3 337	1 990	158	141

Headcount includes non-SA R&D personnel (from 2016/17).

Table C.55: Foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2020/21 to 2022/23)

Collaboration partners	2020/21		2021/22		2022/23	
	Within South Africa	Outside South Africa	Within South Africa	Outside South Africa	Within South Africa	Outside South Africa
Government research institutes	21	9	20	7	22	7
Higher education institutions	82	22	85	22	84	22
Members of own company	36	18	41	20	43	21
Not-for-profit organisations	12	5	11	6	12	5
Other companies	71	33	76	33	80	31
Science councils	53	11	60	8	54	11
Total number of R&D collaborations	275	98	293	96	295	97
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

Collaborative R&D entails partnerships, alliances and collaborations.

The indicator 'No collaboration' was not assessed (N/A) 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 (2013/14 to 2022/23)

Year	Number of R&D performers	R&D expenditure	Proportion of BERD
		R'000	%
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
2021/22	15	2 079 682	15.4
2022/23	15	1 230 797	8.5

Table C.57: Business sector: SOEs – R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	263 523	65 489	65 556	110 249	140 989	153 137	132 998	87 580	665 416	105 586
Applied research	641 358	1 216 953	860 904	1 588 222	1 886 756	1 970 733	1 406 439	1 312 496	1 108 746	799 138
Experimental development research	704 890	737 477	1 046 956	923 413	508 629	368 650	513 895	258 961	305 520	326 073
Total	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Table C.58: Business sector: SOEs – Proportional R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Basic research	16.4	3.2	3.3	4.2	5.6	6.1	6.5	5.3	32.0	8.6
Applied research	39.8	60.2	43.6	60.6	74.4	79.1	68.5	79.1	53.3	64.9
Experimental development research	43.8	36.5	53.1	35.2	20.1	14.8	25.0	15.6	14.7	26.5
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 (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Capital expenditure	245 077	355 725	122 272	726 071	702 156	768 912	368 628	131 658	809 848	130 051
Land: buildings & other structures	12 920	16 307	31 884	183 145	173 025	193 483	204 147	30 276	157 238	21 705
Total: Vehicles, plant, machinery, equipment and software	232 157	339 418	90 388	542 926	529 131	575 429	164 481	101 382	652 610	108 346
Vehicles, plant, machinery, equipment	232 157	339 418	90 388	542 926	529 131	575 429	164 331	100 716	527 075	98 985
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	150	666	125 535	9 361
Current expenditure	1 364 694	1 664 194	1 851 145	1 895 812	1 834 218	1 723 607	1 684 703	1 527 380	1 269 834	1 100 746
Labour costs	849 371	922 321	976 713	1 040 703	968 562	892 376	842 680	721 809	773 881	719 992
Other current expenditure	515 323	741 873	874 432	855 109	865 656	831 231	842 023	805 571	495 953	380 754
Total	1 609 771	2 019 919	1 973 417	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

*Capitalised computer software collected from 2019/20.

Table C.60: Business sector: SOEs – Proportional R&D expenditure by accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Capital expenditure	15.2	17.6	6.2	27.7	27.7	30.8	18.0	7.9	38.9	10.6
Land: buildings & other structures	0.8	0.8	1.6	7.0	6.8	7.8	9.9	1.8	7.6	1.8
Total: Vehicles, plant, machinery, equipment and software	14.4	16.8	4.6	20.7	20.9	23.1	8.0	6.1	31.4	8.8
Vehicles, plant, machinery, equipment	14.4	16.8	4.6	20.7	20.9	23.1	8.0	6.1	25.3	8.0
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	6.0	0.76
Current expenditure	84.8	82.4	93.8	72.3	72.3	69.2	82.0	92.1	61.1	89.4
Labour costs	52.8	45.7	49.5	39.7	38.2	35.8	41.0	43.5	37.2	58.5
Other current expenditure	32.0	36.7	44.3	32.6	34.1	33.3	41.0	48.6	23.8	30.9
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 (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	21 845	16 591	12 278	16 457	18 514	8 116	9 352	9 705	8 636	23 787
Nanotechnology	654	700	144	0	0	0	369	384	422	820
Total	22 499	17 290	12 422	16 457	18 514	8 116	9 721	10 089	9 058	24 607
Business expenditure on R&D	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Table C.62: Business sector: SOEs – Proportional expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biotechnology	1.4	0.8	0.6	0.6	0.7	0.3	0.5	0.6	0.4	1.9
Nanotechnology	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total	1.4	0.9	0.6	0.6	0.7	0.3	0.5	0.6	0.4	2.0

Table C.63: Business sector: SOEs – R&D expenditure on select areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment-related	22 448	51 522	30 864	136 523	150 811	171 166	187 339	152 349	383 861	106 322
Open-source software	4 124	0	50 589	0	0	0	19 769	1 894	142 591	4 146
New materials	12 233	11 111	64 021	15 353	21 144	23 841	32 115	30 962	24 070	26 341
Tuberculosis, HIV/AIDS, malaria	0	0	0	0	0	0	943	496	756	375
Space science	N/A	N/A	N/A	32 571	33 063	34 998	9 462	947	427 774	29 020
Total	38 806	62 633	145 474	184 446	205 018	230 005	249 628	186 648	979 052	166 204
Business expenditure on R&D	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Space science data was only collected from 2016/17.

Table C.64: Business sector: SOEs – Proportional R&D expenditure on selective areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Environment-related	1.4	2.6	1.6	5.2	5.9	6.9	9.1	9.2	18.5	8.6
Open-source software	0.3	0.0	2.6	0.0	0.0	0.0	1.0	0.1	6.9	0.3
New materials	0.8	0.6	3.2	0.6	0.8	1.0	1.6	1.9	1.2	2.1
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	1.2	1.3	1.4	0.5	0.1	20.6	2.4
Total	2.4	3.1	7.4	7.0	8.1	9.2	12.2	11.3	47.1	13.5

Space science data was only collected from 2016/17.

Table C.65: Business sector: SOEs – R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	1 609 771	1 963 779	1 963 821	2 524 169	2 437 185	2 387 524	2 043 870	1 658 091	2 044 035	1 228 724
Mathematical sciences	93 820	137 076	87 387	85 055	134 335	142 171	143 412	143 414	175 702	152 660
Physical sciences	44 460	46 559	32 100	42 210	81 896	86 032	83 931	106 613	73 080	142 356
Chemical sciences	132 399	86 408	64 230	68 251	55 705	50 406	56 752	58 973	70 702	132 447
Earth sciences	48 671	24 356	12 254	17 750	17 522	9 297	27 651	26 227	23 975	4 351
Information, computer and communication technologies	168 174	304 806	541 009	935 325	483 015	511 409	219 824	142 888	650 766	60 385
Applied sciences and technologies	176 391	165 214	133 687	277 702	446 635	363 768	274 949	124 361	260 083	140 466
Engineering sciences	824 057	1 034 900	981 683	971 414	1 059 843	1 040 397	924 156	877 692	537 373	279 822
Biological sciences	30 701	29 183	33 874	13 112	12 338	26 520	27 002	24 903	23 852	40 293
Agricultural sciences	11 711	12 507	12 665	9 079	9 282	5 857	16 669	12 927	10 497	33 188
Medical and health sciences	18 316	49 357	36 548	23 990	76 571	80 711	153 719	81 265	26 028	29 287
Environmental sciences	45 772	59 270	16 310	47 674	51 225	58 605	67 425	40 162	169 783	181 267
Material sciences	9 198	9 849	12 073	32 605	8 818	12 352	48 380	18 666	22 195	32 202
Marine sciences	6 103	4 294	0	0	0	0	0	0	0	0
Division 2: Social sciences and humanities	0	56 140	9 595	97 714	99 189	104 995	9 462	947	35 648	2 073
Social sciences	0	56 140	9 595	97 714	99 189	104 995	9 462	947	35 648	2 073
Humanities	0	0	0	0	0	0	0	0	0	0
Total	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Table C.66: Business sector: SOEs – Proportional R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	100.0	97.2	99.5	96.3	96.1	95.8	99.5	99.9	98.3	99.8
Mathematical sciences	5.8	6.8	4.4	3.2	5.3	5.7	7.0	8.6	8.4	12.4
Physical sciences	2.8	2.3	1.6	1.6	3.2	3.5	4.1	6.4	3.5	11.6
Chemical sciences	8.2	4.3	3.3	2.6	2.2	2.0	2.8	3.6	3.4	10.8
Earth sciences	3.0	1.2	0.6	0.7	0.7	0.4	1.3	1.6	1.2	0.4
Information, computer and communication technologies	10.4	15.1	27.4	35.7	19.0	20.5	10.7	8.6	31.3	4.9
Applied sciences and technologies	11.0	8.2	6.8	10.6	17.6	14.6	13.4	7.5	12.5	11.4
Engineering sciences	51.2	51.2	49.7	37.1	41.8	41.7	45.0	52.9	25.8	22.7

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biological sciences	1.9	1.4	1.7	0.5	0.5	1.1	1.3	1.5	1.1	3.3
Agricultural sciences	0.7	0.6	0.6	0.3	0.4	0.2	0.8	0.8	0.5	2.7
Medical and health sciences	1.1	2.4	1.9	0.9	3.0	3.2	7.5	4.9	1.3	2.4
Environmental sciences	2.8	2.9	0.8	1.8	2.0	2.4	3.3	2.4	8.2	14.7
Material sciences	0.6	0.5	0.6	1.2	0.3	0.5	2.4	1.1	1.1	2.6
Marine sciences	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Division 2: Social sciences and humanities	0.0	2.8	0.5	3.7	3.9	4.2	0.5	0.1	1.7	0.2
Social sciences	0.0	2.8	0.5	3.7	3.9	4.2	0.5	0.1	1.7	0.2
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 (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	512 440	563 927	399 183	304 302	676 595	497 808	524 278	398 046	410 108	371 536
Defence	512 440	563 927	399 183	304 302	676 595	497 808	524 278	398 046	410 108	371 536
Division 2: Economic development	887 024	1 187 718	1 360 120	1 901 235	1 424 957	1 522 995	1 257 352	1 075 905	1 526 222	679 625
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	9 380	10 076	10 203	8 610	8 610	9 287	10 302	9 241	9 835	11 473
Animal production and animal primary products	0	0	0	0	0	0	0	0	0	0
Mineral resources (excluding energy)	6 541	6 996	7 743	8 500	8 818	9 236	0	0	0	6 008
Energy resources	23 549	25 185	27 874	30 602	12 479	13 070	71 813	54 254	126 681	21 911
Energy supply	253 757	419 084	316 868	410 091	516 908	546 952	614 824	584 239	543 753	401 193
Manufacturing	105 372	178 376	103 757	110 104	112 307	114 695	103 465	95 463	307 542	109 100
Construction	99 484	81 944	0	0	0	0	0	0	0	0
Transport	122 633	126 069	253 742	333 284	335 410	357 608	222 975	177 757	182 152	80 957
Information and communication services	191 811	270 175	609 251	873 600	302 316	319 210	72 508	15 498	335 899	28 220
Commercial services	10 644	11 434	16 235	16 878	18 002	19 049	16 898	640	703	820
Economic framework	40 833	37 065	14 447	109 566	110 107	115 191	120 014	118 203	0	0
Natural resources	23 019	21 316	0	0	0	18 697	24 554	20 611	19 657	19 945
Division 3: Society	59 171	67 371	54 784	51 876	70 963	87 496	188 813	109 720	76 869	44 154
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	29 360	26 193	19 804	25 631	39 533	54 213	150 830	75 259	57 930	32 821

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Education and training	13 281	14 266	14 447	0	0	0	0	0	0	0
Social development and community services	16 530	26 912	20 533	26 246	31 431	33 282	37 984	34 461	18 939	11 333
Division 4: Environment	31 720	68 425	56 760	86 865	94 694	100 236	82 888	75 367	66 483	135 482
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	15 860	26 193	33 494	28 662	30 816	32 619	39 060	34 101	30 487	54 742
Environmental aspects of development	0	16 040	2 741	32 571	33 063	34 998	0	0	10 763	49 200
Environmental and other aspects	15 860	26 193	20 525	25 631	30 816	32 619	43 828	41 265	25 234	31 540
Division 5: Advancement of knowledge	119 417	132 476	102 570	277 605	269 165	283 984	0	0	0	0
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	116 668	129 393	99 448	277 605	269 165	283 984	0	0	0	0
Social sciences and humanities	2 750	3 083	3 122	0	0	0	0	0	0	0
Total	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Table C.68: Business sector: SOEs – Proportional R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	31.8	27.9	20.2	11.6	26.7	20.0	25.5	24.0	19.7	30.2
Defence	31.8	27.9	20.2	11.6	26.7	20.0	25.5	24.0	19.7	30.2
Division 2: Economic development	55.1	58.8	68.9	72.5	56.2	61.1	61.2	64.9	73.4	55.2
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	0.6	0.5	0.5	0.3	0.3	0.4	0.5	0.6	0.5	0.9
Animal production and animal primary products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mineral resources (excluding energy)	0.4	0.3	0.4	0.3	0.3	0.4	0.0	0.0	0.0	0.5
Energy resources	1.5	1.2	1.4	1.2	0.5	0.5	3.5	3.3	6.1	1.8
Energy supply	15.8	20.7	16.1	15.6	20.4	21.9	29.9	35.2	26.1	32.6
Manufacturing	6.5	8.8	5.3	4.2	4.4	4.6	5.0	5.8	14.8	8.9
Construction	6.2	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport	7.6	6.2	12.9	12.7	13.2	14.3	10.9	10.7	8.8	6.6

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Information and communication services	11.9	13.4	30.9	33.3	11.9	12.8	3.5	0.9	16.2	2.3
Commercial services	0.7	0.6	0.8	0.6	0.7	0.8	0.8	0.0	0.0	0.1
Economic framework	2.5	1.8	0.7	4.2	4.3	4.6	5.8	7.1	0.0	0.0
Natural resources	1.4	1.1	0.0	0.0	0.0	0.8	1.2	1.2	0.9	1.6
Division 3: Society	3.7	3.3	2.8	2.0	2.8	3.5	9.2	6.6	3.7	3.6
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	1.8	1.3	1.0	1.0	1.6	2.2	7.3	4.5	2.8	2.7
Education and training	0.8	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Social development and community services	1.0	1.3	1.0	1.0	1.2	1.3	1.8	2.1	0.9	0.9
Division 4: Environment	2.0	3.4	2.9	3.3	3.7	4.0	4.0	4.5	3.2	11.0
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	1.0	1.3	1.7	1.1	1.2	1.3	1.9	2.1	1.5	4.4
Environmental aspects of development	0.0	0.8	0.1	1.2	1.3	1.4	0.0	0.0	0.5	4.0
Environmental and other aspects	1.0	1.3	1.0	1.0	1.2	1.3	2.1	2.5	1.2	2.6
Division 5: Advancement of knowledge	7.4	6.6	5.2	10.6	10.6	11.4	0.0	0.0	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	7.2	6.4	5.0	10.6	10.6	11.4	0.0	0.0	0.0	0.0
Social sciences and humanities	0.2	0.2	0.2	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.69: Business sector: SOEs – R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	38 634	37 244	10 854	45 081	52 404	50 850	27 532	18 658	18 057	2 176
Free State	26 428	25 193	10 854	42 824	45 798	48 477	34 521	17 170	89 353	8 394
Gauteng	1 012 556	1 448 092	1 558 538	1 937 851	1 682 598	1 715 224	1 306 669	1 037 875	1 342 306	875 847
KwaZulu-Natal	91 406	45 588	86 565	188 606	197 355	242 371	222 198	219 340	113 762	42 764
Limpopo	19 596	18 612	3 019	615	1 024	1 094	2 619	2 613	22 228	2 995
Mpumalanga	28 976	33 927	13 222	9 594	9 594	10 348	19 056	10 931	93 017	21 178
North West	160 739	289 990	170 118	180 261	214 709	189 393	245 578	175 388	157 993	152 366
Northern Cape	52 104	17 998	2 397	0	409	431	11 465	2 919	82 058	6 321
Western Cape	179 332	103 275	117 850	217 052	332 484	234 330	183 695	174 142	160 908	118 756
Total	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Table C.70: Business sector: SOEs – Proportional R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.4	1.8	0.5	1.7	2.1	2.0	1.3	1.1	0.9	0.2
Free State	1.6	1.2	0.5	1.6	1.8	1.9	1.7	1.0	4.3	0.7
Gauteng	62.9	71.7	79.0	73.9	66.3	68.8	63.6	62.6	64.5	71.2
KwaZulu-Natal	5.7	2.3	4.4	7.2	7.8	9.7	10.8	13.2	5.5	3.5
Limpopo	1.2	0.9	0.2	0.0	0.0	0.0	0.1	0.2	1.1	0.2
Mpumalanga	1.8	1.7	0.7	0.4	0.4	0.4	0.9	0.7	4.5	1.7
North West	10.0	14.4	8.6	6.9	8.5	7.6	12.0	10.6	7.6	12.4
Northern Cape	3.2	0.9	0.1	0.0	0.0	0.0	0.6	0.2	3.9	0.5
Western Cape	11.1	5.1	6.0	8.3	13.1	9.4	8.9	10.5	7.7	9.6
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 (2013/14 to 2022/23)

Standard Industrial Classification	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	17 187	18 413	18 646	20 052	20 390	21 702	24 242	25 263	11 875	48 757
Mining and quarrying	0	0	0	0	0	0	0	0	0	0
Manufacturing	475 294	480 601	370 407	161 096	461 776	270 718	284 344	157 561	271 556	189 538
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	1 340	1 439	1 458	1 230	1 230	1 327	1 230	1 280	12 645	14 751
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	72 216	77 350	8 616	14 489	24 007	14 343	14 950	15 185	13 274	13 523
Manufacture of non-metallic mineral products	7 850	8 395	0	0	0	0	0	0	0	0
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	272 253	293 575	297 289	75 855	146 953	74 588	212 512	86 276	98 338	53 855
Manufacture of electrical machinery and apparatus	63 824	52 760	20 430	21 690	242 822	127 036	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	25 444	9 722
Manufacture of transport equipment	57 812	47 081	42 614	47 833	46 764	53 425	55 652	54 820	121 855	97 687
Manufacture of furniture; Recycling; Manufacturing not elsewhere classified	0	0	0	0	0	0	0	0	0	0

Standard Industrial Classification	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Electricity, gas and water supply	340 670	534 569	424 561	531 606	633 700	698 810	725 835	697 653	406 475	376 574
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 & communication	397 326	565 363	826 532	1 516 160	952 348	1 004 572	396 000	260 144	576 953	84 638
Financial intermediation, real estate and business services	158 060	150 347	196 661	174 576	176 127	184 533	288 975	201 458	426 482	206 139
Community, social and personal services	221 233	270 626	136 609	218 393	292 033	312 183	333 936	316 958	386 342	325 151
Total	1 609 771	2 019 919	1 973 416	2 621 883	2 536 374	2 492 520	2 053 331	1 659 038	2 079 682	1 230 797

Table C.72: Business sector: SOEs – Proportional R&D expenditure by Standard Industrial Classification (2013/14 to 2022/23)

Standard Industrial Classification	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Agriculture, hunting, forestry and fishing	1.1	0.9	0.9	0.8	0.8	0.9	1.2	1.5	0.6	4.0
Mining and quarrying	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacturing	29.5	23.8	18.8	6.1	18.2	10.9	13.8	9.5	13.1	15.4
Manufacture of food products, beverages and tobacco products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of textiles, clothing and leather goods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of wood and products of wood and cork, except furniture; Manufacture of articles of straw and plaiting materials; Manufacture of paper and paper products; Manufacture of publishing, printing and reproduction of recorded material	0.1	0.1	0.1	0.0	0.0	0.1	0.7	0.1	0.6	1.2
Manufacture of refined petroleum, coke and nuclear fuel; Manufacture of chemicals and chemical products (incl. pharmaceuticals); Manufacture of rubber and plastic products	4.5	3.8	0.4	0.6	0.9	0.6	0.0	0.9	0.6	1.1
Manufacture of non-metallic mineral products	0.5	0.4	0.0	0.0	0.0	0.0	10.3	0.0	0.0	0.0
Manufacture of basic metals, fabricated metal products, machinery & equipment; Manufacture of office, accounting and computing machinery	16.9	14.5	15.1	2.9	5.8	3.0	0.0	5.2	4.7	4.4
Manufacture of electrical machinery and apparatus	4.0	2.6	1.0	0.8	9.6	5.1	0.0	0.0	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	2.7	0.0	1.2	0.8
Manufacture of transport equipment	3.6	2.3	2.2	1.8	1.8	2.1	0.0	3.3	5.9	7.9
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

Standard Industrial Classification	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Electricity, gas and water supply	21.2	26.5	21.5	20.3	25.0	28.0	35.3	42.1	19.5	30.6
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 & communication	24.7	28.0	41.9	57.8	37.5	40.3	19.3	15.7	27.7	6.9
Financial intermediation, real estate and business services	9.8	7.4	10.0	6.7	6.9	7.4	14.1	12.1	20.5	16.7
Community, social and personal services	13.7	13.4	6.9	8.3	11.5	12.5	16.3	19.1	18.6	26.4
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 (2013/14 to 2022/23)

Year	Headcount				Full-time equivalents (FTEs)			
	Total	Researchers	Technicians	Other R&D personnel	Total	Researchers	Technicians	Other R&D personnel
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
2021/22	1 797	857	690	250	718.0	318.2	274.0	125.8
2022/23	1 437	686	533	218	616.1	309.0	211.6	95.6

Headcount includes non-SA R&D personnel (from 2016/17).

Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than 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 (2020/21 to 2022/23)

Occupation	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
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
2021/22							
Researchers	857	689	168	318.2	225.2	93.0	37.1
Technicians directly supporting R&D	690	535	155	274.0	198.5	75.5	32.0
Other personnel directly supporting R&D	250	90	160	125.8	31.5	94.3	14.7
Total	1 797	1 314	483	718.0	455.2	262.8	40.0
2022/23							
Researchers	686	522	164	309.0	209.5	99.6	45.0
Technicians directly supporting R&D	533	388	145	211.6	145.9	65.7	30.8
Other personnel directly supporting R&D	218	85	133	95.6	29.4	66.2	13.9
Total	1 437	995	442	616.1	384.7	231.5	42.9

Headcount includes non-SA R&D personnel (from 2016/17).

Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.75: Business sector: SOEs – R&D personnel headcount by occupation, qualification, population group and gender (2022/23)

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	686	522	164	160	84	25	5	57	23	268	49	12	3
Doctoral degree or equivalent	78	57	21	17	9	3	0	8	6	21	5	8	1
Master's, honours, bachelor or equivalent	518	399	119	127	59	17	5	44	17	207	36	4	2
Diplomas	90	66	24	16	16	5	0	5	0	40	8	0	0
Technicians directly supporting R&D	533	388	145	177	77	29	17	15	3	167	48	0	0
Doctoral degree or equivalent	4	1	3	1	1	0	1	0	0	0	1	0	0
Master's, honours, bachelor or equivalent	119	89	30	46	19	4	2	8	2	31	7	0	0
Diplomas	410	298	112	130	57	25	14	7	1	136	40	0	0
Other personnel directly supporting R&D	218	85	133	41	83	7	9	3	3	34	38	0	0
Doctoral degree or equivalent	3	2	1	2	1	0	0	0	0	0	0	0	0
Master's, honours, bachelor or equivalent	55	20	35	13	25	0	3	1	1	6	6	0	0
Diplomas	160	63	97	26	57	7	6	2	2	28	32	0	0
Total	1 437	995	442	378	244	61	31	75	29	469	135	12	3

Headcount includes non-SA R&D personnel (from 2016/17).

Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.76: Business sector: SOEs – Foreign and local business sector partners engaged in collaborative R&D, and total R&D collaboration expenditure (2020/21 to 2022/23)

Collaboration partners	2020/21		2021/22		2022/23	
	Within South Africa	Outside South Africa	Within South Africa	Outside South Africa	Within South Africa	Outside South Africa
Government research institutes	4	3	3	3	6	2
Higher education institutions	10	5	10	4	9	3
Members of own company	3	0	4	0	4	2
Not-for-profit organisations	3	1	3	1	3	0
Other companies	3	1	2	1	5	0
Science councils	10	2	10	1	9	2
Total number of R&D collaborations	33	12	32	10	36	9
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

Collaborative R&D entails partnerships, alliances and collaborations.

The indicator 'No collaboration' was not assessed (N/A) from 2016/17 onwards.

C.2.2. Not-for-profit sector

Table C.77: Not-for-profit sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	132 478	181 492	200 040	232 304	280 032	291 509	349 219	381 683	407 280	444 288
Applied research	322 295	426 132	508 738	558 059	661 575	841 861	779 943	805 222	872 076	1 030 519
Experimental development research	128 391	171 149	182 365	227 254	274 703	352 334	380 353	381 402	320 201	295 346
Total	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

Table C.78: Proportional not-for-profit sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Basic research	22.7	23.3	22.4	22.8	23.0	19.6	23.1	24.3	25.5	25.1
Applied research	55.3	54.7	57.1	54.8	54.4	56.7	51.7	51.3	54.5	58.2
Experimental development research	22.0	22.0	20.5	22.3	22.6	23.7	25.2	24.3	20.0	16.7
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 (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Capital expenditure	39 983	49 647	53 800	91 083	75 522	103 851	57 865	65 031	80 526	91 063
Land: buildings & other structures	19 047	18 794	18 391	20 765	23 962	41 676	15 201	17 132	24 650	39 844
Total: Vehicles, plant, machinery, equipment and software	20 936	30 853	35 409	70 318	51 560	62 175	42 664	47 899	55 876	51 219
Vehicles, plant, machinery, equipment	20 936	30 853	35 409	70 318	51 560	62 175	38 076	39 173	48 528	44 602
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	4 588	8 726	7 348	6 617
Current expenditure	543 182	729 125	837 342	926 534	1 140 787	1 381 853	1 451 650	1 503 276	1 519 030	1 679 090
Labour costs	303 644	420 462	468 883	506 181	634 168	648 726	681 740	742 825	767 849	827 265
Other current expenditure	239 538	308 663	368 459	420 353	506 620	733 127	769 910	760 451	751 182	851 826
Total	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

*Capitalised computer software collected from 2019/20.

Table C.80: Proportional not-for-profit sector R&D expenditure by accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Capital expenditure	6.9	6.4	6.0	9.0	6.2	7.0	3.8	4.1	5.0	5.1
Land: buildings & other structures	3.3	2.4	2.1	2.0	2.0	2.8	1.0	1.1	1.5	2.3
Total: Vehicles, plant, machinery, equipment and software	3.6	4.0	4.0	6.9	4.2	4.2	2.8	3.1	3.5	2.9
Vehicles, plant, machinery, equipment	3.6	4.0	4.0	6.9	4.2	4.2	2.5	2.5	3.0	2.5
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	0.3	1.6	0.5	0.4
Current expenditure	93.1	93.6	94.0	91.0	93.8	93.0	96.2	95.9	95.0	94.9
Labour costs	52.1	54.0	52.6	49.7	52.1	43.7	45.2	47.4	48.0	46.7
Other current expenditure	41.1	39.6	41.3	41.3	41.7	49.3	51.0	48.5	47.0	48.1
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 R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	62 082	128 964	159 045	123 879	160 846	261 324	339 841	305 702	401 968	415 476
Nanotechnology	4 915	70 348	81 102	841	543	569	0	0	0	0
Total	66 997	199 312	240 148	124 720	161 389	261 892	339 841	305 702	401 968	415 476
NPO expenditure on R&D	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

Table C.82: Proportional not-for-profit sector expenditure on multidisciplinary R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biotechnology	10.6	16.6	17.8	12.2	13.2	17.6	22.5	19.5	25.1	23.5
Nanotechnology	0.8	9.0	9.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total	11.5	25.6	26.9	12.3	13.3	17.6	22.5	19.5	25.1	23.5

Table C.83: Not-for-profit sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment-related	27 142	50 364	52 156	54 904	56 218	70 733	85 245	148 730	121 822	135 518
Open-source software	481	69 509	756	824	952	930	1 335	3 065	4 963	3 828
New materials	191	634	79 322	223	1 814	0	20 594	27 149	25 925	27 581
Tuberculosis, HIV/AIDS, malaria	301 086	374 460	482 298	689 315	876 132	1 118 507	1 147 804	1 142 974	1 174 877	1 117 917
Space science	N/A	N/A	N/A	0	0	0	0	0	0	0
Total	328 901	494 966	614 532	745 265	935 117	1 190 170	1 254 979	1 321 918	1 327 587	1 284 845
NPO expenditure on R&D	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

Space science data collected from 2016/17.

Table C.84: Proportional not-for-profit sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Environment-related	4.7	6.5	5.9	5.4	4.6	4.8	5.6	9.9	7.6	7.7
Open-source software	0.1	8.9	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.2
New materials	0.0	0.1	8.9	0.0	0.1	0.0	1.4	1.8	1.6	1.6
Tuberculosis, HIV/AIDS, malaria	51.6	48.1	54.1	67.7	72.0	75.3	76.0	75.7	73.5	63.2
Space science	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	56.4	63.6	69.0	73.2	76.9	80.1	83.1	87.6	83.0	72.6

Space science data collected from 2016/17.

Table C.85: Not-for-profit sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	427 237	647 068	766 355	909 337	1 096 247	1 374 844	1 402 157	1 451 797	1 469 338	1 652 073
Mathematical sciences	9 674	14 613	14 293	13 540	14 797	16 009	16 684	14 497	45 199	50 218
Physical sciences	802	989	1 191	1 300	1 504	1 551	1 616	1 284	1 429	547
Chemical sciences	1 309	0	0	0	0	0	0	0	0	0
Earth sciences	5 907	8 371	8 356	8 727	8 008	8 594	7 532	9 157	9 399	13 070
Information, computer and communication technologies	39	197	528	0	1 925	0	365	2 350	2 804	6 345
Applied sciences and technologies	4 666	19 123	30 565	29 946	29 379	30 941	31 097	32 863	36 228	50 847
Engineering sciences	4 915	4 638	4 005	3 393	1 572	1 645	1 746	30	554	1 264
Biological sciences	23 435	23 338	11 400	42 787	44 312	62 027	64 866	67 468	68 638	66 308

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	34 165	53 777	60 727	62 269	63 037	52 807	52 884	56 448	61 799	69 538
Medical and health sciences	329 293	497 588	614 889	719 902	905 867	1 174 074	1 200 011	1 244 118	1 201 431	1 335 336
Environmental sciences	12 238	23 548	19 552	25 746	24 150	25 335	23 586	21 949	40 560	52 985
Material sciences	0	0	0	0	0	0	0	0	0	3 978
Marine sciences	794	886	848	1 725	1 697	1 860	1 770	1 634	1 296	1 636
Division 2: Social sciences and humanities	155 928	131 705	124 787	108 280	120 063	110 860	107 358	116 510	130 219	118 080
Social sciences	147 029	122 105	117 549	98 355	109 068	99 304	87 132	94 871	104 766	100 578
Humanities	8 898	9 599	7 238	9 925	10 995	11 556	20 226	21 639	25 452	17 502
Total	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

Table C.86: Proportional not-for-profit sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	73.3	83.1	86.0	89.4	90.1	92.5	92.9	92.6	91.9	93.3
Mathematical sciences	1.7	1.9	1.6	1.3	1.2	1.1	1.1	0.9	2.8	2.8
Physical sciences	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Chemical sciences	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Earth sciences	1.0	1.1	0.9	0.9	0.7	0.6	0.5	0.6	0.6	0.7
Information, computer and communication technologies	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.1	0.2	0.4
Applied sciences and technologies	0.8	2.5	3.4	2.9	2.4	2.1	2.1	2.1	2.3	2.9
Engineering sciences	0.8	0.6	0.4	0.3	0.1	0.1	0.1	0.0	0.0	0.1
Biological sciences	4.0	3.0	1.3	4.2	3.6	4.2	4.3	4.3	4.3	3.7
Agricultural sciences	5.9	6.9	6.8	6.1	5.2	3.6	3.5	3.6	3.9	3.9
Medical and health sciences	56.5	63.9	69.0	70.7	74.5	79.0	79.5	79.3	75.1	75.4
Environmental sciences	2.1	3.0	2.2	2.5	2.0	1.7	1.6	1.4	2.5	3.0
Material sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Marine sciences	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Division 2: Social sciences and humanities	26.7	16.9	14.0	10.6	9.9	7.5	7.1	7.4	8.1	6.7
Social sciences	25.2	15.7	13.2	9.7	9.0	6.7	5.8	6.0	6.5	5.7
Humanities	1.5	1.2	0.8	1.0	0.9	0.8	1.3	1.4	1.6	1.0
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 (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	0	690	0	0	0	0	0	0	0	0
Defence	0	690	0	0	0	0	0	0	0	0
Division 2: Economic development	113 991	152 573	157 608	129 359	118 415	103 702	92 455	108 865	119 692	134 055
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	35 511	28 974	32 936	35 240	35 197	26 579	23 124	22 599	22 735	21 457
Animal production and animal primary products	3 083	4 000	7 628	9 856	2 635	2 858	2 378	3 084	4 252	3 652
Mineral resources (excluding energy)	9 831	9 242	7 955	7 708	0	0	0	0	0	0
Energy resources	3 083	3 993	4 008	3 278	4 022	4 875	4 508	5 307	8 184	8 422
Energy supply	8 690	7 663	6 242	10 628	7 994	8 852	7 102	8 177	11 197	16 380
Manufacturing	2 955	26 291	31 646	230	0	308	321	316	352	359
Construction	0	0	0	0	0	0	0	0	0	0
Transport	424	0	0	0	0	0	0	0	0	0
Information and communication services	1 823	316	2 411	327	2 513	0	365	0	1 854	1 218
Commercial services	0	0	1 135	1 962	1 675	0	0	0	522	0
Economic framework	42 423	54 435	53 406	47 465	57 125	53 099	47 407	52 747	57 058	70 385
Natural resources	6 167	17 659	10 242	12 665	7 253	7 131	7 251	16 635	13 538	12 183
Division 3: Society	415 093	555 151	632 030	767 620	941 505	1 058 928	1 079 921	1 218 236	1 140 634	1 227 713
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	303 535	449 619	527 783	667 371	835 603	955 738	962 721	1 074 859	993 512	1 083 650
Education and training	63 833	61 150	59 917	59 123	61 652	60 123	80 287	102 542	95 100	99 281
Social development and community services	47 725	44 382	44 330	41 126	44 250	43 066	36 913	40 835	52 022	44 782
Division 4: Environment	15 044	16 135	17 503	19 734	38 078	39 974	37 194	45 433	46 995	55 671
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	7 845	8 697	9 949	9 712	23 780	23 201	22 225	30 236	35 262	39 432
Environmental aspects of development	4 545	4 569	4 494	6 269	6 559	7 544	6 393	7 294	7 428	9 742
Environmental and other aspects	2 654	2 869	3 060	3 753	7 739	9 229	8 576	7 903	4 305	6 498

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 5: Advancement of knowledge	39 036	54 223	84 002	100 903	118 312	283 100	299 945	195 773	292 236	352 714
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	31 450	42 017	69 845	90 114	107 310	272 540	286 464	186 060	280 279	340 885
Social sciences and humanities	7 586	12 206	14 157	10 789	11 001	10 561	13 481	9 713	11 957	11 828
Total	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

Table C.88: Proportional not-for-profit sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Defence	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Division 2: Economic development	19.5	19.6	17.7	12.7	9.7	7.0	6.1	6.9	7.5	7.6
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	6.1	3.7	3.7	3.5	2.9	1.8	1.5	1.4	1.4	1.2
Animal production and animal primary products	0.5	0.5	0.9	1.0	0.2	0.2	0.2	0.2	0.3	0.2
Mineral resources (excluding energy)	1.7	1.2	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Energy resources	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.5	0.5
Energy supply	1.5	1.0	0.7	1.0	0.7	0.6	0.5	0.5	0.7	0.9
Manufacturing	0.5	3.4	3.6	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Information and communication services	0.3	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.1	0.1
Commercial services	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Economic framework	7.3	7.0	6.0	4.7	4.7	3.6	3.1	3.4	3.6	4.0
Natural resources	1.1	2.3	1.1	1.2	0.6	0.5	0.5	1.1	0.8	0.7
Division 3: Society	71.2	71.3	70.9	75.4	77.4	71.3	71.5	77.7	71.3	69.4
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	52.0	57.7	59.2	65.6	68.7	64.3	63.8	68.5	62.1	61.2
Education and training	10.9	7.9	6.7	5.8	5.1	4.0	5.3	6.5	5.9	5.6

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Social development and community services	8.2	5.7	5.0	4.0	3.6	2.9	2.4	2.6	3.3	2.5
Division 4: Environment	2.6	2.1	2.0	1.9	3.1	2.7	2.5	2.9	2.9	3.1
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	1.3	1.1	1.1	1.0	2.0	1.6	1.5	1.9	2.2	2.2
Environmental aspects of development	0.8	0.6	0.5	0.6	0.5	0.5	0.4	0.5	0.5	0.6
Environmental and other aspects	0.5	0.4	0.3	0.4	0.6	0.6	0.6	0.5	0.3	0.4
Division 5: Advancement of knowledge	6.7	7.0	9.4	9.9	9.7	19.1	19.9	12.5	18.3	19.9
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	5.4	5.4	7.8	8.9	8.8	18.3	19.0	11.9	17.5	19.3
Social sciences and humanities	1.3	1.6	1.6	1.1	0.9	0.7	0.9	0.6	0.7	0.7
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 (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	25 478	27 219	21 026	17 053	15 150	19 452	19 676	20 462	14 846	36 166
Free State	15 953	14 214	8 890	6 643	8 086	11 332	29 633	9 743	2 432	6 635
Gauteng	175 651	287 783	345 937	333 359	440 863	528 725	543 971	572 423	469 019	535 873
KwaZulu-Natal	166 603	181 052	232 636	277 770	317 706	316 771	267 615	357 192	334 603	348 433
Limpopo	13 719	49 971	56 143	64 105	78 996	67 940	79 897	92 664	118 601	85 290
Mpumalanga	26 979	30 594	25 944	29 964	32 775	29 863	25 003	18 360	17 170	18 634
North West	72 446	105 904	97 918	136 641	133 473	136 626	162 503	171 737	140 181	225 031
Northern Cape	3 583	1 546	2 200	4 782	4 868	3 238	3 837	2 389	70 706	4 430
Western Cape	82 753	80 489	100 448	147 299	184 392	371 758	377 380	323 336	431 998	509 661
Total	583 165	778 772	891 142	1 017 616	1 216 310	1 485 704	1 509 515	1 568 307	1 599 557	1 770 153

Table C.90: Proportional not-for-profit sector R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	4.4	3.5	2.4	1.7	1.2	1.3	1.3	1.3	0.9	2.0
Free State	2.7	1.8	1.0	0.7	0.7	0.8	2.0	0.6	0.2	0.4
Gauteng	30.1	37.0	38.8	32.8	36.2	35.6	36.0	36.5	29.3	30.3
KwaZulu-Natal	28.6	23.2	26.1	27.3	26.1	21.3	17.7	22.8	20.9	19.7
Limpopo	2.4	6.4	6.3	6.3	6.5	4.6	5.3	5.9	7.4	4.8
Mpumalanga	4.6	3.9	2.9	2.9	2.7	2.0	1.7	1.2	1.1	1.1
North West	12.4	13.6	11.0	13.4	11.0	9.2	10.8	11.0	8.8	12.7
Northern Cape	0.6	0.2	0.2	0.5	0.4	0.2	0.3	0.2	4.4	0.3
Western Cape	14.2	10.3	11.3	14.5	15.2	25.0	25.0	20.6	27.0	28.8
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 by occupation (2013/14 to 2022/23)

Year	Headcount				Full-time equivalents (FTEs)			
	Total	Researchers	Technicians	Other R&D personnel	Total	Researchers	Technicians	Other R&D personnel
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	1 556.1	352.0	595.7	608.4
2021/22	1 844	444	680	720	1 577.1	349.4	549.4	678.3
2022/23	1 909	472	714	723	1 622.1	354.7	584.4	683.0

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.92: Not-for-profit sector R&D personnel by occupation and gender (2020/21 to 2022/23)

Occupation	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
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
2021/22							
Researchers	444	171	273	349.4	135.7	213.7	78.7
Technicians directly supporting R&D	680	182	498	549.4	133.5	415.9	80.8
Other personnel directly supporting R&D	720	213	507	678.3	203.0	475.3	94.2
Total	1 844	566	1 278	1 577.1	472.2	1 104.9	85.5
2022/23							
Researchers	472	176	296	354.7	136.6	218.1	75.1
Technicians directly supporting R&D	714	170	544	584.4	140.1	444.3	81.9
Other personnel directly supporting R&D	723	210	513	683.0	200.0	483.0	94.5
Total	1 909	556	1 353	1 622.1	476.7	1 145.4	85.0

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.93: Not-for-profit sector R&D personnel by occupation, qualification, population group and gender (2022/23)

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	472	176	296	81	143	7	25	13	32	63	77	12	19
Doctoral degree or equivalent	114	41	73	8	19	1	6	3	13	23	26	6	9
Master's, honours, bachelor or equivalent	313	115	198	57	103	5	17	8	17	39	51	6	10
Diplomas	45	20	25	16	21	1	2	2	2	1	0	0	0
Technicians directly supporting R&D	714	170	544	124	385	16	53	9	63	12	35	9	8
Doctoral degree or equivalent	11	5	6	1	1	0	0	1	4	1	1	2	0
Master's, honours, bachelor or equivalent	288	53	235	28	125	8	35	5	42	5	26	7	7
Diplomas	415	112	303	95	259	8	18	3	17	6	8	0	1
Other personnel directly supporting R&D	723	210	513	177	390	5	25	8	46	14	46	6	6
Doctoral degree or equivalent	13	7	6	2	1	0	4	1	0	3	1	1	0
Master's, honours, bachelor or equivalent	179	38	141	24	80	2	10	3	29	7	20	2	2
Diplomas	531	165	366	151	309	3	11	4	17	4	25	3	4
Total	1 909	556	1 353	382	918	28	103	30	141	89	158	27	33

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than 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 (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	245 167	338 250	358 666	348 775	329 263	416 131	400 775	411 837	442 048	496 883
Applied research	1 194 866	1 292 421	1 390 221	1 444 821	1 685 367	1 495 783	1 241 999	1 572 122	1 762 689	1 936 355
Experimental development research	257 118	262 339	264 134	305 051	311 246	311 513	250 769	253 572	267 697	286 627
Total	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866

Table C.95: Proportional government sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Basic research	14.4	17.9	17.8	16.6	14.2	18.7	21.2	18.4	17.9	18.3
Applied research	70.4	68.3	69.1	68.8	72.5	67.3	65.6	70.3	71.3	71.2
Experimental development research	15.1	13.9	13.1	14.5	13.4	14.0	13.2	11.3	10.8	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.96: Government sector R&D expenditure by spheres and institutes of government and accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Municipalities	59 418	62 485	61 703	76 493	59 114	84 160	99 754	106 207	122 886	184 068
Capital expenditure	23 033	12 921	13 059	20 271	13 265	30 048	20 120	24 170	17 150	71 454
Land: buildings and other structures	10 000	6 537	6 598	9 575	7 065	13 305	8 500	8 750	2 750	4 200
Total: Vehicles, plant, machinery, equipment and software	13 033	6 384	6 461	10 696	6 200	16 743	11 620	15 420	14 400	67 254
Vehicles, plant, machinery, equipment	13 033	6 384	6 461	10 696	6 200	16 743	7 900	9 600	8 500	13 154
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	3 720	5 820	5 900	54 100
Current expenditure	36 385	49 564	48 644	56 222	45 849	54 112	79 634	82 037	105 736	112 614
Labour costs	27 513	39 314	38 687	41 407	38 279	42 316	70 310	74 527	77 686	81 802
Other current expenditure	8 872	10 250	9 957	14 815	7 570	11 796	9 324	7 510	28 050	30 812
Provincial departments	390 301	421 126	401 512	405 760	411 195	410 454	412 428	427 623	446 832	444 272
Capital expenditure	45 930	39 325	43 918	48 084	35 517	27 502	44 238	42 072	29 115	22 265
Land: buildings and other structures	6 348	5 500	7 900	12 264	14 864	12 130	14 035	13 506	10 548	11 665
Total: Vehicles, plant, machinery, equipment and software	39 582	33 825	36 018	35 820	20 653	15 372	30 203	28 566	18 567	10 600
Vehicles, plant, machinery, equipment	39 582	33 825	36 018	35 820	20 653	15 372	25 056	25 763	14 980	7 606
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	5 147	2 803	3 587	2 994
Current expenditure	344 371	381 801	357 594	357 676	375 678	382 951	368 190	385 551	417 716	422 007
Labour costs	233 321	248 823	225 621	252 286	264 285	252 129	265 436	278 148	277 591	273 489
Other current expenditure	111 050	132 978	131 973	105 390	111 393	130 823	102 754	107 403	140 125	148 518
National departments	249 705	248 041	356 575	408 803	512 743	546 432	453 849	668 116	729 031	726 992
Capital expenditure	17 540	4 406	57 905	56 999	71 632	77 174	66 915	78 421	86 032	84 665
Land: buildings and other structures	2 122	811	18 037	6 424	6 920	16 143	18 321	17 861	18 480	18 954
Total: Vehicles, plant, machinery, equipment and software	15 418	3 595	39 868	50 575	64 712	61 031	48 594	60 560	67 552	65 711
Vehicles, plant, machinery, equipment	15 418	3 595	39 868	50 575	64 712	61 031	46 705	58 950	65 957	64 935
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	1 889	1 610	1 595	776
Current expenditure	232 165	243 635	298 670	351 804	441 111	469 258	386 934	589 695	642 999	642 327
Labour costs	198 440	150 921	171 849	216 103	228 761	194 471	204 110	181 989	198 143	197 214
Other current expenditure	33 725	92 714	126 821	135 701	212 350	274 787	182 824	407 706	444 856	445 113
Government research institutes	973 807	1 134 875	1 165 161	1 179 994	1 326 427	1 161 197	885 825	996 858	1 128 652	1 313 813
Capital expenditure	98 010	233 386	202 878	199 952	271 029	342 078	254 023	236 377	276 091	359 506
Land: buildings and other structures	4 542	93 477	112 710	107 971	131 824	105 507	116 115	132 749	133 505	161 297
Total: Vehicles, plant, machinery, equipment and software	93 468	139 909	90 168	91 981	139 205	236 571	137 908	103 628	142 586	198 209
Vehicles, plant, machinery, equipment	93 468	139 909	90 168	91 981	139 205	236 571	132 565	93 433	119 181	153 114
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	5 343	10 195	23 405	45 095
Current expenditure	875 797	901 489	962 283	980 042	1 055 398	819 119	631 802	760 482	852 561	954 307
Labour costs	316 256	375 939	311 876	323 121	328 656	394 182	425 678	459 866	574 592	612 831
Other current expenditure	559 541	525 550	650 407	656 921	726 741	424 937	206 124	300 616	277 969	341 476
Museums	23 920	26 484	28 070	27 596	16 396	21 184	41 688	38 727	45 033	50 720
Capital expenditure	946	1 996	2 005	2 704	796	2 106	5 574	6 679	4 100	5 290
Land: buildings and other structures	638	687	663	774	0	0	1 346	50	1 066	1 067
Total: Vehicles, plant, machinery, equipment and software	308	1 309	1 342	1 930	796	2 106	4 228	6 629	3 034	4 223
Vehicles, plant, machinery, equipment	308	1 309	1 342	1 930	796	2 106	2 626	6 349	2 825	3 808
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	1 602	280	209	415
Current expenditure	22 974	24 488	26 065	24 892	15 600	19 078	36 114	32 048	40 933	45 430
Labour costs	20 769	22 429	23 751	24 004	14 775	17 610	29 837	30 059	36 680	40 568
Other current expenditure	2 205	2 059	2 314	888	825	1 468	6 277	1 989	4 253	4 862
Government sector	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866
Capital expenditure	185 459	292 034	319 765	328 010	392 239	478 908	390 870	387 719	412 488	543 180
Land: buildings and other structures	23 650	107 012	145 908	137 008	160 673	147 085	158 317	172 916	166 349	197 183
Total: Vehicles, plant, machinery, equipment and software	161 809	185 022	173 857	191 002	231 566	331 823	232 553	214 803	246 139	345 997
Vehicles, plant, machinery, equipment	161 809	185 022	173 857	191 002	231 566	331 823	214 852	194 095	211 443	242 617
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	17 701	20 708	34 696	103 380
Current expenditure	1 511 692	1 600 976	1 693 256	1 770 636	1 933 636	1 744 518	1 502 673	1 849 812	2 059 946	2 176 685
Labour costs	796 299	837 425	771 784	856 921	874 757	900 707	995 370	1 024 588	1 164 692	1 205 904
Other current expenditure	715 393	763 551	921 472	913 715	1 058 879	843 811	507 303	825 224	895 253	970 781

* 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 (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Municipalities	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	38.8	20.7	21.2	26.5	22.4	35.7	20.2	22.8	14.0	38.8
Land: buildings and other structures	16.8	10.5	10.7	12.5	12.0	15.8	8.5	8.2	2.2	2.3
Total: Vehicles, plant, machinery, equipment and software	21.9	10.2	10.5	14.0	10.5	19.9	11.6	14.5	11.7	36.5
Vehicles, plant, machinery, equipment	21.9	10.2	10.5	14.0	10.5	19.9	7.9	9.0	6.9	7.1
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	3.7	5.5	4.8	29.4
Current expenditure	61.2	79.3	78.8	73.5	77.6	64.3	79.8	77.2	86.0	61.2
Labour costs	46.3	62.9	62.7	54.1	64.8	50.3	70.5	70.2	63.2	44.4
Other current expenditure	14.9	16.4	16.1	19.4	12.8	14.0	9.3	7.1	22.8	16.7
Provincial departments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	11.8	9.3	10.9	11.9	8.6	6.7	10.7	9.8	6.5	5.0
Land: buildings and other structures	1.6	1.3	2.0	3.0	3.6	3.0	3.4	3.2	2.4	2.6
Total: Vehicles, plant, machinery, equipment and software	10.1	8.0	9.0	8.8	5.0	3.7	7.3	6.7	4.2	2.4
Vehicles, plant, machinery, equipment	10.1	8.0	9.0	8.8	5.0	3.7	6.1	6.0	3.4	1.7
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	1.2	0.7	0.8	0.7
Current expenditure	88.2	90.7	89.1	88.1	91.4	93.3	89.3	90.2	93.5	95.0
Labour costs	59.8	59.1	56.2	62.2	64.3	61.4	64.4	65.0	62.1	61.6
Other current expenditure	28.5	31.6	32.9	26.0	27.1	31.9	24.9	25.1	31.4	33.4
National departments	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	7.0	1.8	16.2	13.9	14.0	14.1	14.7	11.7	11.8	11.6
Land: buildings and other structures	0.8	0.3	5.1	1.6	1.3	3.0	4.0	2.7	2.5	2.6
Total: Vehicles, plant, machinery, equipment and software	6.2	1.4	11.2	12.4	12.6	11.2	10.7	9.1	9.3	9.0
Vehicles, plant, machinery, equipment	6.2	1.4	11.2	12.4	12.6	11.2	10.3	8.8	9.0	8.9
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	0.4	0.2	0.2	0.1
Current expenditure	93.0	98.2	83.8	86.1	86.0	85.9	85.3	88.3	88.2	88.4
Labour costs	79.5	60.8	48.2	52.9	44.6	35.6	45.0	27.2	27.2	27.1
Other current expenditure	13.5	37.4	35.6	33.2	41.4	50.3	40.3	61.0	61.0	61.2
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	10.1	20.6	17.4	16.9	20.4	29.5	28.7	23.7	24.5	27.4
Land: buildings and other structures	0.5	8.2	9.7	9.2	9.9	9.1	13.1	13.3	11.8	12.3
Total: Vehicles, plant, machinery, equipment and software	9.6	12.3	7.7	7.8	10.5	20.4	15.6	10.4	12.6	15.1
Vehicles, plant, machinery, equipment	9.6	12.3	7.7	7.8	10.5	20.4	15.0	9.4	10.6	11.7
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	0.6	1.0	2.1	3.4
Current expenditure	89.9	79.4	82.6	83.1	79.6	70.5	71.3	76.3	75.5	72.6
Labour costs	32.5	33.1	26.8	27.4	24.8	33.9	48.1	46.1	50.9	46.6
Other current expenditure	57.5	46.3	55.8	55.7	54.8	36.6	23.3	30.2	24.6	26.0
Museums	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	4.0	7.5	7.1	9.8	4.9	9.9	13.4	17.2	9.1	10.4
Land: buildings and other structures	2.7	2.6	2.4	2.8	0.0	0.0	3.2	0.1	2.4	2.1
Total: Vehicles, plant, machinery, equipment and software	1.3	4.9	4.8	7.0	4.9	9.9	10.1	17.1	6.7	8.3
Vehicles, plant, machinery, equipment	1.3	4.9	4.8	7.0	4.9	9.9	6.3	16.4	6.3	7.5
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	3.8	0.7	0.5	0.8
Current expenditure	96.0	92.5	92.9	90.2	95.1	90.1	86.6	82.8	90.9	89.6
Labour costs	86.8	84.7	84.6	87.0	90.1	83.1	71.6	77.6	81.5	80.0
Other current expenditure	9.2	7.8	8.2	3.2	5.0	6.9	15.1	5.1	9.4	9.6
Government sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Capital expenditure	10.9	15.4	15.9	15.6	16.9	21.5	20.6	17.3	16.7	20.0
Land: buildings and other structures	1.4	5.7	7.2	6.5	6.9	6.6	8.4	7.7	6.7	7.2
Total: Vehicles, plant, machinery, equipment and software	9.5	9.8	8.6	9.1	10.0	14.9	12.3	9.6	10.0	12.7
Vehicles, plant, machinery, equipment	9.5	9.8	8.6	9.1	10.0	14.9	11.3	8.7	8.6	8.9
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	0.9	0.9	1.4	3.8
Current expenditure	89.1	84.6	84.1	84.4	83.1	78.5	79.4	82.7	83.3	80.0
Labour costs	46.9	44.2	38.3	40.8	37.6	40.5	52.6	45.8	47.1	44.3
Other current expenditure	42.2	40.3	45.8	43.5	45.5	38.0	26.8	36.9	36.2	35.7

*Capitalised computer software collected from 2019/20.

Table C.98: Government sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	97 816	85 385	81 409	87 557	84 738	89 293	100 237	104 270	64 506	95 648
Nanotechnology	16 929	13 112	11 774	12 620	12 741	24 732	10 784	13 115	13 490	19 562
Total	114 745	98 497	93 183	100 176	97 479	114 025	111 021	117 385	77 996	115 210
Government expenditure on R&D	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866

Table C.99: Proportional government sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biotechnology	5.8	4.5	4.0	4.2	3.6	4.0	5.3	4.7	2.6	3.5
Nanotechnology	1.0	0.7	0.6	0.6	0.5	1.1	0.6	0.6	0.5	0.7
Total	6.8	5.2	4.6	4.8	4.2	5.1	5.9	5.2	3.2	4.2

Table C.100: Government sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment-related	194 564	232 090	192 774	202 351	316 188	339 012	314 713	552 121	551 439	696 625
Open-source software	0	0	0	0	597	711	5 553	43 034	45 500	54 026
New materials	30 945	12 062	5 291	6 143	7 599	13 172	8 594	15 866	21 353	45 733
Tuberculosis, HIV/AIDS, malaria	380 640	359 074	389 279	395 996	435 045	237 974	114 727	190 057	212 240	273 399
Space science	N/A	N/A	N/A	39 882	0	0	51 887	52 566	28 322	69 646
Total	606 149	603 226	587 343	644 372	759 430	590 869	495 475	853 644	858 854	1 139 429
Government expenditure on R&D	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866

Space science data collected from 2016/17.

Table C.101: Proportional government sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Environment-related	11.5	12.3	9.6	9.6	13.59	15.2	16.6	24.7	22.3	25.6
Open-source software	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.9	1.8	2.0
New materials	1.8	0.6	0.3	0.3	0.3	0.6	0.5	0.7	0.9	1.7
Tuberculosis, HIV/AIDS, malaria	22.4	19.0	19.3	18.9	18.7	10.7	6.1	8.5	8.6	10.1
Space science	N/A	N/A	N/A	1.9	0.0	0.0	2.7	2.3	1.1	2.6
Total	24.3	19.6	29.2	30.7	32.7	26.6	26.2	38.2	34.7	41.9

Space science data collected from 2016/17.

Table C.102: Government sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	1 359 179	1 558 094	1 520 894	1 560 315	1 722 617	1 592 766	1 401 551	1 739 342	1 860 053	2 090 277
Mathematical sciences	1 525	28 302	397	539	85	1 855	11 408	8 075	7 075	48 703
Physical sciences	0	30 154	26 455	28 529	49 051	54 017	8 725	5 105	5 971	5 607
Chemical sciences	19 394	61 881	61 688	68 937	73 898	81 603	45 405	32 280	35 965	59 372
Earth sciences	65 501	139 388	79 942	85 550	50 110	103 767	163 319	359 200	327 087	404 267
Information, computer and communication technologies	8 431	12 141	4 662	5 540	398	0	0	35 986	36 418	34 935
Applied sciences and technologies	23 216	29 723	22 531	25 444	23 016	38 562	49 438	45 394	40 847	49 485
Engineering sciences	11 853	13 176	12 129	13 572	17 076	14 574	14 071	27 752	6 568	13 004
Biological sciences	138 000	152 735	196 053	195 922	215 624	254 654	246 541	187 733	261 068	256 817
Agricultural sciences	397 687	506 445	471 798	485 417	523 343	557 157	591 668	566 999	618 335	630 458
Medical and health sciences	594 684	553 534	608 530	615 067	673 437	370 294	167 039	307 108	343 477	422 890
Environmental sciences	55 245	14 353	14 478	13 921	13 085	17 270	29 249	30 808	29 510	31 274
Material sciences	10 537	0	0	0	0	0	0	3 244	3 050	0
Marine sciences	33 106	16 262	22 232	21 877	83 495	99 013	74 686	129 657	144 682	133 466
Division 2: Social sciences and humanities	337 972	334 916	492 127	538 331	603 258	630 660	491 992	498 188	612 381	629 588
Social sciences	326 603	328 522	479 316	529 080	591 813	620 433	476 565	485 014	600 385	616 589
Humanities	11 369	6 394	12 811	9 251	11 445	10 227	15 427	13 174	11 997	13 000
Total	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866

Table C.103: Proportional government sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	80.1	82.3	75.6	74.3	74.1	71.6	74.0	77.7	75.2	76.9
Mathematical sciences	0.1	1.5	0.0	0.0	0.0	0.1	0.6	0.4	0.3	1.8
Physical sciences	0.0	1.6	1.3	1.4	2.1	2.4	0.5	0.2	0.2	0.2
Chemical sciences	1.1	3.3	3.1	3.3	3.2	3.7	2.4	1.4	1.5	2.2
Earth sciences	3.9	7.4	4.0	4.1	2.2	4.7	8.6	16.1	13.2	14.9
Information, computer and communication technologies	0.5	0.6	0.2	0.3	0.0	0.0	0.0	1.6	1.5	1.3
Applied sciences and technologies	1.4	1.6	1.1	1.2	1.0	1.7	2.6	2.0	1.7	1.8

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Engineering sciences	0.7	0.7	0.6	0.6	0.7	0.7	0.7	1.2	0.3	0.5
Biological sciences	8.1	8.1	9.7	9.3	9.3	11.5	13.0	8.4	10.6	9.4
Agricultural sciences	23.4	26.8	23.4	23.1	22.5	25.1	31.2	25.3	25.0	23.2
Medical and health sciences	35.0	29.2	30.2	29.3	29.0	16.7	8.8	13.7	13.9	15.5
Environmental sciences	3.3	0.8	0.7	0.7	0.6	0.8	1.5	1.4	1.2	1.1
Material sciences	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Marine sciences	2.0	0.9	1.1	1.0	3.6	4.5	3.9	5.8	5.9	4.9
Division 2: Social sciences and humanities	19.9	17.7	24.4	25.7	25.9	28.4	26.0	22.3	24.8	23.1
Social sciences	19.2	17.4	23.8	25.2	25.4	27.9	25.2	21.7	24.3	22.7
Humanities	0.7	0.3	0.6	0.4	0.5	0.5	0.8	0.6	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.104: Government sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	21 118	21 472	42 233	34 213	7 582	46 886	31 484	26 989	22 188	27 986
Defence	21 118	21 472	42 233	34 213	7 582	46 886	31 484	26 989	22 188	27 986
Division 2: Economic development	510 688	763 932	745 129	826 860	1 009 575	1 117 257	1 045 765	1 068 644	1 257 768	1 364 823
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	89 446	107 672	92 506	103 212	117 664	115 406	127 551	117 715	114 499	262 849
Animal production and animal primary products	137 279	156 437	125 737	134 227	129 024	135 755	141 189	131 528	141 857	0
Mineral resources (excluding energy)	311	5 403	6 548	2 854	12 395	5 508	5 729	4 829	5 159	5 256
Energy resources	1 023	12 062	5 291	5 716	5 706	6 413	2 446	1 312	1 312	1 336
Energy supply	8 482	34 845	29 705	32 772	40 959	53 254	15 204	11 714	30 105	43 675
Manufacturing	1 544	79 583	1 318	5 201	5 433	10 794	15 855	28 956	14 533	29 656
Construction	741	4 312	1 394	1 501	1 584	8 501	6 112	5 935	28 103	28 638
Transport	1 672	24 105	21 537	24 896	21 926	7 268	9 686	7 231	7 186	15 008
Information and communication services	5 515	14 397	7 977	6 071	19 938	18 583	13 385	5 220	14 292	14 184
Commercial services	12 162	15 532	13 531	12 616	47 515	72 388	55 141	53 609	9 749	7 913
Economic framework	116 604	167 690	262 289	343 537	394 216	404 073	381 306	388 478	503 328	525 234
Natural resources	135 909	141 895	177 298	154 258	213 214	279 313	272 162	312 117	387 645	431 075

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 3: Society	872 096	912 216	952 108	951 859	1 029 316	746 234	529 902	669 831	711 446	812 110
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	487 130	475 983	482 472	511 031	554 746	303 831	137 831	253 420	285 713	0
Education and training	165 906	174 540	209 544	169 499	173 547	139 984	96 114	116 193	138 154	508 298
Social development and community services	219 061	261 693	260 092	271 328	301 023	302 419	295 956	300 218	287 579	303 812
Division 4: Environment	172 006	127 394	191 334	204 573	208 704	237 373	191 622	374 408	364 490	372 524
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	124 445	91 677	107 265	116 996	100 339	117 228	123 194	340 112	328 874	333 682
Environmental aspects of development	38 877	27 206	53 541	55 508	50 936	64 148	48 503	23 399	20 336	30 295
Environmental and other aspects	8 684	8 511	30 528	32 069	57 429	55 997	19 924	10 898	15 280	8 547
Division 5: Advancement of knowledge	121 243	67 996	82 217	81 141	70 698	75 676	94 771	97 658	116 542	142 424
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	96 381	43 170	58 401	57 655	57 473	61 475	78 751	77 069	88 698	113 855
Social sciences and humanities	24 862	24 825	23 816	23 486	13 225	14 201	16 019	20 590	27 844	28 568
Total	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866

Table C.105: Proportional government sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	1.2	1.1	2.1	1.6	0.3	2.1	1.7	1.2	0.9	1.0
Defence	1.2	1.1	2.1	1.6	0.3	2.1	1.7	1.2	0.9	1.0
Division 2: Economic development	30.1	40.4	37.0	39.4	43.4	50.2	55.2	47.8	50.9	50.2
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	5.3	5.7	4.6	4.9	5.1	5.2	6.7	5.3	4.6	9.7
Animal production and animal primary products	8.1	8.3	6.2	6.4	5.5	6.1	7.5	5.9	5.7	0.0
Mineral resources (excluding energy)	0.0	0.3	0.3	0.1	0.5	0.2	0.3	0.2	0.2	0.2
Energy resources	0.1	0.6	0.3	0.3	0.2	0.3	0.1	0.1	0.1	0.0

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Energy supply	0.5	1.8	1.5	1.6	1.8	2.4	0.8	0.5	1.2	1.6
Manufacturing	0.1	4.2	0.1	0.2	0.2	0.5	0.8	1.3	0.6	1.1
Construction	0.0	0.2	0.1	0.1	0.1	0.4	0.3	0.3	1.1	1.1
Transport	0.1	1.3	1.1	1.2	0.9	0.3	0.5	0.3	0.3	0.6
Information and communication services	0.3	0.8	0.4	0.3	0.9	0.8	0.7	0.2	0.6	0.5
Commercial services	0.7	0.8	0.7	0.6	2.0	3.3	2.9	2.4	0.4	0.3
Economic framework	6.9	8.9	13.0	16.4	16.9	18.2	20.1	17.4	20.4	19.3
Natural resources	8.0	7.5	8.8	7.4	9.2	12.6	14.4	13.9	15.7	15.8
Division 3: Society	51.4	48.2	47.3	45.4	44.3	33.6	28.0	29.9	28.8	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	28.7	25.1	24.0	24.4	23.9	13.7	7.3	11.3	11.6	0.0
Education and training	9.8	9.2	10.4	8.1	7.5	6.3	5.1	5.2	5.6	18.7
Social development and community services	12.9	13.8	12.9	12.9	12.9	13.6	15.6	13.4	11.6	11.2
Division 4: Environment	10.1	6.7	9.5	9.7	9.0	10.7	10.1	16.7	14.7	13.7
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	7.3	4.8	5.3	5.6	4.3	5.3	6.5	15.2	13.3	12.3
Environmental aspects of development	2.3	1.4	2.7	2.6	2.2	2.9	2.6	1.0	0.8	1.1
Environmental and other aspects	0.5	0.4	1.5	1.5	2.5	2.5	1.1	0.5	0.6	0.3
Division 5: Advancement of knowledge	7.1	3.6	4.1	3.9	3.0	3.4	5.0	4.4	4.7	5.2
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	5.7	2.3	2.9	2.7	2.5	2.8	4.2	3.4	3.6	4.2
Social sciences and humanities	1.5	1.3	1.2	1.1	0.6	0.6	0.8	0.9	1.1	1.1
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 (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	133 657	227 427	225 603	222 456	281 201	305 629	301 816	383 648	390 162	401 321
Free State	55 095	60 860	61 802	81 957	81 890	59 694	45 660	51 714	52 374	58 749
Gauteng	689 915	760 199	832 397	885 142	974 192	836 827	581 945	626 239	821 650	914 244
KwaZulu-Natal	161 962	177 517	187 088	172 655	206 551	236 602	205 503	284 898	290 063	306 663
Limpopo	95 668	83 683	84 232	76 541	86 876	89 889	81 308	90 390	112 845	114 631
Mpumalanga	77 479	93 566	112 173	107 237	104 154	88 922	83 648	74 233	78 600	82 241
North West	73 576	56 719	61 815	57 994	60 594	66 727	57 423	60 752	25 891	30 024
Northern Cape	61 932	52 579	69 174	66 200	94 659	88 575	52 399	131 729	136 529	139 064
Western Cape	347 869	380 461	378 737	428 465	435 757	450 560	483 841	533 926	564 321	672 928
Total	1 697 151	1 893 010	2 013 021	2 098 646	2 325 875	2 223 426	1 893 543	2 237 531	2 472 434	2 719 866

Table C.107: Proportional government sector R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	7.9	12.0	11.2	10.6	12.1	13.7	15.9	17.1	15.8	14.8
Free State	3.2	3.2	3.1	3.9	3.5	2.7	2.4	2.3	2.1	2.2
Gauteng	40.7	40.2	41.4	42.2	41.9	37.6	30.7	28.0	33.2	33.6
KwaZulu-Natal	9.5	9.4	9.3	8.2	8.9	10.6	10.9	12.7	11.7	11.3
Limpopo	5.6	4.4	4.2	3.6	3.7	4.0	4.3	4.0	4.6	4.2
Mpumalanga	4.6	4.9	5.6	5.1	4.5	4.0	4.4	3.3	3.2	3.0
North West	4.3	3.0	3.1	2.8	2.6	3.0	3.0	2.7	1.0	1.1
Northern Cape	3.6	2.8	3.4	3.2	4.1	4.0	2.8	5.9	5.5	5.1
Western Cape	20.5	20.1	18.8	20.4	18.7	20.3	25.6	23.9	22.8	24.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.108: Government sector R&D personnel headcount and full-time equivalents by occupation (2013/14 to 2022/23)

Year	Headcount				Full-time equivalents (FTEs)			
	Total	Researchers	Technicians	Other R&D personnel	Total	Researchers	Technicians	Other R&D personnel
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
2021/22	3 314	1 789	623	902	2 095.5	1 030.2	338.5	726.8
2022/23	3 374	1 872	626	876	2 100.2	1 060.2	362.3	677.7

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.109: Government sector R&D personnel headcount and full-time equivalents by occupation and gender (2020/21 to 2022/23)

Occupation	Headcount			Full-time equivalents (FTEs)				
	2020/21	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
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
2021/22	Total	Male	Female	Total	Male	Female	FTEs as % of headcount	
Researchers		1 789	774	1 015	1 030.2	440.5	589.7	57.6
Technicians directly supporting R&D		623	340	283	338.5	186.0	152.5	54.3
Other personnel directly supporting R&D		902	542	360	726.8	487.9	238.9	80.6
Total		3 314	1 656	1 658	2 095.5	1 114.4	981.1	63.2
2022/23	Total	Male	Female	Total	Male	Female	FTEs as % of headcount	
Researchers		1 872	869	1 003	1 060.2	452.8	607.4	56.6
Technicians directly supporting R&D		626	348	278	362.3	192.3	170.1	30.0
Other personnel directly supporting R&D		876	538	338	677.7	457.7	220.0	77.4
Total		3 374	1 755	1 619	2 100.2	1 102.7	997.5	53.1

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.110: Government sector R&D personnel headcount by occupation, qualification, population group and gender (2022/23)

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	1 872	869	1 003	583	614	41	79	50	89	178	214	17	7
Doctoral degree or equivalent	505	292	213	177	67	11	20	19	24	74	98	11	4
Master's, honours, bachelor or equivalent	1 237	523	714	375	493	29	55	26	58	91	108	2	0
Diplomas	130	54	76	31	54	1	4	5	7	13	8	4	3
Technicians directly supporting R&D	626	348	278	208	167	56	47	26	17	52	47	6	0
Doctoral degree or equivalent	17	12	5	5	3	1	0	0	0	4	2	2	0
Master's, honours, bachelor or equivalent	392	209	183	126	109	29	30	19	12	34	32	1	0
Diplomas	217	127	90	77	55	26	17	7	5	14	13	3	0
Other personnel directly supporting R&D	876	538	338	351	232	143	60	7	12	23	33	14	1
Doctoral degree or equivalent	11	9	2	0	1	0	0	0	0	5	0	4	1
Master's, honours, bachelor or equivalent	105	40	65	15	39	4	8	4	7	7	11	10	0
Diplomas	760	489	271	336	192	139	52	3	5	11	22	0	0
Total	3 374	1 755	1 619	1 142	1 013	240	186	83	118	253	294	37	8

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

C.2.4. Science council sector

Table C.111: Science council sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	970 785	1 166 491	1 348 533	1 372 702	1 349 946	1 244 253	1 388 847	1 294 844	1 423 138	1 809 051
Applied research	2 114 943	2 421 309	2 781 198	3 202 019	3 460 650	2 855 564	3 337 342	3 033 375	3 276 969	3 871 742
Experimental development research	1 218 827	1 416 869	1 611 166	1 561 462	1 502 748	1 344 068	1 472 175	1 574 195	1 654 191	1 342 514
Total	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

Table C.112: Proportional science council sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Basic research	22.6	23.3	23.49	22.37	21.4	22.9	22.4	21.9	22.4	25.8
Applied research	49.1	48.4	48.45	52.18	54.8	52.5	53.8	51.4	51.6	55.1
Experimental development research	28.3	28.3	28.06	25.45	23.8	24.7	23.8	26.7	26.0	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.113: Science council sector R&D expenditure by accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Capital expenditure	323 190	598 429	916 480	857 241	823 937	460 304	571 628	499 152	459 899	539 802
Land: buildings & other structures	71 602	362 246	162 904	211 246	386 063	62 598	105 660	37 189	42 472	91 878
Total: Vehicles, plant, machinery, equipment and software	251 588	236 183	753 576	645 995	437 874	397 706	465 968	461 963	417 427	447 924
Vehicles, plant, machinery, equipment	251 588	236 183	753 576	645 995	437 874	397 706	430 090	424 749	371 431	431 817
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	35 878	37 214	45 996	16 107
Current expenditure	3 981 366	4 406 240	4 824 418	5 278 942	5 489 407	4 983 581	5 626 735	5 403 262	5 894 399	6 483 505
Labour costs	2 187 401	1 986 918	2 142 875	2 339 348	2 421 297	2 371 273	2 260 207	2 264 933	2 601 051	2 644 197
Other current expenditure	1 793 965	2 419 322	2 681 543	2 939 594	3 068 110	2 612 308	3 366 528	3 138 329	3 293 348	3 839 308
Total	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

*Capitalised computer software collected from 2019/20.

Table C.114: Proportional science council sector R&D expenditure by accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Capital expenditure	6.8	7.5	12.0	16.0	14.0	13.1	9.2	8.5	7.2	7.7
Land: buildings & other structures	1.7	1.7	7.2	2.8	3.4	6.1	1.7	0.6	0.7	1.3
Total: Vehicles, plant, machinery, equipment and software	5.1	5.8	4.7	13.1	10.5	6.9	7.5	7.8	6.6	6.4
Vehicles, plant, machinery, equipment	5.1	5.8	4.7	13.1	10.5	6.9	6.9	7.2	5.8	6.1
Capitalised computer software*	N/A	N/A	N/A	N/A	N/A	N/A	0.6	0.6	0.7	0.2
Current expenditure	93.2	92.5	88.0	84.0	86.0	86.9	90.8	91.5	92.8	92.3
Labour costs	51.0	50.8	39.7	37.3	38.1	38.4	36.5	38.4	40.9	37.6
Other current expenditure	42.2	41.7	48.3	46.7	47.9	48.6	54.3	53.2	51.8	54.7
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.115: Science council sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	143 868	312 793	320 048	360 163	299 783	257 498	325 251	296 543	348 861	366 530
Nanotechnology	114 990	125 107	139 107	139 783	272 372	222 662	289 934	95 110	104 250	92 613
Total	258 857	437 900	459 154	499 946	572 155	480 160	615 186	391 652	453 110	459 143
Science council expenditure on R&D	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

Table C.116: Proportional science council sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biotechnology	3.3	6.3	5.6	5.9	4.7	4.7	5.2	5.0	5.5	5.2
Nanotechnology	2.7	2.5	2.4	2.3	4.3	4.1	4.7	1.6	1.6	1.3
Total	6.0	8.7	8.0	8.1	9.1	8.8	9.9	6.6	7.1	6.5

Table C.117: Science council sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment-related	297 097	1 037 320	1 054 651	1 031 393	953 077	831 377	881 520	802 772	946 401	1 140 335
Open-source software	0	389 871	692 096	453 879	842 548	107 063	226 090	56 908	61 508	121 145
New materials	229 854	358 361	374 463	373 768	401 995	329 199	297 042	225 040	234 872	215 777
Tuberculosis, HIV/AIDS, malaria	398 880	346 751	470 488	625 806	670 209	572 650	492 341	519 670	620 403	693 579
Space science	N/A	N/A	N/A	296 236	0	593 920	614 780	635 906	743 319	757 468
Total	925 831	2 132 304	2 591 697	2 781 082	2 867 828	2 434 208	2 511 774	2 240 296	2 606 502	2 928 304
Science council expenditure on R&D	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

Space science data collected from 2016/17.

Table C.118: Proportional science council sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Environment-related	6.9	20.7	18.4	16.8	15.1	15.3	14.2	13.6	14.9	16.2
Open-source software	0.0	7.8	12.1	7.4	13.3	2.0	3.6	1.0	1.0	1.7
New materials	5.3	7.2	6.5	6.1	6.4	6.0	4.8	3.8	3.7	3.1
Tuberculosis, HIV/AIDS, malaria	9.3	6.9	8.2	10.2	10.6	10.5	7.9	8.8	9.8	9.9
Space science	N/A	N/A	N/A	4.8	0.0	10.9	9.9	10.8	11.7	10.8
Total	21.5	42.6	45.1	45.3	45.4	44.7	40.5	38.0	41.0	41.7

Space science data collected from 2016/17.

Table C.119: Science council sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	4 109 105	4 800 742	5 486 847	5 889 463	6 112 974	5 314 694	6 062 356	5 801 859	6 197 153	6 782 596
Mathematical sciences	128 291	48 258	54 212	47 890	61 223	180 075	154 147	44 050	46 717	22 504
Physical sciences	129 568	263 302	418 648	444 274	502 615	410 797	457 042	423 591	446 937	497 805
Chemical sciences	18 166	63 775	71 024	66 188	77 952	48 685	94 308	59 447	61 528	74 172
Earth sciences	110 092	162 880	181 876	254 414	198 140	202 037	231 490	214 568	286 203	342 069
Information, computer and communication technologies	182 402	780 044	977 891	999 538	1 124 366	852 856	996 778	977 489	1 008 671	1 396 655
Applied sciences and technologies	1 046 934	277 649	296 162	475 568	356 409	369 603	474 058	538 072	499 354	459 679
Engineering sciences	349 666	1 001 486	1 107 289	1 016 283	1 171 287	849 940	1 171 031	1 176 104	1 233 584	1 112 718
Biological sciences	482 728	148 268	144 341	138 673	169 717	87 630	138 416	113 597	124 691	200 105

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	859 600	1 075 165	1 043 494	1 067 146	989 974	898 199	886 212	790 931	822 351	956 286
Medical and health sciences	430 472	596 600	775 858	836 967	1 021 905	984 580	885 544	1 048 315	1 347 929	1 343 960
Environmental sciences	326 122	228 909	240 075	343 218	267 495	212 887	283 782	181 584	186 033	221 953
Material sciences	35 093	113 457	133 231	122 130	143 684	114 491	151 654	111 190	117 631	134 549
Marine sciences	9 970	40 949	42 747	77 173	28 207	102 913	137 894	122 922	15 524	20 141
Division 2: Social sciences and humanities	195 452	203 927	254 050	246 721	200 370	129 191	136 007	100 554	157 145	240 711
Social sciences	173 407	179 456	223 966	239 011	192 200	123 414	136 007	100 554	157 145	240 711
Humanities	22 044	24 471	30 084	7 710	8 170	5 777	0	0	0	0
Total	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

Table C.120: Proportional science council sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering	95.5	95.9	95.6	96.0	96.8	97.6	97.8	98.3	97.5	96.6
Mathematical sciences	3.0	1.0	0.9	0.8	1.0	3.3	2.5	0.7	0.7	0.3
Physical sciences	3.0	5.3	7.3	7.2	8.0	7.5	7.4	7.2	7.0	7.1
Chemical sciences	0.4	1.3	1.2	1.1	1.2	0.9	1.5	1.0	1.0	1.1
Earth sciences	2.6	3.3	3.2	4.1	3.1	3.7	3.7	3.6	4.5	4.9
Information, computer and communication technologies	4.2	15.6	17.0	16.3	17.8	15.7	16.1	16.6	15.9	19.9
Applied sciences and technologies	24.3	5.5	5.2	7.8	5.6	6.8	7.6	9.1	7.9	6.5
Engineering sciences	8.1	20.0	19.3	16.6	18.6	15.6	18.9	19.9	19.4	15.8
Biological sciences	11.2	3.0	2.5	2.3	2.7	1.6	2.2	1.9	2.0	2.8
Agricultural sciences	20.0	21.5	18.2	17.4	15.7	16.5	14.3	13.4	12.9	13.6
Medical and health sciences	10.0	11.9	13.5	13.6	16.2	18.1	14.3	17.8	21.2	19.1
Environmental sciences	7.6	4.6	4.2	5.6	4.2	3.9	4.6	3.1	2.9	3.2
Material sciences	0.8	2.3	2.3	2.0	2.3	2.1	2.4	1.9	1.9	1.9
Marine sciences	0.2	0.8	0.7	1.3	0.4	1.9	2.2	2.1	0.2	0.3
Division 2: Social sciences and humanities	4.5	4.1	4.4	4.0	3.2	2.4	2.2	1.7	2.5	3.4
Social sciences	4.0	3.6	3.9	3.9	3.0	2.3	2.2	1.7	2.5	3.4
Humanities	0.5	0.5	0.5	0.1	0.1	0.1	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.121: Science council sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence	262 203	762 464	826 261	754 207	915 281	536 553	715 553	630 997	552 826	674 838
Defence	262 203	762 464	826 261	754 207	915 281	536 553	715 553	630 997	552 826	674 838
Division 2: Economic development	2 686 504	2 306 795	2 529 244	2 471 163	2 625 282	2 140 026	2 419 541	2 178 829	2 317 530	3 084 061
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	624 675	413 737	396 612	396 536	368 829	339 896	290 267	258 061	319 184	351 482
Animal production and animal primary products	419 259	269 519	247 883	247 835	230 518	212 435	207 333	184 329	191 131	213 760
Mineral resources (excluding energy)	234 273	232 114	265 006	255 226	274 778	287 423	303 480	294 486	330 010	317 316
Energy resources	106 823	5 590	5 063	8 108	6 682	5 568	21 334	20 002	55 770	60 775
Energy supply	2 937	0	0	0	1 468	1 499	4 072	4 065	0	22 019
Manufacturing	393 152	88 746	146 395	170 040	179 215	138 141	147 634	147 455	149 384	149 669
Construction	245 333	31 034	60 828	67 003	70 943	65 389	69 621	71 721	91 572	94 679
Transport	0	0	0	0	0	0	0	0	7 611	8 236
Information and communication services	135 629	396 310	419 252	410 724	462 785	386 839	499 564	455 370	503 252	889 281
Commercial services	19 724	5 236	5 671	7 756	2 937	2 998	0	0	0	0
Economic framework	75 411	537 499	664 440	571 815	713 045	419 073	559 622	467 458	400 333	668 848
Natural resources	429 288	327 009	318 094	336 119	314 082	280 766	316 614	275 882	269 284	307 995
Division 3: Society	425 943	801 370	977 159	1 074 539	978 471	1 053 871	1 254 643	1 041 731	1 573 279	1 179 414
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	316 987	424 639	552 314	613 932	632 851	722 673	653 443	727 194	843 323	937 494
Education and training	72 216	335 946	374 704	145 215	98 348	70 575	93 081	50 329	53 431	89 344
Social development and community services	36 741	40 785	50 141	315 392	247 273	260 622	508 119	264 208	676 525	152 576
Division 4: Environment	46 559	422 650	455 404	852 597	782 034	610 761	423 727	389 939	317 858	598 094
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	28 295	402 820	426 582	466 312	434 251	304 725	373 973	344 017	218 392	513 087
Environmental aspects of development	14 071	15 824	14 179	17 451	13 215	13 493	0	0	32 980	35 690
Environmental and other aspects	4 194	4 006	14 644	368 834	334 567	292 543	49 754	45 922	66 486	49 318

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 5: Advancement of knowledge	883 346	711 390	952 830	983 677	1 012 276	1 102 675	1 384 899	1 660 917	1 592 806	1 486 900
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	746 397	422 429	620 283	692 258	708 020	723 871	1 074 410	1 260 670	1 263 423	1 203 355
Social sciences and humanities	136 949	288 961	332 547	291 419	304 256	378 804	310 489	400 247	329 382	283 545
Total	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

Table C.122: Proportional science council sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	6.1	15.2	14.4	12.3	14.5	9.9	11.5	10.7	8.7	9.6
Defence	6.1	15.2	14.4	12.3	14.5	9.9	11.5	10.7	8.7	9.6
Division 2: Economic development	62.4	46.1	44.1	40.3	41.6	39.3	39.0	36.9	36.5	43.9
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	14.5	8.3	6.9	6.5	5.8	6.2	4.7	4.4	5.0	5.0
Animal production and animal primary products	9.7	5.4	4.3	4.0	3.7	3.9	3.3	3.1	3.0	3.0
Mineral resources (excluding energy)	5.4	4.6	4.6	4.2	4.4	5.3	4.9	5.0	5.2	4.5
Energy resources	2.5	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.9	0.9
Energy supply	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.3
Manufacturing	9.1	1.8	2.6	2.8	2.8	2.5	2.4	2.5	2.4	2.1
Construction	5.7	0.6	1.1	1.1	1.1	1.2	1.1	1.2	1.4	1.3
Transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Information and communication services	3.2	7.9	7.3	6.7	7.3	7.1	8.1	7.7	7.9	12.7
Commercial services	0.5	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Economic framework	1.8	10.7	11.6	9.3	11.3	7.7	9.0	7.9	6.3	9.5
Natural resources	10.0	6.5	5.5	5.5	5.0	5.2	5.1	4.7	4.2	4.4
Division 3: Society	79.9	16.0	17.0	17.5	15.5	19.4	20.2	17.6	24.8	16.8
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	7.4	8.5	9.6	10.0	10.0	13.3	10.5	12.3	13.3	13.3
Education and training	1.7	6.7	6.5	2.4	1.6	1.3	1.5	0.9	0.8	1.3

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Social development and community services	0.9	0.8	0.9	5.1	3.9	4.8	8.2	4.5	10.6	2.2
Division 4: Environment	1.1	8.4	7.9	13.9	12.4	11.2	6.8	6.6	5.0	8.5
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	0.7	8.0	7.4	7.6	6.9	5.6	6.0	5.8	3.4	7.3
Environmental aspects of development	0.3	0.3	0.2	0.3	0.2	0.2	0.0	0.0	0.5	0.5
Environmental and other aspects	0.1	0.1	0.3	6.0	5.3	5.4	0.8	0.8	1.0	0.7
Division 5: Advancement of knowledge	20.5	14.2	16.6	16.0	16.0	20.3	22.3	28.1	25.1	21.2
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	17.3	8.4	10.8	11.3	11.2	13.3	17.3	21.4	19.9	17.1
Social sciences and humanities	3.2	5.8	5.8	4.7	4.8	7.0	5.0	6.8	5.2	4.0
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 council sector R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	115 925	259 128	269 658	273 509	279 550	183 931	206 142	189 604	202 745	246 369
Free State	47 271	58 608	59 953	60 149	59 300	110 995	94 188	85 089	59 246	151 060
Gauteng	3 062 983	2 745 142	2 998 643	3 221 705	3 350 135	3 053 440	3 624 098	3 467 734	3 500 581	3 600 017
KwaZulu-Natal	239 387	484 142	575 016	477 823	540 084	427 585	448 070	437 452	558 627	686 654
Limpopo	7 286	117 270	111 649	114 852	107 457	80 249	65 682	59 687	72 253	82 761
Mpumalanga	62 349	124 613	122 432	128 883	118 267	171 535	148 618	134 637	143 892	127 429
North West	39 615	153 911	153 676	108 010	97 730	43 764	57 117	50 771	109 872	179 675
Northern Cape	122 454	148 387	218 317	223 524	236 797	601 757	634 734	651 793	691 351	792 186
Western Cape	607 285	913 468	1 231 555	1 527 729	1 524 025	770 631	919 714	825 647	1 015 731	1 157 157
Total	4 304 556	5 004 669	5 740 897	6 136 183	6 313 344	5 443 885	6 198 363	5 902 414	6 354 298	7 023 307

Table C.124: Proportional science council sector R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	2.7	5.2	4.7	4.5	4.4	3.4	3.3	3.2	3.2	3.5
Free State	1.1	1.2	1.0	1.0	0.9	2.0	1.5	1.4	0.9	2.2
Gauteng	71.2	54.9	52.2	52.5	53.1	56.1	58.5	58.8	55.1	51.3
KwaZulu-Natal	5.6	9.7	10.0	7.8	8.6	7.9	7.2	7.4	8.8	9.8
Limpopo	0.2	2.3	1.9	1.9	1.7	1.5	1.1	1.0	1.1	1.2
Mpumalanga	1.4	2.5	2.1	2.1	1.9	3.2	2.4	2.3	2.3	1.8
North West	0.9	3.1	2.7	1.8	1.5	0.8	0.9	0.9	1.7	2.6
Northern Cape	2.8	3.0	3.8	3.6	3.8	11.1	10.2	11.0	10.9	11.3
Western Cape	14.1	18.3	21.5	24.9	24.1	14.2	14.8	14.0	16.0	16.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table C.125: Science council sector R&D personnel headcount and full-time equivalents by occupation (2013/14 to 2022/23)

Year	Headcount				Full-time equivalents (FTEs)			
	Total	Researchers	Technicians	Other R&D personnel	Total	Researchers	Technicians	Other R&D personnel
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
2021/22	4 190	1 735	1 528	927	3 838.5	1 594.4	1 451.0	793.1
2022/23	4 117	1 749	1 556	812	3 784.1	1 558.9	1 467.0	758.2

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.126: Science council sector R&D personnel headcount and full-time equivalents by occupation and gender (2020/21 to 2022/23)

Occupation	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
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
2021/22							
Researchers	1 735	914	821	1 594.4	859.5	734.9	91.9
Technicians directly supporting R&D	1 528	848	680	1 451.0	799.0	652.0	95.0
Other personnel directly supporting R&D	927	479	448	793.1	386.2	406.9	85.6
Total	4 190	2 241	1 949	3 838.5	2 044.7	1 793.8	91.6
2022/23							
Researchers	1 749	893	856	1 558.9	791.1	767.8	89.1
Technicians directly supporting R&D	1 556	839	717	1 467.0	788.7	678.3	94.3
Other personnel directly supporting R&D	812	392	420	758.2	360.9	397.3	93.4
Total	4 117	2 124	1 993	3 784.1	1 940.7	1 843.4	91.9

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.127: Science council sector R&D personnel headcount by occupation, qualification, population group and gender (2022/23)

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	1 749	893	856	401	422	51	65	58	76	244	231	139	62
Doctoral degree or equivalent	892	461	431	162	154	27	35	28	39	131	151	113	52
Master's, honours, bachelor or equivalent	818	411	407	230	254	19	30	30	36	106	77	26	10
Diplomas	39	21	18	9	14	5	0	0	1	7	3	0	0
Technicians directly supporting R&D	1 556	839	717	488	499	74	36	50	52	203	123	24	7
Doctoral degree or equivalent	77	47	30	14	10	1	2	0	4	23	12	9	2
Master's, honours, bachelor or equivalent	981	503	478	293	329	35	20	44	43	119	82	12	4
Diplomas	498	289	209	181	160	38	14	6	5	61	29	3	1
Other personnel directly supporting R&D	812	392	420	258	278	43	62	25	30	52	45	14	5
Doctoral degree or equivalent	40	24	16	15	7	3	2	2	3	2	2	2	2
Master's, honours, bachelor or equivalent	455	209	246	142	182	18	11	14	19	24	31	11	3
Diplomas	317	159	158	101	89	22	49	9	8	26	12	1	0
Total	4 117	2 124	1 993	1 147	1 199	168	163	133	158	499	399	177	74

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but are undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.128: Science council sector overview (2021/22 to 2022/23)

Science councils	2021/22				2022/23			
	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	764 522	415.0	152 904	38 668	855 039	392.0	213 760	57 261
Council for Scientific and Industrial Research	2 573 255	451.0	117 083	50 972	2 838 098	438.0	166 880	88 256
Council for Geoscience	253 692	163.0	50 738	44 555	274 539	155.0	54 908	63 786
Human Sciences Research Council	356 120	99.0	53 418	15 128	548 154	143.0	82 223	14 478
Medical Research Council	1 049 232	212.0	629 539	8 235	1 125 212	226.0	675 127	21 553
Mintek	394 924	150.4	78 985	52 017	366 986	102.5	249 550	12 108
National Research Foundation	962 554	104.0	340 470	250 324	1 015 280	102.4	366 603	282 360
Total	6 354 298	1 594.4	1 423 138	459 899	7 023 307	1 558.9	1 809 051	539 802

C.2.5. Higher education sector

Table C.129: Higher education sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Basic research	3 785 149	4 601 453	5 395 693	6 679 585	7 243 562	7 463 879	8 145 359	6 979 245	7 308 509	7 419 273
Applied research	2 412 316	2 649 558	3 176 685	3 466 381	4 264 753	4 303 881	4 497 102	4 423 435	4 633 761	5 093 466
Experimental development research	1 095 388	1 126 565	1 304 245	1 513 291	1 501 561	1 415 358	1 536 500	2 383 056	2 289 858	2 384 810
Total	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

Table C.130: Proportional higher education sector R&D expenditure by type of research (2013/14 to 2022/23)

Type of research	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Basic research	51.9	54.9	54.6	57.3	55.7	56.6	57.4	50.6	51.4	49.8
Applied research	33.1	31.6	32.2	29.7	32.8	32.6	31.7	32.1	32.6	34.2
Experimental development research	15.0	13.4	13.2	13.0	11.5	10.7	10.8	17.3	16.1	16.0
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 (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Capital expenditure	706 336	779 789	1 141 349	1 092 704	1 386 695	683 592	706 929	565 762	800 757	647 559
Land: buildings & other structures	256 114	200 253	198 032	616 761	874 171	257 899	220 810	90 184	115 363	163 931
Total: Vehicles, plant, machinery, equipment and software	450 222	579 536	943 317	475 943	512 524	425 693	486 119	475 578	685 394	483 628
Vehicles, plant, machinery, equipment	450 222	579 536	943 317	475 943	512 524	425 693	465 711	335 047	676 116	467 601
Capitalised computer software#	N/A	N/A	N/A	N/A	N/A	N/A	20 408	140 531	9 278	16 027
Current expenditure	6 586 517	7 597 786	8 735 274	10 566 554	11 623 181	12 499 527	13 472 031	13 219 974	13 431 371	14 249 990
Labour costs	3 248 542	3 539 733	3 576 140	4 315 989	5 080 369	5 579 653	6 054 648	6 323 292	6 310 941	6 499 444
Total cost of R&D postgraduate students	1 224 611	1 579 088	1 926 301	1 928 108	1 889 065	1 938 984	1 969 872	1 895 876	1 989 659	2 048 469
Other current expenditure*	2 113 364	2 478 965	3 232 833	4 322 457	4 653 747	4 980 889	5 447 511	5 000 806	5 130 771	5 702 078
Total	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

*Includes specific categories of R&D personnel costs for 2016/17.

#Capitalised computer software collected from 2019/20.

Table C.132: Proportional higher education sector R&D expenditure by accounting category (2013/14 to 2022/23)

Type of expenditure	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Capital expenditure	9.7	9.3	11.6	9.4	10.7	5.2	5.0	4.1	5.6	4.3
Land: buildings & other structures	3.5	2.4	2.0	5.3	6.7	2.0	1.6	0.7	0.8	1.1
Total: Vehicles, plant, machinery, equipment and software	6.2	6.9	9.6	4.1	3.9	3.2	3.4	3.4	4.8	3.2
Vehicles, plant, machinery, equipment	6.2	6.9	9.6	4.1	3.9	3.2	3.3	2.4	4.8	3.1
Capitalised computer software#	N/A	N/A	N/A	N/A	N/A	N/A	0.1	1.0	0.1	0.1
Current expenditure	90.3	90.7	88.4	90.6	89.3	94.8	95.0	95.9	94.4	95.7
Labour costs	44.5	42.3	36.2	37.0	39.1	42.3	42.7	45.9	44.3	43.6
Total cost of R&D postgraduate students	16.8	18.8	19.5	16.5	14.5	14.7	13.9	13.8	14.0	13.8
Other current expenditure*	29.0	29.6	32.7	37.1	35.8	37.8	38.4	36.3	36.1	38.3
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 for 2016/17.

#Capitalised computer software collected from 2019/20.

Table C.133: Higher education sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Biotechnology	406 285	470 837	553 562	531 958	529 948	552 583	701 411	1 051 272	1 176 323	1 181 200
Nanotechnology	356 826	393 137	505 380	431 558	319 610	420 500	477 909	1 168 384	1 063 508	1 108 611
Total	763 111	863 974	1 058 942	963 516	849 558	973 083	1 179 319	2 219 656	2 239 831	2 289 812
Higher education expenditure on R&D	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

Table C.134: Proportional higher education sector expenditure on multidisciplinary areas of R&D (2013/14 to 2022/23)

Multi-disciplinary area of R&D	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Biotechnology	5.6	5.6	5.6	4.6	4.1	4.2	4.9	7.6	8.3	7.9
Nanotechnology	4.9	4.7	5.1	3.7	2.5	3.2	3.4	8.5	7.5	7.4
Total	10.5	10.3	10.7	8.3	6.5	7.4	8.3	16.1	15.7	15.4

Table C.135: Higher education sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Environment-related	340 386	499 958	583 723	883 069	1 112 755	1 369 351	1 503 980	1 693 912	1 635 364	1 618 855
Open-source software	105 008	117 646	125 883	164 097	196 300	202 026	220 567	310 748	295 344	396 103
New materials	381 136	436 975	462 962	449 336	252 340	355 152	421 202	304 415	625 956	79 381
Tuberculosis, HIV/AIDS, malaria	794 810	845 245	944 490	1 082 645	1 308 224	1 374 952	1 582 666	1 558 253	1 361 066	1 674 622
Space science	N/A	N/A	N/A	264 712	258 472	247 276	296 166	348 616	384 300	379 345
Total	1 621 339	1 899 823	2 117 058	2 843 859	3 128 090	3 548 757	4 024 580	4 215 944	4 302 031	4 148 306
Higher education expenditure on R&D	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

Space science data collected from 2016/17.

Table C.136: Proportional higher education sector R&D expenditure on selected areas of interest (2013/14 to 2022/23)

Area of interest	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Environment-related	4.7	6.0	5.9	7.6	8.6	10.4	10.6	12.3	11.5	10.9
Open-source software	1.4	1.4	1.3	1.4	1.5	1.5	1.6	2.3	2.1	2.7
New materials	5.2	5.2	4.7	3.9	1.9	2.7	3.0	2.2	4.4	0.5
Tuberculosis, HIV/AIDS, malaria	10.9	10.1	9.6	9.3	10.1	10.4	11.2	11.3	9.6	11.2
Space science	N/A	N/A	N/A	2.3	2.0	1.9	2.1	2.5	2.7	2.5
Total	22.2	22.7	21.4	24.4	24.0	26.9	28.4	30.6	30.2	27.8

Space science data collected from 2016/17.

Table C.137: Higher education sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	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	4 925 713	5 704 150	6 340 905	6 976 302	7 941 477	7 580 936	8 172 232	7 366 884	7 695 481	8 096 239
Mathematical sciences	278 183	333 587	458 068	512 534	614 391	540 054	605 557	549 049	600 854	624 574
Physical sciences	198 735	230 826	287 830	356 090	427 400	376 229	397 447	357 722	301 613	314 117
Chemical sciences	286 511	326 992	386 300	472 883	362 105	452 369	520 849	406 563	419 953	347 539
Earth sciences	207 261	260 862	271 814	327 638	349 553	356 360	333 039	281 443	301 410	305 748
Information, computer and communication technologies	192 911	245 257	322 406	378 763	295 577	487 825	489 190	505 675	517 445	521 356
Applied sciences and technologies	280 310	274 283	272 429	139 046	76 434	155 627	199 427	211 761	195 209	155 266
Engineering sciences	855 529	918 494	891 532	926 463	907 241	1 082 308	1 107 713	896 415	883 144	987 939
Biological sciences	721 229	825 432	846 897	788 716	912 256	1 020 774	1 060 541	916 723	977 599	1 008 870

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agricultural sciences	311 355	354 949	326 296	440 433	644 885	535 299	517 978	573 725	697 034	708 957
Medical and health sciences	1 339 755	1 641 683	2 089 591	2 412 996	2 554 061	2 409 084	2 759 378	2 515 304	2 586 897	2 963 922
Environmental sciences	166 493	180 324	79 430	128 784	760 600	110 409	135 137	104 655	150 344	125 104
Material sciences	82 479	100 358	93 871	67 707	6 751	12 407	5 921	6 000	13 374	15 073
Marine sciences	4 961	11 105	14 441	24 249	30 223	42 192	40 056	41 851	50 605	17 775
Division 2: Social sciences and humanities										
Social sciences	2 367 140	2 673 425	3 535 718	4 682 956	5 068 399	5 602 183	6 006 728	6 418 852	6 536 647	6 801 310
Humanities	1 825 026	2 056 555	2 855 673	3 770 136	4 209 945	4 668 015	4 984 831	5 404 627	5 534 476	5 746 648
Total	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

Table C.138: Proportional higher education sector R&D expenditure by research field (2013/14 to 2022/23)

Main research field	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Natural sciences, technology and engineering										
Mathematical sciences	67.5	68.1	64.2	59.8	61.0	57.5	57.6	53.4	54.1	54.3
Physical sciences	3.8	4.0	4.6	4.4	4.7	4.1	4.3	4.0	4.2	4.2
Chemical sciences	2.7	2.8	2.9	3.1	3.3	2.9	2.8	2.6	2.1	2.1
Earth sciences	3.9	3.9	3.9	4.1	2.8	3.4	3.7	2.9	3.0	2.3
Information, computer and communication technologies	2.8	3.1	2.8	2.8	2.7	2.7	2.3	2.0	2.1	2.1
Applied sciences and technologies	2.6	2.9	3.3	3.2	2.3	3.7	3.5	3.7	3.6	3.5
Engineering sciences	3.8	3.3	2.8	1.2	0.6	1.2	1.4	1.5	1.4	1.0
Biological sciences	11.7	11.0	9.0	7.9	7.0	8.2	7.8	6.5	6.2	6.6
Agricultural sciences	9.9	9.9	8.6	6.8	7.0	7.7	7.5	6.6	6.9	6.8
Medical and health sciences	4.3	4.2	3.3	3.8	5.0	4.1	3.7	4.2	4.9	4.8
Environmental sciences	18.4	19.6	21.2	20.7	19.6	18.3	19.5	18.2	18.2	19.9
Material sciences	2.3	2.2	0.8	1.1	5.8	0.8	1.0	0.8	1.1	0.8
Marine sciences	1.1	1.2	1.0	0.6	0.1	0.1	0.0	0.0	0.1	0.10
Marine sciences	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.1
Division 2: Social sciences and humanities										
Social sciences	32.5	31.9	35.8	40.2	39.0	42.5	42.4	46.6	45.9	45.7
Humanities	25.0	24.5	28.9	32.3	32.4	35.4	35.2	39.2	38.9	38.6
Total	7.4	7.4	6.9	7.8	6.6	7.1	7.2	7.4	7.0	7.1
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 (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 1: Defence										
Defence	6 121	7 266	8 330	10 899	13 792	12 592	14 392	13 602	14 603	16 133
Division 2: Economic development										
Economic development unclassified	0	0	0	0	0	0	0	0	0	0
Plant production and plant primary products	534 417	220 024	282 188	358 551	551 241	473 094	519 167	451 434	508 770	514 630
Animal production and animal primary products	173 865	190 421	199 545	288 114	390 549	341 481	368 539	338 612	378 745	377 203
Mineral resources (excluding energy)	129 459	127 236	131 141	115 367	157 215	161 069	162 124	129 226	135 226	146 013
Energy resources	82 011	75 367	84 862	68 184	98 739	100 429	121 081	67 507	84 276	75 033
Energy supply	221 160	233 075	237 993	225 645	247 610	289 618	307 754	248 977	248 077	241 621
Manufacturing	340 630	329 083	380 258	444 203	478 631	557 911	518 485	466 422	456 904	486 061
Construction	79 775	96 642	111 437	177 750	223 367	257 483	184 267	174 602	173 922	187 448
Transport	32 503	38 549	47 577	72 250	101 938	47 056	72 113	67 299	82 662	77 461
Information and communication services	139 305	152 987	232 257	191 378	240 992	351 560	355 508	348 737	391 270	396 265
Commercial services	156 001	124 971	125 771	182 456	199 639	262 863	317 151	281 074	298 091	299 106
Economic framework	363 483	493 154	544 118	612 373	703 369	968 057	933 506	1 049 281	989 437	1 046 477
Natural resources	294 645	391 322	472 871	638 827	651 085	534 072	557 782	630 786	564 410	543 759
Division 3: Society										
Society unclassified	0	0	0	0	0	0	0	0	0	0
Health	654 525	1 074 951	1 375 861	1 652 001	1 730 300	1 273 726	1 915 131	1 882 024	2 033 842	2 152 499
Education and training	547 108	739 611	925 245	912 877	1 041 714	1 057 301	1 297 282	1 272 888	1 310 373	1 273 539
Social development and community services	367 738	366 099	519 649	701 234	768 158	657 303	538 240	548 113	597 198	753 052
Division 4: Environment										
Environment unclassified	0	0	0	0	0	0	0	0	0	0
Environmental knowledge	184 169	269 688	246 804	331 243	341 909	469 090	452 706	423 839	443 038	448 651
Environmental aspects of development	154 462	202 787	212 879	233 609	233 947	317 976	353 870	356 402	347 753	341 358
Environmental and other aspects	117 989	156 658	154 328	172 411	204 580	283 352	298 809	358 850	303 890	279 387

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Division 5: Advancement of knowledge	2 713 487	3 087 684	3 583 508	4 269 886	4 631 099	4 767 086	4 891 055	4 676 061	4 869 640	5 241 854
Advancement of knowledge unclassified	0	0	0	0	0	0	0	0	0	0
Natural sciences, technologies and engineering	1 633 257	2 006 195	2 262 831	2 887 227	3 269 179	3 373 533	3 346 297	3 197 657	3 323 014	3 566 849
Social sciences and humanities	1 080 231	1 081 488	1 320 677	1 382 659	1 361 920	1 393 552	1 544 758	1 478 404	1 546 626	1 675 005
Total	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

Table C.140: Proportional higher education sector R&D expenditure by socio-economic objective (2013/14 to 2022/23)

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Division 1: Defence	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Defence	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Division 2: Economic development	34.9	29.5	28.9	28.9	31.1	33.0	31.2	30.9	30.3	29.5
Economic development unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant production and plant primary products	7.3	2.6	2.9	3.1	4.2	3.6	3.7	3.3	3.6	3.5
Animal production and animal primary products	2.4	2.3	2.0	2.5	3.0	2.6	2.6	2.5	2.7	2.5
Mineral resources (excluding energy)	1.8	1.5	1.3	1.0	1.2	1.2	1.1	0.9	1.0	1.0
Energy resources	1.1	0.9	0.9	0.6	0.8	0.8	0.9	0.5	0.6	0.5
Energy supply	3.0	2.8	2.4	1.9	1.9	2.2	2.2	1.8	1.7	1.6
Manufacturing	4.7	3.9	3.9	3.8	3.7	4.2	3.7	3.4	3.2	3.3
Construction	1.1	1.2	1.1	1.5	1.7	2.0	1.3	1.3	1.2	1.3
Transport	0.4	0.5	0.5	0.6	0.8	0.4	0.5	0.5	0.6	0.5
Information and communication services	1.9	1.8	2.4	1.6	1.9	2.7	2.5	2.5	2.7	2.7
Commercial services	2.1	1.5	1.3	1.6	1.5	2.0	2.2	2.0	2.1	2.0
Economic framework	5.0	5.9	5.5	5.3	5.4	7.3	6.6	7.6	7.0	7.0
Natural resources	4.0	4.7	4.8	5.5	5.0	4.1	3.9	4.6	4.0	3.6
Division 3: Society	21.5	26.0	28.6	28.0	27.2	22.7	26.5	26.9	27.7	28.1
Society unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health	9.0	12.8	13.9	14.2	13.3	9.7	13.5	13.7	14.3	14.4
Education and training	7.5	8.8	9.4	7.8	8.0	8.0	9.1	9.2	9.2	8.5

Socio-economic objective	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Social development and community services	5.0	4.4	5.3	6.0	5.9	5.0	3.8	4.0	4.2	5.1
Division 4: Environment	6.3	7.5	6.2	6.3	6.0	8.1	7.8	8.3	7.7	7.2
Environment unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Environmental knowledge	2.5	3.2	2.5	2.8	2.6	3.6	3.2	3.1	3.1	3.0
Environmental aspects of development	2.1	2.4	2.2	2.0	1.8	2.4	2.5	2.6	2.4	2.3
Environmental and other aspects	1.6	1.9	1.6	1.5	1.6	2.1	2.1	2.6	2.1	1.9
Division 5: Advancement of knowledge	37.2	36.9	36.3	36.6	35.6	36.2	34.5	33.9	34.2	35.2
Advancement of knowledge unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural sciences, technologies and engineering	22.4	23.9	22.9	24.8	25.1	25.6	23.6	23.2	23.3	23.9
Social sciences and humanities	14.8	12.9	13.4	11.9	10.5	10.6	10.9	10.7	10.9	11.2
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 (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Eastern Cape	557 292	612 239	975 099	1 002 978	1 017 383	1 027 996	1 123 901	1 190 432	1 161 879	1 216 878
Free State	449 852	491 203	523 782	625 646	894 118	803 727	847 104	624 925	620 362	652 324
Gauteng	2 233 696	2 733 330	3 305 576	4 105 237	4 269 020	3 730 236	4 188 428	4 474 214	4 112 581	4 435 871
KwaZulu-Natal	750 507	843 111	903 664	1 157 722	1 428 653	1 646 915	1 514 301	1 377 646	1 471 778	1 496 220
Limpopo	187 317	216 352	229 364	301 809	358 543	384 346	466 703	540 991	576 400	580 675
Mpumalanga	147 134	174 657	190 716	148 981	155 430	170 553	213 914	220 654	584 924	428 361
North West	405 963	404 575	444 135	469 171	449 196	833 635	856 833	555 118	642 430	662 862
Northern Cape	161 603	146 769	164 487	188 515	180 632	161 714	169 999	52 337	74 812	81 581
Western Cape	2 399 489	2 755 339	3 139 800	3 659 198	4 256 902	4 423 997	4 797 779	4 749 419	4 986 962	5 342 777
Total	7 292 853	8 377 575	9 876 623	11 659 258	13 009 876	13 183 119	14 178 960	13 785 736	14 232 128	14 897 549

Table C.142: Proportional higher education sector R&D expenditure by province (2013/14 to 2022/23)

Province	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	%	%	%	%	%	%	%	%	%	%
Eastern Cape	7.6	7.3	9.9	8.6	7.8	7.8	7.9	8.6	8.2	8.2
Free State	6.2	5.9	5.3	5.4	6.9	6.1	6.0	4.5	4.4	4.4
Gauteng	30.6	32.6	33.5	35.2	32.8	28.3	29.5	32.5	28.9	29.8
KwaZulu-Natal	10.3	10.1	9.1	9.9	11.0	12.5	10.7	10.0	10.3	10.0
Limpopo	2.6	2.6	2.3	2.6	2.8	2.9	3.3	3.9	4.0	3.9
Mpumalanga	2.0	2.1	1.9	1.3	1.2	1.3	1.5	1.6	4.1	2.9
North West	5.6	4.8	4.5	4.0	3.5	6.3	6.0	4.0	4.5	4.4
Northern Cape	2.2	1.8	1.7	1.6	1.4	1.2	1.2	0.4	0.5	0.5
Western Cape	32.9	32.9	31.8	31.4	32.7	33.6	33.8	34.5	35.0	35.9
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 headcount and full-time equivalents by occupation (2013/14 to 2022/23)

Year	Headcount				Full-time equivalents (FTEs)			
	Total	Researchers*	Technicians	Other R&D personnel	Total	Researchers*	Technicians	Other R&D personnel
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	9 099.6	6 034.1	1 021.5	2 044.0
2021/22	33 134	26 759	2 043	4 332	8 824.6	5 896.4	882.9	2 045.3
2022/23	32 100	25 648	2 021	4 431	8 667.9	5 686.4	894.3	2 087.3

* Excludes doctoral and post-doctoral students.

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are classified as not from South Africa but undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.144: Higher education sector R&D personnel headcount (including doctoral students and post-doctoral fellows) and full-time equivalents by occupation and gender (2020/21 to 2022/23)

Year	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
Researchers*	52 985	27 946	25 039	21 777.6	11 608.9	10 168.8	41.1
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	24 843.1	12 793.7	12 049.4	41.8
2021/22							
Researchers*	54 784	28 746	26 038	21 861.6	11 568.0	10 293.6	39.9
Technicians directly supporting R&D	2 043	1 182	861	882.9	511.6	371.3	43.2
Other personnel directly supporting R&D	4 332	1 364	2 968	2 045.3	623.9	1 421.4	47.2
Total	61 159	31 292	29 867	24 789.8	12 703.5	12 086.3	40.5
2022/23							
Researchers*	53 059	27 557	25 502	21 424.6	11 180.4	10 244.1	40.4
Technicians directly supporting R&D	2 021	1 168	853	894.3	505.9	388.4	44.2
Other personnel directly supporting R&D	4 431	1 395	3 036	2 087.3	675.7	1 411.6	47.1
Total	59 511	30 120	29 391	24 406.1	12 362.0	12 044.1	41.0

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

Table C.145: Higher education sector R&D personnel headcount (excluding doctoral students and post-doctoral fellows) and full-time equivalents by occupation and gender (2020/21 to 2022/23)

Year	Headcount			Full-time equivalents (FTEs)			
	Total	Male	Female	Total	Male	Female	FTEs as % of headcount
2020/21							
Researchers*	25 651	13 452	12 199	6 034.1	3 159.8	2 874.4	23.5
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	9 099.6	4 344.6	4 755.0	28.3
2021/22							
Researchers*	26 759	14 052	12 707	5 896.4	3 086.0	2 810.4	22.0
Technicians directly supporting R&D	2 043	1 182	861	882.9	511.6	371.3	43.2
Other personnel directly supporting R&D	4 332	1 364	2 968	2 045.3	623.9	1 421.4	47.2
Total	33 134	16 598	16 536	8 824.6	4 221.5	4 603.1	26.6
2022/23							
Researchers*	25 648	13 386	12 262	5 686.4	2 984.6	2 701.7	22.2
Technicians directly supporting R&D	2 021	1 168	853	894.3	505.9	388.4	44.2
Other personnel directly supporting R&D	4 431	1 395	3 036	2 087.3	675.7	1 411.6	47.1
Total	32 100	15 949	16 151	8 667.9	4 166.2	4 501.7	27.0

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

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.146: Higher education sector R&D postgraduate headcount by qualification and gender, and full-time equivalents by qualification (2020/21 to 2022/23)

Occupation	Headcount			Full-time equivalents (FTEs)	
	Total	Male	Female	Total	Total FTEs as % of total headcount
2020/21					
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	37 843.9	43.3
2021/22					
Post-doctoral fellows	3 028	1 761	1 267	2 689.1	88.8
Doctoral students	24 997	12 933	12 064	13 276.1	53.1
Master's students (full research master's)	29 665	12 993	16 672	13 327.4	44.9
Master's students (coursework plus thesis with research component)	27 755	12 233	15 522	8 668.8	31.2
Total	85 445	39 920	45 525	37 961	44.4
2022/23					
Post-doctoral fellows	2 718	1 567	1 151	2 500.8	92.0
Doctoral students	24 693	12 604	12 089	13 237.4	53.6
Master's students (full research master's)	27 909	12 621	15 288	12 792.7	45.8
Master's students (coursework plus thesis with research component)	28 318	13 092	15 226	7 717.9	27.3
Total	83 638	39 884	43 754	36 248.9	43.3

Table C.147: Higher education sector R&D personnel headcount by occupation, qualification, population group and gender (2022/23)

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*	25 648	13 386	12 262	4 653	4 339	595	802	1 043	1 295	4 050	4 646	3 045	1 180
Doctoral degree or equivalent	14 208	8 063	6 145	2 078	1 615	340	389	552	629	2 650	2 659	2 443	853
Master's, honours, bachelor or equivalent	10 152	4 726	5 426	2 349	2 436	218	369	444	580	1 233	1 780	482	261
Diplomas	1 288	597	691	226	288	37	44	47	86	167	207	120	66
Technicians directly supporting R&D	2 021	1 168	853	547	398	213	133	59	42	286	250	63	30
Doctoral degree or equivalent	123	55	68	8	11	6	7	1	6	27	39	13	5
Master's, honours, bachelor or equivalent	1 048	534	514	313	248	36	71	27	32	126	142	32	21
Diplomas	850	579	271	226	139	171	55	31	4	133	69	18	4
Other personnel directly supporting R&D	4 431	1 395	3 036	715	1 230	190	700	49	152	302	804	139	150
Doctoral degree or equivalent	479	224	255	99	69	12	34	15	30	63	94	35	28
Master's, honours, bachelor or equivalent	1 868	552	1 316	271	537	62	229	21	70	137	398	61	82
Diplomas	2 084	619	1 465	345	624	116	437	13	52	102	312	43	40
Total	32 100	15 949	16 151	5 915	5 967	998	1 635	1 151	1 489	4 638	5 700	3 247	1 360

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

Headcount includes non-SA R&D personnel (from 2016/17). Non-SA personnel are not from South Africa but undertaking research in South Africa for more than six months. They can be temporary or permanent residents as described by the SNA.

Table C.148: Higher education sector overview (2021/22 to 2022/23)

Higher education overview	2021/22					2022/23				
	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	141 429	139	41.7	471.0	121.1	153 969	110	35.5	330.0	171.8
Public universities	12 773 127	22 126	5 083.2	25 230.0	14 364.3	13 440 235	20 968	4 898.8	24 670.0	14 062.3
Nelson Mandela Metropolitan University	407 031	888	132.6	718.0	352.5	449 386	920	132.7	702.0	369.4
North-West University	580 071	699	349.5	1 749.0	1 106.6	619 940	411	352.7	1 745.0	1 053.9
Rhodes University	305 470	431	167.7	654.0	654.0	311 757	425	82.1	570.0	570.0
Sefako Makgatho Health Sciences University	208 553	704	140.0	139.0	98.8	205 954	713	142.4	139.0	98.8
University of Cape Town	2 026 477	1 036	380.0	2 600.0	1 640.7	2 301 342	1 065	434.7	2 567.0	1 613.9
University of Fort Hare	190 795	326	104.1	546.0	341.6	190 902	336	100.8	546.0	341.6
University of Johannesburg	792 760	1 941	249.2	1 956.0	1 255.3	861 050	2 055	368.4	2 060.0	1 213.0
University of KwaZulu-Natal	889 371	2 687	562.2	3 351.0	1 483.4	1 042 340	2 452	536.5	3 154.0	1 397.2
University of Limpopo	407 543	878	314.5	267.0	138.4	427 588	807	307.7	267.0	138.4
University of Mpumalanga	343 419	66	65.4	7.0	5.3	164 046	58	9.0	24.0	17.2
University of Pretoria	1 124 017	2 449	289.3	2 814.0	1 502.1	1 185 071	2 461	317.0	2 759.0	1 688.5
University of South Africa	993 566	1 933	381.2	2 729.0	1 864.7	1 002 353	1 975	379.8	2 729.0	1 864.7
University of Stellenbosch	1 973 377	1 811	532.5	2 019.0	1 135.3	2 180 125	1 652	481.4	1 931.0	1 052.5
University of the Free State	407 801	666	188.2	1 229.0	606.1	473 098	695	198.1	1 197.0	600.8
University of the Western Cape	793 623	1 040	312.0	1 388.0	612.8	698 088	683	291.8	1 394.0	616.1
University of the Witwatersrand	1 132 171	4 226	742.3	2 717.0	1 366.6	1 210 996	3 926	697.0	2 539.0	1 226.1
University of Zululand	197 082	345	172.5	347.0	200.3	116 199	334	66.8	347.0	200.3

Higher education overview	2021/22					2022/23				
	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				
Universities of (science) and technology	1 317 572	4 494	771.5	2 324.0	1 479.8	1 303 345	4 570	752.1	2 411.0	1 504.2
Cape Peninsula University of Technology	219 364	698	109.6	339.0	245.7	221 831	666	115.1	367.0	267.4
Walter Sisulu University of Technology and Science	219 052	908	136.2	82.0	60.7	219 666	910	136.5	82.0	60.7
Central University of Technology	135 751	252	100.8	206.0	89.7	110 215	259	77.7	221.0	92.5
Durban University of Technology	229 129	777	130.1	673.0	361.0	164 668	749	114.8	702.0	351.6
Mangosuthu University of Technology	29 835	181	28.2	19.0	19.0	36 426	243	31.7	14.0	14.0
Tshwane University of Technology	283 306	879	175.8	632.0	459.2	342 300	875	175.0	647.0	474.2
University of Venda for Science and Technology	111 190	425	42.5	234.0	163.8	113 474	469	42.5	234.0	163.8
Vaal University of Technology	89 944	374	48.3	139.0	80.7	94 767	399	58.8	144.0	80.0
Total	14 232 128	26 759	5 896.4	28 025.0	15 965.2	14 897 549	25 648	5 686.4	27 411.0	15 738.2

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

Headcount includes non-SA R&D staff from 2016/17. Non-SA personnel are not from South Africa but undertaking research for more than six months. They can be temporary or permanent residents as described by the SNA.

**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.

Table C.149: Gross domestic product and employment (2013/14 to 2022/23)

Reference year	Survey year	GDP level (current values)	GDP level (constant 2015 values)	Employment
		R' 000	R' 000	(000)
2013	2013/14	3 868 630	4 302 291	15 055
2014	2014/15	4 133 873	4 363 118	15 459
2015	2015/16	4 420 793	4 420 793	15 675
2016	2016/17	4 759 555	4 450 171	16 212
2017	2017/18	5 078 190	4 501 702	16 378
2018	2018/19	5 363 190	4 571 783	16 291
2019	2019/20	5 625 207	4 583 667	16 383
2020	2020/21	5 562 760	4 300 904	14 995
2021	2021/22	6 220 152	4 514 016	14 914
2022	2022/23	6 655 524	4 600 300	16 192

Data source: Stats SA (2023, 2024)

D. DESCRIPTION OF SURVEY METHODOLOGY

D.1. Survey design and planning

The South African National Survey of Research and Experimental Development (R&D Survey) is one of the tools used to monitor and evaluate the performance of South Africa’s national system of innovation (NSI).

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

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

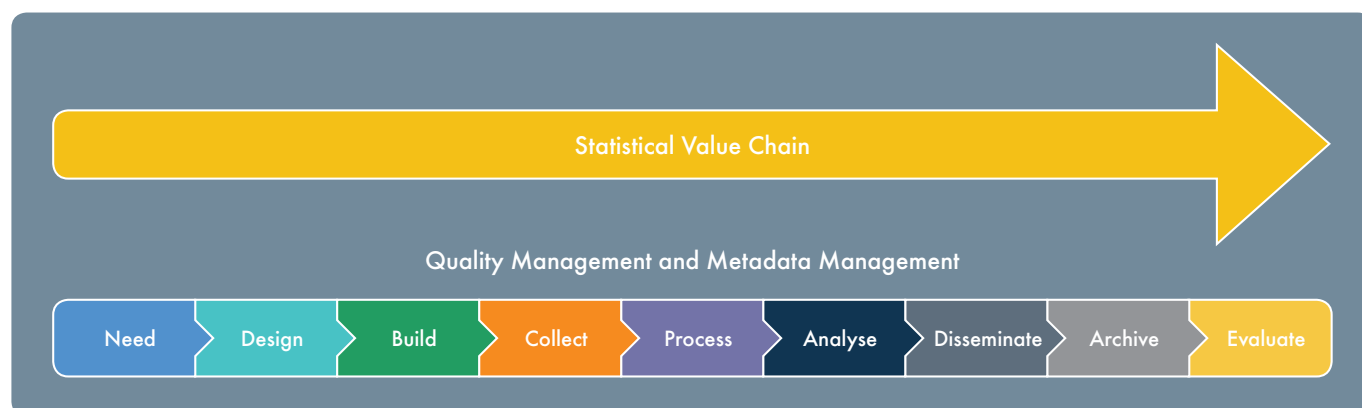
In the interests of coherence of its data with other South African economic survey data, the South African R&D Survey adheres to the standards and methods applied or recommended by Statistics South Africa. Concepts and definitions are aligned as far as possible with those in use by the National Statistical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

- Gross domestic product values for the 2022 annual reference period taken from the quarterly Stats SA GDP statistical release P0441 (Stats SA, 2024); and
- Employment level value for the first quarter of 2022 obtained from the Stats SA Quarterly Labour Force Survey statistical release P0211 (Stats SA, 2023).

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

Overall, HSRC-CeSTII performs quality management in line with practices recommended by Stats SA in the South African Statistical Quality Assessment Framework (SASQAF) (Stats SA, 2010b). The survey was conducted according to a project plan aligned with the phases of the statistical value chain (SVC) illustrated in Figure D1, modelled on the practice of 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 2022/23. Table D.1 describes 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 2022 to 31 March 2023 or the 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 and thus 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.	14 November 2023 to 31 July 2024
Not-for-profit	Non-governmental and not-for-profit entities. Those registered as section 21 companies.	1 April 2022 to 31 March 2023 or the 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.	7 November 2023 to 31 July 2024
Government	National and provincial departments, local government, museums, research institutes and other research units with an R&D components.	1 April 2022 to 31 March 2023 or the nearest complete financial year	Government departments were surveyed using a census approach. All government departments, associated research institutes and museums performing R&D at national, provincial and local levels were included in the government sector.	15 November 2023 to 31 July 2024
Science councils	The nine science councils established through Acts of Parliament.	1 April 2022 to 31 March 2023 or the nearest complete financial year	Seven statutory science councils were surveyed.	21 November 2023 to 31 July 2024
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 2022)	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.	23 November 2023 to 31 July 2024

D.3. Fieldwork

The R&D data were collected through questionnaires sent to the units in each sector by electronic mail or by use of an online submission system first piloted in 2021. All five sectors were surveyed between 7 November 2023 and 31 July 2024.

The online submission platform could be obtained at <https://rdisurveys.hsrc.ac.za/login> for registered R&D performers activated by researchers who confirmed the presence of R&D activity.

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, headcount, and source of funds 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 to the 2016/17 R&D Survey collection instruments on the R&D personnel tables for all sectors were maintained in the 2022/23 R&D Survey (see 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, desktop research based on business intelligence, and either online or physical investigations at techno-parks. A list of 647 companies was investigated. A total of 504 business sector units were selected for the 2022/23 survey period. Of this cohort, 233 units were reported as in-scope units and 50 as out-of-scope. A total of 82 units were imputed to account for non-response of in-scope units.

Non-response during the 2022/23 Survey may be attributed to several issues including resistance from respondents to participate in the survey and newly appointed individuals assigned to R&D survey responsibilities within their companies.

Steps were implemented to improve the quality of the survey through new business coverage expansion activities including the Business Sector Coverage Improvement Project, continuing with traditional business intelligence efforts, and cleaning existing registers, all to expand coverage through the addition of new units to the frame to boost response rates.

The business intelligence strategies implemented for the 2022/23 R&D Survey included:

1. Cleaning the existing frame and removing units that were out-of-scope
2. Frame-building activities through business intelligence and investigating survey lists of innovation studies for possible inclusion or investigation of business units
3. Identifying events to improve the visibility of the R&D Survey and networking to identify entities likely to perform R&D
4. Sectoral engagements with R&D performers

The 2022/23 Survey also included several virtual engagements with respondents as well as face-to-face meetings. This worked well to overcome resistance to participation in the survey and to receive more complete questionnaires from respondents.

Science councils sector

Seven R&D-active science councils responded to the survey questionnaire. One of these was surveyed at the level of its constituent units resulting in a total of 11 reporting units for the 2022/23 financial period.

Not-for-profit sector

The fieldwork staff investigated a list of 169 units within the not-for-profit sector, which consisted of well-known and likely R&D performers. Fifty-eight units were deemed in-scope and selected to compile statistics for the 2022/23 R&D Survey. Since many of the units were outside the scope of the previous survey cycle, the not-for-profit sector register also underwent cleaning. These units, which included those that had advised no R&D for three years or longer, as well as those that had been imputed for three years or longer, were recognised and eliminated from the frame by researchers.

Government sector

The government sector team investigated a list of 84 units consisting of national and provincial departments, municipalities, research centres and museums. Sixty-eight possible R&D performing units were selected to be surveyed for the 2022/23 survey cycle. The government sector register also underwent a cleaning process. The previous survey cycle had included many out-of-scope units. These units were identified and removed from the frame (including units that had advised no R&D for three years or more, or units that were imputed for three years or more).

Higher education sector

In the 2022/23 R&D Survey, the survey frame for the higher education sector was 31, which consisted of six private universities and 25 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. As of the 2016/17 R&D Survey, 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 measures to improve fieldwork for the 2022/23 R&D Survey

The frame used in previous R&D survey cycles included many out-of-scope units. In the end, fewer units will inevitably be on the frame because cleaning the frame for all sectors is a crucial step.

To mitigate this impact, frame-building or survey coverage initiatives were carried out concurrently, reaching out to a variety of fresh sources to locate organisations that were probably engaged in research and experimental development. These new units increased the register and made up for those that were lost. Temporarily suspended R&D units are retained on the register and will be re-examined in subsequent surveys. The 2022/23 reference year’s higher response and collection rates could be partially attributed to the cleaner frame.

In addition to frame maintenance measures, resistance to participate in the R&D survey (mostly from the business and not-for-profit sectors) resulted in the R&D survey project team implementing strategic and focussed measures to counteract this. These included:

- 1. Extending fieldwork:** Fieldwork for the R&D Survey 2022/23 commenced in November 2023 and was scheduled to end on 30 June 2024, but was extended by one month due to a lack of responses, and the addition of new units to the existing register. Large units that returned beyond this date were accepted to boost the sectoral and overall response and collection rates of the survey.
- 2. Targeting the top 200 firms:** An R&D survey should include all size classes, according to the Frascati Manual. Given that big businesses contribute a lot to R&D, every effort needs to be taken to guarantee that big businesses are included (OECD, 2015: Chapter 7). To direct more concentrated fieldwork efforts in the business sector, the top 200 South African companies were identified in addition to the units currently in the field. This approach has proven effective since the introduction of COVID-19 in 2020.
- 3. Sectorising firms in the business sector:** Based on Standard Industrial Classification codes, the business sector is divided into ten industrial sectors. Based on the business framework of responding units, industrial sector-specific researcher expertise was determined to concentrate exclusively on these industries. With the addition of R&D performing organizations and quality assessment of received data, based on sector-specific expertise, this ensured a higher quality of R&D frame maintenance. Within the business domain, researchers have acquired specialized information pertaining to manufacturing, mining, state-owned companies, and the pharmaceutical industry.
- 4. Prepopulated questionnaires based on statistical imputation techniques:** Researchers constructed questionnaires using historical data submissions, with the use of a statistically calculated GDP inflation factor, and annual reports in cases where respondents were new or unable to finish the survey. After receiving the questionnaire, respondents have the option to review, make any necessary changes, and then sign and approve it. This approach was used in all sectors that had exceptionally large outstanding units, and only based on evidence the unit was still operational. The imputation would be noted as a regular impute/estimated value imputation if no answer or modification was received.

5. Digital meetings: To further increase response rates, virtual meetings were arranged with respondents whenever feasible. Because they didn't require travel, virtual meetings fit well with the hectic schedules of the participants. The frequency of these sessions and the opportunity for senior CeSTII staff members to engage with respondents increased response rates and enhanced the quality of data obtained.

6. Face-to-face visits with respondents: Face-to-face visits were conducted with business sector respondents to garner improved rates, especially from respondents who had difficulty returning the survey data. During the data collection period face-to-face visits were conducted Gauteng (5 – 9 February), (22 – 26 July) and in the Western Cape, Cape Town (6 – 17 May).

7. Workshops with respondents:

- An event themed "Harnessing RDI to grow the economy and tackle key challenges" collaboratively arranged by CeSTII, DSTI and the Business Unity South Africa was held on 13 March 2024 in Johannesburg, Gauteng. The event was well attended in person and online and it was a good opportunity to stimulate a conversation between stakeholders, including researchers, policy makers and representatives from the private sector. Dr Kruss had an opportunity to share data from the different projects in CeSTII including the latest 2021/22 R&D Survey results which was launched in early 2024.
- A formal virtual community societal engagement workshop was held with the government and science councils' respondents on 19 March 2024. The event was designed with three main purposes: to engage with government and science council community respondents about how they use the R&D Survey data for strategic and policy decision-making purposes; to showcase the latest 2021/22 R&D Survey results released on 15 February 2024; and to demonstrate the latest updates to the relatively new Research and Experimental Development and Innovation (RDI) online digital data submission platform.

The workshop proved to be a success and was strongly supported by government officials. Based on the positive respondent feedback, a similar engagement will occur in higher education for the next 2023/24 R&D Survey round.

- An engagement with the not-for-profit and non-governmental communities of the National Survey of Research and Experimental Development (R&D). The NPO Workshop on Knowledge Exchange, held on 21 May 2024, underscored the pivotal role of research and experimental development (R&D) within South Africa's not-for-profit (NPO) sector. The event highlighted the importance of R&D in informing national socio-economic policies, enhancing NPO capacity, and addressing pressing social issues. It also allowed the R&D survey research team to engage directly with NPO respondents, with whom they had previously only communicated through calls and emails.

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

Questionnaire response rates for 2022/23 decreased to 56.0% in 2022/23. The majority of these were based on the non-response units resulting in higher imputation rates in the business sector.

Given the nature of R&D, a firm's R&D-performing business unit may only have a small number of active projects in a given year. According to field reports, these projects typically last about three years. Once a project concludes, the firm's R&D expenditure for the specific reference period may drop to zero, which would classify the firm as out-of-scope under current CeSTII operational procedures, despite the potential for future R&D activities. Therefore, both collection rates and questionnaire response rates serve as key quality indicators for the R&D survey during the collection phase of the SVC.

*Non-response*² 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 2022/23 R&D survey. *In-scope units*³ were defined as units performing in-house R&D or with likely in-house R&D activity.

² Adapted from Sarndal, Swensson and Wretman (1992).

³ This is the HSRC-CeSTII operational definition.

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

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

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

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

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

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

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

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

Table D.2: Quality indicators of survey coverage by sector (2022/23)

Sector	Number of units investigated	Number of units selected to collect statistics	Non-response	Out-of-scope	Responses	Questionnaire response rate	Collection rate	Unit imputation rate	Weighted response rate	Number of units used to compile statistics
Business	647	504	271	50	233	51.3%	63.5%	18.1%	88.0%	315
Not-for-profit	169	58	24	6	34	65.4%	74.1%	11.5%	98.4%	40
Government	84	68	27	7	41	67.2%	76.5%	16.4%	93.1%	51
Science councils	11	11	0	0	11	100.0%	100.0%	0.0%	100.0%	11
Higher education	31	31	9	0	22	71.0%	71.0%	19.4%	87.6%	28
HE: Public	25	25	6	0	19	76.0%	76.0%	24.0%	87.5%	25
HE: Private	6	6	3	0	3	50.0%	50.0%	0.0%	100.0%	3
Total	942	672	331	63	341	56.0%	66.7%	17.1%	90.7%	445

D.6. Imputation

The unit imputation rate increased from 12.0% in 2021/22 to 17.1% in 2022/23 (Table D.2). The reason for this increase could be attributed to a reduction in human resources accompanied by the shortened fieldwork period to reduce survey publication timelines. Further compounding this situation was a Personal Protection of Information Act breach which resulted in a slow-down of fieldwork collection for several weeks to reflect, enhance and institute new security measures to avoid a similar occurrence.

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.3). 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 1.9% in 2022/23.

Table D.3: Number of units and age of data used in the imputation models by sector

Age of data	Business	NPO	Government	Science councils	Higher education	Total
Imputed (data from current reference period)	0	0	0	0	0	0
Imputed (data from previous year)	0	0	0	0	0	0
Imputed (data more than one year old)	0	0	0	0	0	0
Commuted (data from previous year)	20	2	0	0	0	22
Commuted (data more than one year old)	62	4	10	0	6	82
Total	82	6	10	0	6	104

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 tool (RDI) and PDF and Excel questionnaires, with built-in validations.

Experienced researchers reviewed the responses to the PDF questionnaires, including the summaries and percentage calculations. The data were then manually entered into the R&D Survey Management System (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 DSTI 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 were produced by selecting known SOEs from enterprises in the business sector.

D.8. Dissemination

The 2022/23 R&D Survey reports will be disseminated to all respondents as well as other users of the R&D statistics. This report is available on request from HSRC-CeSTII and the DSTI.

The report can be downloaded from the HSRC-CeSTII and DSTI websites:

- <https://hsrc.ac.za/about-cestii/measuring-rd-activity-in-south-africa/>
- <https://www.dsti.gov.za/index.php/resource-center/rad-reports/r-d-survey-reports>

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

Data from 2001 onwards is available from CeSTII on request. The guidelines for accessing data may be downloaded from:

- <https://hsrc.ac.za/about-cestii/accessing-cestii-data/>

Data extractions in response to users' special data requests are generally provided free of charge, unless substantial analytical work is required to meet the request. Such data extractions are done in accordance with the approved data access protocol.

Access to the online data collection platform and several additional resources are available at:

- <https://rdisurveys.hsrc.ac.za/login>

D.9. Storage and archiving

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.

Data is curated by the HSRC and archived according to the HSRC policies on archiving and curation. Curated datasets and the conditions under which these are available may be found at:

- <http://dx.doi.org/doi:10.14749/1685446986>

E. REFERENCES

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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
2022/23 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 and Innovation
Statistics South Africa

 **HSRC**
Human Sciences
Research Council

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 2022/23 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 2022 to 31 March 2023 (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	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
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

Details of person completing the questionnaire (please print):

Name (with title)	<input type="text"/>	Tel	<input type="text"/>
Designation	<input type="text"/>	Cell	<input type="text"/>
Signature	<input type="text"/>	E-mail	<input type="text"/>
		Date	<input type="text"/>

In order for HSRC-CeSTII to meet our obligations to produce national STI indicators on behalf of the DSI, we collect information about R&D from various organisation types: businesses, not-for-profit organisations, science councils, government departments and higher education institutions. We store this information in a secure database that is part of a data management system within the HSRC secure server environment. This information is retained in line with S14(1) and (2) of POPIA.

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.

Key



Definition



Instruction

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 2022/23 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 2022/23 financial year?

Yes No

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

Please tick	2023/24	2024/25	2025/26
Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4b. Did the organisation have extramural (outsourced) R&D expenditures during the 2022/23 financial year?

Yes No



Instruction

- If you have conducted intramural (or in-house) R&D in the 2022/23 financial year please continue to Part 2.
- If you have conducted only extramural (or outsourced) R&D in the 2022/23 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

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.

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:

$(\text{Person/s employed}) \times (\text{Portion of their job spent on R\&D}) \times (\text{Portion of the year employed}) = \text{FTE on R\&D}$

For example:

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

$1 \times 1 \times 1 = 1 \text{ FTE on R\&D}$

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

$1 \times 0.4 \text{ persons} \times 0.5 \text{ years} = 0.2 \text{ FTE on R\&D}$

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

$1 \times 0.4 \times 1 = 0.4 \text{ FTE on R\&D}$

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

$20 \times 0.4 \times 1 = 8 \text{ FTE on R\&D}$

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 ↓

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	<input type="text"/>
Capitalised computer software	<input type="text"/>
Total: Vehicles, plant, machinery and equipment and software	A <input type="text"/>
Land, buildings and other structures	B <input type="text"/>

LABOUR COSTS OF R&D

	R'000 (excl. VAT)
Labour Costs of R&D (to match Question 6)	C <input type="text"/>

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 <input type="text"/>
Total R&D Expenditure (A + B + C + D = E)	E <input type="text"/>

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.

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								
	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	<input type="text" value=""/>	%	Mpumalanga	<input type="text" value=""/>	%
Free State	<input type="text" value=""/>	%	Northern Cape	<input type="text" value=""/>	%
Gauteng	<input type="text" value=""/>	%	North West	<input type="text" value=""/>	%
KwaZulu-Natal	<input type="text" value=""/>	%	Western Cape	<input type="text" value=""/>	%
Limpopo	<input type="text" value=""/>	%	Total (must sum to 100%)	<input type="text" value=""/>	%

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. 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 <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
RF <input type="text"/>	<input type="text"/> %	RF <input type="text"/>	<input type="text"/> %
Total	(must sum to 100%)		<input type="text"/> %

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	<input type="text"/>	<input type="checkbox"/> No R&D in these areas ← Tick if no such R&D is done
Nanotechnology	<input type="text"/>	

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	<input type="text"/>	<input type="checkbox"/> No R&D in these areas ← Tick if no such R&D is done
Space science	<input type="text"/>	
Tuberculosis (TB), HIV/AIDS, Malaria	<input type="text"/>	
Environment and sustainability R&D	<input type="text"/>	
New materials	<input type="text"/>	

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	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
S	<input type="text"/>	<input type="text"/> %	S	<input type="text"/>	<input type="text"/> %
Total			(must sum to 100%)		<input type="text"/> %

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.

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

* 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.

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)
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

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

Category	Percentage Extramural R&D Outside South Africa								
	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.

G. USER SATISFACTION SURVEY

SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT: STATISTICAL REPORT 2022/23

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

International organisation

Private enterprise

Media

Public enterprise

Not-for-profit organisation

Academic or research institution

Other, specify _____

3. In which country do you work?

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

Excellent

Good

Average

Satisfactory

Poor

5. How useful is this publication for your work?

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

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

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

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

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

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

9. What did you like best about the publication?

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

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