



**SCIENCE AND
INNOVATION**

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Science and Innovation

The Department of Science and Innovation (DSI) derives its mandate from the 1996 *White Paper on Science and Technology*, which introduced the concept of the national system of innovation, a set of interacting organisations and policies through which South Africa creates, acquires, diffuses and puts into practice new knowledge to help achieve individual and collective goals.

A coordinated and efficient national system of innovation will help the country achieve its national development priorities by promoting change through innovation. This will enable all South Africans to enjoy the economic, socio-political and intellectual benefits of science, technology and innovation.

Over the medium term, the department planned to focus on providing funding for research infrastructure to strengthen South Africa's research and innovation capabilities, including implementing the national space strategy; developing human capital; and advancing innovation to improve South Africa's competitiveness in the global market through measures such as supporting emerging farmers.

Strengthening research infrastructure and innovation capabilities

In recognising that the availability of adequate research infrastructure is vital for the development of a robust and competitive national system of innovation, the DSI will continue to fund projects that are in line with the South African research infrastructure roadmap.

These include constructing large national infrastructure platforms and facilities; acquiring scientific equipment; and developing pilot plants, technology demonstrators and specialised facilities such as drug development and aerospace platforms.

The department's work is also geared towards strengthening research capabilities. Key among these are the South African National Space Agency's (SANSA) space infrastructure hub project, a multiyear infrastructure development project that involves the development of space infrastructure such as satellite imagery to map geographical information, satellite-based augmentation systems and earth observation satellites; and the Square Kilometre Array (SKA), which is a global endeavour to construct the world's largest and most sensitive wavelength radio telescope.

Over the medium-term period, substantial allocations were expected to be made to the SANSA for the space infrastructure hub project and to the South African Radio Astronomy Observatory (SARAO) for the expansion of the SKA.

The SARAO is a national facility managed by the National Research Foundation (NRF) and incorporates all national radio astronomy telescopes and programmes.

Developing human capital

Human capital is key to the development of a national system of innovation that is globally competitive and responsive to South Africa's developmental needs. In recognition of this, the department provides support through granting

postgraduate bursaries and scholarships; sponsoring internships; and funding emerging and established researchers, including for strategic instruments such as the South African research chairs initiative and centres of excellence projects.

To date, the department has awarded 257 research chairs, 240 of which are operational. Centres of excellence serve as hubs that draw a range of universities and science councils together to tackle challenges in areas such as health, food security, human development, energy and biodiversity.

Advancing innovation to improve South Africa's competitiveness in the global market

Over the medium term, the department planned to advance innovation and address key competitiveness challenges, including market sustainability and facilitating access to new export markets. To achieve this, it intended to support 15 commercial outputs in designated areas such as healthcare and 85 technology demonstrations, prototypes, products and services each year over the period ahead.

These included locally developed fermentation-based skin care products and cotton baling machines for small-scale farmers. The department also planned to financially support black emerging farmers; train artisans in the space, energy and bioeconomy sectors; train graduates through experiential learning opportunities in the energy sector; and support learnership initiatives in publicly financed research and development (R&D) institutions.

Hydrogen Society Roadmap (HSRM)

To support innovation in South Africa's energy markets, the DSI launched the HSRM in February 2022 to unlock the potential of new sources of clean energy to facilitate a just transition from a carbon-intensive to a carbon neutral economy.

Through the HSRM, the DSI have unlocked the potential of new sources of clean energy to facilitate a just transition from a carbon-intensive to a carbon-neutral economy. The department has also registered the Hydrogen Valley Programme with Infrastructure South Africa under Strategic Integrated Projects in December 2022.

The South African hydrogen economy journey started in 2007 when Cabinet approved the national hydrogen and fuel cells research, development and innovation Hydrogen South Africa Strategy (HySA Strategy). The DSI is implementing the HySA Strategy through the 15-year HySA Programme.

The HySA Programme, on its 14th year of implementation in 2023, has made significant contribution towards the creation of a Hydrogen Economy in South Africa. This has been achieved through the creation of knowledge, technological expertise and human resources development.

Square Kilometre Array

The South African and Australian governments are co-signatories to co-host the SKA Observatory array telescopes and associated infrastructures over the period

2021-2030. Through the SKA Observatory, South Africa will be producing a whole new generation of science and scientists, many of whom are being trained in the country.

By mid-2023, South Africa had begun with the construction of the SKA project and the construction, together with that of Australia, forms the biggest-ever radio telescope array, at a cost of US\$2, 2 billion.

It is estimated that these two sites will together create 710 petabytes of science data when fully operational in 2029. It is therefore expected that astronomers can get 50 years or more of transformational science through the SKA. In South Africa, 133 dish antennas will be added to the existing 64-dish MeerKAT precursor telescope, totalling nearly 200 dishes, to form the SKA's mid-frequency telescope array.

A total of 1 400 students have been supported through the SKA bursary programme by mid-2023. South African companies and the South African Radio Astronomy Observatory are expected to benefit immensely from the rolling out of this infrastructure, which includes the building of the SKA Exploratorium in Carnarvon in the Northern Cape.

The initiative is expected to boost science awareness and outreach, stimulate science tourism in the region and create employment. The MeerKAT telescope, built by South Africans, will continue to do world-class scientific work until it is fully integrated into the SKA in the next five to seven years.

By mid-2023, more than 180 scientific articles based on MeerKAT observations had been published in leading scientific journals. Among the groundbreaking results is the discovery of “Nkalakatha”, a powerful radio laser, the most distant of its kind, with the faint radio waves now detected in the Karoo emitted in colliding galaxies before the Earth was even formed.

Entities:

Academy of Science of South Africa (ASSAf)

The ASSAf was established in terms of the ASSAf Act of 2001, as amended, to promote outstanding achievements in all fields of scientific inquiry, recognise excellence, and provide evidence-based scientific advice to government and other stakeholders.

Over the medium term, the academy aimed to enhance South Africa's capacity to produce and publish research, provide evidence-based policy advice to government, and increase the quality and visibility of South African research publications. This entailed undertaking various consensus studies in the categories of health, education, climate change, energy, the science-policy nexus, biosafety and biosecurity, poverty reduction, genderresponsive issues, young people and people with disabilities.

To complement this work, the academy aimed to host 15 lectures on scientific topics, form 12 strategic partnerships with players in the science community and publish six journal titles on the Scientific Electronic Library Online open-access platform over the medium-term period.

Council for Scientific and Industrial Research (CSIR)

The CSIR was established in 1945 and is governed in terms of the Scientific Research Council Act of 1988. The council fosters industrial and scientific development in the national interest through multidisciplinary research and technological innovation to improve the ability of the state to efficiently deliver basic services in fields such as health, education, social security, energy and shelter to all South Africans, and, in doing so, reduce inequality.

Over the medium term, the CSIR planned to focus on conducting high-quality and relevant research, pursuing technological innovation to foster industrial and scientific development, and building on industrial development opportunities in fields such as pharmaceutical innovation and agro-processing.

To achieve this, the council aimed to support 56 registered patents and publish 960 journal articles over the medium term. The CSIR also planned to implement a range of research, development and innovation programmes in areas such as health, energy, defence and security.

Human Sciences Research Council (HSRC)

The Human Sciences Research Council was established in 1968 to undertake, promote and coordinate research in the human and social sciences. The council is mandated to initiate, undertake and foster strategic, basic and applied research in human sciences; and address developmental challenges by gathering, analysing and publishing relevant data, especially through projects linked to collaborative programmes geared towards the public sector.

The council's research outputs are widely disseminated to support policy development at all levels of government. Over the medium term, the council planned to continue focusing on producing research that serves the public; contributing to good governance and public service delivery; helping to address the challenges of poverty, inequality and unemployment; and building the capacity of scholars and researchers.

National Research Foundation

The NRF was established in terms of the NRF Act of 1998, as amended. In terms of this legislation, the foundation is mandated to fund research, develop human resources and provide research facilities to enable knowledge creation, innovation and development in all fields of science and technology. It is also mandated to promote indigenous knowledge.

Over the medium-term period, the NRF planned focus on implementing its 10-year strategy, Vision 2030. This involves interventions to catalyse transformation in the science and technology system through measures such as creating grant funding instruments that focus on women and black researchers; scaling up the development of a research and innovation workforce for renewing, regenerating and replenishing the cohort of South African researchers; establishing a transformed knowledge workforce with a greater diversity of people and ideas to lead the knowledge enterprise; and advancing the international competitiveness

of the scientific workforce. There is also new funding for major infrastructure investments for the SKA, which includes the science processing and regional centres, the science operations centre building, the engineering operations centre building, and fencing for the MeerKAT National Park.

South African Council for Natural Scientific Professions (SACNASP)

The SACNASP is the legislated regulatory body for natural science practitioners in South Africa. The natural sciences encompass a wide range of scientific fields covering all of the basic sciences and many of their applied derivatives. Its mission is to establish, direct, sustain and ensure a high level of professionalism and ethical conscience amongst its scientists.

South African National Space Agency

The SANSA was established in terms of the SANSA Act of 2008. The agency became operational in 2010 and is broadly required to promote the peaceful use of space, foster international cooperation in space-related activities, and facilitate the creation of an environment conducive to space technology and industrial development.

Space services provide an indispensable tool for the formulation of government decisions and policies by helping to provide knowledge on and address challenges in industries such as agriculture, water, energy, health, safety and security.

Over the medium term, the agency planned to continue focusing on activities that ensure that these services are integrated into service delivery. Key among these is the space infrastructure hub project, where the agency plans to develop spacecraft and ground segment infrastructure to support deep space operations, earth observation and space science operations.

Through the SANSA, South Africa has been appointed to host one of the designated International Civil Aviation Organization regional centres for the provision of space weather information to the entire aviation sector flying in African airspace.

South Africa has signed an agreement with the USA National Aeronautics and Space Administration (NASA) to build a deep-space vehicle tracking and communications ground station in the semi-desert Karoo region of Matjiesfontein, in the Western Cape. This new ground station will be helping to track history-making NASA missions to the moon and beyond by 2025. The partnership will also see continued skills development in space science and technology, which the DSI has been investing in for years.

Technology Innovation Agency (TIA)

The TIA draws its mandate from the TIA Act of 2008, as amended. The agency serves as the key institutional intervention to bridge the innovation gap between R&D outcomes from higher education institutions, science councils, public entities and private companies to maximise the potential of technological innovation for stimulating the economy.

Over the medium term, the TIA planned to continue focusing on bridging the innovation gap between R&D; supporting technologies within the national system of innovation; scaling up all strategic programmes by increasing the pace at which applications and internal processes occur; creating a conducive environment for engaging with innovators, stakeholders and suppliers; adopting measures to support small, medium and micro enterprises in the sector; and increasing the participation of marginalised segments of society.

Over the next three years, the TIA aimed to license 70 technological innovations, launch 101 products into the market and ensure that 24 technology innovations were operational and functional.

Research and science bodies

South African Bureau of Standards (SABS)

The SABS was established as a statutory body in terms of the Standards Act of 2008 and is part of South Africa's standardisation, quality assurance, accreditation and metrology technical infrastructure institutions.

The bureau is mandated to develop, promote and maintain South African national standards; render conformity assessment services; and promote the quality of commodities, products and services in an effort to protect the integrity of the South African market, protect consumers, create a competitive advantage, and facilitate access for South Africans to local and international markets.

Over the medium term, the SABS planned to continue revitalising testing operations and facilities in targeted sectors such as cement, radiation protection services and the automotive industry.

The bureau also intended to improve its standard development processes to enable industrialisation and faster turnaround times. It expected to do this by enhancing digital collaborative tools to effectively engage with stakeholders that participate in its technical committees.

National Intellectual Property Management Office (NIPMO)

The NIPMO is mandated to ensure that intellectual property from publicly financed R&D is identified, protected, used and commercialised for the benefit of the people of South Africa, whether it be for social, economic, military or any other benefit.

Agricultural Research Council (ARC)

The ARC is the main agricultural research institution in South Africa. It was established by the Agricultural Research Act of 1990 and is mandated to conduct R&D and effect the transfer of technology to promote agriculture and industry; contribute to better quality of life; and facilitate and ensure the conservation of natural resources.

Over the medium term, the ARC planned to focus on generating knowledge and technologies that will enhance the efficiencies of crop production, animal production and health; managing natural resources; developing a foot-and-

mouth vaccine production facility at Onderstepoort to reduce reliance on imports; maintaining national assets; and providing diagnostic and analytical services on behalf of the department.

Mintek

Mintek's mandate, as set out in the Mineral Technology Act of 1989, is to maximise the value derived from South Africa's mineral resources through, among other things, R&D, technology transfer, and the creation of an enabling environment for the establishment and expansion of mineral industries.

To this end, Mintek develops appropriate, innovative technology for transfer to the industry, and provides test work, consultancy, analytical and mineralogical services to clients around the world.

Council for Geoscience (CGS)

The CGS was established in terms of the Geoscience Act of 1993 to promote the search for and exploitation of minerals in South Africa. Its mandate is to generate, compile, curate and publish world-class geoscience knowledge products, provide geoscience-related services to the South African public and industry, and render advisory services related to geohazards and geo-environmental pollution.

The data generated by the CGS enables key activities such as the assessment of environmental impacts from mining, geohazards and shale gas development.

South African Medical Research Council (SAMRC)

The council's mandate in terms of the SAMRC Act of 1991 is to promote the improvement of the health and quality of life of the population through research, development and technology transfer.

In line with this mandate, the SAMRC conducts and funds relevant and responsive health research, capacity development, innovation and research translation. Over the medium-term period, the council aimed to accept or publish about 1 900 journal articles, books and book chapters by authors affiliated with and/or funded by it.

National Health Laboratory Service (NHLS)

The NHLS was established in terms of the NHLS Act of 2000, and provides pathology services for the majority of the South African population through its 233 laboratories across the country. This includes forensic chemistry laboratory services, which the service took over from the Department of Health in 2022/23. The service also houses the National Institute for Communicable Diseases and the National Institute for Occupational Health.

South African National Energy Development Institute (SANEDI)

The SANEDI was established in terms of the National Energy Act of 2008. It is mandated to direct, monitor and conduct applied energy R&D, and demonstrate

and deploy specific measures to promote the uptake of green energy and energy efficiency in South Africa.

Water Research Commission (WRC)

The legislative mandate of the WRC is set out in the Water Research Act of 1971. Its primary functions include promoting coordination, cooperation and communication in water R&D; establishing water research needs and priorities; enhancing knowledge and capacity building within the water sector; and stimulating and funding priority-based water research.

Over the next three years, the commission planned to support government programmes in the water and sanitation sector. This included the implementation of the National Water Resource Strategy.

To ensure that water is supplied efficiently and predictably while ensuring transparency, the commission aimed to conduct 240 sector-related research projects over the period ahead.

South African Environmental Observation Network (SAEON)

The SAEON is a long-term environmental observation and research facility of the NRF. The SAEON's three focus areas are environmental observation, data management and education outreach.

The DSI provides core funding for these activities. The SAEON has a distributed network of seven nodes, two research infrastructures and a national office. The research network covers the major terrestrial and marine ecosystems in South Africa and supports well over 100 researchers and students a year.

South African Astronomical Observatory (SAAO)

The SAAO is South Africa's leading astronomy research institute and home to the Southern African Large Telescope, the largest optical telescope in the southern hemisphere.

Founded in 1820, the SAAO is the national centre for optical and infrared astronomy in South Africa. Its primary role is to conduct fundamental research in astronomy and astrophysics by providing a world-class facility to scientists.

The SAAO also promotes astronomy and astrophysics in southern Africa, by sharing research findings and discoveries, and participating in outreach activities to enthuse citizens about physics and astronomy.