Government Funding for Scientific and Technological Activities

2015/16

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

2030 NDP

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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

The 1996 White Paper on Science and Technology envisions a National System of Innovation (NSI) that is central to the growth and development of South Africa.

Increased levels of scientific and technological activities (STAs) are required to help the country achieve its ambitions in a range of areas, including the economy, education, health, minerals, energy, agriculture and the environment. The limited economic incentive for the private sector to invest at optimal socio-economic levels in these areas makes it necessary for the government to serve as a primary source of funding. This is particularly true for fundamental basic research, human capital development, technology transfer activities and a range of scientific services that support service delivery in core areas of government competency.

This report presents information about the Government Funding for STAs Survey (STA Survey). It is based on a survey of the expenditure and budget data of 30 national government departments that confirmed having either performed or funded STAs in the 2015/16 financial year. The report also provides information on trends and projections of STA budgets for the Medium Term Expenditure Framework (MTEF).

An estimated R23,4 billion was spent on STAs in the 2015/16 financial year (i.e. period from April 2015 to March 2016). This amount represents a nominal increase of 6,4% from the R22,0 billion recorded in 2014/15. In real terms (amounts stated in constant 2010 Rands), STAs increased by 6,6% from 2014/15 to 2015/16. The MTEF appropriations indicate that expenditure on STAs will increase to R26,0 billion by 2018/19. The funding for STAs for the 2014/15 financial year was 1,7% of the total national government budget.

The overall pattern of the classifications of funding the STAs remained largely the same as in previous years. A largest proportion of STA (R14,567 billion or 63%) was Government Budget Appropriation or Outlays on Research and Development (GBAORD), followed by Scientific and Technical Education and Training (STET), with

R2,613 billion (11%) and Scientific and Technological Services (STS) with R6,120 billion (26%).

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 70,6% (R16,5 billion) of the total STA expenditure constituted transfers and subsidies towards such activities. About 27,5% (R6,9 billion) of the total STAs was spent internally within national departments, part on capital assets (R1,67 billion) and part on current expenditure items (R4,8 billion).

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 R9,0 billion (38,5%) 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 R6,0 billion (25,6%) towards economic development and R4,5 billion (19,2%) towards "justice and protection". R3,2 billion (13,9%) was appropriated towards the "advancement of knowledge". Other, smaller, categories account for the remaining 3%.

The annual STA Survey follows a funder-based approach in compiling aggregate indicators on government funding of the science and technology (S&T) sector, an internationally recognised approach, which relies on drawing data from budget appropriation tables. This approach makes it possible to produce relevant indicators in a timelier fashion than collecting data on actual spending from performers of STAs / recipients of funds. The STA Survey, therefore, measures different indicators from those measured through the National Survey of Research and Experimental Development (R&D Survey).

The definition of STAs is broader than just R&D. It covers the family of scientific and technological activities of which R&D is a part. On the other hand, the R&D Survey follows a performer perspective and 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, one of which is government. Both these approaches are therefore complementary and useful in understanding the context of government funding for the science and technology sector.

Total funding for science councils and related public research institutions declined to R5,48 billion in 2015/16, a nominal decline of 3,4% from the previous financial year's R5,68 billion. In 2016/17, their funding is projected to be R5,51 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. The analysis also establishes that contract income comes from government institutions, the South African private sector and contracts with foreign governments and businesses. However, it is not clear how much of the contract funding is sourced specifically from government institutions and each of the other sources mentioned.

International comparison, based on GBAORD per capita indicator is done to show South Africa's relative position compared to selected set of countries. This reveals that South Africa's GBAORD per capita of $1.00 in Purchasing Power Parity (PPP) terms, 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. Context of different countries must be considered in interpreting these comparisons.

1. Introduction and Overview

The survey on public funding for STAs gives insights 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 expenditures 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 2015/16 survey, 30 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 of 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).

This report analyses funding on STAs in terms of the following:

- By department, indicating how much each department is contributing to overall STA expenditure, and what percentage of the relevant department's budget is used for STA.
- By mode and/or instrument, indicating whether the expenditure is spent within the department or is allocated to other entities as transfers or subsidies, as well as the policy instrument used. This reflects major channels through which government STA funding are deployed.
- By socio-economic objective (SEO), indicating the policy intention with the funding by linking the expenditure with a list of "targeted areas of use". This gives an overview of how the overall STA funding is allocated across a range of government functions and objectives.

Text Box 1: STA definitions and concepts

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 include 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 and 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.

STA activities 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 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.

2. 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 analyses. This report shows actual expenditure, 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 benefits of research results are uncertain, and often appear only after several years, or a great deal of further research, perhaps not even obviously related to the initial research. 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.

3. Flows of government funding for STAs

Figure 1 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 some, 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 also 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.

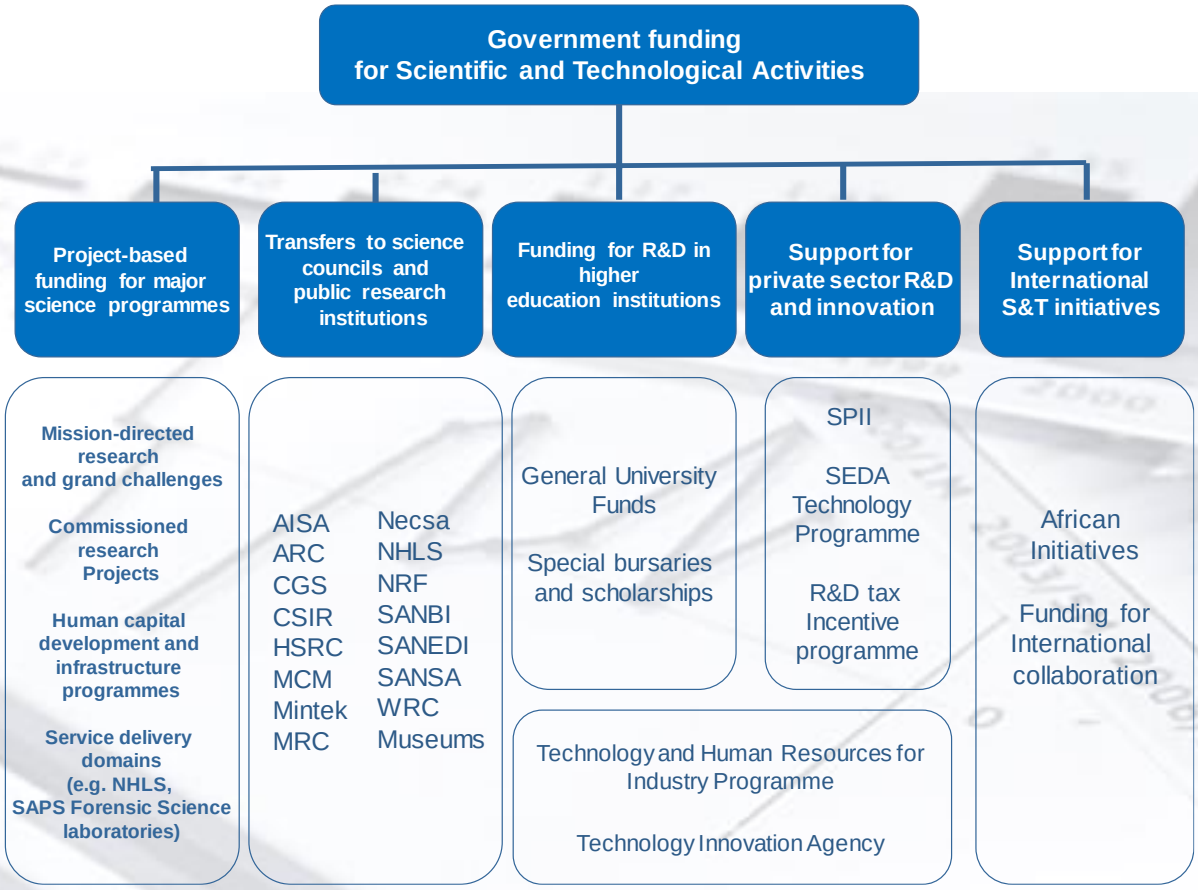


Figure 1: Flows of government funding for STAs

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

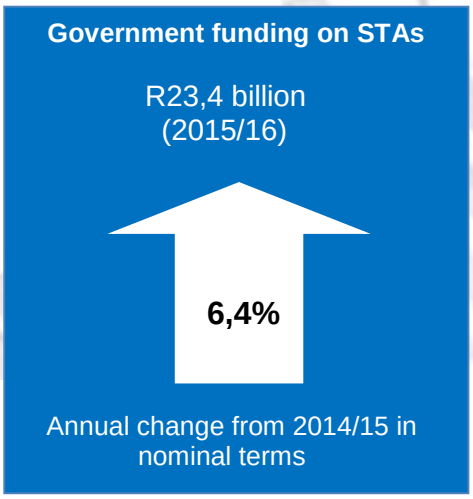
3.1 Overall national government expenditure on STAs

4. Key Findings

The 2015/16 total national government budget on STAs is R23,4 billion. This is a nominal increase of 6,4% from 2014/15. In real terms (amounts stated in constant 2010 Rands), STAs increased by 6,6% from 2014/15 to 2015/16. The MTEF appropriations indicate that this expenditure will increase to R24,7 billion by 2018/19.

While STA funding has shown increases over the years covered in this report, the rate of year-on-year increases is slowing down. The nominal growth of 6,4% 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 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 being significantly reduced. Total STA spending as a percentage of total government budget has also declined to 1,7%. In 2014/15, this ratio was 1.8% and it is projected to decrease to 1,6% in 2016/17. During the period covered by this report, the South African government was 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, which also affected STA budgets across government, slowing the year-on-year increases in overall STA allocations compared to previous years.



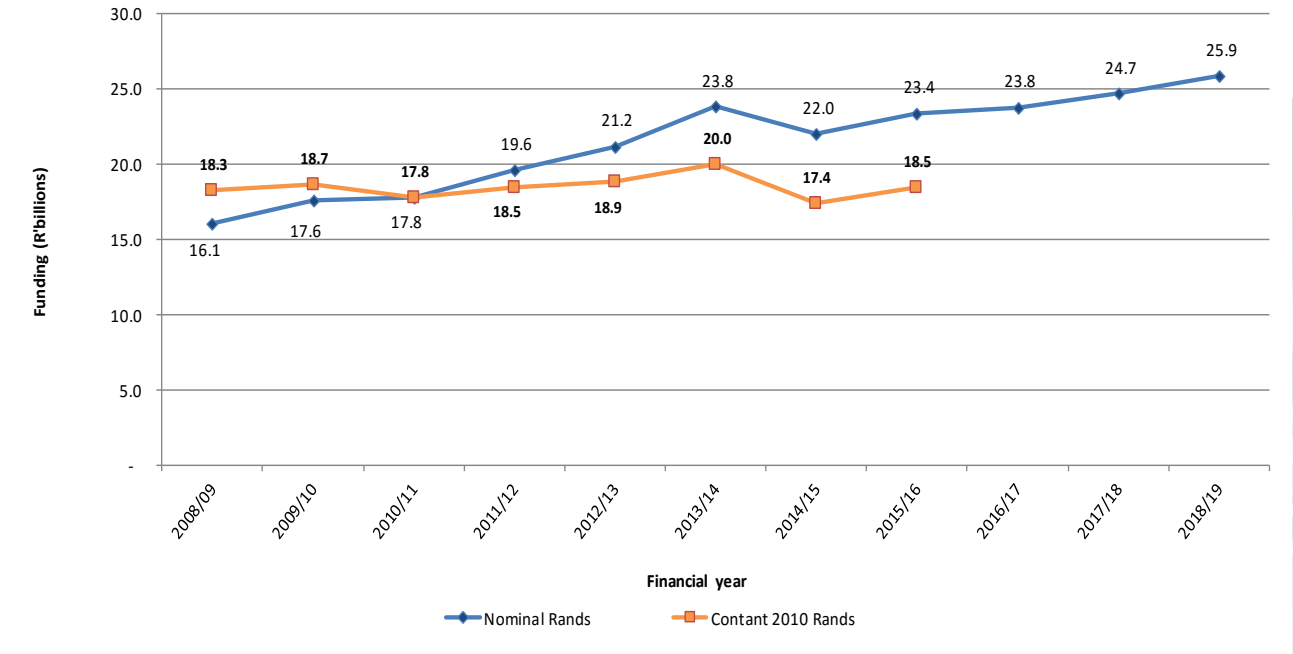


Figure 2: Total government funding for STAs

(Nominal and constant 2010 Rands in R billions)

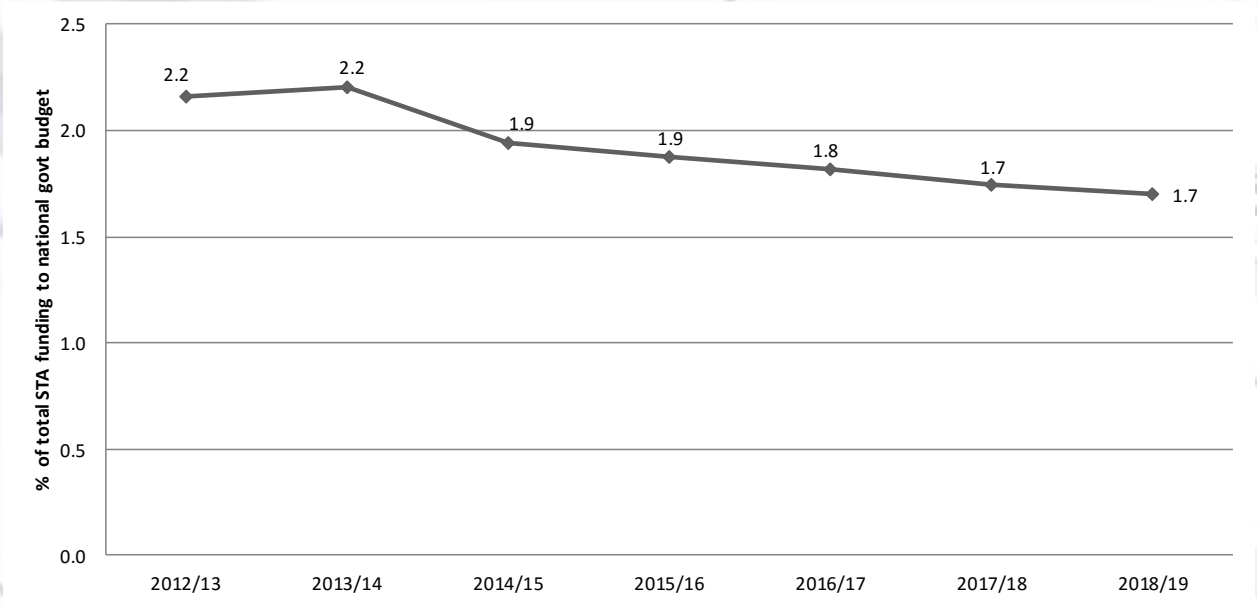


Figure 3: Total funding for STAs as percentage of annual government budget

Text Box 2: Examples of S&T-related activities funded by national departments

Departments with highest budgeted allocations for STAs in 2015/16

Department of Science and Technology (R7,5 billion). This 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. The DST also is responsible for the government support for private sector R&D through the R&D tax incentive, offering 150% tax deduction on R&D expenditure in terms of section 11D of the Income Tax Act. This incentive has contributed up to R6 billion since its inception in 2006 up to February 2014.

South African Police Service (R3,9 billion). This includes funding for the Criminal Record Centre and Forensic Science Laboratories as part of the revamp of the criminal justice sector, and the acquisition of specialised technical analysis equipment, X-Ray Machines and related resources. Enhanced utilisation of investigative aids and DNA database and improvement by employees in Research due to trainings within a project called " A Hi Khomaneni" project

Department of Higher Education and Training (R3,3 billion). The STA funding is mostly towards transfers to higher education and training for research output subsidies, improvement of broadband connectivity and general Information Communications Technology (ICT) infrastructure at universities

Department of Basic Education (R1,3 billion). The funding is transfers and subsidies towards science and technological activities related to training. It is also towards mathematics, science and technology grants for technical secondary school recapitalization and participation in mathematics, science and technology Olympiads/fairs/expos.

Department of Agriculture, Forestry and Fisheries (R1,2 billion). The STA funding is for transfers to the Agricultural Research Council (ARC) and Onderstepoort Biological Products SOC (Ltd). The funding is also allocated towards 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.

Department of Health (R1,1 billion). This includes institutional funding for the Medical Research Council (MRC), the National Health Laboratory Service (NHLS), the National Health Scholars Programme and the Health Systems Trust. National Health Laboratory Service, quality laboratory services to health care facilities. The impact of the funding is effective production of diagnostic laboratory results provided through provision of diagnostic pathology services and analytical test results for legal purposes through provision of forensic laboratory services

The circle packing in Figure 5 is based on a total STA funding of R23,4 billion for the 2015/16 financial year. This figure shows the funding on STAs by each national government department. The bubbles are proportionate to the amount of STA funding per department.

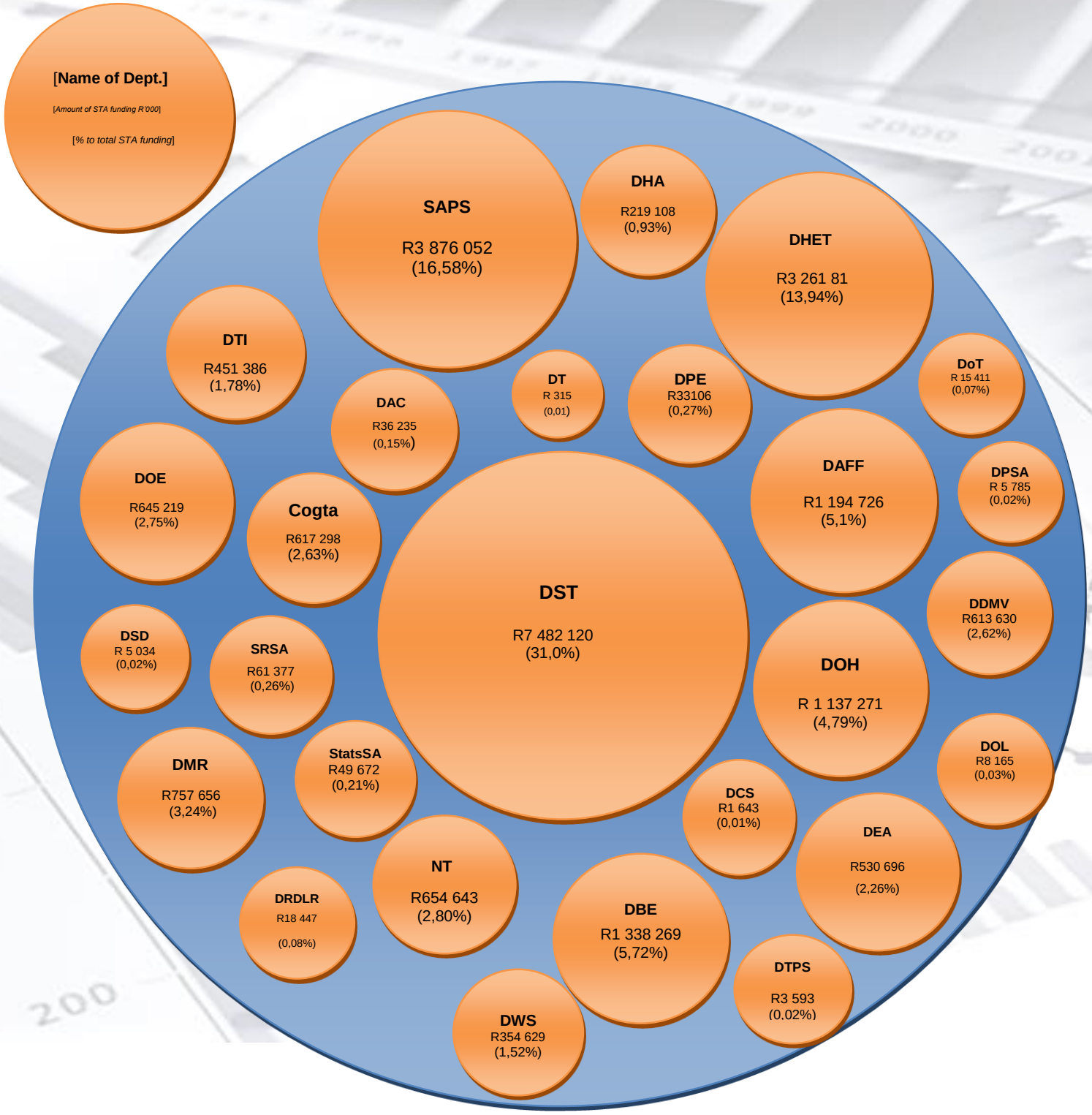


Figure 4: Funding on STAs by national government departments

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

3.2 Main categories of STAs

STAs = GBAORD + STS + STET

The chart is based on a total STA funding of **R23,4 billion** for the 2015/16 financial year.

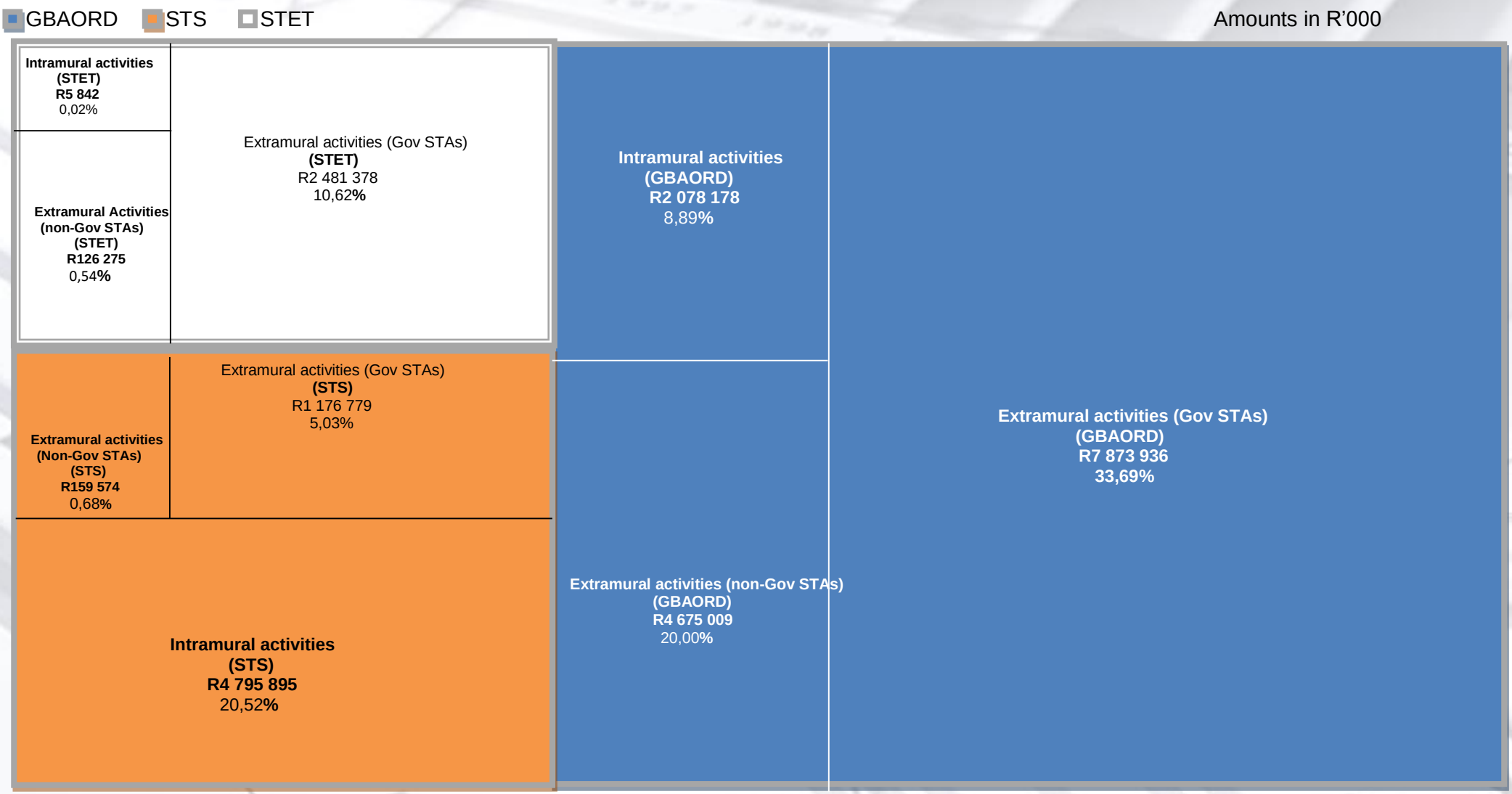


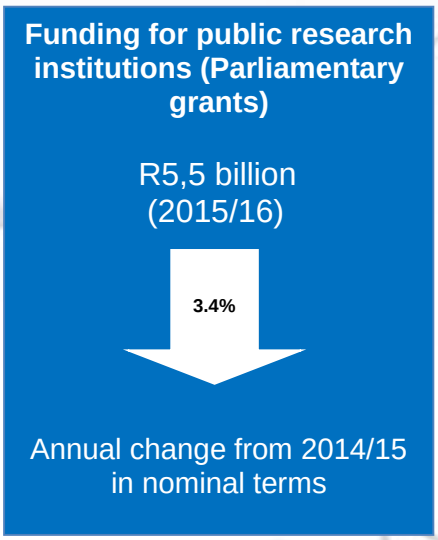
Figure 5: Categories of STAs

3.3 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 decreased from R5,7 billion in 2014/15 to R5,5 billion in 2015/16 - this translates into a nominal decline of 3,4%. Parliamentary grants are intended to finance the public research institutions' research mandates and operating costs.

The decline can be associated with the significantly reduced funding for the Economic Competitiveness Support Package (ECSP), as well as the budget cuts and reprioritisation that has taken effect across government.



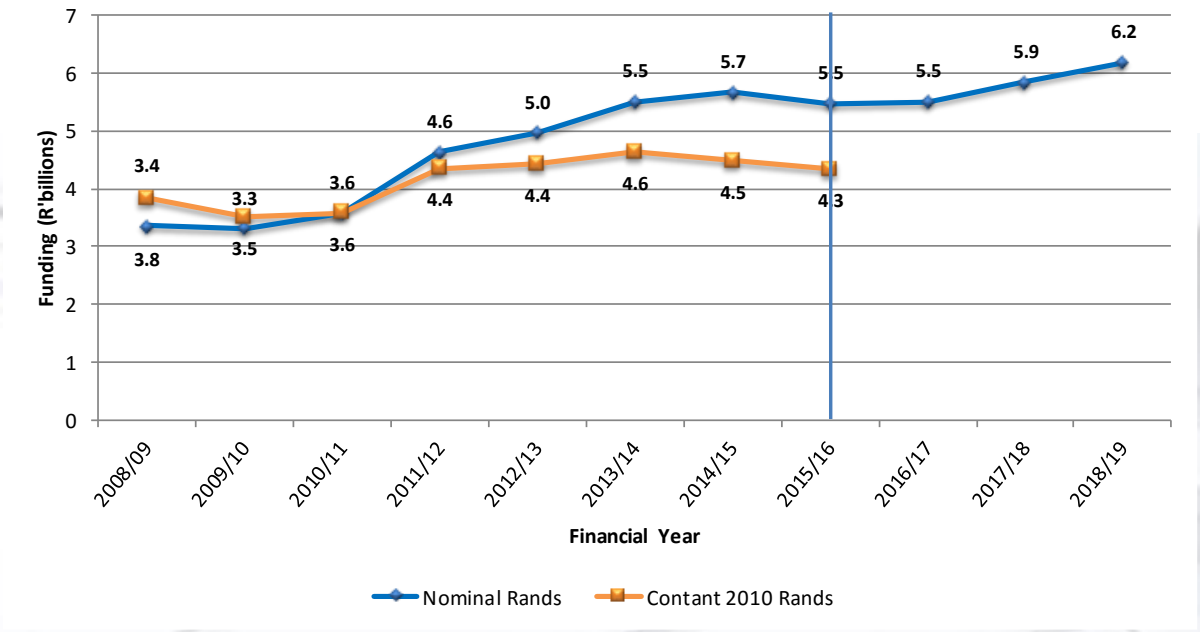


Figure 6: Parliamentary grant funding to science councils and related institutions

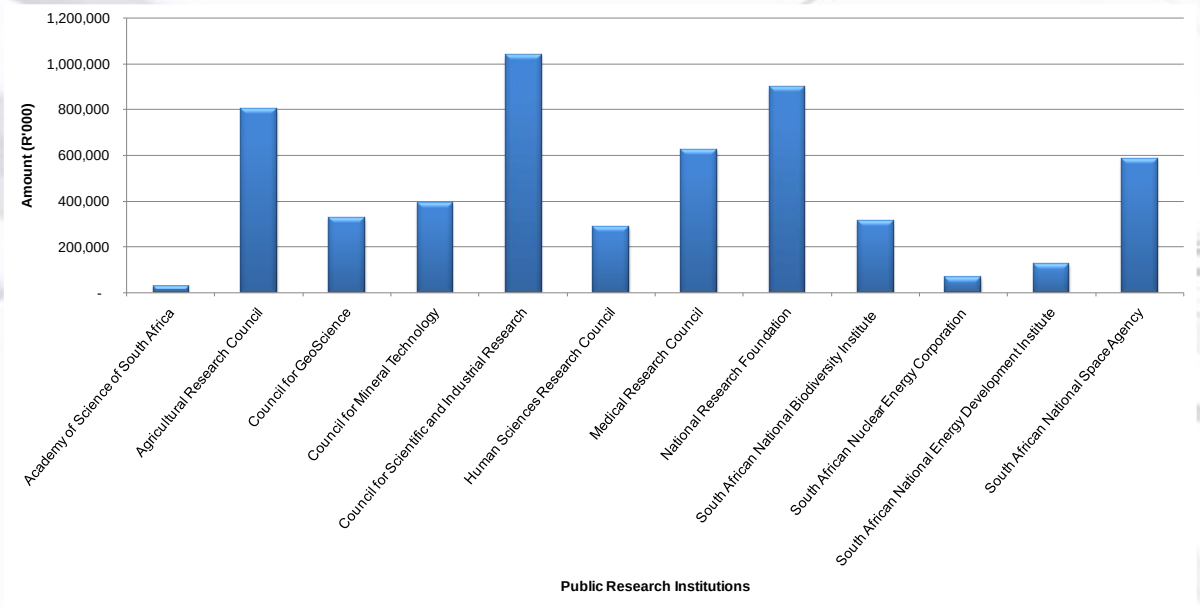


Figure 7: 2015/16 National government funding for public research institutions (Parliamentary grants)

Figure 8 represents both the parliamentary grants reported as funding for public research institutions in Table A2, 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

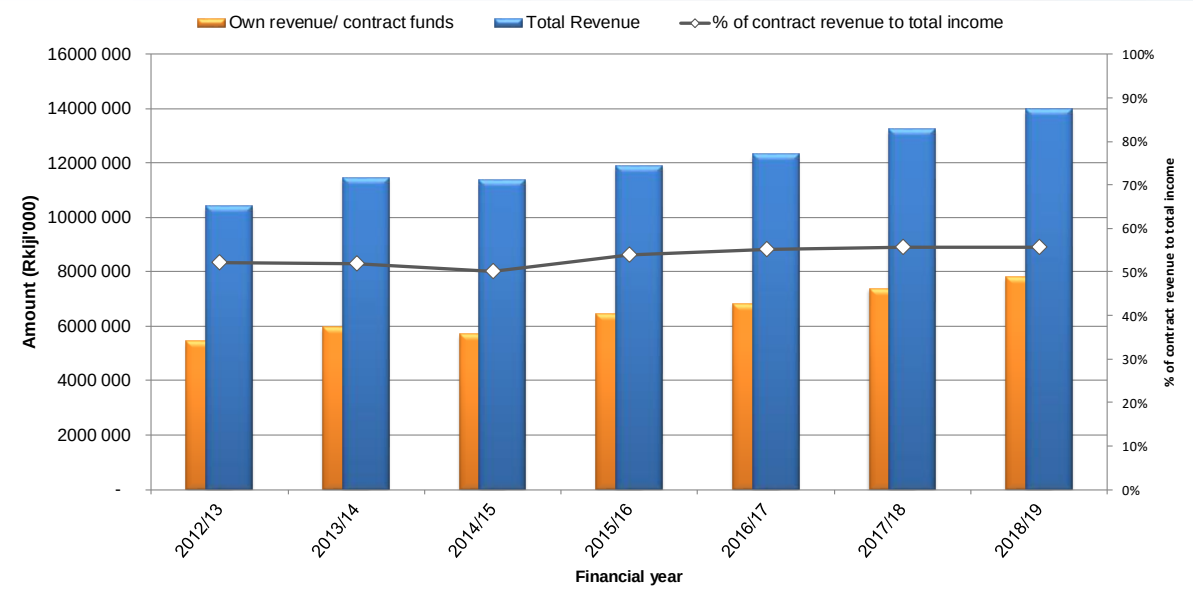


Figure 8: Parliamentary grant vs own/contract income

Contract work is becoming an increasingly important source of revenue for science councils. Total revenue generated by the 12 science councils in 2015/16 was R11,9 billion, compared to the projected R12,3 billion for 2016/17. 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 ratio is approximately 54:46). Science councils receive contract work both from private sector and government departments. The contribution of funding by either private or government to the contract work is not clear from the data sourced.

The fact that on average more than 50% of the income of public research institutions is contractual work 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.

3.4 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

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	Health
	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

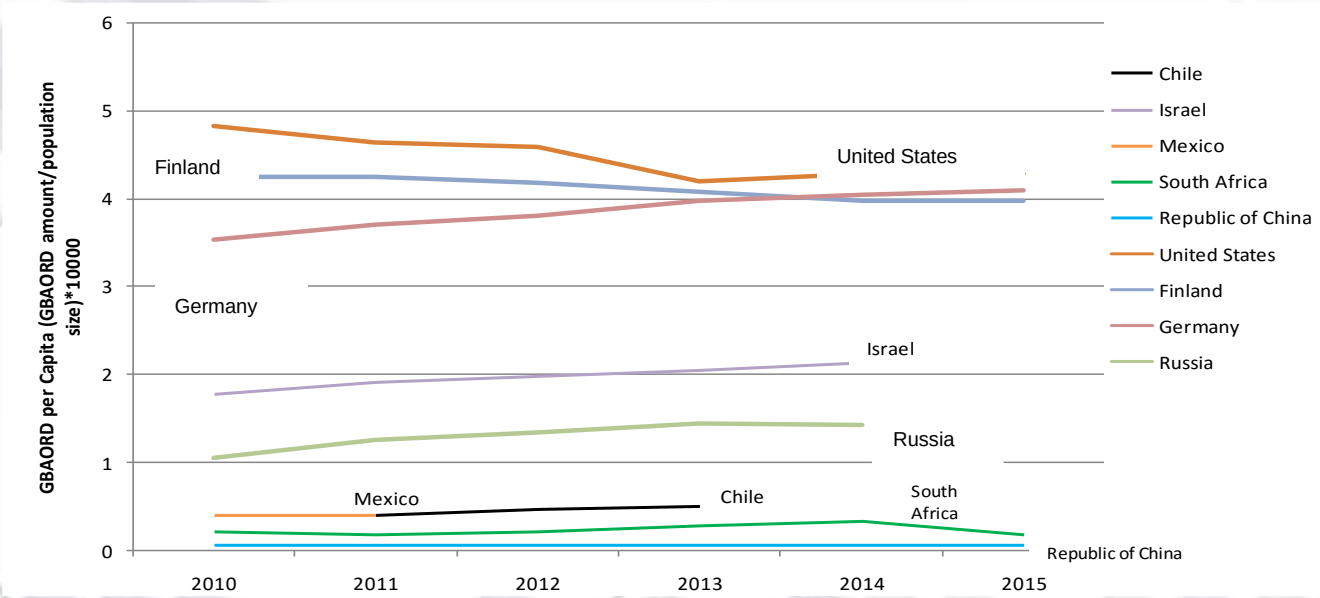
Data note: The doughnut and accompanying column chart are based on a total STA funding of **R23,4 billion** for the 2015/16 financial year.

Figure 9: Analysis by socio-economic objective

3.5 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 with GBAORD per capita below $2.00 and Israel. 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 10: International comparison of GBAORD per capita

5. Conclusion

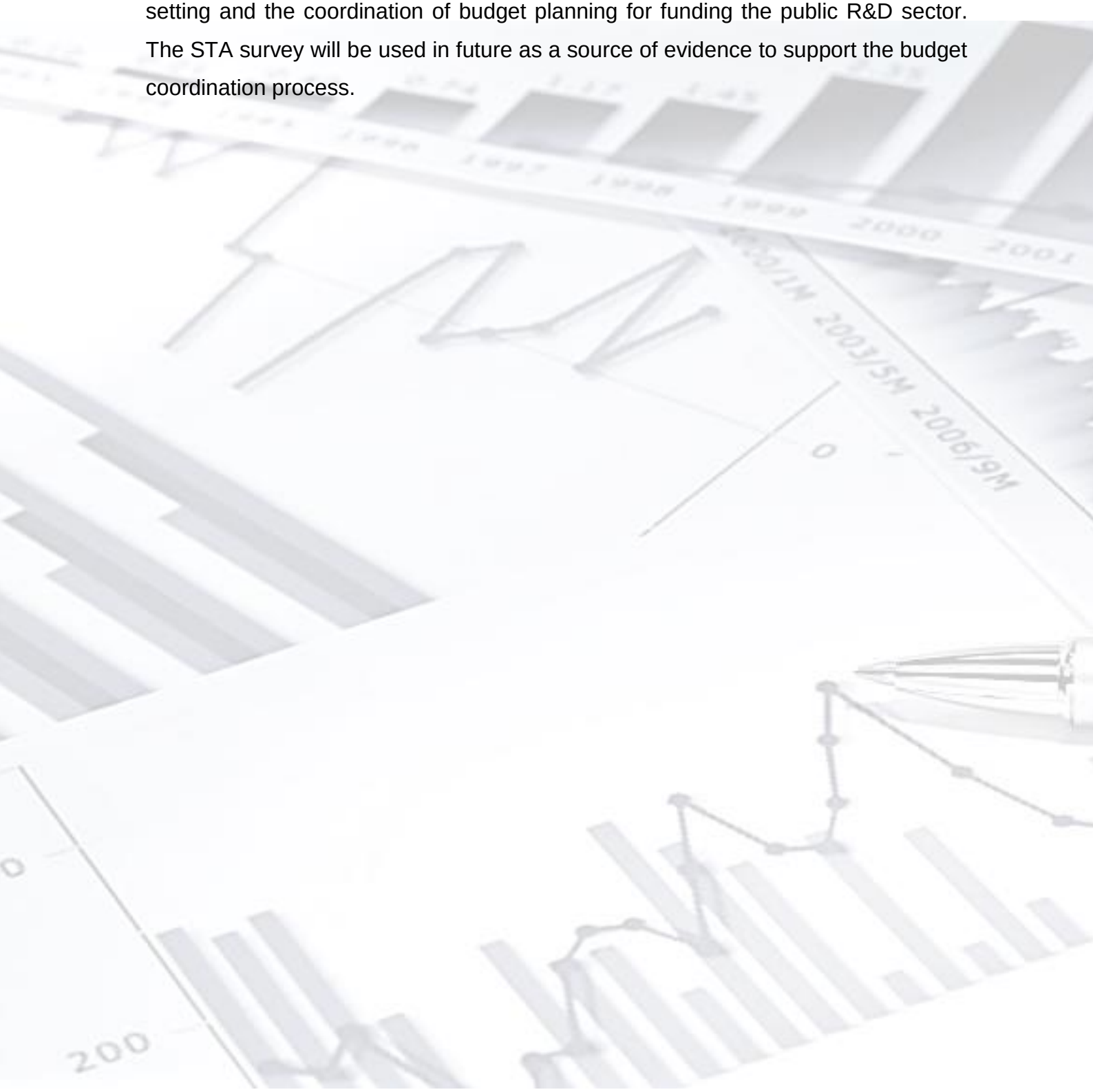
The aggregated indicators of government spending on STAs provided in this report give a sense of how R&D and related STAs are prioritised within the overall government budget, within specific departments and across a range of policy objectives.

The report indicates an inflationary growth in the funding for STAs. However, the rate of increase in funding for STAs continues to slow down since 2013/14 owing to fiscal pressures. Government funding for STAs remains crucial in the context of the National Development Plan, which requires an increased prioritisation of S&T in supporting national development. Budget pressures require departments to make better use of the available resources, through for example, building partnerships with the private sector and leveraging resources from international partners.

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 with GBAORD per capita below $2.00 and Israel. 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 are different.

The report also highlights the trend that public research institutions are increasingly depending on contract funding as source of income over the parliamentary grants. The fact that on average more than 50% of the income of public research institutions is contractual work may point to a risk of those institutions constrained in achieving their mandates that directly link to government funding. This, on the other hand, may reflect demand for knowledge that these institutions produce.

Cabinet has approved a proposal to introduce a Research and Development budget planning coordination process. This process will serve as a mechanism for priority setting and the coordination of budget planning for funding the public R&D sector. The STA survey will be used in future as a source of evidence to support the budget coordination process.



ANNEXURE A: TABLES

TABLE 2: Expenditure on STAs by national government department

National Government Department	R'000						
	Audited Outcome			Actual Expenditure	Medium-Term Expenditure Estimate		
	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Agriculture, Forestry and Fisheries	1,081,103	1,018,461	1,138,325	1,194,726	1,253,948	1,316,645	1,393,010
Arts and Culture	20,452	33,058	35,069	36,235	38,047	39,950	42,267
Basic Education	771,612	1,003,102	1,058,681	1,338,269	1,406,055	1,493,231	1,581,331
Communications	737,499	916,995	823,798	0	0	0	0
Cooperative Governance and Traditional Affairs	541,446	565,401	596,699	617,298	649,819	682,310	721,884
Correctional Services	-	4,298	1,815	1,643	1,726	1,812	1,917
Defence and Military Veterans	496,095	505,171	613,959	613,630	601,125	574,790	608,128
Energy	623,689	726,526	923,363	645,219	619,963	731,146	773,552
Environmental Affairs	437,894	476,816	505,425	530,696	557,231	585,093	619,028
Health	2,842,351	3,740,164	693,976	1,137,271	1,156,242	1,155,172	1,198,537
Higher Education and Training	2,403,401	2,743,149	3,003,557	3,261,381	3,425,620	3,596,901	3,805,522
Home Affairs	386,690	125,729	442,164	219,108	230,063	241,567	255,577
Human Settlements	0	18,446	0	0	0	0	0
Labour	1,844	4,274	4,345	8,165	8,573	9,002	9,524
Mineral Resources	476,537	612,741	663,693	757,656	735,014	733,244	653,230
National Treasury	-	-	692,497	654,643	484,721	412,008	435,904
Police	4,834,560	3,704,057	3,625,723	3,876,052	4,086,175	4,379,332	4,633,333
Public Enteprises	0	0	63,141	33,106	0	0	0
Public Service and Administration	0	0	3,050	5,785	6,074	6,378	6,748
Public Works	0	0	0	0	0	0	0
Rural Development and Land Reform	56,272	10,245	18,716	18,447	19,369	20,337	21,517
Science and Technology	4,951,196	6,943,155	6,479,890	7,482,120	7,562,186	7,608,642	8,049,943
Social Development	51,393	490	5,097	5,034	5,273	5,524	5,845
Sport and Recreation South Africa	37,588	51,456	43,982	61,377	64,301	67,595	71,516
Statistics South Africa	-	27,753	42,479	49,672	50,675	55,656	58,884
Telecommunications and Postal Services	-	-	8,867	3,593	3,715	3,900	4,096
Tourism	-	300	451	315	497	695	735
Trade and Industry	211,871	215,495	224,725	451,386	455,785	536,454	546,408
Transport	79,817	14,104	17,308	15,411	16,243	17,054	18,043
Water and Sanitation	175,411	378,959	227,600	354,629	372,360	390,978	413,655
TOTAL	**21,218,721**	**23,840,345**	**21,958,395**	**23,372,867**	**23,810,802**	**24,665,417**	**25,930,135**

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: National government funding for public research institutions (Parliamentary grants)

Science Councils (R'000)	Financial year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	**2015/16**	2016/17	2017/18	2018/19
Academy of Science of South Africa	16,430	9,893	10,554	18,952	16,284	20,744	27,782	**29,481**	29,628	31,109	32,913
Agricultural Research Council	514,556	537,153	503,407	755,510	943,026	950,254	1,029,151	**803,933**	812,989	974,583	1,031,109
Council for GeoScience	122,672	132,677	154,148	154,405	223,006	271,232	292,839	**325,914**	357,627	348,978	369,219
Council for Mineral Technology	135,835	161,108	178,639	196,956	253,531	364,709	370,854	**390,742**	311,416	299,287	316,646
Council for Scientific and Industrial Research	554,687	599,384	685,784	873,849	958,766	974,378	1,029,785	**1,041,183**	1,086,589	1,140,918	1,207,091
Human Sciences Research Council	163,851	166,185	224,887	238,609	247,820	258,867	276,010	**288,706**	290,149	304,656	322,326
Medical Research Council	236,509	251,531	292,769	283,564	288,863	419,460	446,331	**623,892**	657,590	614,961	650,629
National Research Foundation	683,420	692,131	749,142	1,114,110	1,075,469	1,139,014	864,221	**899,429**	896,403	940,242	994,776
South African National Biodiversity Institute	318,200	138,866	147,830	220,387	209,698	264,254	289,951	**309,412**	324,331	329,928	349,064
South African Nuclear Energy Corporation	554,726	564,144	574,110	45,100	56,110	134,344	162,685	**64,861**	20,625	59,774	63,241
South African National Energy Development Institute	31,077	32,500	25,654	106,719	126,008	123,708	118,298	**124,355**	124,977	131,226	138,837
South African National Space Agency	-	-	-	586,034	567,579	592,182	760,678	**580,358**	599,338	671,372	710,312
Africa Institute of South Africa	30,464	29,280	30,594	32,440	33,643	-	-	-	-	-	-
Total	**3,362,427**	**3,314,852**	**3,577,518**	**4,626,635**	**4,966,160**	**5,513,146**	**5,668,585**	**5,482,266**	**5,511,662**	**5,847,034**	**6,186,162**

TABLE 4: 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	2,078,178	7,873,936	4,675,009
STS	4,795,895	1,176,779	159,574
STET	5,842	2,481,378	126,275
Sub-totals	6,879,915	11,532,093	4,960,858
% to total STA expenditure	29.4%	49.3%	21.2%

TABLE 5: Analysis by Socio-economic objective

MAJOR DIVISION	STA EXPENDITURE	SEO CLASSIFICATION	STA EXPENDITURE	% TOTAL
Justice and Protection	4,489,682 (19%)	Defence	613,630	2.6%
		Police	3,876,052	16.6%
Economic Development	5,983,738 (26%)	Energy	827,035	3.5%
		Agriculture (Plant Production and Animal Production)	1,286,756	5.5%
		Transport	33,106	0.1%
		Economic Framework	459,551	2.0%
		Commercial Services	830,515	3.6%
		Mineral Resources (Excluding Energy)	757,656	3.2%
		Manufacturing	261,874	1.1%
		Construction	312,074	1.3%
		Information and Communication services	1,215,171	5.2%
		Natural Resources	0	0.0%
Society	8,994,029 (38%)	Health	1,289,906	5.5%
		Education and Training	6,927,036	29.6%
		Social Development and Community Services	777,087	3.3%
Environment	657,106 (3%)	Environmental Knowledge	1	0.0%
		Environmental aspects of Development	98,039	0.4%
		Environmental management and other Aspects	559,066	2.4%
Advancement of knowledge	3,248,312 (14%)	Natural Sciences, Technlogies and Engineering	2,830,174	12.1%
		Social Sciences and Humanities	418,138	1.8%
TOTAL	**23,372,867**		**23,372,867**	**100.0%**

TABLE 6: GBAORD of selected countries

Country ($)	Year					
	2010	2011	2012	2013	2014	2015
Chile	–	692	822	881	–	–
Israel	1,355	1,480	1,569	1,652	1,753	–
Mexico	4,698	4,736	–	–	–	–
South Africa	1,022	904	1,052	1,496	1,770	993
Republic of China	7,044	7,363	7,351	7,311	7,357	7,935
United States	148,962	144,379	143,737	132,477	136,159	137,172
Russia	15,026	18,097	19,280	20,768	20,567	–
Finland	2,273	2,282	2,262	2,210	2,167	2,185
Germany	28,917	30,279	30,638	32,640	32,683	33,017

Source: Organisation for Economic Co-operation and Development data - https://data.oecd.org/

TABLE 7: Population size of selected countries (headcount)

Country	Year					
	2010	2011	2012	2013	2014	2015
Chile	17,015,048	17,201,305	17,388,437	17,575,833	17,762,647	17,948,141
Israel	7,623,600	7,765,800	7,910,500	8,059,500	8,215,700	8,380,400
Mexico	118,617,542	120,365,271	122,070,963	123,740,109	125,385,833	127,017,224
South Africa	50,791,808	51,553,479	52,341,695	53,157,490	54,001,953	54,490,406
Republic of China	1,339,724,852	1,340,910,000	1,347,350,000	1,354,040,000	1,360,720,000	1,367,820,000
United States	309,347,057	311,721,632	314,112,078	316,497,531	318,857,056	321,773,631
Russia	142,849,449	142,960,868	143,201,676	143,506,911	143,819,569	143,456,918
Finland	5,363,352	5,388,272	5,413,971	5,438,972	5,461,512	5,503,457
Germany	81,776,930	81,797,673	80,425,823	82,132,753	80,970,732	80,688,545

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

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 TableA1. The survey focuses on the budgets 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 on a level basis and then disaggregated based on the three categories, namely, GBOARD, STET and STS, and, furthermore, on socio-economic objectives. Attempts were made, where possible, by the DST to present project-related information with a view to give a sense of which type of projects are being funded. The data collection does not currently cover provinces.

B2. Survey planning and design

The survey on public funding for STAs is undertaken by the DST as part of monitoring the performance of the 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. They are included in each annual data collection. 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* (2002). Particular focus has been on improving the survey's relevance to those who use this type of information for policy making, analysis and research.

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 Text Box 1 of this report.

B3. Sampling and data collection process

The survey plan identified 30 national departments from which data had to be collected. Of the 30 national departments, 22 verified and validated their data, at first level, within the targeted time frame. Their responses covered 75,9% of the total STA appropriation; the other 24,1% 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 of departmental data for verification and validation. This step is important to ensure the accuracy of the information.

Furthermore, following data validations, figures for the Department of Health, Public Enterprises, Communications, Mineral Resources, Trade and Industry and Telecommunications and Postal Services were revised to reflect 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 the research; but the function later changed to administering the HIV/Aids programme in the provinces.

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).

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 compiled with appropriations from departmental sources. The data is subject to revision as and when audited or actual expenditure data becomes available.

B6. Data processing, analysis and report writing

A database that contains the historical data on STA has been developed. The responses from 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.

B7. Reliability of the data and data accuracy

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 was 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.

	Government funding for STAs	National Survey of Research and 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	• 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)	• 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.

Table 8: Differences between the R&D Survey and the survey on the public funding of STAs

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.

2013/14 National Survey of Research and Experimental Development (R&D Survey)

South Africa's gross expenditure on research and development (GERD) amounted to R25,661 billion at current Rand value in 2013/14, a nominal increase of 7,5% from R23,871 billion recorded in 2012/13

GERD increased by 1,4% in real terms between 2012/13 and 2013/1; the increase in GERD was for all the sectors except higher education

The business sector was the largest performer of R&D in 2013/14, with expenditure amounting to 45,9% of GERD. This is the first year since 2008/09 that the business sector has shown a positive year-on-year change in R&D expenditure since 2008/09.

The higher education sector accounted for 28,4% of GERD, although this represented a decrease of 0,5% (estimated at R40 million) from the expenditure in this sector in 2012/13.

The government and business sectors were the largest funders of R&D in South Africa in 2013/14, funding 42,9% and 41,4% respectively.

Source: 2013/14 National Survey of Research and Experimental Development

ACKNOWLEDGEMENTS

Acknowledgements are due to the Department of Science and Technology project team that compiled this report: Mr Godfrey Mashamba, Mr Sandisa Siyengo, Ms Mavis Anim, Mr Nape Mothiba, Ms Katlego Kotu, Ms Rachel Phala and Ms Luthando Zondi. The team is grateful for the guidance provided by the Director-General of Science and Technology, Dr Phil Mjwara, and the Deputy Director-General: Socio-economic Innovation Partnerships, Mr Imraan Patel, as well as for the cooperation of officials in other national or provincial government departments who assisted in collating data on STA expenditure related to their departments.

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