R&D SURVEY

Investment ▪ Insight ▪ Impact

SOUTH AFRICAN NATIONAL SURVEY OF RESEARCH AND EXPERIMENTAL DEVELOPMENT

MAIN TRENDS IN SOUTH AFRICAN R&D 2021/22

Science, Technology and Innovation Statistics South Africa

HSRC Human Sciences Research Council

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

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DISSEMINATION

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- https://hsrc.ac.za/about-cestii/measuring-rd-activity-in-south-africa/

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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. This may result from revisions by Stats SA of socio-economic indicators such as the gross domestic product (GDP), 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 current R&D intensity series was revised to take into account the revision of the GDP series (Stats SA, 2022). The R&D expenditure in real terms was also rebased to 2015 constant prices.

Companion publications

- Centre for Science, Technology and Innovation Indicators (CeSTII). (2024). *South African National Survey of Research and Experimental Development: Statistical Report 2021/22*. Pretoria: Human Sciences Research Council (HSRC).
- Centre for Science, Technology and Innovation Indicators (CeSTII). (2024). *Boosting R&D Funding in South Africa in the Context of Reindustrialisation*. Pretoria: Human Sciences Research Council (HSRC).

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The findings and trend analysis presented in this report are based on a time series meticulously compiled over many years, utilising data from the longstanding South African National Survey of R&D. The HSRC-CeSTII project team for the 2021/22 South African National Survey of Research and Experimental Development comprised: Yolanda Baptista, Lindiwe Binda, Mbali Bongoza, Jacqueline Borel-Saladin, Isaac Cameron, Mario Clayford, Marco Davids, Atoko Kasongo, Jerry Mathekga, Tlangelani Makamu, Sintu Mavi, Thuliswa Mazikwana, Nazeem Mustapha, Litha Phika, Gerard Ralphs, Theodore Sass, Natasha Saunders, Kgabo Ramoroka, Viwe Sigenu, Moses Sithole, Natalie Vlotman, Darryn Whisgary, and Luthando Zondi. This report is accompanied by a statistical release for the 2021/22 reference year.

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ABBREVIATIONS

BERD	Business expenditure on R&D
BRICS	Brazil, the Russian Federation, India, China and South Africa
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
HSRC	Human Sciences Research Council
ICT	Information and communication technology
NPO	Not-for-profit organisation
NSI	National system of innovation
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
R&D	Research and experimental development
RF	Research field
SIC	Standard Industrial Classification
SOE	State-owned enterprise
Stats SA	Statistics South Africa
STI	Science, technology and innovation
UIS	UNESCO Institute for Statistics
UNESCO	United Nations Educational, Scientific and Cultural Organisation

DEFINITION OF TERMS

Applied research is original investigation undertaken to acquire new knowledge. It is 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.

BERD refers to business expenditure on research and experimental development.

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 expenditure is the annual gross expenditure on fixed assets used repeatedly or continuously in the performance of R&D programmes for more than one year. Such expenditure is reported in full in the period in which it took place and is not registered as an element of depreciation. Capital expenditure includes expenditure on land, buildings, instruments and equipment.

Constant 2015 (Real) 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, Fourth quarter 2021 (Stats SA 2021).

Current expenditure is 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 is included in 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 or services, or to improving substantially those already produced or installed.

Full-time equivalent (FTE) refers to the number of hours (person-years of effort) spent on R&D activities.

FTE per 1 000 in total employment is the number of professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, as well as in the management of these projects during a given year expressed as a proportion of 1 000 employed people. It is calculated by number of researchers during a given year divided by the total employed people and multiplied by 1 000.

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.

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

Headcount refers to the actual number of people directly involved in or supporting R&D (i.e. the total number of R&D personnel).

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

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

Real prices: see Constant 2015 (Real) Rands.

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

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

Research field (RF) refers to a branch of science, either natural or social and humanities sciences.

R&D intensity refers to gross expenditure on R&D as a percentage of GDP.

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

R&D-performing sectors comprise the government, higher education, business and not-for-profit institutional sectors.

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

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

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.

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

Total employment is the total employment in the economy. This statistic is obtained from the Statistics South Africa Labour Force Survey series P0211 (Stats SA 2022), where employed persons are 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).

Year-on-year changes are calculated as follows: (current year's figure - previous year's figure) / previous year's figure × 100%.

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INTRODUCTION

A wealth of information spans more than two decades of South Africa's annual R&D surveys, with each survey yielding a wide range of indicators, and providing valuable insight to policymakers. Each year, HSRC-CeSTII publishes the *R&D Statistical Report*, with R&D trend data up to the most recent complete round of the survey. While the data are valuable in themselves, their explanatory power is limited for those not already familiar with them. To address this, we have created two companion publications to meet these needs.

This report *(Main Trends in South African R&D 2021/22)* highlights trends from the most recent survey cycle and provides high-level analysis of R&D data in South Africa over time. This is presented in areas of interest, that correspond with the principal themes of the R&D Survey, and the policy concerns expressed in the White Paper on Science, Technology and Innovation (Department of Science and Technology, 2019). International comparisons are provided for each core area, as international benchmarking is an important component in monitoring South Africa's R&D progress and development.

A companion publication *(Boosting R&D Funding in South Africa in the Context of Reindustrialisation)* delves deeper into key policy questions, in a set of inter-related analytical briefs. The briefs interrogate the data on select R&D topics relevant to current policy priorities, research interests and the global economic situation. These studies utilise available data and draw from academic literature to describe the interplay between policy matters and the STI landscape in the country. While they do not adopt the formal structure of academic articles, they adhere to rigorous scientific methods including review by subject matter experts. They are crafted to contribute insights into areas of current policy relevance, for use by policymakers and the interested lay person. They raise critical questions, and present contrasting scenarios. In this way, they are designed to stimulate critical conversations and inform policy discussion on future ways forward.

Accessing the R&D data and analysis

The **South African National Survey of Research and Experimental Development (R&D Survey) data** for the period 2001/02 to 2021/22 that is cited in this document was created by the Centre for Science, Technology and Innovation Indicators at the Human Sciences Research Council. Data is available for download and use by readers in different formats on the HSRC's website (https://hsrc.ac.za/about-cestii/measuring-rd-activity-in-south-africa/). For specialised data requests from CeSTII, visit https://data-request.hsrc.ac.za/

Also available on the HSRC website are the companion publications to the briefs presented here, which includes the *R&D Survey Statistical Report 2021/22* and *Boosting R&D Funding in South Africa in the Context of Reindustrialisation*.

1. MAIN FINDINGS OF THE 2021/22 R&D SURVEY

GERD increased by 13.8% in 2021/22

Nominal R&D expenditure increased in all five institutional sectors, particularly in the business sector, which increased by R3.480 billion (Table 1.2). The higher education sector increased R&D expenditure by R446 million, the government sector increased by R235 million, while the not-for-profit sector increased R&D expenditure by R31 million.

Table 1.1 Gross domestic expenditure on R&D in South Africa, 2017/18 to 2021/22

	2017/18	2018/19	2019/20	2020/21	2021/22
Gross domestic expenditure on R&D (GERD) (R million)	38 725	36 784	34 485	33 541	38 186
Gross domestic expenditure on R&D in constant 2015 prices (R million)	34 328	31 356	28 100	25 965	27 756
GERD as a % of GDP	0.76	0.69	0.61	0.60	0.62
Civil GERD* as a % of GDP	0.72	0.66	0.58	0.57	0.59
Business expenditure on R&D (BERD) as a % of GERD	41.0	39.3	31.0	30.0	35.4

Note: *GERD excluding defence expenditure.
Source: South African National Survey of Research and Experimental Development, 2017/18 to 2021/22.

South Africa's economy experienced some growth

Unlike the 6.0% contraction in GDP witnessed over the Covid-19 epidemic in 2020, South Africa experienced notable recovery with a GDP growth rate of 4.7% in 2021. (Stats SA, 2023) (Table 1.1).

Table 1.2 South Africa's GDP in current prices (R million), 2017/18 to 2021/22

	2017/18	2018/19	2019/20	2020/21	2021/22
Gross domestic product level at current prices (R million)	5 078 190	5 357 640	5 605 034	5 521 075	6 208 786
GDP (%)	1.2	1.6	0.3	-6.0	4.7

Source: Stats SA. (2023).

R&D expenditure in state-owned enterprises went up in 2021/22

State-owned enterprises spent R421 million (25.4%) more on R&D in 2021/22, bringing their total R&D expenditure to R2.080 billion. Of this, a noticeable R810 million was allocated for capital expenses on R&D. SOEs spent R427 million on space science R&D, more so than all other selected areas of interest.

Manufacturing and financial intermediation show increased R&D activity

Within the business sector, the financial services (financial intermediation, real estate and business services) and manufacturing sectors continued to drive most R&D expenditure, accounting for 45.7% (R6.187 billion) and 29.9% (R4.049 billion) of total expenditure, respectively. The financial services sector increased by R1.937 billion and the manufacturing sector by R1.154 billion in 2021/22. The manufacturing subsector, composed of the manufacture of refined petroleum, coke and nuclear fuel; manufacture of chemicals and chemical products (incl. pharmaceuticals) and manufacture of rubber and plastic products, increased by R608 million, while transportation, storage, and communication increased by R531 million.

R&D personnel grew in all sectors

The R&D personnel headcount went up by 2 857 (an increase of 3.5% year-on-year) to 85 061 in 2021/22, and researchers accounted for 1 716 (an increase of 2.8% year-on-year) (Table 1.3). Enterprises in the business sector employed 917 new R&D personnel, however, they shed 140 researchers. R&D personnel increased by 1 657 in the higher education sector, 155 in the government sector and 79 in the science councils. The non-profit sector recorded an increased R&D personnel headcount of 49.

In 2021/22, 1.9 full-time equivalent researchers were employed for every 1 000 workers, an increase from the 1.8 reported in 2020/21. The ratio of female researchers as a percentage of total researchers (including doctoral and post-doctoral fellows) rose by 0.4 percentage points to 47.0%.

Table 1.3 R&D personnel in South Africa, 2017/18 to 2021/22

	2017/18	2018/19	2019/20	2020/21	2021/22
Total R&D personnel (FTE)	44 259.3	43 774 .3	41 856.5	42 925.9	44 355.4
Total researchers# (FTE)	29 515.2	29 110.8	28 358.6	27 697.6	27 763.3
Total researchers (headcount) #*	61 840	62 166	62 002	61 406	63 122
Female researchers (headcount) #*	27 774	28 401	26 015	28 597	29 658
Total R&D personnel (FTE) per 1 000 in total employment	2.7	2.7	2.8	2.9	3.0
Total researchers (FTE) per 1 000 in total employment #	1.8	1.8	1.9	1.8	1.9
Female researcher headcount #* %	44.9	45.7	46.2	46.6	47.0

Note: #Includes doctoral students and post-doctoral fellows. In 2017/18 it also included emeritus professors, research fellows and honorary research fellows. These categories of personnel do not incur salary costs, but time and other costs are associated with their institutional position.
* Headcounts included non-SA R&D staff in 2019/20.
Source: South African National Survey of Research and Experimental Development, 2017/18 to 2021/22.

Applied research remains most prevalent

Applied research, which continues to be the most common type of research, accounted for 48.1% (R18.380 billion) of R&D activity in 2021/22. Basic research constituted 29.2% (R11.148 billion) of research activity. The least common type of research was experimental development research (22.7%) (R8.657 billion). Applied research dominated in all the sectors except in higher education institutions, where basic research is the predominant type of R&D.

Further decline in the proportion of R&D performed in Gauteng

Gauteng contains most of the research and development enterprises across all institutional sectors in South Africa, together contributing 41.1% (R15.690 billion) of GERD. However, the province's contribution dropped proportionately by 2.8 percentage points in 2021/22, despite a nominal increase in expenditure. Western Cape and KwaZulu-Natal comprised the second and third highest contributions, with R10.171 billion (26.6%) and R3.716 billion (9.7%) respectively. Mpumalanga and Free State provinces saw increased R&D expenditure of R557 million (1.2 percentage points) and R491 million (0.8 percentage points), respectively.

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

The majority of R&D was in medical and health sciences (22.8%) (R8.718 billion), and social sciences (18.4%) (R7.041 billion). The field of research with the third-highest R&D expenditure in South Africa was information, computer, and communication technology (13.1%) (R5.008 billion), which surpassed the engineering sciences field (11.7%) (R4.463 billion). The increase in 2021/22 came mainly from R&D in the natural sciences. Growth in social sciences was stagnant.

R&D in priority policy areas increased

Biotechnology R&D increased by R326 million in 2021/22. Furthermore, R&D expenditure rose by R613 million for research connected to space science, R550 million for the field of new materials, and R475 million for research related to the environment. Research expenditure for open-source software increased by R228 million, whereas funding for communicable diseases (TB, HIV/AIDS, and malaria) went up by R329 million. R&D related to the environment maintained its growing trend, with other areas of interest displaying more erratic growth trends.

Government remains the largest funder of R&D

Government-funded R&D amounted to 52.5% (R20.049 billion), while business-funded R&D was 29.0% (R11.081 billion) and foreign-funded R&D totalled 14.5% (R5.539 billion) (Table 1.4). Foreign funding was the highest in ten years (R5.539 billion), contributing R1.078 billion more in 2021/22. Foreign investment appears to have trended upwards over the last ten years, with most directed to the higher education and business sectors.

Table 1.4 Funding of R&D in South Africa (R million), 2017/18 to 2021/22

	2017/18	2018/19	2019/20	2020/21	2021/22
Government-funded R&D (including science council and university own funds)	18 082 182	17 475 173	19 416 933	18 871 543	20 049 283
Business-funded R&D	16 067	14 534	9 359	9 034	11 081
Foreign-funded R&D	3 937	3 999	4 662	4 462	5 539

Source: South African National Survey of Research and Experimental Development, 2017/18 to 2021/22.

2. MEASURING THE CONTRIBUTION OF R&D TO ECONOMIC GROWTH

Innovation drives economic growth and competitiveness on a global scale and R&D intensity is an important metric used by investors, analysts, and policymakers. Investors use R&D intensity to assess the growth prospects of potential investments and studying the difference in R&D intensity across sectors can help guide policymakers to direct support where it is most needed or can have the greatest impact.

Defining R&D intensity

"R&D intensity for a country is defined as the R&D expenditure as a percentage of GDP."

Source: Eurostat (2022) Statistics Explained, Glossary: R&D Intensity.

Gross domestic expenditure on R&D (GERD) is the total intramural expenditure on R&D performed in a country during a specific period. GERD expressed as a percentage of gross domestic product (GDP) of a country is a widely used indicator of the research intensity within a national economy. Hence, it is used as a key target in the management of national innovation systems (Walwyn, 2010).

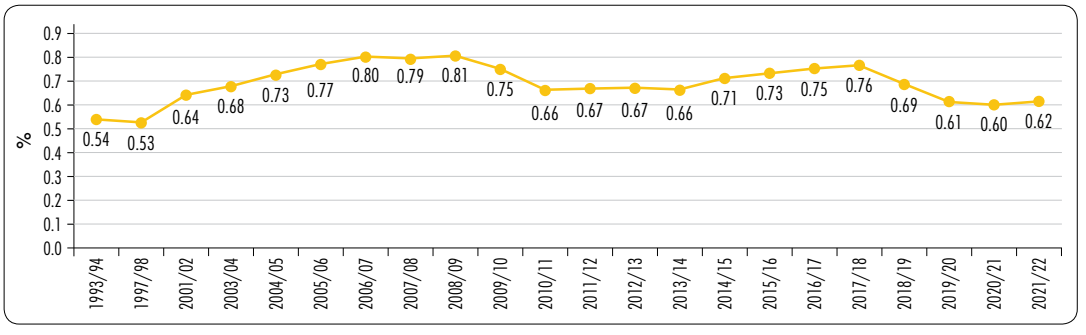
GERD as a percentage of GDP increased steadily from 1997 to reach a peak of 0.81% in 2008/09 in South Africa (Figure 2.1). It then declined but peaked again at 0.76% in 2017/18. It dropped sharply after this, but showed an uptick in 2021/22, reaching 0.62%. This trend of a declining GERD to GDP ratio in recent years has been observed in other middle-income, developing economy countries (Mustapha, Borel-Saladin and Clayford, 2024).

It is of value to compare R&D in South Africa to other countries to assess our performance, as understanding R&D patterns in other countries can help South Africa to improve its own efforts. Figure 2.2 illustrates that GERD/GDP increased in most countries in 2020, largely due to the decline of GDP in response to the Covid-19 pandemic. For example, South Korea increased its GERD to GDP ratio to 4.8% in 2020. Despite the general increase in GERD/GDP, some countries, including South Africa, Germany and Chile, experienced decreases.

Comparing of R&D in South Africa to other countries

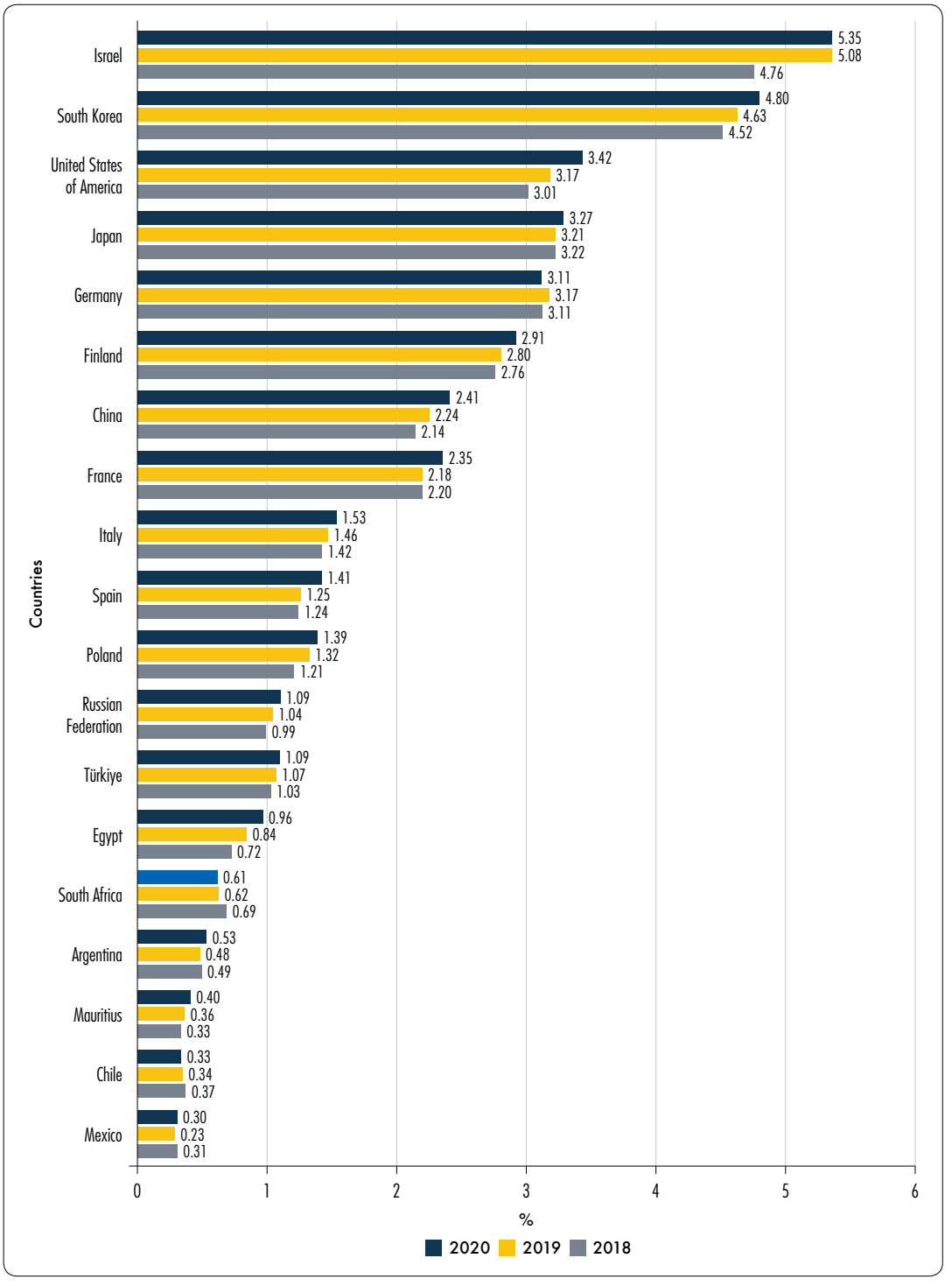
The question of which countries are more appropriate to compare South Africa to in terms of R&D is explored more fully in the companion brief *Comparing R&D: What South Africa can learn from other countries (Mustapha, Borel-Saladin and Clayford, 2024).*

Figure 2.1 GERD as a percentage of GDP (R million), South Africa, 1993/94 to 2021/22



Source: South African National Survey of Research and Experimental Development, 1993/94 to 2021/22

Figure 2.2 GERD as a percentage of GDP for selected countries, 2018 to 2020



Source: Mexico, Egypt, Mauritius: The World Bank (n.d.); South Africa: South African National Survey of Research and Experimental Development, 2018/19 to 2020/21; remaining countries: OECD (n.d.).

3. PATTERNS OF R&D PERFORMANCE

Standard, internationally comparable indicators of R&D performance are calculated annually in South Africa. These include how much money is spent on R&D, how this is distributed across different sectors, and in which specific fields R&D is performed.

Comparing GERD in South Africa to a range of other countries is important for benchmarking R&D spending against international peers. Most countries experienced an increase in GERD in the last few years (Table 3.1).

Purchasing power parities (PPPs)

"Purchasing power parities (PPPs) are the rates of currency conversion that try to equalise the purchasing power of different currencies, by eliminating the differences in price levels between countries. This indicator is measured in terms of national currency per US dollar."

Source: OECD (2022).

Table 3.1: GERD for selected countries (millions in current price PPP$), 2019 to 2021

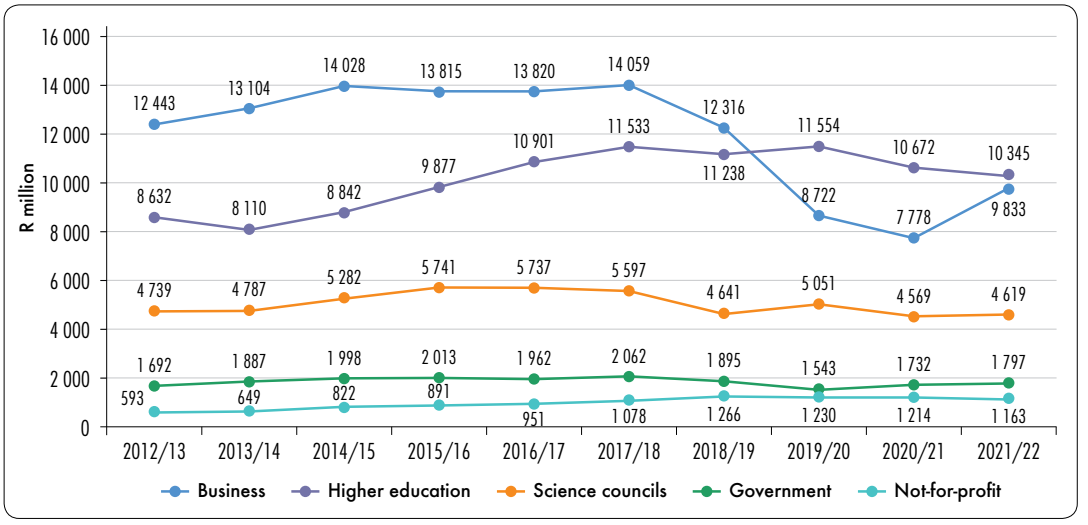
COUNTRY	2019	2020	2021
[1] Czechia	57 915	57 091	61 087
[1] Finland	8 126	8 643	9 569
[1] France	75 682	76 073	80 917
[1] Germany	153 293	150 789	161 232
[1] Italy	118 152	130 426	147 797
[1] Poland	17 830	19 080	21 869
[1,2] Russian Federation	47 413	50 746	-
[1] Spain	25 776	26 008	29 188
[2] China	545 461	607 601	701 115
[1] Japan	173 928	174 926	183 467
[1] South Korea	105 064	112 221	123 460
[1] Israel	6 880	6 680	7 120
Malaysia	-	15 127	-
[1] Türkiye	31 015	32 703	37 327
[1] United States	677 286	730 241	821 811
Mexico	7 493	7 361	7 562
Chile	1 684	1 646	-
Argentina	5 057	5 480	6 186
Egypt	2 646	3 389	3 653
Mauritius	470	490	457
[2] South Africa	4 881	4 627	5 177

Legend:
- Europe
- Asia and Middle East
- North, Central and South America
- Africa

Note: [1] OECD member states, [2] BRICS member/observer states.
Source: Czechia, Mexico, Egypt, Malaysia, Mauritius: The World Bank (n.d.); South Africa: South African National Survey of Research and Experimental Development, 2019/20 to 2021/22; remaining countries: OECD (n.d.).

Historically, the business sector has been the largest performer of R&D in South Africa, with spending peaking at over R14 billion in 2017/18 (Figure 3.1). After this, real R&D expenditure began to decline, reaching its lowest point in the ten years preceding 2021/22—R7.8 billion in 2020/21—before rebounding in 2021/22 (by approximately R2 billion).

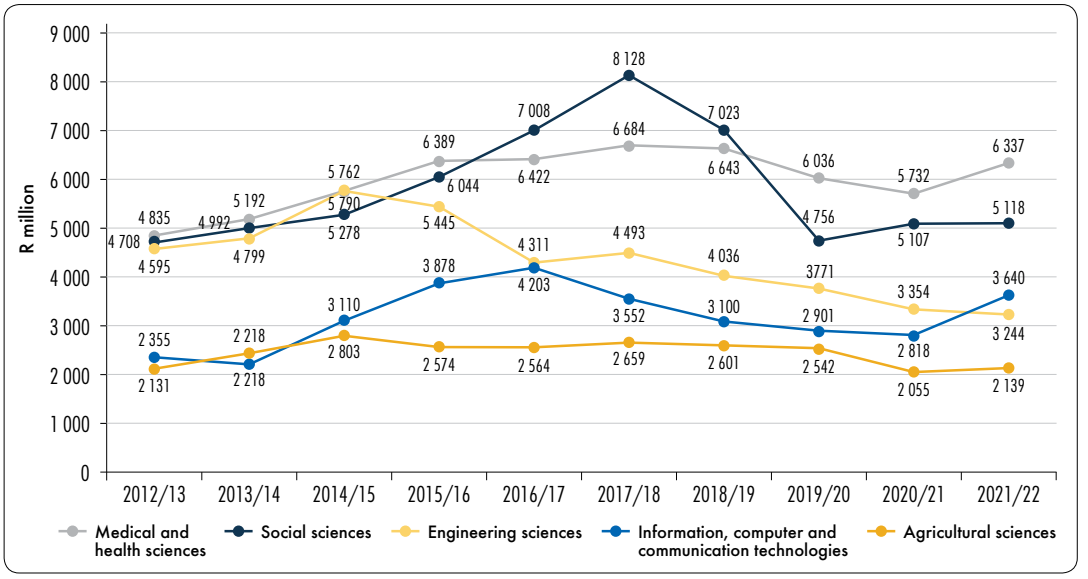
Figure 3.1 R&D expenditure by institutional sector in real terms (R million), South Africa, 2012/13 to 2021/22



Source: South African National Survey of Research and Experimental Development, 2012/13 to 2021/22.

In 2021/22, engineering sciences emerged as the main field for R&D expenditure – exceeding R6 billion (Figure 3.2). R&D expenditure in ICT grew the most, by 29.2% between 2020/21 and 2021/22.

Figure 3.2 R&D expenditure by research field in real terms (R million), South Africa, 2012/13 to 2021/22



Source: South African National Survey of Research and Experimental Development, 2012/13 to 2021/22.

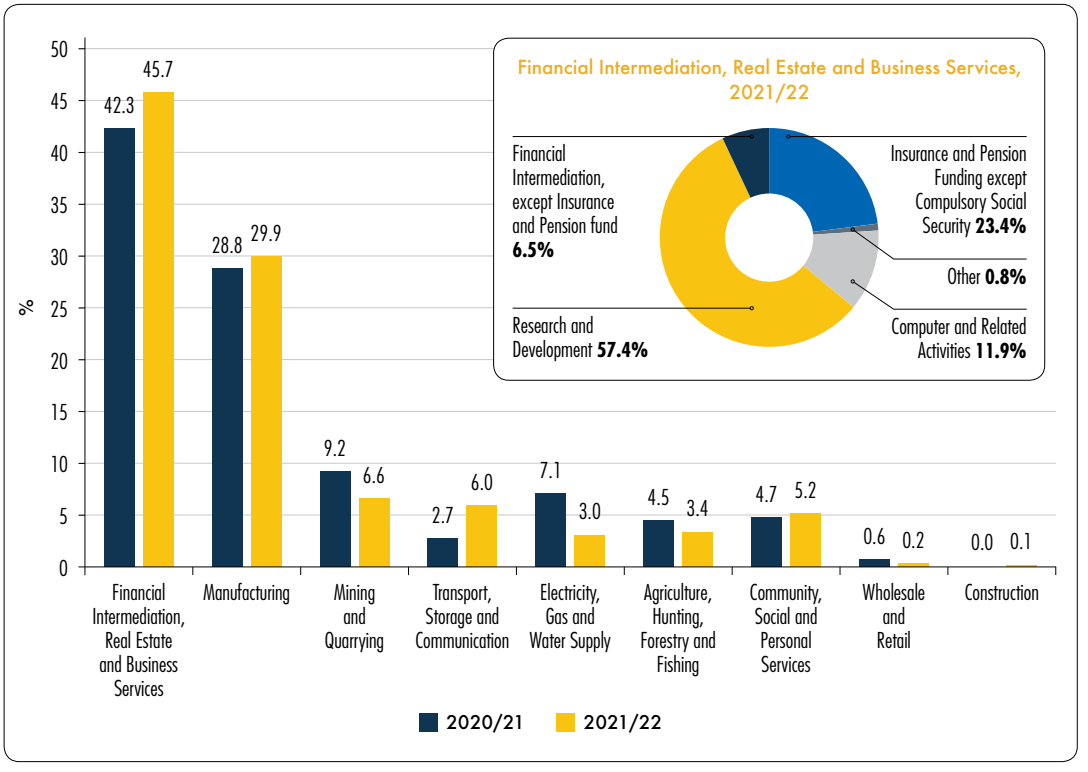
The increase in business expenditure on R&D between 2020/21 and 2021/22 did not occur uniformly across the whole sector (Figure 3.3). Larger industries like Financial Intermediation, Real Estate and Business Services, and Manufacturing, showed significant increases in the share of expenditure, along with a smaller increase in Transport, Storage and Communication. Increased expenditure on R&D was not uniform across these sectors either, with the sub-industries Research and Development, and Insurance and Pension Funding making up the bulk of R&D in the financial services sector. Industrial sectors like Mining and Quarrying, Electricity, Gas and Water Supply, and Agriculture, Hunting, Forestry and Fisheries experienced shrinking shares of business R&D expenditure.

GERD to GDP targets

The South African government has a policy target of a GERD to GDP ratio of 1.5%, to be achieved by 2030 (DST, 2019).

The companion brief, *Pathways to reaching South Africa's R&D intensity target* (Mustapha and Sithole, 2024) models funding scenarios that could assist in meeting the policy target.

Figure 3.3 Business R&D expenditure by Standard Industrial Classification (as a percentage of GERD), South Africa, 2020/21 to 2021/22

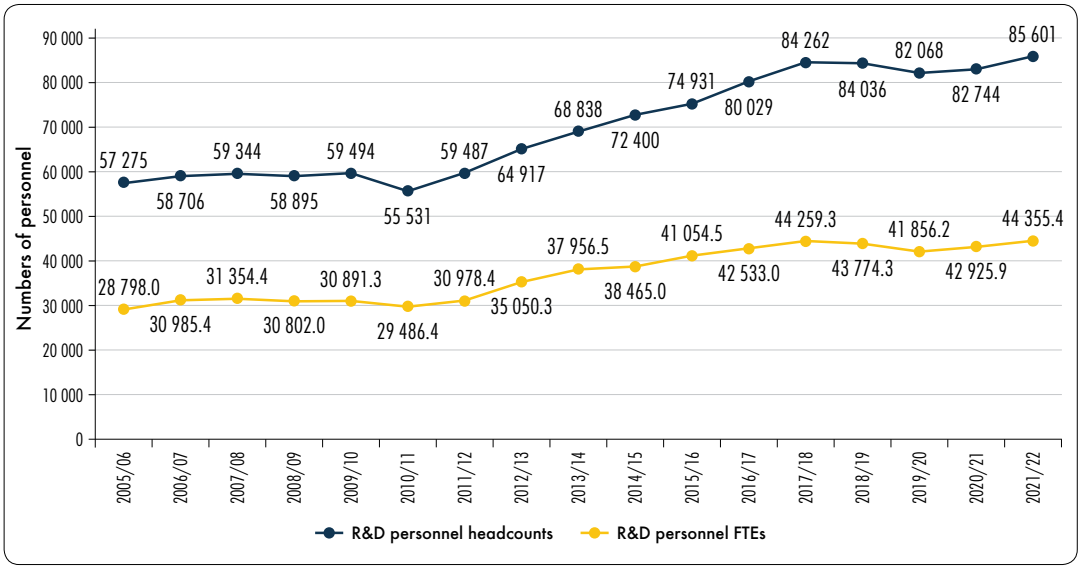


Source: South African National Survey of Research and Experimental Development, 2020/21 to 2021/22

4. THE IMPORTANCE OF SUFFICIENT R&D PERSONNEL

For R&D activities to flourish, a country needs sufficient suitably capable research personnel. The number of R&D personnel in South Africa remained at a similar level between 2005 and 2010, before decreasing in 2010/11 (Figure 4.1). However, the ranks of R&D personnel grew relatively steeply between 2010/11 and 2017/18 (with a 6.5% average annual increase). The numbers dropped off somewhat between 2017/18 and 2019/20, before increasing again to reach a new maximum of 85 601 in 2021/22.

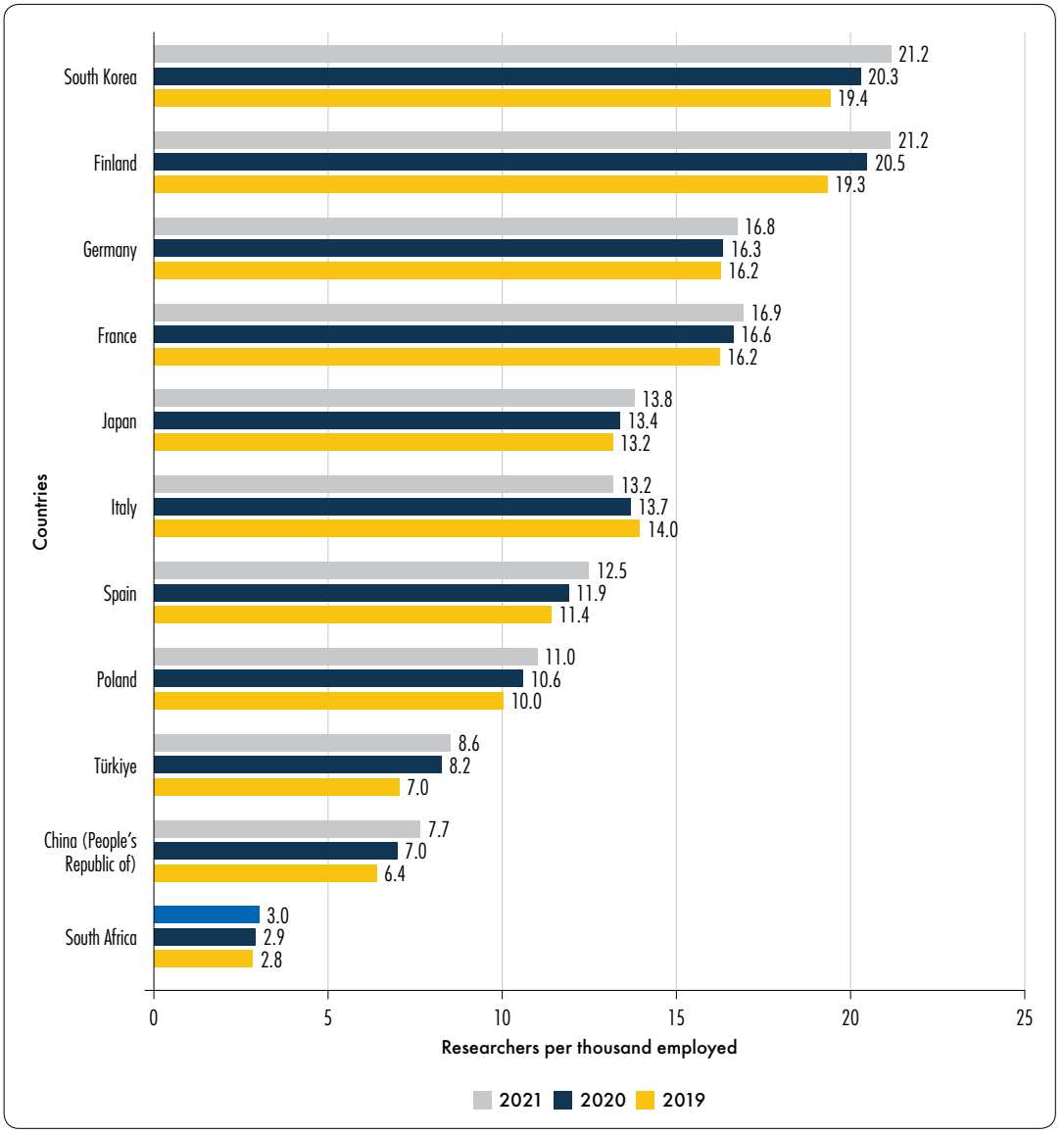
Figure 4.1 R&D personnel (headcount and FTEs), South Africa, 2005/06 to 2021/22



Source: South African National Survey of Research and Experimental Development, 2005/06 to 2021/22.

Developed countries with high GDP per capita boast much higher numbers of full-time equivalent (FTE) researchers per 1 000 people employed e.g., 21.2 for South Korea in 2021 (Figure 4.2) (Mustapha, Borel-Saladin and Clayford, 2024). South Africa by comparison was low, with three full-time equivalent researchers per 1 000 workers employed in 2021—less than half that of fellow BRICS nation China (with 7.7 FTE researchers per thousand employed in 2021). For South Africa to reach the level of a leading R&D performing country like South Korea, the number of research personnel employed needs to be seven times larger.

Figure 4.2 Full-time equivalent researchers per 1000 total employment for selected countries, 2019 to 2021

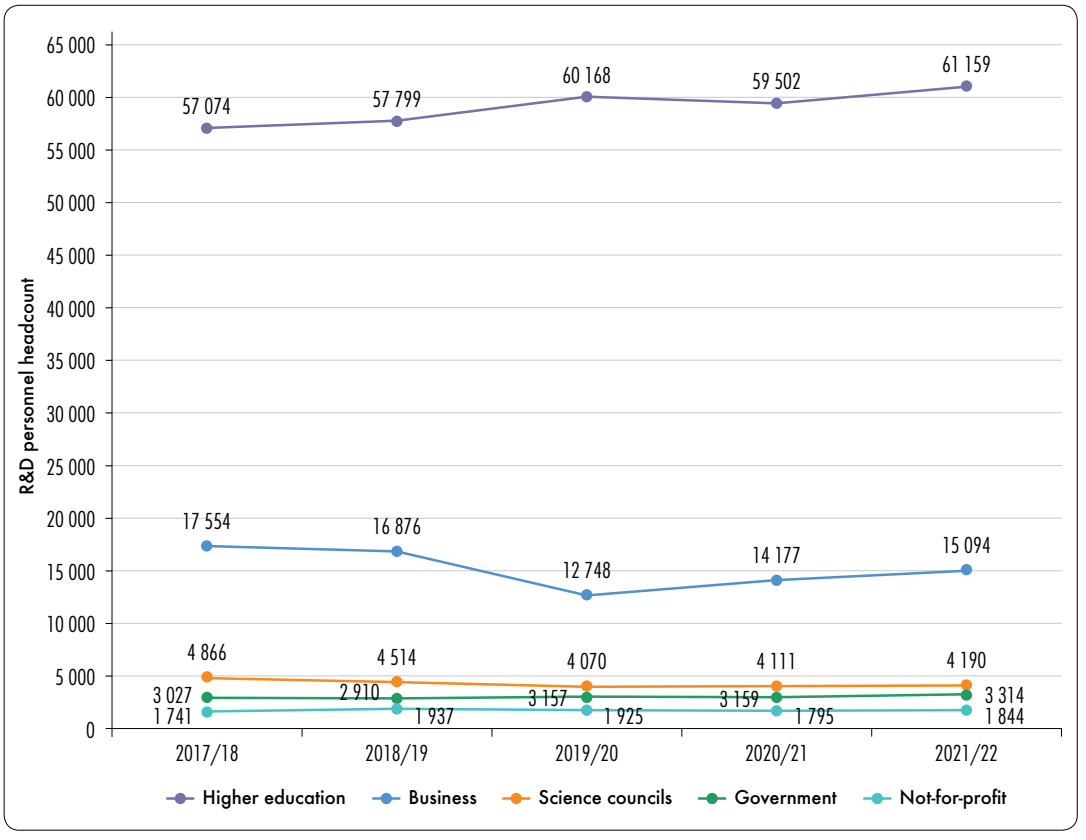


Source: OECD (n.d.); South African National Survey of Research and Experimental Development, 2019/20 to 2021/22.

Most R&D personnel in South Africa are found in the higher education sector (Figure 4.3). The number of R&D personnel increased to 61,159 in 2021/22, up from 57,074 five years earlier. While there was a slight decrease in 2020, possibly due to the impact of Covid-19, the overall trend has been one of steady growth.

Numbers of R&D personnel in the not-for-profit, government and science councils sectors ranged between 1 741 and 4 866 in 2017/18. After a noticeable drop in 2019/20, the number of R&D personnel in the business sector grew, reaching 15 094 in 2021/22. Even with this increase, R&D personnel have not yet recovered to 2017/18 levels in the business sector.

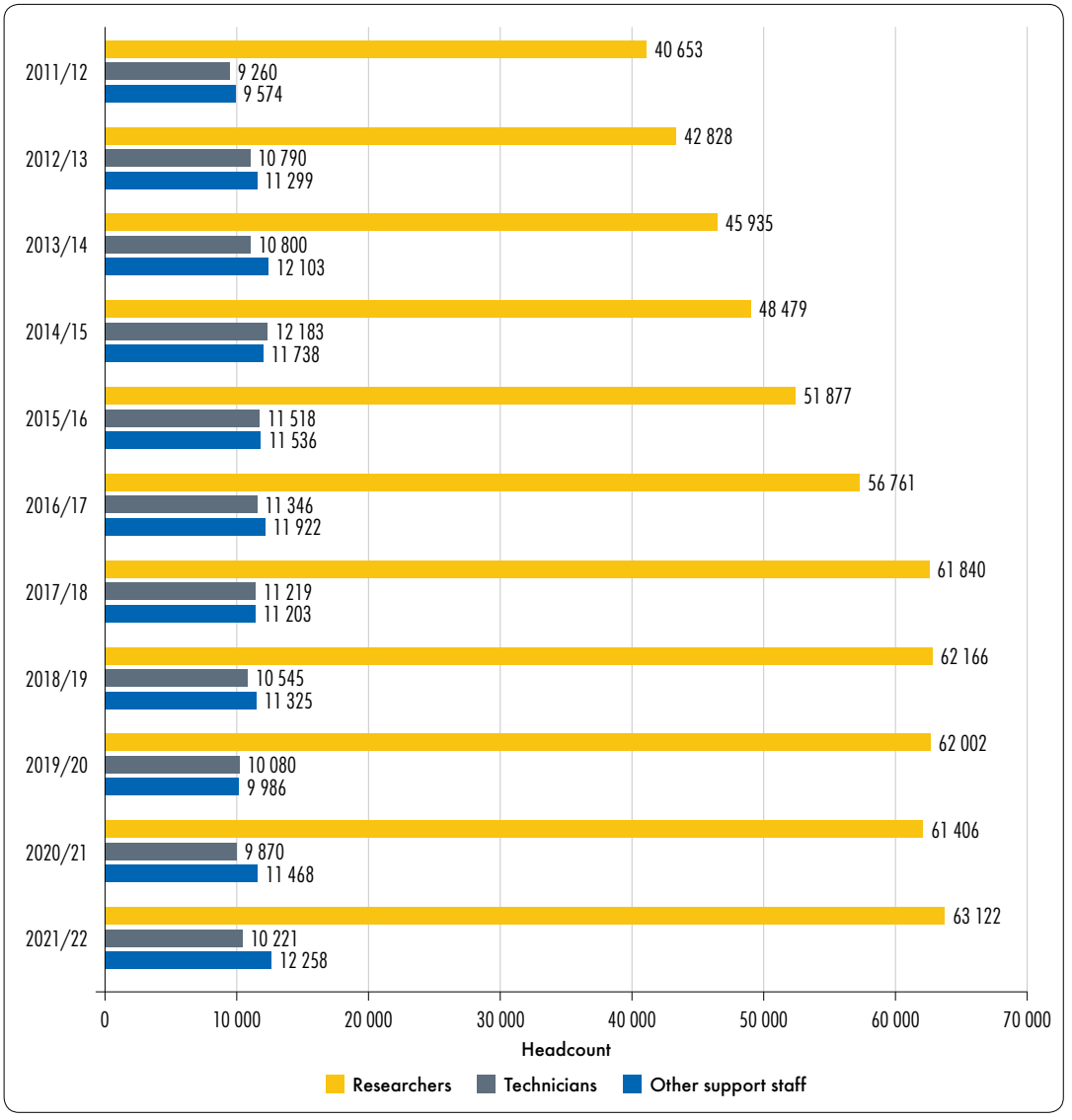
Figure 4.3 R&D personnel headcount by sector, South Africa, 2017/18 to 2021/22



Source: South African National Survey of Research and Experimental Development, 2017/18 to 2021/22.

In addition to a sufficiently large R&D workforce, a healthy balance of different types of R&D personnel is also required. The composition of R&D personnel by occupation has remained relatively stable over the past five years, with researchers constituting over 70% of the workforce, and the remaining staff divided between technicians and other support roles (Figure 4.4).

Figure 4.4 R&D personnel by occupation (headcount), South Africa, 2011/12 to 2021/22

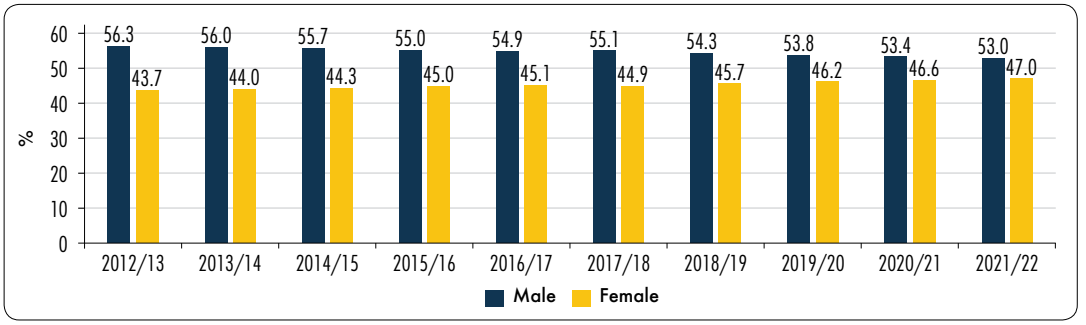


Source: South African National Survey of Research and Experimental Development, 2011/12 to 2021/22.

4.1 Gender

Historically, men have constituted a slightly higher percentage of researchers than women in South Africa (Figure 4.5). This disparity has been gradually narrowing over recent years, declining from 56.3% in 2012/13 to 53.0% in 2021/22.

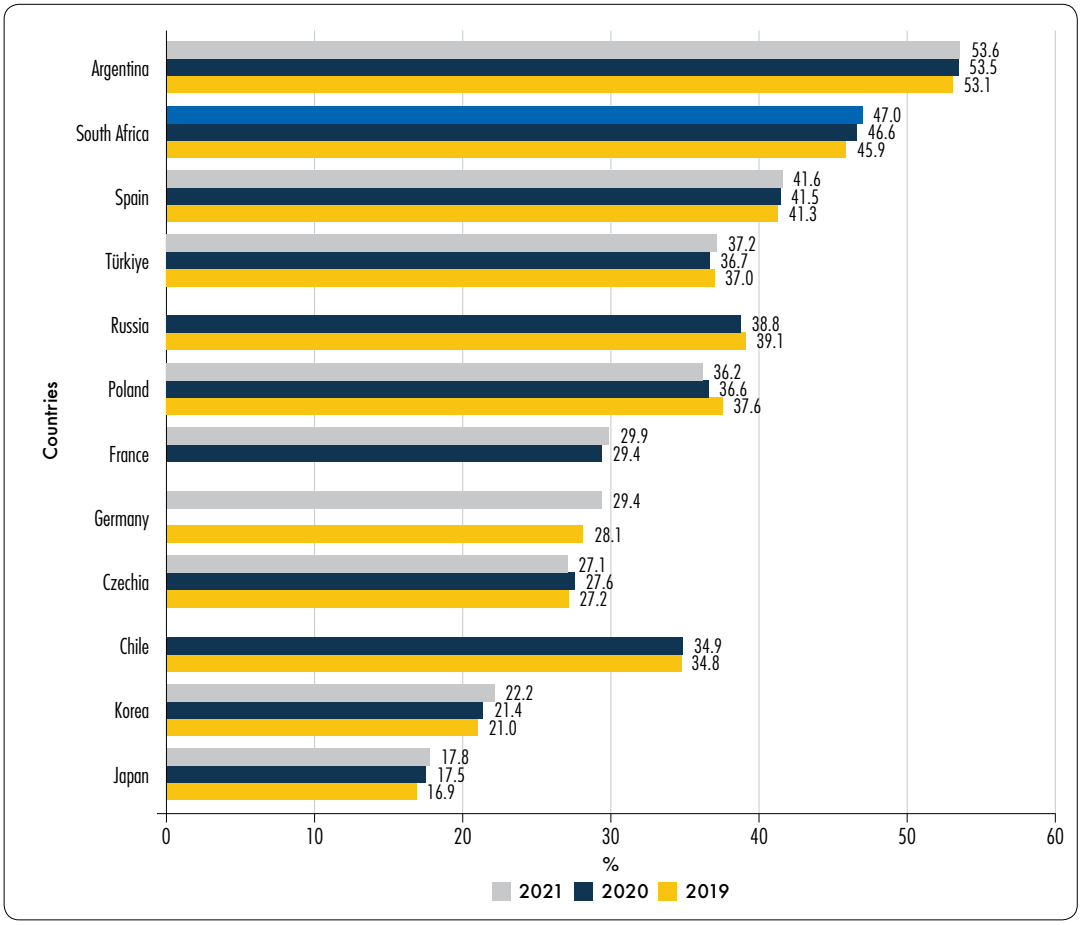
Figure 4.5 Researchers by gender, South Africa, 2012/13 to 2021/22



Source: South African National Survey of Research and Experimental Development, 2012/13 to 2021/22.

South Africa is among countries with the highest percentage of women researchers (Figure 4.6). Argentina too has a high percentage of women researchers at 53.6% versus South Africa's 46.6% in 2021.

Figure 4.6 Female researchers as a percentage of total researchers in selected countries, 2019-2021



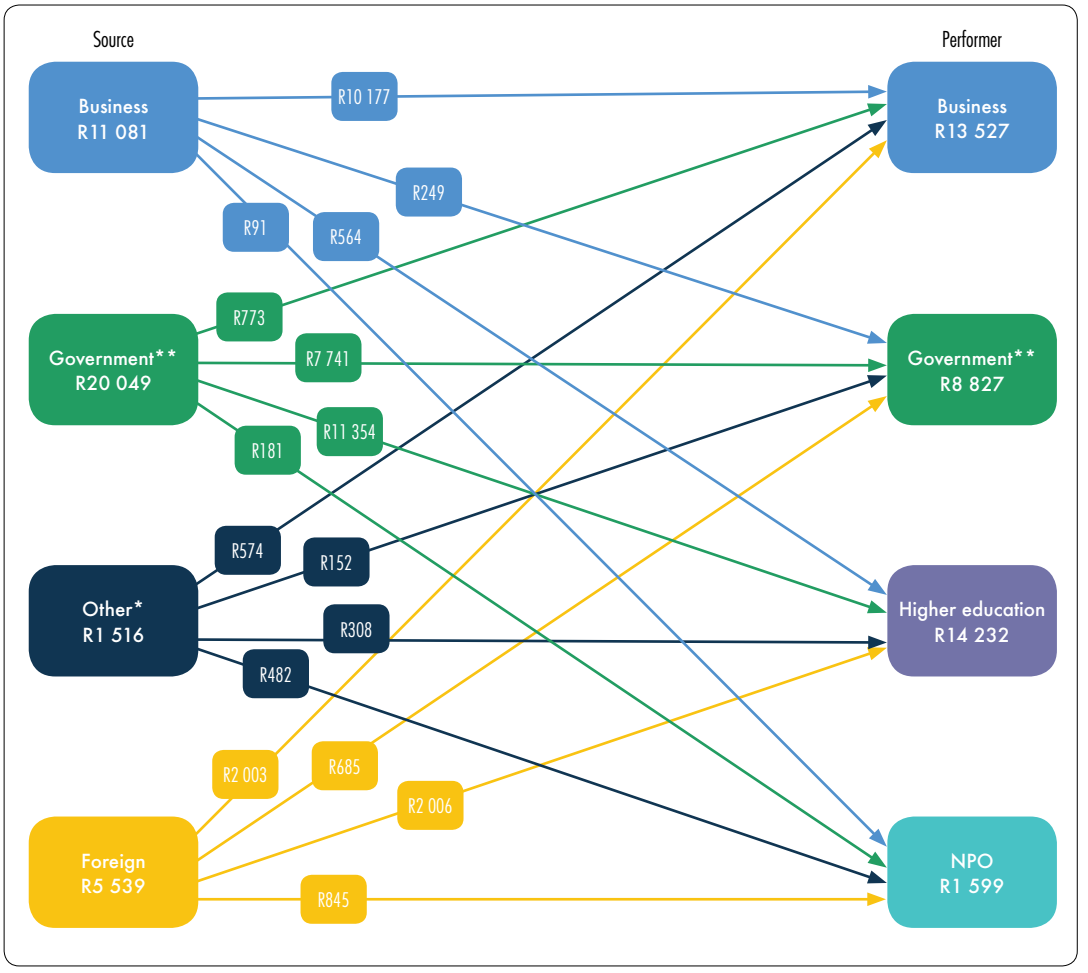
Source: OECD (n.d.); South African National Survey of Research and Experimental Development, 2019/20 to 2021/22.

5. INVESTMENT IN R&D

It is helpful to differentiate between investment in R&D and expenditure on R&D. Expenditure is the money spent on the buildings, machinery, equipment and labour (amongst others) involved in conducting R&D. Investment refers to the funding received for the purposes of conducting R&D.

Government remained the main contributor of funding to R&D in South Africa in 2021/22, contributing nearly twice as much as the next highest contributor, the business sector (Figure 5.1). More than half of the funding contributed by government went to higher education institutions. Over 90% of funds contributed by business remained within the business sector.

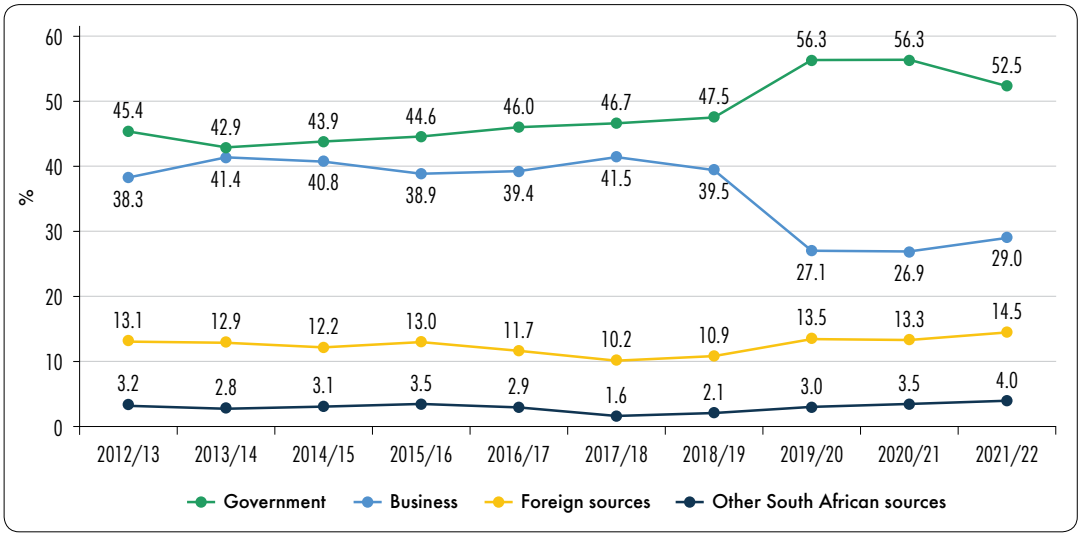
Figure 5.1 Major flows of funding for R&D (R million), South Africa, 2021/22



Note: *Other includes the contribution from higher education, not-for-profit (NPO) organisations and individual donations
**Government includes science councils
Source: South African National Survey of Research and Experimental Development, 2021/22.

While government was consistently the largest funder of GERD between 2012/13 and 2018/19, the business sector was not far behind over this period (Figure 5.2). However, in 2019/20, the proportions of GERD funded by government and the business sector diverged dramatically and have remained the same so that by 2021/22, 52.5% of GERD was funded by government versus only 29.0% by business.

Figure 5.2 GERD by source of funds, South Africa, 2012/13 to 2021/22



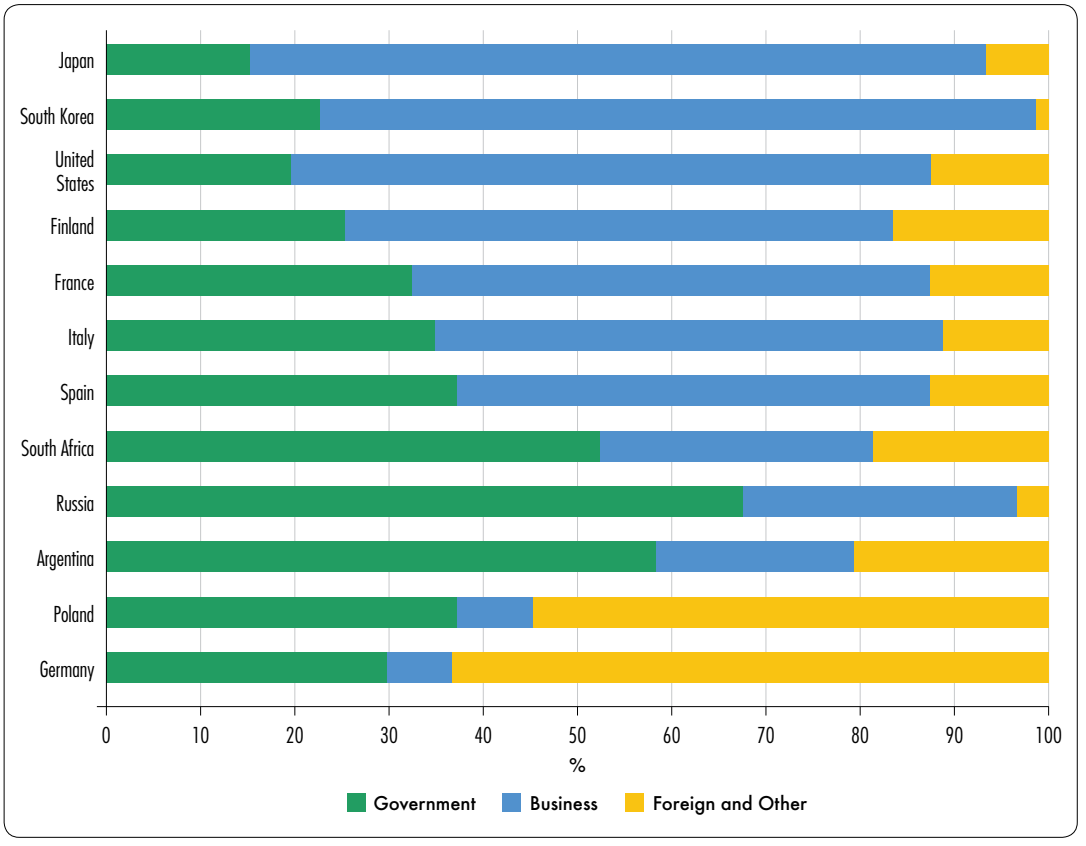
Note: Other South African sources include contributions from higher education, not-for-profit organisations and individual donations; government includes science councils.
Source: South African National Survey of Research and Experimental Development, 2012/13 to 2021/22.

South Africa is one of the countries where government was the main investor in R&D in 2021/22, comparable with Argentina (58.5%) and Russia (67.8%) (Figure 5.3). In countries with high GERD/GDP ratios and higher GDP per capita, business is usually the main source of GERD.

Sources of funding for R&D

Many argue however that strong performance in business sector R&D is essential to achieving the 1.5% GERD/GDP goal. The companion brief *Funding of R&D in a deindustrialising South Africa* (Mustapha, 2024) seeks to illustrate the capacity of public funding to spark and accelerate business sector investment in R&D.

Figure 5.3 GERD by source of funds in selected countries, 2021



Source: OECD (n.d.); South African National Survey of Research and Experimental Development, 2021/22.

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[2] The **South African National Survey of Research and Experimental Development data** for the period 2001/02 to 2021/22 that is cited in this report was created by the Centre for Science, Technology and Innovation Indicators at the Human Sciences Research Council. Data is available for download and use by readers in different formats on the HSRC's website (hsrc.ac.za). For specialised data requests from CeSTII, visit https://data-request.hsrc.ac.za/

R&D SURVEY

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