

Survey on Government Funding for Scientific and Technological Activities

2016/17



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA



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ABBREVIATIONS

ASSAf	Academy of Science of South Africa
DST	Department of Science and Technology
ECSP	Economic Support Competitiveness Package
ENE	Estimates of National Expenditure
GBAORD	Government Budget Appropriation or Outlays on R&D
GERD	Gross Expenditure on Research and Development
MTEF	Medium Term Expenditure Framework
NDP	National Development Plan
NSI	National System of Innovation
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
S&T	Science and Technology
SARCHI	South African Research Chairs Initiative
SEO	Socio-Economic Objective
STA	Scientific and Technological Activity
STET	Scientific and Technical Education and Training
STI	Science, Technology and Innovation
STS	Scientific and Technological Services
TIA	Technology Innovation Agency



EXECUTIVE SUMMARY

This report presents the results of the annual survey of government funding for Scientific and Technological Activities (STA Survey) produced by the Department of Science and Technology. By definition, STAs cover a 'family of scientific and technological activities', including, Research and Development (R&D), Scientific and Technical Education and Training (STET) and Scientific and Technological Services (STS). The latter comprises scientific services run by specialised agencies, e.g. Forensic Laboratories, Critical Genetic Resources, Earth Observations, Geological Surveys, Weather Services, Standards Generation, etc.

The aggregated indicators of government funding for STAs provided in this report give a sense of how R&D and related STAs are prioritised within the overall government budget, within specific departments and across a range of policy objectives. Such evidence is crucial for purposes of policy planning, decision making and evaluations.

An estimated R23,4 billion was budgeted on STAs in the 2016/17 financial year (April 2016 to March 2017). This is a marginal increase of 0.3% (R66,474 million) in nominal terms from the amount reported for 2015/16. Viewed over a four-year period, there are signs of government STA funding to have stagnated at this level. In 2010, Rand (ZAR) terms, STA funding has declined from the previous year.

The Medium Term Expenditure Framework (MTEF) appropriations indicate that budgets on STAs will increase to R25,9 billion by 2018/19. Outer year allocations like these are indicative and can be revised.

The overall pattern of the classifications of funding the STAs remained largely similar to the previous year's trends, with the largest proportion of STA (R13,5 billion or 63.4%) being Government Budget Appropriation or Outlays on Research and Development (GBAORD), followed by Scientific and Technological Services (STS) with R5,8 billion (24.8%) and Scientific Technical Education and Training (STET), with R4,2 billion (11.8%).

The bulk of the STA implementation activities are located outside the national departments and are performed by research entities, universities, provinces and consultants. It is estimated that 71,7% (R16,8 billion) of the total STA expenditure constituted transfers and subsidies towards such activities. An estimated 28,5% (R6,6 billion) of the total STAs was spent internally within national departments.

STA information can also be presented in terms of the government's policy objectives (classified in this report under 20 socio-economic objectives or targeted areas of use, grouped into eight Major Divisions). An estimated R8,8 billion (37%) of total budgeted STA expenditure was allocated to the objective of "society" in the areas of health, education and training, and social development, followed by R6,7 billion (29%) towards economic development with Agriculture (Plant Production and Animal Production) contributing the highest in this SEO classification, and R4 billion (17%) towards "justice and protection" which includes defense and policing. R3,2 billion (14%) was appropriated towards the "advancement of knowledge". Other, smaller categories, account for the remaining 3%.

Total funding for science councils and related public research Institutions increased to R5,38 billion in 2016/17, a nominal increase of 0.98% from the previous financial year's R5,33 billion. Further analysis shows that, at an aggregated level, science councils are looking at contract work as an increasingly important source of revenue to sustain their activities. At an aggregated level, the bulk of contract funding for these institutions comes from contracts with the South African government institutions, followed by foreign or international parties and then the local private sector institutions. However, Government departments are reportedly highlighting difficulties in procuring services from Science Councils and related public research institutions because of the procurement legislative framework that requires departments to go on competitive bidding. At an institutional level, there are variations, for example, SAMRC, SANBI and SANSa receive most of their other contract income from foreign or international parties, whereas a significant other income for South African Weather Service (SAWS) comes from the local private sector.

An international comparison, based on GBAORD per capita indicator, is done to show South Africa's relative position, compared to a selected set of countries. This reveals that South Africa's GBAORD per capita of \$1.00 in Purchasing Power Parity (PPP) terms, is alongside countries such as China, Mexico and Chile, but lower than Russia and several other selected countries, which have GBAORD per capita of above \$2.00. The context of different countries must be considered in interpreting these comparisons.

INTRODUCTION AND OVERVIEW

The survey on public funding for STAs gives insight into the level and pattern of public investment in the S&T sector, as well as the trend in actual and budgeted expenditure over the medium term. The regular analysis of these expenditure- budgets is necessary to inform decision making and planning by government for the S&T sector.

The Department of Science and Technology (DST) has undertaken this survey annually since 2008/09, covering national departments that are identified as funders or performers of STAs. In the 2016/17 STA survey, 29 national government departments were identified, and 27 of them confirmed that they had made STA budgetary allocations. The information presented in this report, therefore, represents data pertaining to those 27 national departments.

The definition of STAs covers the "family of scientific and technological activities", which are R&D, Scientific and Technical Education and Training (STET) and Scientific and Technological Services (STS). The latter comprises scientific services run by specialised dedicated agencies, e.g. forensic laboratories, critical genetic resources, earth observations, geological surveys, weather services, standards generation, etc. (See Text box 1).

SCIENTIFIC AND TECHNOLOGICAL ACTIVITIES (STAs) comprise systematic activities, which are closely concerned with the generation, advancement, dissemination and application of scientific and technical knowledge in all fields of science and technology. These include such activities such as Government Budget Appropriations or Outlays for Research and Development (GBAORD), Scientific and Technical Education and Training (STET) and Scientific and Technological Services (STS).

GBAORD includes all the appropriations allocated to R&D undertaken within national departments, the transfers made towards government-financed R&D carried out by government entities and elsewhere outside government, and direct government financial support for R&D carried out by business enterprises, higher education, and private non-profit sectors.

The STET category includes specialised non-university higher education and training, higher education and training leading to a university degree, postgraduate and further training, and organised lifelong training for scientists, engineers and technologists. These are activities directly related to human capital development.

The STS category includes activities involving the application of scientific and technical knowledge, such as patenting, geological surveys, the generation of standards, and the operation of libraries and national scientific databases.

STAs are found in Social Sciences, Humanities (SSH) and the arts as well as in the Natural Sciences and Engineering (NSE).

STAs can also be categorised in terms of whether they are performed within or outside the funding government departments:

- Intramural STAs are those undertaken by the funding government departments "in-house".
- Extramural STAs are those undertaken outside the funding government departments. Within this category are extramural government STAs for which the government provides funding support with the expectation of ownership of the resulting output; and the non-government STAs, for which government provides funding support without expecting ownership of the resulting output, but in order to advance national priorities. The latter includes funding support to the private sector in order to encourage R&D and technological innovation, through both the direct funding grants and indirect support such as the R&D tax incentive.

Text Box 1: STA Definitions and Concepts



POLICY CONTEXT AND NEED TO MONITOR STA FUNDING

The National Development Plan is clear about a need for increased investment in scientific and technological activities to fuel growth and development. Furthermore, government's vital role in funding and performing STAs is set out in the 1996 White Paper on Science and Technology, the 2002 National Research and Development Strategy, and the 2004 Cabinet-approved Strategic Management Model for the Public Science and Technology System in South Africa. Government is expected to address the systemic underfunding of STAs, as well as their alignment with national development goals.

The DST sees the survey on the government funding of STAs as an important tool for the collation and aggregation of data for informed policy analysis. The report becomes an even more important planning tool for the implementation of the Research and Development budget coordination process. The information provided by the report will be one of the inputs in rationalizing and informing decisions in the budget coordination process. This report shows actual budgeted, as well as government's projected budget allocations for STAs over the MTEF. It draws data from the National Treasury's ENE tables / databases and estimates the aggregate indicators for the government funding of STAs.

Government faces demands for investment in a wide range of areas, from agriculture, health, safety and security, to energy and industrial development. During a period of fiscal pressure, it is even more crucial to enhance the process of setting priorities for the allocation of government funding in the public S&T sector. Increasingly, there is specific focus to improve the efficiency of translating results of government-funded research into commercial / developmental outcomes. This is the reason why institutional platforms for identifying, protecting and using the intellectual property generated from government-funded research have been established.

It is important that government understands the long-term nature of research, and sustains funding for the benefit of future generations. The practical benefit of research is uncertain, and often only appears after several years. An immediate benefit, however, is capacity building, as people acquire knowledge and skills through the STAs in which they participate. These skills can be applied elsewhere, even if a particular research project does not result in the desired outcomes.

FLOWS OF GOVERNMENT FUNDING FOR STAs

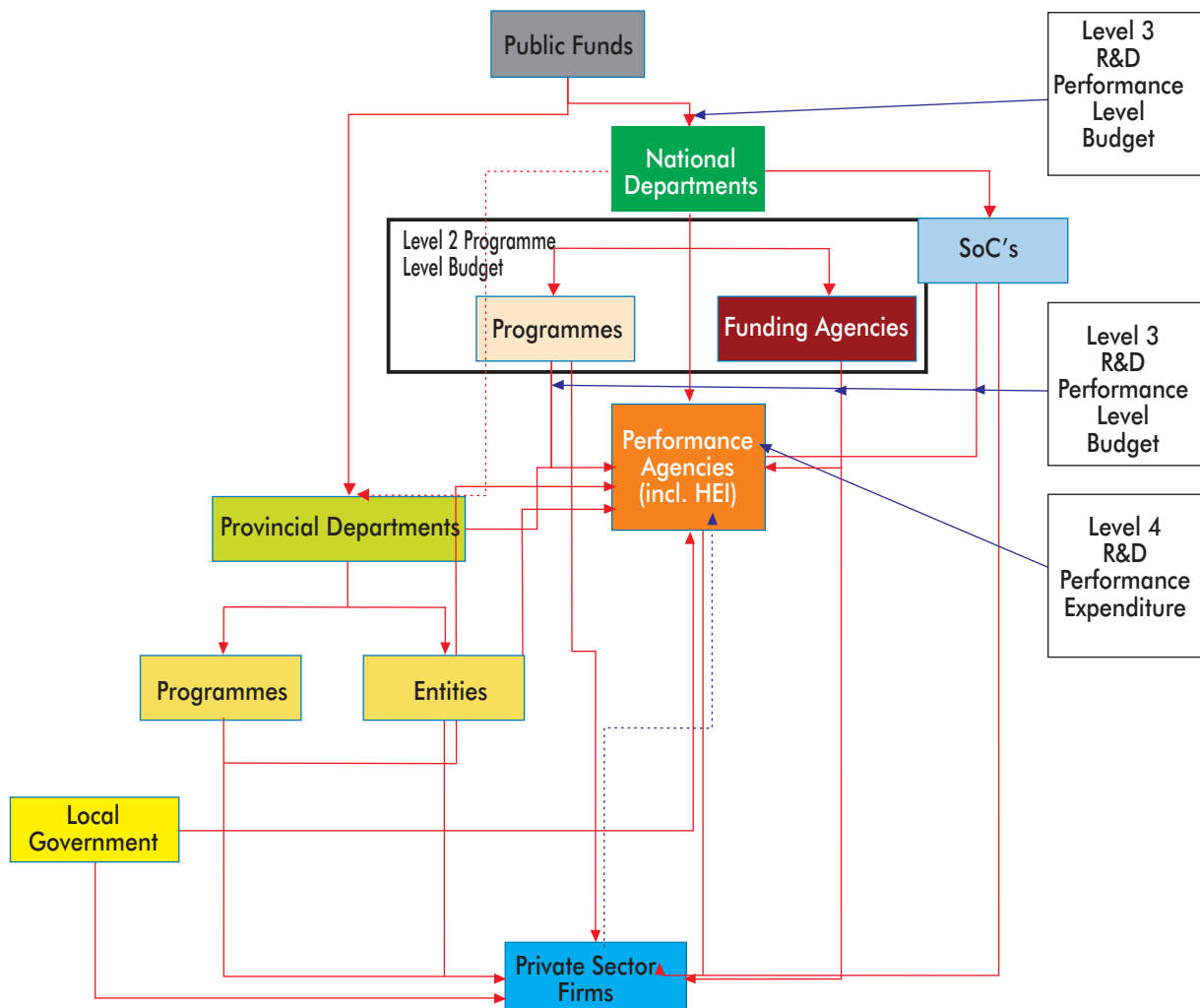


Figure 1: Funding Flows for RDI in South Africa.



Government funding for Scientific and Technological Activities

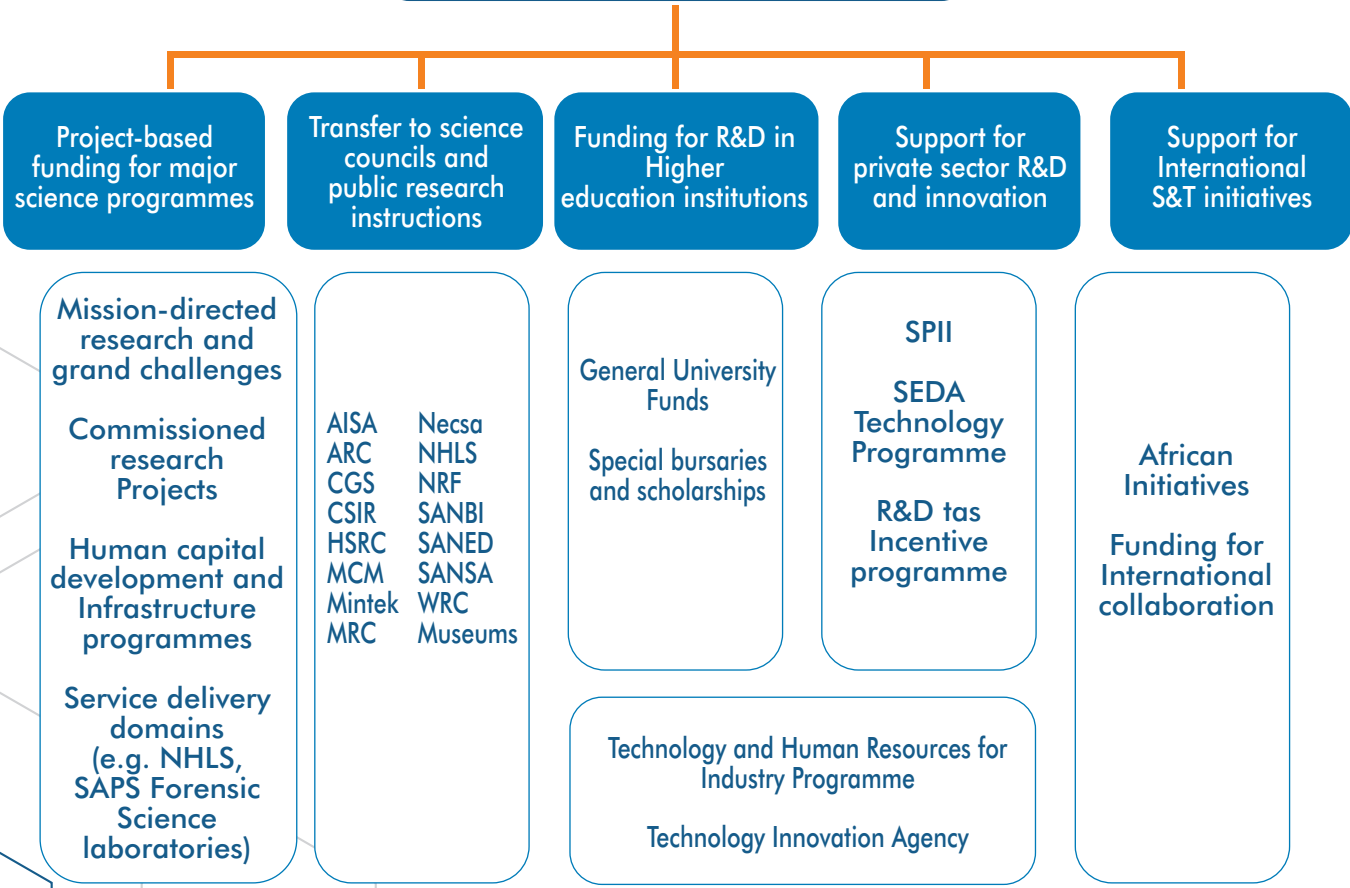


Figure 2: Flows of Government Funding for STAs.



- AISA - Africa Institute of South Africa
- ARC - Agricultural Research Council
- CGS - Council for Geo-science
- CSIR - Council for Scientific and Industrial Research
- HSRC - Human Sciences Research Council
- MCM - Marine & Coastal Management
- Mintek - Council for Mineral Technology
- MRC - Medical Research Council
- Necsa - South African Nuclear Energy Corporation
- NHLS - National Health Laboratory Service
- NRF - National Research Foundation
- SANBI - South African National Bio-informatics Institute
- SANEDI - South African National Energy Development Institute
- SANSA - South African National Space Agency
- SPII - Support Programme for Industrial Innovation
- SEDA - Small Enterprise Development Agency
- WRC - Water Research Commission

Figure 1 and 2 shows how government funding for STAs is typically deployed in South Africa. While the diagram is not intended to be exhaustive, it provides an indication of the major channels through which funding for STAs is deployed. Overall, STAs in South Africa are undertaken outside government departments, by research entities, higher education institutions, in provinces and through private sector consultants. There are variations as well. Some departments, such as the Department of Environmental Affairs and the Department of Agriculture, Forestry and Fisheries, have internal branches that actually perform R&D.

Some entities actually perform scientific research; some are responsible for funding scientific research activities, and others, like the National Research Foundation (NRF) and the Medical Research Council (MRC), do both. The NRF performs research through the national facilities (e.g. the South African Astronomical Observatory, the iThemba Laboratory for Accelerator-Based Sciences and the South African Institute for Aquatic Biodiversity), while it is also a major funding agency responsible for distributing funding to the research community, mostly for human capital development and infrastructure initiatives.

While there are some similarities in the aspects of government STA funding flows and channels across certain countries, the character of these flows and channels evolve with time and reflect the policy approach of a country in question. In South Africa, various government departments fund STAs, either directly or indirectly, and through the procurement of scientific services from public and/or private organisations. The DST is mandated to oversee the functioning of this arrangement in terms of the Strategic Management Model for South Africa's Science and Technology System.





KEY FINDINGS

4.1 Overall National Government Expenditure on STAs

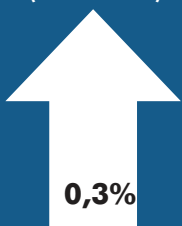
The 2016/17 total national government budget on STAs is R23,4 billion. This is a marginal increase of 0.3% (or R66,474 million) in nominal terms from the amount reported for 2015/16. In real terms (amounts stated in constant 2010 Rands), STA funding has declined from the previous year. STA funding appears to have stagnated at this level for a four year period 2013/14 to 2016/17.

While STA funding has shown increases in some of the years covered in this report, the rate of year-on-year increases since 2013/14 has been slowing down. The nominal growth of 0,3% is lower than the nominal growth reported in the previous three measurement periods, and projections show a further slowdown over the medium term to 2,1% in 2016/17.

The MTEF appropriations indicate that STA funding will increase by 6% from 2016/17 to R27,1 billion by 2019/20. Outer year allocations like these are indicative and can be revised as the government adapts its budget to ensuring fiscal possibilities.

Government funding on STAs

R23,4 billion
(2016/17)



0,3%

Annual change from
2015/16 in nominal terms

The decrease is due to the budget cuts and reprioritisation that has been taking place under the facilitation of National Treasury, as well as the economic competitiveness support package funding coming to an end in 2018/19. Total STA spending as a percentage of total government budget has also declined to 1.8%. During the period covered by this report, the South African government is still operating in a constrained fiscal environment. Fiscal consolidation measures that were initiated in the previous few years had taken effect, a consequence of which were widespread budget cuts and reprioritisation. Cost reduction initiatives continued with greater value-for-money sought by shifting funding from non-essential items to priority items.

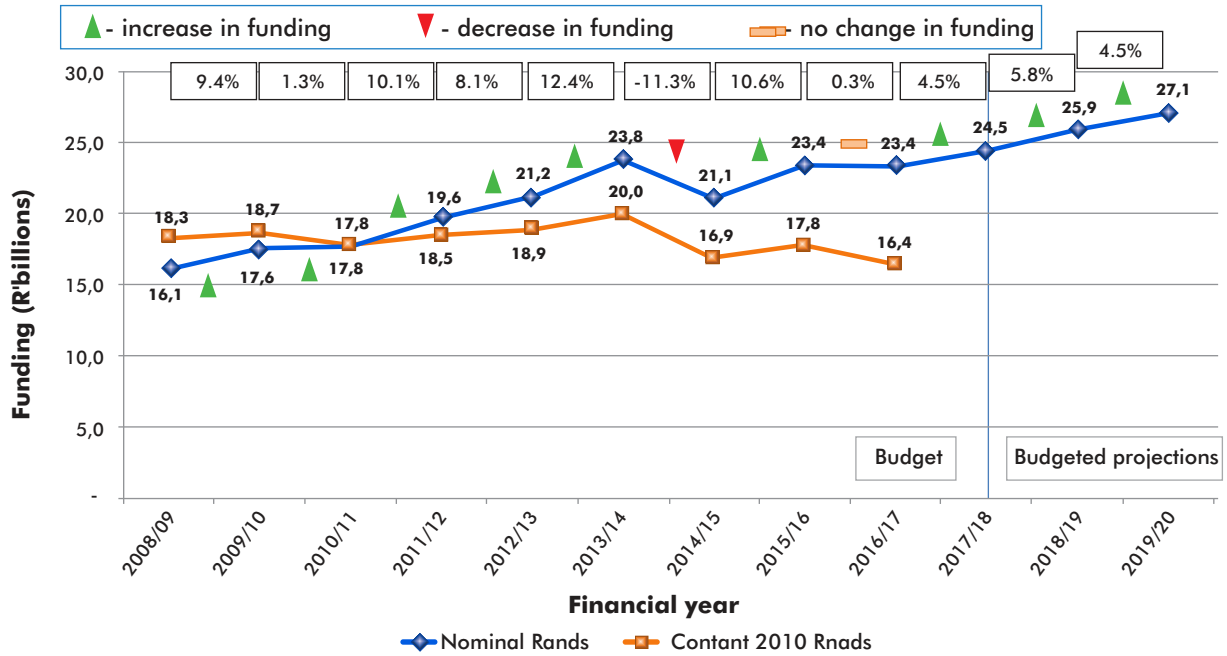


Figure 3: Total Government Funding for STAs.

(Nominal and constant 2010 Rands in R billions)

- 2013/14 to 2014/15 STA decline of 8.0% was due to government-wide cuts due to economic pressure.
- 2016/17 total STA amounted to **R23,44 billion** compared to **R23,37 billion** in 2015/16.
- Year-on-year increase of **R66,5 million**, mainly due to Correctional Services revised once-off contracted researches, Public Works increase in STET budget, and DTPS relating to Cybersecurity readiness related research.

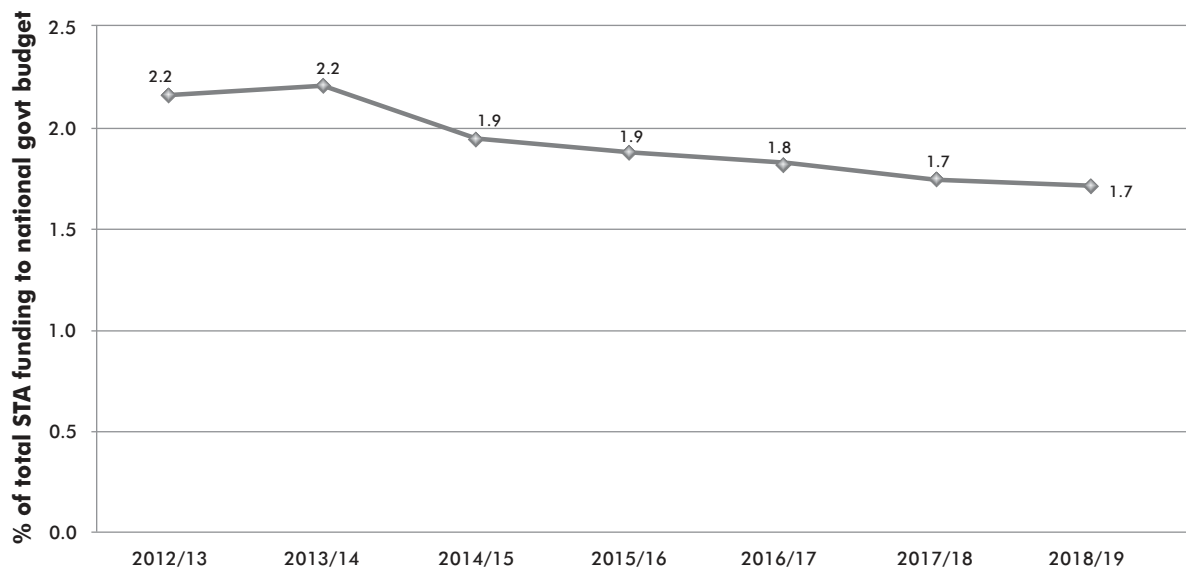


Figure 4: Total Funding for STAs as Percentage of Annual Government Budget.



SOCIO ECONOMIC IMPACT OF STA INVESTMENT

South African Police Service:



The STA investment within SAPS is directed towards the construction of new forensic laboratories in areas such as the Western Cape and into activities within other SAPS forensic laboratories. Machinery and equipment are for technologies installed in vehicles and laboratory equipment.

Department of Agriculture, Forestry and Fisheries:



The department directs some of their STA budget towards technical research and development, which focuses on hazardous agents (such as mycotoxin and pesticide residues) and genetically modified foods (potentially containing allergens and toxins not found in conventional foods). The department also intends publishing 600 reliable laboratory results on mycotoxin analytical programme proficiency, which will maintain consumer confidence in food safety and quality for the country.

Department of Basic Education:



The department budget outcomes are for the provision of infrastructure, equipment and teacher training to improve participation and success rates in mathematics, science and technology, including structured training programmes in technical maths and science for subject advisors and teachers.

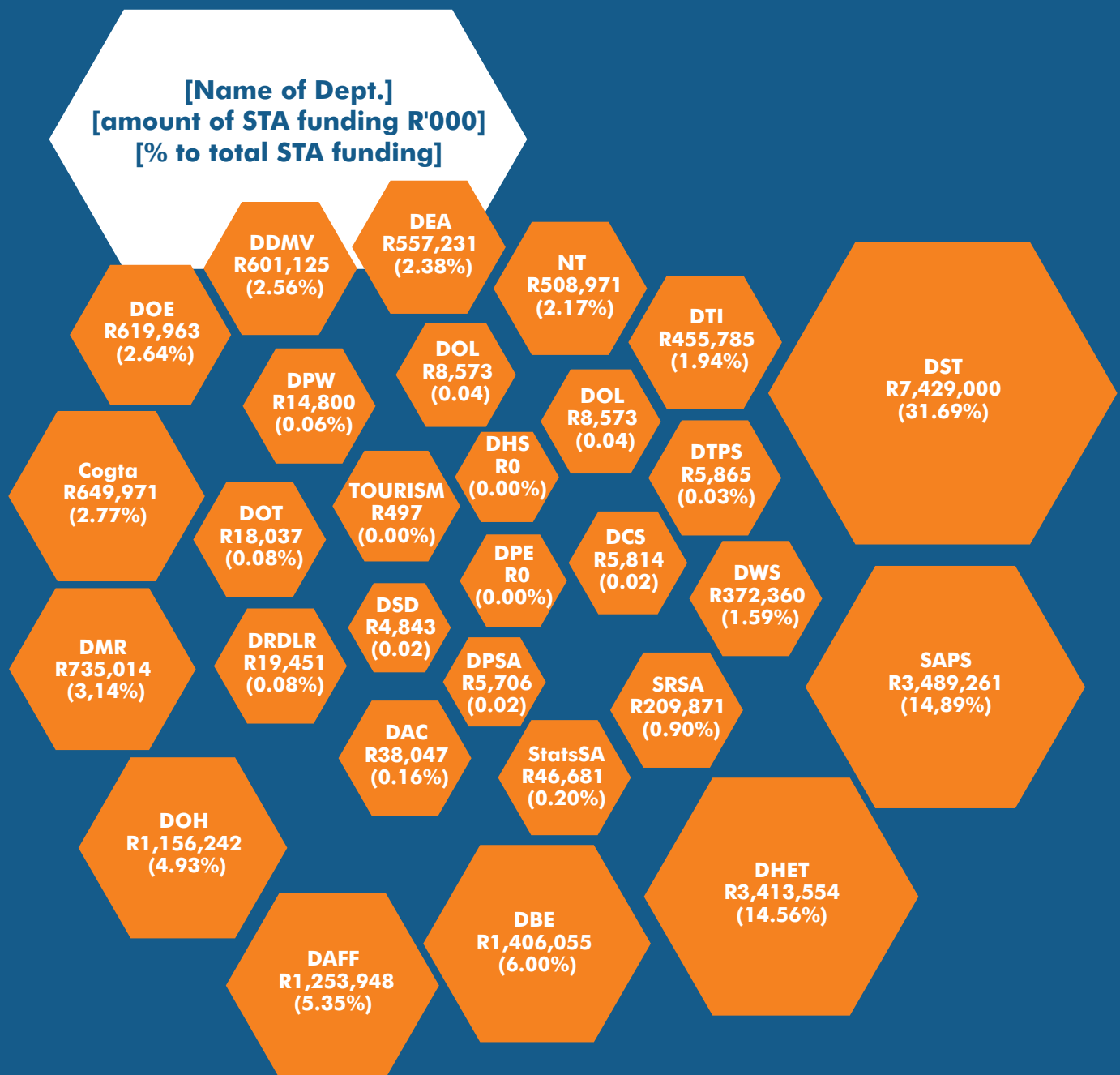


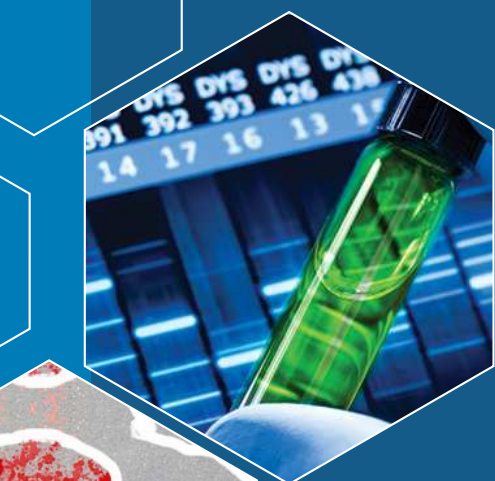
Figure 5: Funding on STAs by National Government Departments.

DST	Dept. of Science & Technology	DTI	Dept. of Trade & Industry
DMR	Dept. of Mineral Resources	DPSA	Dept. of Public Service & Administration
DoH	Dept. of Health	DDMV	Dept. of Defence & Military Veterans
DWS	Dept. of Water & Sanitation	DSD	Dept. of Social Development
DPE	Dept. of Public Enterprises	DCS	Dept. of Correctional Services
DTPS	Dept. of Telecoms & Postal Services	SISA	Dept. of Sport & Recreation South Africa
DHET	Dept. of Higher Edu & Training	DoC	Dept. of Communications
DAFF	Dept. of Agriculture, Forestry & Fisheries	StatsSA	Statistics South Africa
DT	Dept. of Tourism	NT	National Treasury
DoT	Dept. of Transport	SAPS	South African Police Services
DEA	Dept. of Environmental Affairs	DRDLR	Dept. of Rural Dev & Land Reform
DHA	Dept. of Home Affairs	DoE	Dept. of Energy
DAC	Dept. of Arts & Culture		

Departments with highest allocations for STAs in 2016/17

- **Department of Science and Technology (R7.4billion).** This funding mostly includes institutional funding for the Council for Scientific and Industrial Research (CSIR), the Human Sciences Research Council (HSRC), the National Research Foundation (NRF), the South African National Space Agency (SANSA), the Technology Innovation Agency (TIA), and the Academy of Science of South Africa (ASSAf), funding for R&D infrastructure, funding for human capital development initiatives (e.g. the South African Research Chairs Initiative (SARChI) and the Centres of Excellence (CoEs) and innovation platforms to develop new or strengthen existing R&D capabilities and industries (e.g. astronomy and space science, biotechnology and health research, information and communication technologies (ICTs), new and advanced materials, local systems of innovation and local manufacturing), as well as the facilitation of South Africa's role in the international S&T arena. There were some policy lessons highlighted from the investment at HSRC, such as, (a) Urbanisation should be acknowledged and endorsed as a means of fostering human development by bringing people closer to economic opportunities; (b) Government policy should do more to support integrated urban development by providing serviced land, improved infrastructure and other public facilities to accommodate an expanding population and growing economies with less congestion, fewer bottlenecks and less sprawl; (c) Investment in upgrading informal settlements and backyard shacks would reduce the intolerable overcrowding and vulnerability to fires, flooding and disease.
- **South African Police Service (R3.5billion).** This includes mainly funding towards capacitating the detective and forensic services with ICT, equipment and other infrastructure. Forensic services provide specialised evidence related technical analysis and support to investigations.
- **Department of Higher Education and Training (R3.4 billion),** This STA funding is mostly towards the enhancement of research capacity and development at South African Public Higher Education Institutions through the transfer of a research output subsidy and research development grant. This also includes the improvement of broadband connectivity and general Information Communications Technology (ICT) infrastructure at universities.
 - **Department of Basic Education (R1.4billion).** This constitutes funding for the supply of new young teachers entering public service in nationally identified priority areas. Furthermore, this includes funding for the strengthening of collaborative programmes amongst Department of Basic Education, Department of Science and Technology and Department of Higher Education and Training to improve performance in Mathematics, Sciences and Technology in schools.
 - **Department of Agriculture, Forestry and Fisheries (R1.2billion).** This STA funding is mainly for transfers towards the Agricultural Research Council (ARC) in order to conduct research and development and effect the transfer of technology. This constitutes economic development in the form of plant production and animal production research activities, agro-processing, food technology, and safety and fisheries research and development. Manufacturing of innovative animal related pharmaceuticals (including vaccines) and registration of new crop cultivars due to research studies.

Text Box 2: Examples of S&T-related activities funded by National Departments



4.2 Main categories of STAs

The chart is based on a total STA funding of R23,4 billion for the 2016/17 financial year.

$$\text{STAs} = \text{GBAORD} + \text{STS} + \text{STET}$$

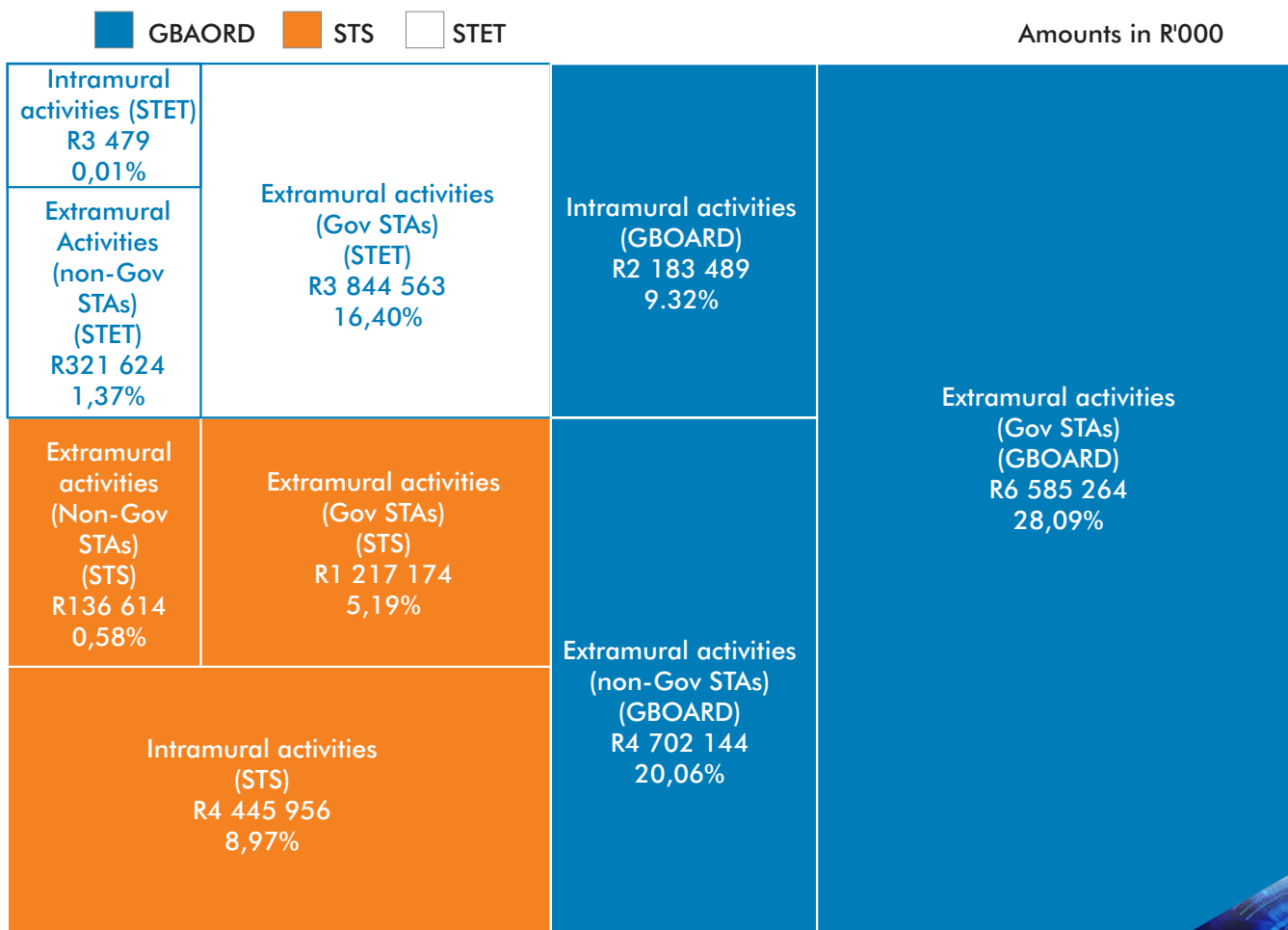


Figure 6: Categories of STAs.

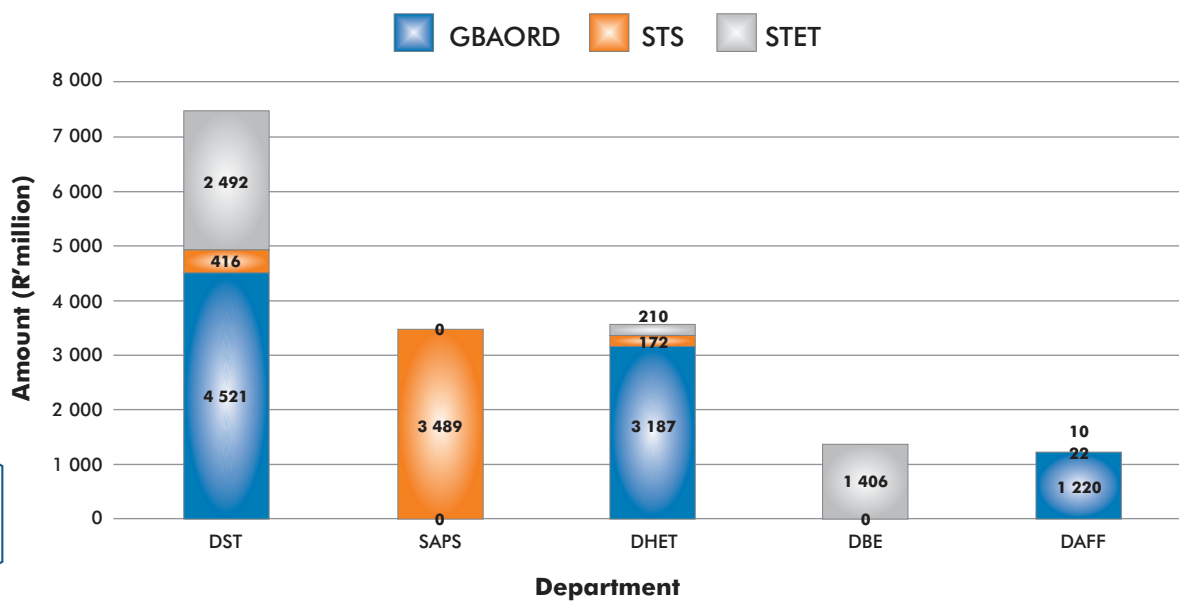


Figure 7: Breakdown of STA Categories of Highest Budgeted Departments.



4.3 Government Funding for Public Research Institutions

This section presents information on government funding for various public research institutions by means of Parliamentary grants.

Parliamentary grant funding for public research institutions increased from R5,3 billion in 2015/16 to R5,4 billion in 2016/17 - this translates into a nominal increase of 0.9%. Parliamentary grants are intended to finance the public research institutions' research mandates and operating costs.

The slow rate of increase can be associated with the significantly reduced funding for the Economic Competitiveness Support Package (ECSP), which ends in 2018/19, as well as the budget cuts and reprioritisation that has taken effect across government.

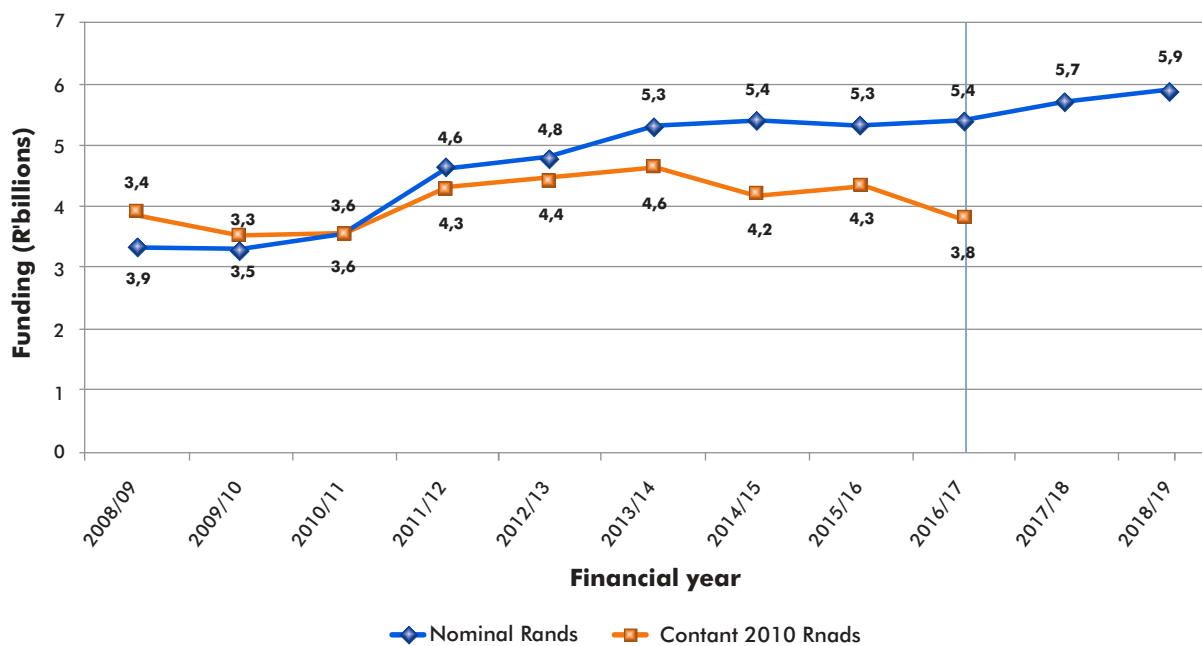
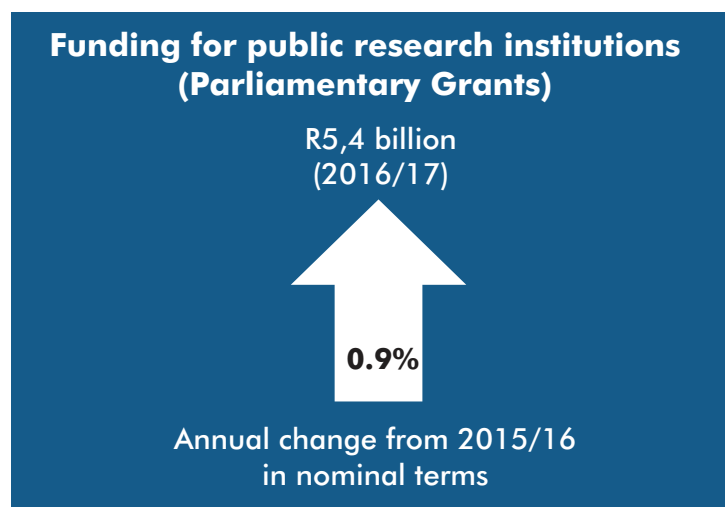


Figure 8: Parliamentary Grant Funding to Public Research Institutions (Parliamentary Grant)

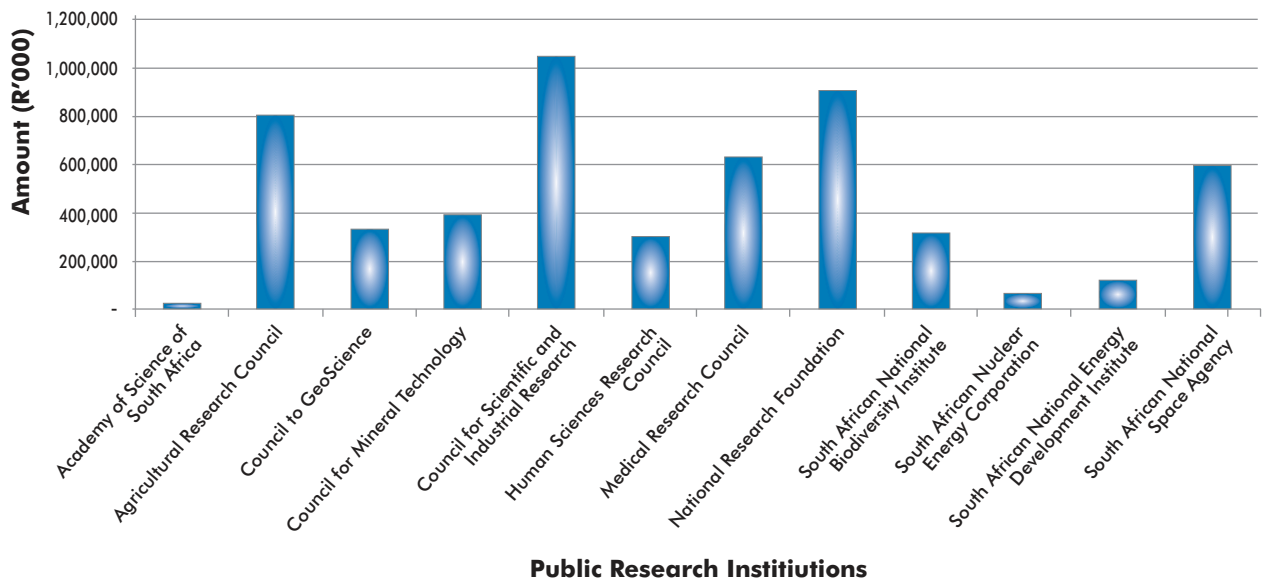
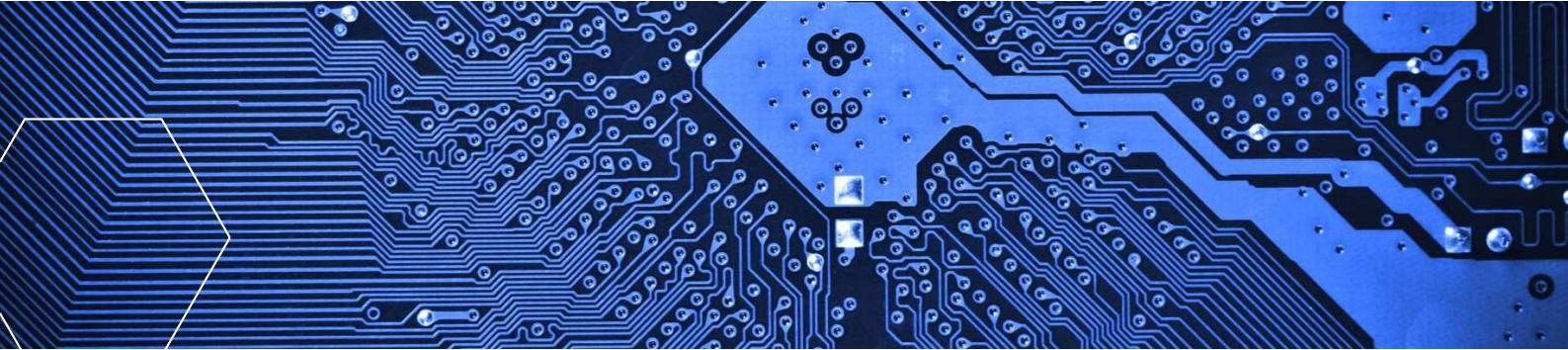


Figure 9: 2016/17 Parliamentary Grant to Public Research Institutions.

Figure 8 represents both the parliamentary grants reported as funding for public research institutions in Table 4 (Annexure A), and funding that is transferred to these institutions for specific projects over and above the parliamentary grants. These organisations perform a wide range of activities, including basic and applied research, and experimental and technological development.

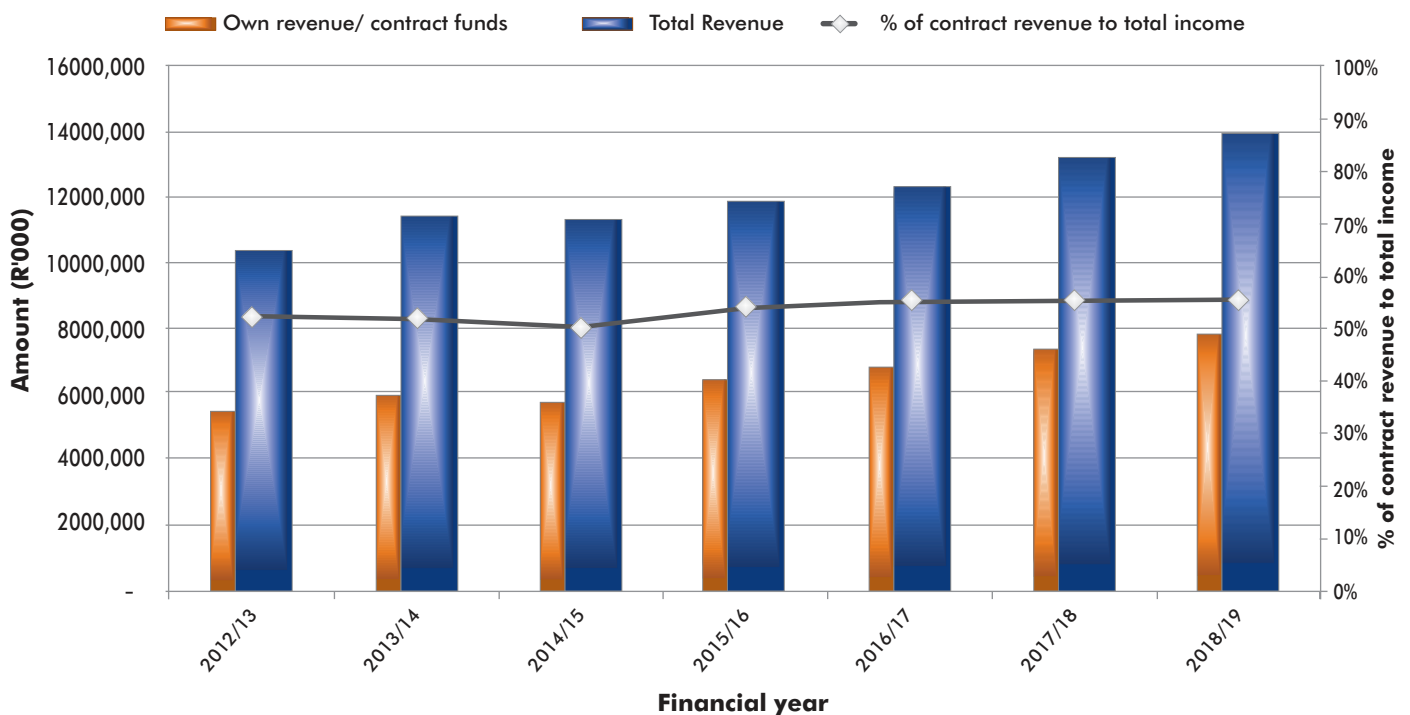


Figure 10: Parliamentary Grant vs Own/Contract Income.

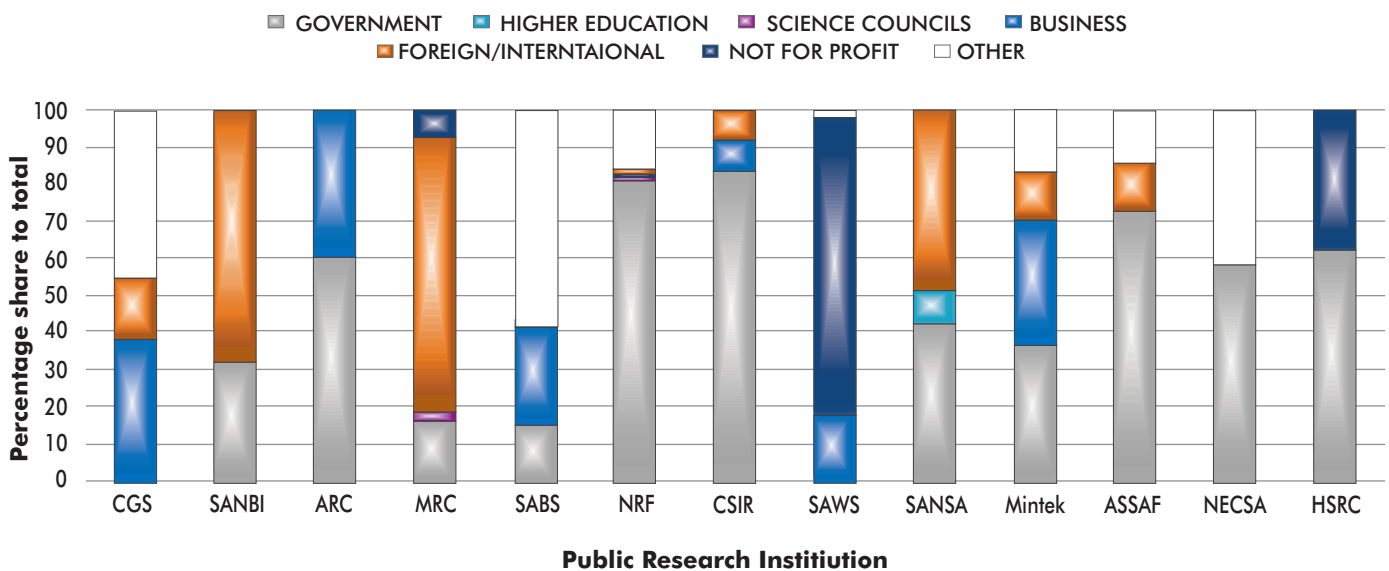
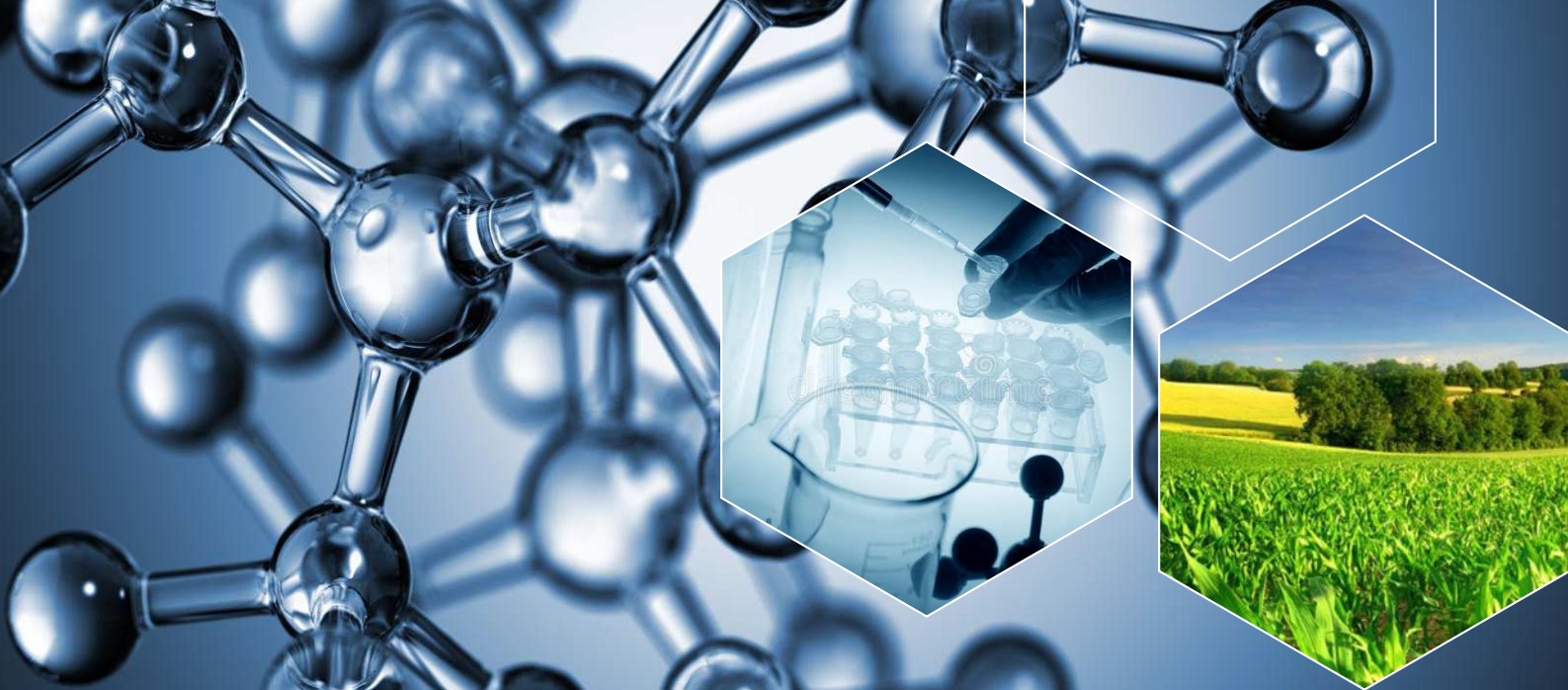


Figure 11: Breakdown of Income other than Parliamentary Grant.

Contract work is becoming an increasingly important source of revenue for science councils. Total revenue generated by the 13 science councils in 2016/17 projected breakdown is as per the above diagram, with 7 out of the 13 validating the breakdown and the remaining 8's breakdown taken from individual 2016/17 annual reports. Science councils receive contract work from both the private sector and government departments. On average, the revenue that most science councils and public research institutions raise through contract work or projects is higher than government funding they receive through Parliamentary grants. The Water Research Levy (WRL) is the WRC's main source of revenue. It is receivable in terms of the Water Research Act No. 34 of 1971. The WRC receives its WRL from three sources, namely, the Rand Water Board, the Umgeni Water Board and the Department of Water and Sanitation (DWS).

It is estimated that on average more than 50% of the income of public research institutions is contractual work and may point to a risk of those institutions constrained in achieving their mandates that directly link to government funding. From another perspective, this could be an indication of growing demand for knowledge-outputs produced by these institutions, and if so, it should be encouraged. Case by case specifics require further examination.

Government Departments are reportedly highlighting difficulties in procuring services from Science Councils and related public research institutions because of the procurement legislative framework that requires departments to go on competitive bidding. A challenge arises when Government seeks to procure and enlist these institutions for long-term R&D services of strategic nature to the country's priorities.



4.4 Analysis by Socio-Economic Objective

The Socio-Economic Objective (SEO) classification is useful in indicating the policy intentions of the government, as a funder, when committing funds for STAs. Each responding department indicated the intentions of their STA allocations per SEO primary purpose. The SEO classifications were aggregated and used to estimate the expenditure devoted to the targeted areas of use.

Table 1: Analysis by Socio-Economic Objective (SEO).

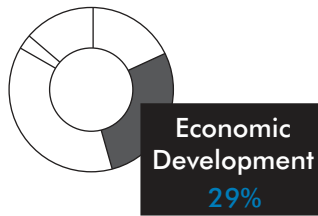
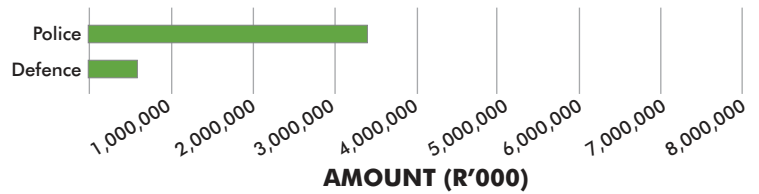
MAJOR DIVISION	SEO CLASSIFICATION
Justice and Protection	Defence
	Police
Economic Development	Energy
	Agriculture (Plant Production and Animal Production)
	Transport
	Economic Framework
	Commercial Services
	Mineral Resources (Excluding Energy)
	Manufacturing
	Construction
	Information and Communication services
	Natural Resources
	Society
Education and Training	
Social Development and Community Services	
Environment	Environmental Knowledge
	Environmental aspects of Development
	Environmental management and other Aspects
Advancement of knowledge	Natural Sciences, Technologies and Engineering
	Social Sciences and Humanities



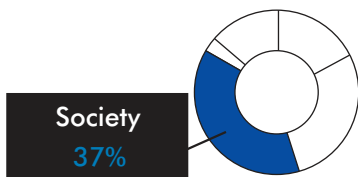
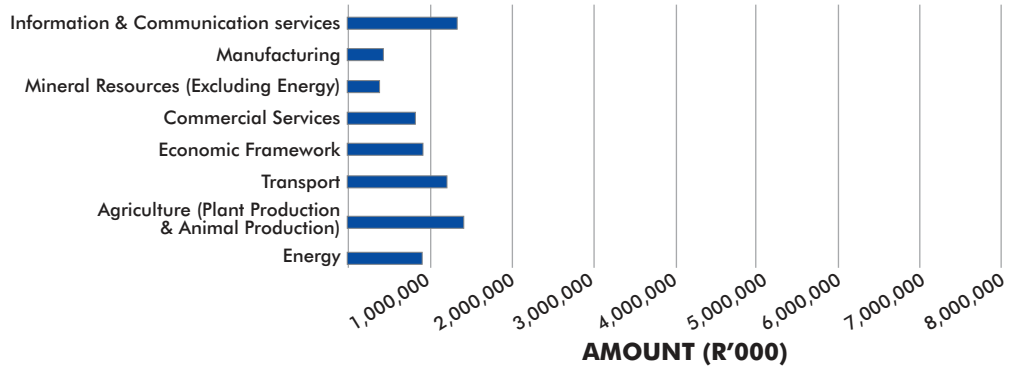
Data note: The doughnut and accompanying column chart are based on a total STA funding of R23,4 billion for the 2015/16 financial year.



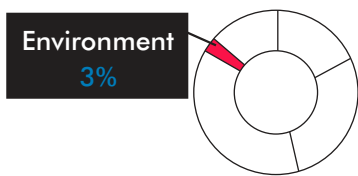
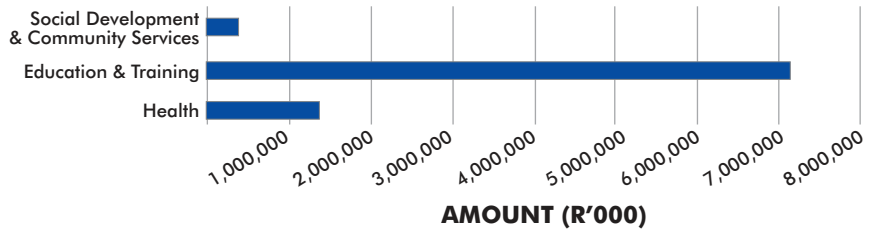
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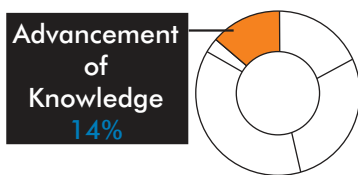
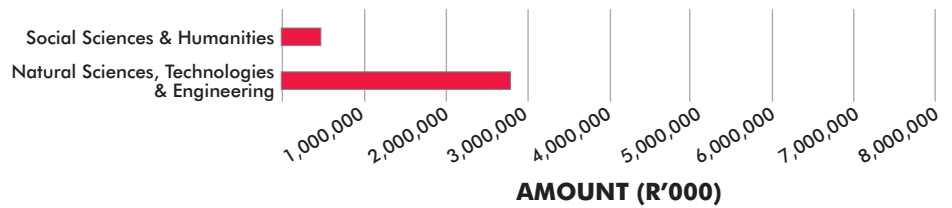
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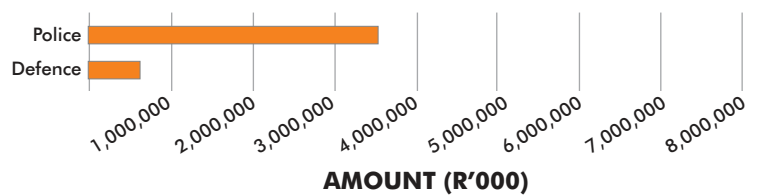
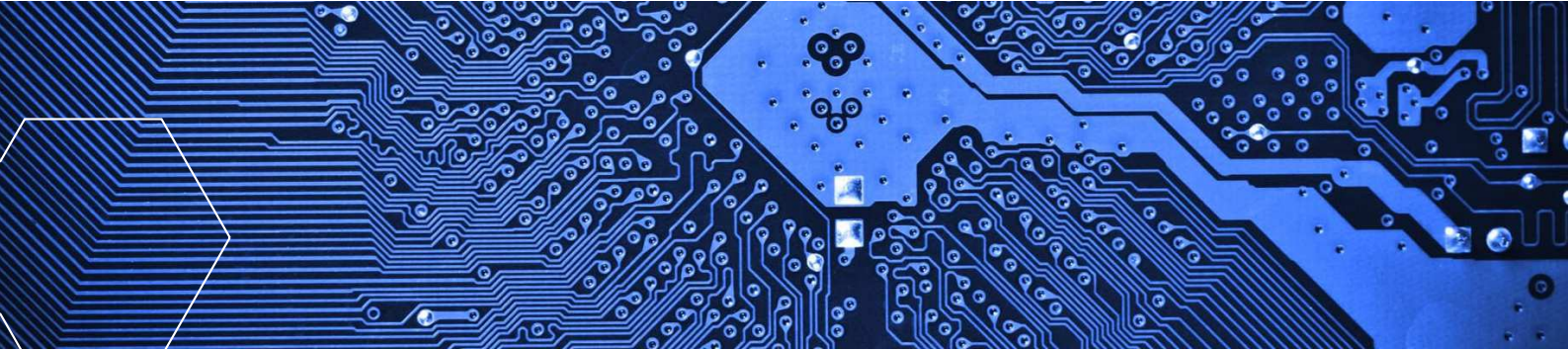


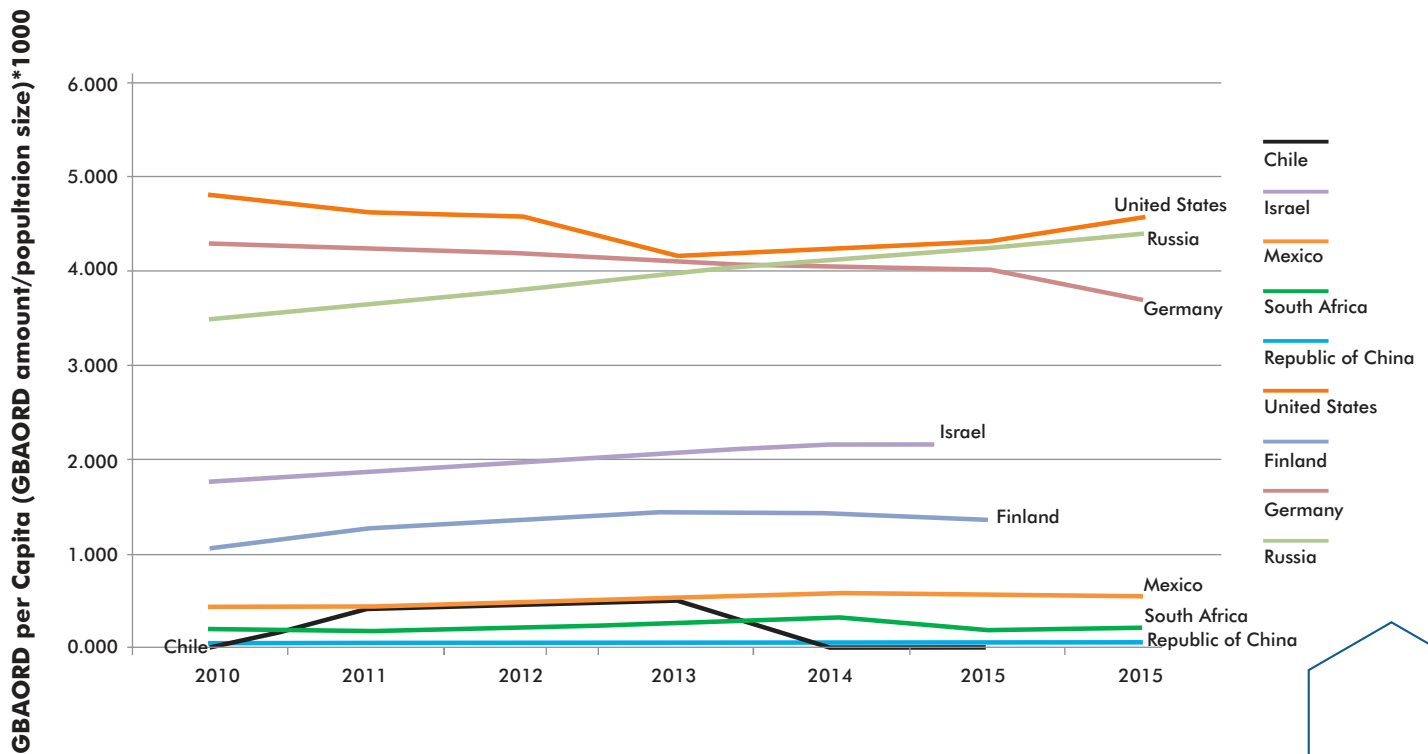
Figure 12: Analysis by Socio-Economic Objective.



4.5 International Comparison on STAs

The report uses the GBAORD per capita indicator to compare South Africa with selected countries. The indicator and the countries were selected mainly because of the availability of data. Developed countries, such as United States and Finland are known to be leading countries in funding R&D. Some of these countries also lead in terms of monitoring indicators related to government funding in their science and technology systems.

International comparison on GBAORD per capita shows South Africa at below \$1.00 PPP, alongside countries such as China, Mexico and Chile. This is lower than Russia and Israel, with GBAORD per capita below \$2.00. Countries such as Finland, US and Germany have GBAORD per capita of around \$4.00. Context must be taken into account in using these comparisons as these countries and their S&T systems are different.



Data note: Data included is for 2010 until 2015 or the latest year available
 Source: OECD database on GBAORD

Figure 13: International Comparison of GBAORD per capita

CONCLUSION

The findings of the 2016/17 report show a marginal increase of 0.3%. When viewed over a four-year period, there are signs that government STA funding may have stagnated. This pattern is consistent with the trend of total annual government budgets.

For several recent years, there has been budget cuts across government, mainly responding to tight fiscal conditions and the lack of new funding available from the national budget. This has also affected the STA activities. Appropriations for the Medium Term Expenditure Framework indicate a possible increase of 6% from 2016/17 to 2018/19. Outer year allocations like these are indicative and can be revised, depending on the factors considered.

While to some extent anticipated, the budget cuts have introduced uncertainty in the planning of projects, both in terms of scale and timeframes. Indications in the October 2017 Medium Term Budget Policy Statement (MTBPS) are that the overall government budget space continues to be constrained. Budget pressures require departments to make better use of the available resources.

Science councils are looking at contract work as an increasingly important source of revenue to sustain their activities. The bulk of contract funding for these institutions comes from contracts with the South African government institutions, followed by foreign or international parties and then the local private sector institutions. Partly and very important, this indicates a sustained demand for the technological services and products of these important institutions. Where this is the case, such networks must be encouraged and be part of a strategy. On the other hand, it is a matter for policy concern if the reliance on contract funding is due to limited funding support from government and a risk to the sustainability of these institutions, as contract funding is most of the time linked to short-term objectives.

ANNEXURE A: TABLES

TABLE 2: Expenditure on STAs by National Government Departments.

National Government Department	R'000					
	Audited Outcome		Appropriations	Medium-Term Expenditure Estimate		
	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Agriculture, Forestry and Fisheries	1 138 325	1 194 726	1 253 948	1 316 645	1 393 010	1 471 019
Arts and Culture	35 069	36 235	38 047	39 950	42 267	44 634
Basic Education	1 058 681	1 338 269	1 406 055	1 460 937	1 545 831	1 632 573
Cooperative Governance and Traditional Affairs	596 699	617 298	649 971	682 470	722 053	762 488
Correctional Services	1 815	1 643	5 814	4 938	5 220	5 475
Defence and Military Veterans	613 959	613 630	601 125	632 690	668 121	687 543
Energy	923 363	645 219	619 963	731 146	773 552	816 871
Environmental Affairs	505 425	530 696	557 231	585 093	619 028	653 694
Health	693 976	1 137 271	1 156 242	1 155 172	1 222 172	1 290 614
Higher Education and Training	3 003 557	3 261 381	3 413 554	3 596 901	3 805 522	4 018 631
Home Affairs	442 164	219 108	413 640	518 915	549 012	579 757
Human Settlements	0	0	0	0	0	0
Labour	4 345	8 165	8 573	9 002	9 524	10 057
Mineral Resources	663 693	757 656	735 014	733 244	775 7724	819 215
National Treasury	692 497	654 643	508 971	440 607	65 687	492 585
Police	3 625 723	3 876 052	3 489 261	3 749 510	4 050 096	4 190 081
Public Enterprises	63 141	33 106	0	0	0	0
Public Service and Administration	3 050	5 785	5 706	6 063	6 415	6 774
Public Works	0	0	14 800	18 000	18 000	0
Rural Development and Land Reform	18 716	18 447	19 451	20 424	21 609	22 819
Science and Technology	6 479 890	7 482 120	7 429 000	7 557 200	7 916 000	8 191 400
Social Development	5 097	5 034	4 843	5 524	5 845	6 172
Sport and Recreation South Africa	43 982	61 377	209 871	230 302	243 660	257 304
Statistics South Africa	42 479	49 672	46 681	47 230	49 342	53 093
Telecommunications and Postal Services	8 867	3 593	5 865	1 253	2 019	1 089
Tourism	451	315	497	695	735	776
Trade and Industry	224 725	451 386	455 785	536 454	567 569	599 353
Transport	17 308	15 411	18 037	18 564	19 490	20 556
Water and Sanitation	227 600	354 629	372 360	390 978	413 655	436 820
TOTAL	21 134 597	23 372 867	23 440 306	24 489 907	25 911 206	27 071 393

Zeros in the table indicate a case where no allocations were made towards STAs, and hyphens indicate a case where there is no data available

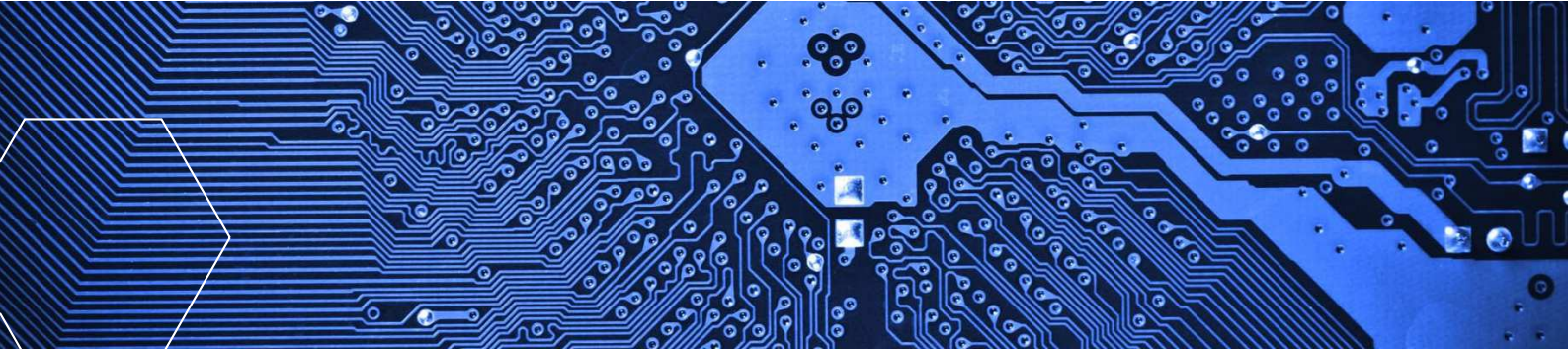


TABLE 3: STA Categories per National Department.

National Government Department	Total STA budget	STA categories		
		GBAORD	STET	STS
Defence Military and Veterans	601 125	527 196	12 383	61 546
Environmental Affairs	557 231	557 231	-	-
Energy	619 963	619 963	-	-
Higher Education and Training	3 413 554	3 186 831	209 547	17 176
Human Settlements	-	-	-	-
Health	1 156 242	1 107 262	9 250	39 730
Labour	8 573	-	1 353	7 220
Mineral Resource	735 014	735 014	-	-
Transport	18 037	7 568	10 469	-
Trade and Industry	455 785	244 100	-	211 686
Social Development	4 843	4 843	-	-
Rural Development and Land Reform	19 451	10 703	-	8 748
Sports and Recreation South Africa	209 871	209 871	-	-
Water and Sanitation	372 360	372 360	-	-
Science and Technology	7 429 000	4 521 190	2 491 858	415 951
Public Service and Administration	5 706	-	-	5 706
Public Works	14 800	-	14 800	-
Agriculture, Forestry and Fisheries	1 253 948	1 220 028	10 300	23 620
Corporate governance and Traditional Affairs	649 971	6 833	2 647	640 491
Home Affairs	413 640	-	-	413 640
Art and Culture	38 047	38 047	-	-
Telecommunications and Postal Service	5 865	4 499	1 003	363
Basic Education	1 406 055	-	1 406 055	-
Public Enterprises	-	-	-	-
National Treasury	508 971	44 862	-	464 109
Tourism	497	-	-	497
Correctional Service	5 814	5 814	-	-
Statistics South Africa	46 681	46 681	-	-
South African Police Service	3 489 261	-	-	3 489 261
TOTAL	23 440 306	13 470 897	4 169 666	5 799 744



TABLE 4: National Government Funding for Public Research Institutions (Parliamentary Grants).

Science Councils (R'000)	Financial year						
	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Academy of Science of South Africa	16 284	20 744	27 782	23 229	23 106	24 261	25 668
Agricultural Research Council	726 724	848 655	921 456	691 484	694 570	850 232	899 534
Council for GeoScience	223 006	271 232	292 839	342 914	378 598	365 988	302 862
Council for Mineral Technology	253 531	364 709	370 854	414 742	356 416	367 256	350 368
Council for Scientific and Industrial Research	958 766	974 378	1 029 785	1 041 183	1 086 589	1 140 918	1 207 091
Human Sciences Research Council	247 820	258 867	276 010	290 149	304 656	304 656	304 495
Medical Research Council	288 863	419 460	446 331	623 892	657 590	614 961	624 829
National Research Foundation	1 075 469	1 139 014	864 221	899 429	896 403	940 242	994 776
South African National Biodiversity Institute	194 448	208 684	223 447	232 149	237 973	249 928	264 714
South African Nuclear Energy Corporation	567 579	592 182	760 678	580 358	599 338	671 372	710 312
South African National Energy Development Institute	56 110	63 344	51 685	64 861	20 625	59 774	63 241
South African National Space Agency	126 008	123 708	118 298	124 355	124 977	131 226	138 837
Africa Institute of South Africa	33 643	-	-	-	-	-	-
TOTAL	4 768 251	284 977	5 383 386	5 328 745	5 380 841	5 720 814	5 886 727

TABLE 5: Intramural and Extramural STA Allocations.

Main STA categories	Intramural activities (R'000)	Extramural activities (R'000)	
		Funding support for government STAs	Funding support for non-government STAs
GBAORD	2 183 489	6 585 264	4 702 144
STS	4 445 489	1 217 174	136 614
STET	3 479	3 844 563	321 624
Sub-totals	6 632 924	11 647 001	5 160 381
% of Total STA Expenditure	28,3%	49,7%	22,0%

TABLE 6: Analysis by Socio-Economic Objective.

MAJOR DIVISION	STA FUNDING	SEO CLASSIFICATION	STA EXPENDITURE	% TO TOTAL
Justice and Protection (17%)	4 090 386	Defence	601 125	2.6%
		Police	3 489 261	14.9%
Economic Development (29%)	6 691 475	Energy	800 801	3.4%
		Agriculture (Plant Production and Animal Production)	1 345 375	5.7%
		Transport	0	0.0%
		Economic Framework	1 114 330	4.8%
		Commercial Services	833 977	3.6%
		Mineral Resources (Excluding Energy)	735 014	3.1%
		Manufacturing	261 318	1.1%
		Construction	342 478	1.5%
		Information and Communication services	1 258 182	5.4%
		Natural Resources	0	0.0%
Society (37%)	8 746 738	Health	1 305 903	5.6%
		Education and Training	7 133 453	30.4%
		Social Development and Community Services	307 382	1.3%
Environment (3%)	684 725	Environmental Knowledge	0	0.0%
		Environmental aspects of Development	97 705	0.4%
		Environmental management and other Aspects	587 020	2.5%
Advancement of knowledge (14%)	3 226 982	Natural Sciences, Technologies and Engineering	2 812 209	12.0%
		Social Sciences and Humanities	414 772	1.8%
TOTAL	23 440 306		23 440 306	100.0%

TABLE 7: Population Size of Selected Countries (Headcount).

COUNTRY	YEAR							
	2010	2011	2012	2013	2014	2015	2016	2017
Chile	17 015 048	17 201 305	17 388 437	17 575 833	17 948 141	17 948 141	18 131 850	18 313 495
Israel	7 623 600	7 765 800	7 910 500	8 059 500	8 380 400	8 380 400	8 192 463	8 323 248
Mexico	118 617 542	120 365 271	122 070 963	123 740 109	127 017 224	127 017 224	128 632 004	130 222 815
South Africa	50 791 808	51 553 479	52 341 695	53 157 490	54 490 406	54 490 406	54 978 907	55 436 360
Republic of China	1 339 724 852	1 340 910 000	1 347 350 000	1 354 040 000	1 367 820 000	1 367 820 000	1 382 323 332	1 388 232 693
United States	309 347 057	311 721 632	314 112 078	316 497 531	321 773 631	321 773 631	324 118 787	326 474 013
Russia	142 849 449	142 960 868	143 201 676	143 50 6911	143 456 918	143 456 918	143 439 832	143 375 006
Finland	5 363 352	5 388 272	5 413 971	5 438 972	5 503 457	5 503 457	5 523 904	5 541 274
Germany	81 776 930	81 797 673	80 425 823	82 132 753	80 688 545	80 688 545	80 682 351	80 636 124

Source: World Bank Data - <http://databank.worldbank.org/data/home.aspx>

TABLE 8: GBAORD of Selected Countries.

COUNTRY	YEAR						
	2010	2011	2012	2013	2014	2015	2016
Chile	-	691.530	821.910	881.370	-	-	-
Israel	1 356.407	1 479.658	1 568.809	1 677.942	1 781.875	1 806.503	-
Mexico	5 141.142	5 400.243	5 850.798	6 323.5	7 226.558	7 030.580	6 692.912
South Africa	1 021.510	904.033	1 051.592	141 495.833	1 769.970	993.125	1 140.100
Republic of China	7 044.232	7 362.590	7 350.646	7 302.967	7 368.369	7 585.921	8 027.656
United States	148 962.000	144 379.000	143 737.000	132 447.000	136 159.000	138 544.000	148 999.000
Russia	15 026.495	18 096.798	19 280.015	20 768.348	20 566.912	19 466.164	-
Finland	2 301.845	2306.845	2 272.106	2 230.860	2 210.488	2214.883	2 043.452
Germany	28 642.357	30 103.139	30 575.241	32 775.487	33 288.341	34 329.647	35 608.300

Data note: Hyphens indicate a case wherein there is no data available

Source: <https://data.oecd.org/>

Measure: PPP Dollars - current prices

Unit: US Dollar, Million

s



ANNEXURE B: METHODOLOGY

B1. Scope and Limitations of the Data.

The DST collects data from national government departments that either perform STAs or have a budgetary allocation to fund them. There are currently 30 national government departments in this category. A list of these departments is provided in Table 2 (Annexure A). The survey focuses on the budgets and projections allocated for scientific and technological activities by the national departments. The White Paper on Science and Technology of 1996 highlights that an annual science budget document developed from data drawn from departmental budgets to incorporate science and technology expenditures from science councils and national facilities, departmental intramural expenditures and transfer payments on S&T, transfers in the Defence sector for S&T, other departmental transfers for S&T including the support offered by the Department of Education to institutions in the higher education sector.

The data is aggregated and the disaggregation is based on 3 categories, namely, GBOARD, STET and STS and furthermore on socio-economic objectives. Attempts are being made by the DST to collect project-related-data which should provide a sense on which type of projects are being funded. The data does not currently cover provinces.

B2. Survey Planning and Design.

The survey on government funding for STAs is undertaken by the Department of Science and Technology as part of monitoring the performance of the National System of Innovation (NSI). Regular monitoring of public investment in the system is required in terms of the 1996 White Paper on Science and Technology and the 2002 National Research and Development Strategy, and was also recommended in the 2012 report of the Ministerial Review Committee on the Science, Technology and Innovation Landscape in South Africa. The survey has been undertaken annually since 2008/09.

The survey information is used in estimating the aggregated indicators of government funding for the NSI. The survey design is based on international guidelines, namely, the United Nations Education, Scientific and Cultural Organisation's Recommendation concerning the International Standardisation of Statistics on Science and Technology (1978) and the OECD's Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development (2015). Particular focus has been on improving the survey's relevance to those who use this type of information for policymaking, analysis and research.

There is a chapter in the new Frascati Manual focusing on Government Budget Appropriation or Outlays on Research and Development (GBAORD). In the next round of survey, we will be incorporating the Government Budget Appropriation on Research and Development (GBAORD), which is a revised version of the new Frascati manual. This chapter provides guidance on the measurement of financial and human resources for research and experimental development (R&D) performed in the Government sector. The STA concepts defined by the United Nations Education, Scientific and Cultural Organisation's Recommendation concerning the International Standardisation of Statistics on Science and Technology (1978) are currently undergoing revisions from the old manual. The process of finalising the revisions will be completed in 2019; however, certain relevant aspects of the revisions have already been adopted in this survey.

The approach in South Africa has been gradually improved as lessons are learnt from the survey each year. The main categories of STAs that are presented in this survey are GBAORD, STS and STET. Descriptions of these appear in par. 3.2 of this report.

B3: Sampling and Data Collection Process

The survey plan identified 29 national departments from which data had to be collected. Of the 29 national departments, 23 verified and validated their data, at first level, within the targeted timeframe. Their responses covered 79% of the total STA appropriation; the other 21% of the data was imputed/estimated.

The process of data collection entails filling the data collection tool with preliminary data obtained from various departmental documents (i.e. National Treasury's Estimates of National Expenditure, departmental strategic plans and departmental annual reports). Following this, the tool is sent out to the respective national departments for their respective Directors General to sign-off departmental data for verification and validation. This step is important to ensure the accuracy of the information. The information is then signed-off by the relevant Directors-General of each of the departments.

Furthermore, following data validations, figures for the Department of Health, Public Enterprises, Communications, Mineral Resources, Trade, Industry, Telecommunications, and Postal Services were revised to reflect on the feedback received. Of significance was a change in the purpose of a line item on comprehensive HIV/Aids grant that Health transfers to provinces. The grant was initially classified as research; but the function later changed to administering the HIV/Aids programme in the provinces.

A new process of quality assurance was also introduced in the 2016/17 survey. A quality reference group consisting of officials from the DST, NACI, CesTII and Statistics South Africa was established to assist and assess certain aspects of the data quality and the report.

B4. Data Sources.

- Scientific and technological activities questionnaire, which is completed by the departments.
- National Treasury Estimates of National of Expenditure.
- National Departments annual reports.
- National Treasury Budget Review document (for data on R&D tax incentive).
- Science councils or public research institutions annual reports and officials.

B5. Error, Fault Detection and Revisions.

Errors are manually checked as and when data collection tools are received from the respondent departments. This is followed by a consolidation of these into a single analysis spreadsheet, which makes way for further error detection.

The STA data for the year in consideration is first compiled with appropriations from departmental sources and is subject to revision as and when National Treasury's Estimates of National of Expenditure budget data becomes available for the reference year. Data is then sent to the respective national departments for their respective Directors General to sign-off of departmental data for verification and validation.

B6. Data Processing, Analysis and Report Writing.

A database that contains the historical data on STA has been developed. The responses from the various departments were used to compute aggregates of key- indicators of government funding for STAs. Responses were checked against the figures from previous financial years and, where necessary, verified with the department concerned. Standard data tables and graphs were developed and used in preparing the report and analysing historical and medium-term trends.

B3. Sampling and Data Collection Process.

Imputation was done on the departments that did not verify their data based on the projections that the departments provided in the 2014/15 survey. All the possible errors and outliers were verified and validated. In the 2015/16 STA report, the sign-off by Directors-General were introduced as per the government cluster's recommendation.

B8. Dissemination and Use of Results.

The report is published for use by government and other interested parties, both in print and on the DST website. The information on government STA funding is of great value to policy-makers and decision-makers. An annual workshop is therefore held with government departments to discuss the content and implications of the findings of the STA Survey. The findings are also submitted to Cabinet and presented to various government clusters.

B9. Future Enhancements.

An online system to facilitate online submission of information by the departments and an online system with an online visualisation of data to ensure the proper storage of historical information for future reference are in the final stages of development. The DST survey team will continue to hold workshops and one-on-one meetings to guide departments in identifying their STAs and in interpreting technical definitions. The current revised Frascati Manual and STA concepts may inform further enhancements to the STA Survey.

ANNEXURE C: DIFFERENCES BETWEEN STA MEASUREMENT AND MEASUREMENT OF R&D PERFORMANCE.

This annexure is meant to explain the key differences between the data in this report on government funding of STAs and the data generated from the R&D Survey. This report presents data from the funder's perspective. It reflects the budget intentions of government in supporting the S&T sector. This is more than just spending on R&D, covering a whole family of STAs of which R&D is a part, including innovation, the processing of scientific samples, and the implementation of research results.

The R&D Survey, on the other hand, captures the performer perspective. It traces the flows of funding for R&D based on the replies from performers of R&D and not the funding source. In the R&D Survey, the R&D-performing units indicate the amount they spent on R&D and the sources from which they obtained funding for R&D activities. The table below outlines some key differences between the two surveys in terms of scope, reference period and key indicators.

Table 9: Differences between the R&D Survey and the Survey on the Public Funding of STAs.

	Government funding for STAs	National Survey of Research & Experimental Development
Conceptual basis	STAs funded by government, including government funding for R&D	Focus is on R&D, which is a component of a broader set of STAs
Focus of data collection and analysis	Government departments as funders of STAs	Performers of R&D (government, science councils, higher education institutions, and the business and non-profit sectors)
Reference period	One financial year (retrospective survey of actual spending by departments for the two previous financial years, and prospective survey of the budget appropriations for the next three financial years)	One financial year (retrospective survey of actual spending by R&D-performing units), published two years after financial year reviewed
Key indicators	<ul style="list-style-type: none"> • Total government expenditure on STA funding • Total government expenditure on STAs funding as a percentage of overall government budget • Estimation of GBAORD direct from budget appropriations • Expenditure on STAs by socio-economic objective, department, etc. • Modes and/or instruments for public funding for STAs (i.e. channels for disbursing funds for STAs) 	<ul style="list-style-type: none"> • Gross expenditure on research and development • (GERD) as a percentage of gross domestic product (GDP) • GERD by funding sources (GBAORD can be estimated indirectly/as a derived figure) • GERD by R&D-performing sectors, type of research, field of research, SEO, etc.

This report publishes both the retrospective and prospective STA budgets for government departments and public research entities. The measurement is done from the funder's perspective, showing how much government has budgeted and planned for S&T. The data collected for this report is the administrative financial data from departments.

Budget information is available earlier than the results generated by the retrospective R&D Surveys. The STAs survey will therefore be used in the future as a basis for generating a country-level indicator on GBAORD, which can be used as a leading indicator for future R&D investment. International experience shows that the two approaches for generating GBAORD complement each other, although they do not produce exactly the same figures. A parallel analysis is necessary to ensure the correlation of information between these two sources.

	2014/15	2015/16	Difference in R&D spending (2014/15 - 2015/16)	Change from 2014/15 - 2015/16 (%)
Figures in nominal terms				
GERD	29 345	32 337	2 992	10,2
Business Enterprise	13 291	13 815	524	3,9
Higher Education	8 378	9 877	1 499	17,9
Science Councils	5 005	5 741	736	14,7
Government	1 893	2 013	120	6,3
Not-for-profit	779	1 891	112	14,4
Figures in constant 2010 rands				
GERD	23 256	24 458	1 202	5,2
Business Enterprise	10 532	10 449	-83	-0,8
Higher Education	6 638	7 470	832	12,5
Science Councils	3 966	4 342	376	9,5
Not-for-profit	617	674	57	9,2
Government	1 500	1 523	23	1,5

Text Box 3: Gross Expenditure on Research and Development (GERD)

Source: 2015/16 South African National Survey of Research and Experimental Development Statistical Report. The 2015/16 survey registered GERD totaling R29.3 billion, an increase of R2.9 billion or 10.2% in nominal terms from the R29.6 billion of 2014/15. In nominal terms, R&D expenditure increased in all sectors and GERD has increased for 5th consecutive year in nominal terms after contraction in 2009/10 and 2010/11

2014/15 National Survey of Research and Experimental Development (R&D Survey)

South Africa's Gross Expenditure on Research and Development (GERD) amounted to R32 337 billion at current Rand value in 2015/16, a nominal increase of 5% from R29 337 billion recorded in 2014/15

According to the 2015/16 R&D survey, Government (inclusive of science councils funding and higher education owned-funds) has increased its funding of R&D in both nominal and real terms, thereby remaining the largest funder of R&D, funding 44.6% of GERD in 2015/16. However according to the 2015/16 survey, the growth in Government-funded R&D is showing signs of slowing down in 2015/16.

The growth in funds from the business sector has been slowing down since at least 2013/14, and now stands at 38.9%. In-as-much as there appears to be accelerated growth in funding of R&D by foreign sources, the proportion of funding that may be attributed to foreign sources is still at a level that it has been historically, at around 13.0% of GERD, up by 0.8 of a percentage point from 2014/15.

GERD as a percentage of gross domestic product (GDP) or R&D intensity was 0.8% in 2015/16, an increase from 0.77% in 2014/15. The calculations are based on the rebased and revised GDP series first published in November 2014 by Stats SA.

The business sector was the largest performer of R&D in 2015/16, with expenditure amounting to 42,7% of GERD. The higher education sector accounted for the second-largest expenditure on R&D at 30,5% of GERD.

Expenditure on R&D by science councils accounted for 17.8% of GERD, following by government at 6.2%, while the R&D expenditure recorded for not-for-profit organisations increased by 2.8%.

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