OFFICIAL GUIDE TO

South Africa

2018/19

Science and Innovation

The National Development Plan (NDP) acknowledges that science, technology and innovation (STI) are crucial to enabling broad-based socio-economic development through a skilled and innovative population.

This is expressed in terms of Outcome 5 (a skilled and capable workforce to support an inclusive growth path) and Outcome 6 (an efficient, competitive and responsive economic infrastructure network) of government's 2014-2019 Medium Term Strategic Framework.

Following the reconfiguration of government departments in June 2019, the Department of Science and Technology (DST) was renamed the Department of Science and Innovation (DSI). The department is furthering its ability to take advantage of rapid technological change to build a prosperous nation.

The 2019 *White Paper on STI* notes that the Fourth Industrial Revolution (4IR) is based on three sets of megatrends – physical, digital and biological – and involves a convergence of technologies and disciplines that is having a multisystem impact.

In recent years, the then DST has enabled the development of individual 4IR technologies such as nanotechnology, biotechnology, information and communications technologies (ICT), robotics, photonics and additive manufacturing.

In response to the 4IR and its disruptions, government has developed a new policy framework for science and technology which is contained in the new *White Paper on Science and Technology and Innovation*, adopted by Cabinet in March 2019, which is aligned to the NDP.

To realise the objectives of the new White Paper, government was expected to develop a Decadal Plan on Science Technology and Innovation (STI), which would serve as an implementation plan over the period 2020-2030.

The DSI has initiated the Converging Technologies Platform (CTP) to introduce a more collaborative approach between technologies.

The overall vision of the CTP is to fuse the assets of the national system of innovation (NSI) in order to create an innovation explosion that will result in greater and increased socio-economic impact for the benefit of all South Africans.

The department's Centre for Artificial Intelligence Research programme conducts foundational, directed and applied research into various aspects of artificial intelligence.

Producing new knowledge

The DSI is committed to strengthening research and innovation competencies and programmes that form the strategic foundation for scientific innovation.

It has invested in the industrial, health and agricultural sectors, as well as in the development of indigenous knowledge applications, which particularly seek to find solutions to the disposal of industrial and municipal waste; facilitate the development of biopharmaceuticals, vaccines and biofuels; and improve crop production.

The National Space Strategy aims to promote the peaceful use of space; support the creation of an environment conducive to industrial development in space technology; foster research in space science, communications, navigation and space physics; and advance scientific, engineering and technological competencies in spacerelated activities.

This will ensure that South Africa captures a reasonable share of the global space market, which involves economic activities related to manufacturing components that enter the earth's orbit or go beyond.

In December 2018, South Africa launched into space the continent's most advanced nanosatellite, the ZACube-2, to help monitor the ocean traffic as part of the Oceans Economy, and to also monitor veld fires and provide near real-time fire information to ensure a quick response time by disaster management teams.

Research, innovation and infrastructure

The availability of adequate infrastructure is vital for the NSI to be globally competitive. This infrastructure includes research equipment, pilot plants (small production plants that test processes before they are commercialised), technology demonstrators (proof concepts to showcase possible applications, feasibility, performance and methods of ideas for new technologies), and facilities for specialised sectors such as aerospace.

The National Integrated Cyber-infrastructure System, implemented by the Council for Scientific and Industrial Research, supports the successful and sustainable implementation of national projects such as MeerKAT and the Square Kilometre Array (SKA), as well as large research infrastructure dependent on the presence of a robust cyber-infrastructure system.

The department also support scientific research in strategic research areas defined by South Africa's geographic advantage, such as palaeosciences, astronomy, climate change, marine and polar research, and indigenous knowledge.

The department is expected to invest in a range of ICT initiatives such as artificial intelligence, nanotechnology, quantum computing and biotechnology, many of which are essential for South Africa to exploit the opportunities associated with the fourth industrial revolution.

It is also driving the pursuit of new sectors and sources of growth while endeavouring to the green economy. The Biorefinery Innovation Programme aims to enhance the competitiveness of these sugar and forestry sectors by developing technologies to produce new renewable products from agricultural feedstocks.

The DSI has initiated a new Carbon Capture Storage and Use RDI Flagship Programme, which aims to integrate aspects of digitisation and the circular economy in order to extract chemical elements from waste gases in an environmentally sustainable manner.

By combining a selected suite of local and international technologies, and involving the triple helix of government, academia and industry, the programme seeks to demonstrate the possibility of converting the carbon dioxide contained in coal-fired power station flue gases into multiple chemical commodity streams using green ammonia and green hydrogen.

The programme aims to address multiple environmental, economic and societal challenges while enabling the country to extract maximum value from its vast coal resources in a sustainable and environmentally friendly manner.

MeerKAT

The 64-dish MeerKAT radio telescope, situated some 90 km outside the small Northern Cape town of Carnarvon, is a precursor to the Square Kilometre Array (SKA) telescope.

The mega infrastructure project continues to generate new findings that are adding to the global body of radio astronomy knowledge.

Square Kilometre Array

The SKA project is an important endeavour for Africa, with huge potential to contribute to and raise the profile of science, technology and innovation. The SKA Project is an international enterprise to build the largest and most sensitive radio telescope in the world, and will be located in Africa and Australia.

Supported by 10 member countries – Australia, Canada, China, India, Italy, New Zealand, South Africa, Sweden, The Netherlands and the United Kingdom – SKA Organisation has brought together some of the world's finest scientists, engineers and policy makers and more than 100 companies and research institutions across 20 countries in the design and development of the telescope.

Hydrogen Fuel Cell Technology (HFCT)

Local HFCT development holds the promise of boosting manufacturing capacity and competitiveness in South Africa.

This forms part of the technologies which seek to boost the economy and create much-needed jobs. HFCT has been indentified as a clean and reliable alternative energy source to fossil fuels.

Titanium metal powder project

Government supports the Titanium Metal Powder Project, which has a potentially significant economic impact for South Africa. Titanium is used in industries such as aerospace, medical applications, transport and chemocal processing to create high-performance, lighweight parts.

The titanium powder is also used in 3D printing, which is considered an alternative mode of manufacturing.

National Bio-economy Strategy

The Bio-economy Strategy positions bio-innovation as essential to the achievement of government's industrial and social development goals.

The strategy provides a high-level framework to guide biosciences research and innovation investments, as well as decision-making as South Africa adapts to the realities of global transition to a low-carbon economy.

Through the Bio-economy Strategy, bio-innovation would be used to generate sustainable economic, social and environmental development.

The DSI was aiming to have biotechnology make up 5% of the country's gross domestic product by 2050.

The strategy focused on three sectors namely agriculture, health and industrial applications and is also closely linked to other policies such as the Industrial Policy Action Plan, the NDP and the New Growth Path.

Entities

Academy of Science of South Africa (ASSAf)

The ASSAf aspires to be the apex organisation for science and scholarship in South Africa, recognised and connected both nationally and internationally.

The ASSAf recognises and rewards excellence; promotes innovation and scholarly activity; provides effective, evidence-based scientific advice to government and other stakeholders;promotes public interest in and awareness of science and science education; and promotes national, regional and international linkages.

Council for Scientific and Industrial Research

The CSIR is a world-class African research and development organisation, which was established through in 1945. It undertakes directed, multidisciplinary research and technological innovation that contributes to the improved quality of life of South Africans.

The organisation plays a key role in supporting government's programmes through directed research that is aligned with the country's priorities, the organisation's mandate, and its science, engineering and technology areas of competence.

Human Sciences Research Council (HSRC)

The HSRC is mandated to initiate, undertake and foster strategic basic and applied policy research in the human sciences, and to gather, analyse and publish data relevant to developmental challenges in South Africa, elsewhere in Africa and in the rest of the world.

National Advisory Council on Innovation (NACI)

The NACI is a statutory advisory board that advises on the role and contribution of science, mathematics, innovation and technology in promoting and achieving national objectives.

National Research Foundation (NRF)

The primary objective of the NRF is to contribute to the improvement of the quality of life of all the people of the country through the promotion of a knowledge economy based on the generation, transfer and use of knowledge.

The organisation promotes and supports research through the provision of grants and bursaries, research infrastructure, international and industry collaboration opportunities and mobility through all the stages of a researcher's career, across the spectrum of basic, applied, and strategic research, with an appropriate mix of programmes and funding mechanisms, in alignment to national priorities.

South African Council for Natural Scientific Professions (SACNASP)

The SACNASP is the regulatory body for natural science practitioners (professional natural scientists, natural scientists in training, natural science technologists and natural science technologists in training) in South Africa.

South African National Space Agency (SANSA)

SANSA is mandated to promote the peaceful use of space; support the creation of an environment conducive to industrial development in space technology; foster research in space science, communications, navigation and space physics; advance scientific, engineering and technological competencies and capabilities through human capital development, outreach programmes and infrastructure development; and foster international cooperation in space-related activities.

SANSA provides space weather knowledge, expertise, products and services through the SANSA Space Weather Centre, which is the only Regional Warning Centre for Africa under the International Space Environment Service.

It is also the only organisation performing compass swings in South Africa, making it an invaluable service to the nation and ensuring the safety of thousands of planes every year.

Technology Innovation Agency (TIA)

TIA is mandated to provide customer-centric technology development funding and support, to provide an enabling

environment for technology innovation in collaboration with other role players, and to develop an effective and efficient internal environment for the execution of the strategy.

Research and science bodies

South African Bureau of Standards (SABS)

The SABS provides standardisation and conformity assessment services to protect the integrity of the South African market, protect consumers, create a competitive advantage for South African industry, and facilitate access by South Africans to local and international markets. The bureau is the sole publisher of South African national standards.

National Intellectual Property Management Office (NIPMO)

NIPMO provides support to the offices of technology transfer at publicly funded research institutions, which has led to significantly improved intellectual property management in universities and other research institutions.

Agricultural Research Council (ARC)

The ARC conducts fundamental and applied research with partners to generate knowledge, develop human capital, and foster innovation in agriculture by developing technology and disseminating information.

Mintek

Mintek, South Africa's national mineral research organisation, develops appropriate and innovative technology for transfer to the minerals industry; and provides the industry with test work, consultancy, analytics and mineralogical services.

Council for Geoscience (CGS)

As a scientific research council, the CGS provides for the promotion of research and the extension of knowledge in the field of geoscience as well as the provision of specialised geoscientific services.

South African Medical Research Council

The SAMRC is an independent statutory body that coordinates health and medical research activities throughout South Africa. The scope of the organisation's research projects includes tuberculosis, HIV and AIDS, cardiovascular and

non-communicable diseases, gender and health, and alcohol and other drug abuse.

With a strategic objective to help strengthen the health systems of the country, in line with that of the Department of Health, the SAMRC constantly identifies the main causes of death in South Africa.

National Health Laboratory Service (NHLS)

The NHLS is the largest diagnostic pathology service in South Africa with the responsibility of supporting the national and provincial health departments in the delivery of healthcare.

The NHLS provides laboratory and related public health services to over 80% of the population through a national network of laboratories. Its specialised divisions include the National Institute for Communicable Diseases, National Institute for Occupational Health, National Cancer Registry and Antivenom Unit.

Bureau for Economic Research (BER)

The BER primarily focuses on the South African macro economy and selected economic sectors. It monitors and forecasts macroeconomic economic and sector trends, and identifies and analyses local and international factors that affect South African businesses.

National Institute for Tropical Diseases

The National Institute for Tropical Diseases in Tzaneen, Limpopo, is responsible for the ongoing assessment of malaria-control programmes carried out by various authorities in South Africa. A malaria-reference service is also provided. Malaria tests are carried out by the institute, and statistical analyses of data pertaining to the programme is undertaken.

South Africa's National Energy Development Institute (SANEDI)

The main function of SANEDI is to direct, monitor and conduct applied energy research and development, demonstration and deployment as well to undertake specific measures to promote the uptake of Green Energy and Energy Efficiency in South Africa.

National Agricultural Research Forum (NARF)

The mission of the NARF is to facilitate consensus and integrate coordination in the fields of research, development, and technology transfer to agriculture in order to enhance national economic growth, social welfare and environmental sustainability.

Water Research Commission (WRC)

The WRC aims to develop and support a water-related knowledge base in South Africa, with all the necessary competencies and capacity vested in the corps of experts and practitioners within academia, science councils, other research organisations and government organisations (central, provincial and local) which serve the water sector.

The WRC provides the country with applied knowledge and water-related innovation, by continuously translating needs into research ideas and, in turn, transferring research results and disseminating knowledge and new technology-based products and processes to end-users.

Institute for Water Research (IWR)

The IWR is a multidisciplinary research department of Rhodes University. The objectives of the IWR are to contribute to the knowledge of and promote the understanding and wise use of natural water resources in southern Africa.

South African Environmental Observation Network (SAEON)

SAEON is a research facility that establishes and maintains nodes (environmental observatories, field stations or sites) linked by an information management network to serve as research and education platforms for long-term studies of ecosystems that will provide for incremental advances in the understanding of ecosystems and the ability to detect, predict and react to environmental change.

Fluorspar industry

South Africa has the world's largest reserves of fluorspar, with estimated reserves of 41 million tons. The country supplies around 10% of the flouride requirements to the global flourochemicals industry.