SCIENCE AND TECHNOLOGY

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The Department of Science and Technology seeks to realise the full potential of science and technology (S&T) in social and economic development, through the development of human resources (HR), research and innovation.

The department primarily focuses on implementing the National Research and Development Strategy (NRDS), which provides for an integrated approach to HR development, knowledge generation, investment in infrastructure and improving the strategic management of the public S&T system.

Between 2007/08 and 2008/09, total research and development (R&D) expenditure in South Africa increased from R18,633 billion to R21,041 billion, representing a nominal annual increase of R2,4 billion (or 12,9%). This is 2,2% in real terms, when the effects of price increases are removed from the equation.

Strategies and programmes

The department has five strategic goals, namely to:

- develop the innovation capacity of the science system and thereby contribute to socio-economic development
- develop South Africa's knowledge-generation capacity
- develop appropriate human capital for research, development and innovation (RDI)
- build world-class RDI infrastructure
- position South Africa as a strategic international RDI partner and destination.

Human-capital development

The Department of Science and Technology's Human Capital and Science Platforms (HC&SP) Subprogramme supports new and emerging researchers.

In 2009/10, it rendered support to 43 postdoctoral students and 287 Honours students in Science, Engineering and Technology. A number of postdoctoral students received funding through centres of excellence and the South African Research Chairs Initiative (SARChI).

The SARChI is proving to be an effective instrument for developing human capital.

During 2009/10, the number of research chairs increased from 72 to 82 with the appointment and public announcement of 10 new research chairs in August 2009.

In May 2010, the South African Astronomical Observatory in Cape Town won a bid to host the International Astronomical Union's (IAU's) Office for Astronomy Development, which will play a key role in taking astronomy to the developing world.

The office will play a central role in coordinating and managing all IAU educational activities, as well as in recruiting and mobilising volunteers.

South Africa was chosen as the winner from about 20 countries that submitted proposals.

The number of students and postdoctorates supported under the research chairs grants grew from 392 in 2007 to 514 in 2009.

In addition to students supported through research chairs' grants, a number of students with other sources of funding are supervised and mentored by research chairs.

These students grew from 252 in 2007 to 397 in 2009/10, bringing the total number of students supervised and mentored by research chairs to 644 and 911 in 2007 and 2009, respectively.

Astronomy

South Africa continues to promote high-technology investment in space science to ensure that local researchers and students are able to participate in international astronomy.

A key result was the launch of the Southern African Large Telescope (Salt) in November 2005, in Sutherland in the Northern Cape. Salt is a multimillion rand project involving Germany, Poland, the United States of America, New Zealand

By October 2010, five years before South Africa's MeerKAT telescope becomes operational, more than 43 000 hours of observing time (adding up to about five years) had already been allocated to radio astronomers from Africa and around the world, who have applied for time to do research with this instrument. Surveys of radio pulsars and hydrogen gas in the deep universe came out on top in the first round of allocating MeerKAT's observing time.

MeerKAT is South Africa's precursor telescope to the Square Kilometre Array and will consist of 64 dishes, each 13,5 m in diameter. It will be built in the radio astronomy reserve near Carnarvon in the Northern Cape over the next five years. An engineering test bed of seven dishes (KAT-7) is already complete.

and the United Kingdom. Salt is the largest single optical telescope in the southern hemisphere.

South Africa has been shortlisted, along with Australia, as one of the sites for the world-class radio telescope, the Square Kilometre Array (SKA). A final decision in this regard is expected in 2012/13.

In October 2010, South African astronomy received a major boost, in the form of a R100-million, ultra-high-speed broadband link between the Northern Cape sites of the Salt and SKA and the South African National Research Network in Cape Town.

The link will enable local and international researchers to process data from the Salt and the SKA in near real time, and significantly boost South Africa's bid to host the SKA.

The 62nd International Astronomical Congress will be held in Cape Town in October 2011.

The National Space Strategy and South African National Space Agency (Sansa) were launched in December 2010.

The Sansa will be responsible for implementing the country's National Space Strategy. Its mandate is to promote the peaceful use of space, foster research in space science and communications navigation and promote international cooperation in space-related activities.

Nanotechnology

Known as "the technology of the very small" (that is about 1/80 000 of the diameter of a human hair), nanotechnology comprises a wide range of technologies, techniques and multidisciplinary research efforts for application in a range of cross-cutting industries and activities.

These include aerospace, manufacturing and automotive industries; energy conversion, storage and distribution; the hydrogen economy; chemicals; electronics and information processing; as well as biotechnology and medicines.

The Department of Science and Technology has established nanotechnology innovation centres based on a triangular model, involving higher education institutions, government and some industry players. This ensures the concurrent realisation of human-capital development and nanotechnology innovation.

The South African Government has been promoting the need to involve industry in nanotechnology development. The

department drafted a nanotechnology research plan that will guide development efforts to ensure that strategic objectives are met.

As with all new technologies, nanotechnology holds potential risks to health, safety and ethical practices. The National Nanotechnology Strategy requires that the Department of Science and Technology considers these vitally important areas, and the department is working to provide a platform for the proactive identification and mitigation of risks. Through the establishment of the Nanotechnology Ethics Committee and the Nanotechnology Health, Safety and Environmental Research Platform, efforts are being made towards ensuring the responsible development and application of nanotechnology.

Indigenous Knowledge System (IKS)

The Department of Science and Technology established the National Indigenous Knowledge Systems Office (Niko) to, among other things, increase public awareness, understanding, knowledge and appreciation of the IKS. Niko has created an appropriate platform through the Interdepartmental Committee on IKS to coordinate and promote the work of different departments.

The National Recordal System, a large fingerprint initiative of the Department of Science and Technology, will document, record and store indigenous knowledge for the benefit of the communities of South Africa. It will be the first worldwide.

The system also aims to collect grassroots community experiences in local languages. This flagship project creates a platform for the documentation of unrecorded and oral forms of indigenous knowledge for posterity.

The National Recordal System will be developed in phases. In 2010, the department tested the cataloguing system as it documented indigenous knowledge at six sites spread across four provinces.

Biotechnology

South Africa's research institutions and universities are conducting biotechnology research to increase production of crops suited to local conditions, enhance crop nutritional value and improve preservation and processing methods resulting in novel and improved food products.

Research is being conducted on understanding the nutritional components of food indigenous to South Africa, with the aim of making those with a high nutritional value available and accessible to the majority of people.

South Africa is classified as one of the 14 mega biotech countries in the world, and the only one in Africa. These countries, including South Africa, have a special responsibility to ensure that the potential impacts of genetically modified organisms on human or animal health; on the environment; together with their probable socio-economic impact, are carefully measured, assessed and estimated before they are released. A favourable risk-benefit ratio can only be ensured in this way.

Supporting innovators

Technology Innovation Agency (TIA)

TIA was formed from a merger of seven organisations funded by the Department of Science and Technology, including the Advanced Manucfacturing Technology Strategy, Biotechnology Partnerships and Development, Cape Biotech, Innovation Fund, LIFElab, PlantBio and Tshumisano and is mandated to stimulate and intensify technological innovation to improve economic growth and the quality of life of all South Africans.

The agency seeks to build on the achievements of its forming entities, by continuing to support innovation and product development in the sectors it operates within.

Among the key projects and initiatives that receive support from TIA is the Centre for the AIDS Programme of Research in South Africa 004 trial of the Tenofovir microbicide gel, for the prevention of HIV infection in women. The results of the trial were announced at the 18th International AIDS Conference in Vienna.

The microbicide containing 1% Tenofovir, an antiretroviral drug widely used in the treatment of HIV, was found to be 39% effective in reducing a woman's risk of becoming infected with HIV during sex and 51% effective in preventing genital herpes infections in the women participating in the trial.

National Advisory Council on Innovation (Naci)

The Naci Act, 1997 mandates the council to advise the Minister of Science and Technology, and through him/her the

Cabinet, on the role and contribution of innovation (including S&T) in promoting and achieving national objectives.

These national objectives include the improvement of the quality of life of South Africans, the promotion of sustainable economic growth and international competitiveness.

The advice should be directed at, among other things:

- coordinating and stimulating the National System of Innovation (NSI)
- promoting cooperation within the NSI
- structuring, governing and coordinating the S&T system
- revising the innovation policy
- strategies for the promotion of all aspects of technological innovation
- identifying R&D priorities
- funding the S&T system.

National research facilities

The National Research Foundation (NRF) manages South Africa's national research facilities. It promotes and supports basic and applied research. The NRF oversees the following national research facilities:

- South African Astronomical Observatory
- Hartebeesthoek Radio Astronomy Observatory
- Hermanus Magnetic Observatory
- South African Institute for Aquatic Biodiversity
- South African Environmental Observation Network
- National Zoological Gardens
- iThemba Laboratory for Accelerator-Based Sciences (iThemba Labs).

Science councils

Council for Scientific and Industrial Research (CSIR)

The CSIR is one of the largest scientific and technology, R&D and implementation organisations in Africa. The organisation undertakes and applies directed research and innovation in S&T to improve the quality of life of South Africans.

Mintek

Mintek, South Africa's national mineral-research organisation, is one of the world's leading technology organisations specialising in mineral processing, extractive metallurgy and related areas.

South Africa's all-electric car, known as "Joule", was on show in April 2010 at the Geneva Motor Show in Switzerland, one of Europe's most important automotive industry events.

The plug-in, zero-emission vehicle gave designers an idea of the final design and layout of the car when it goes on sale early in 2013.

However, South African motorists expected Joule on the country's roads earlier, as a fleet was mobile to gather technical feedback on the car and to gauge public response. These cars, like the show car, would be hand-built in Port Elizabeth.

The car was conceived by Cape Town-based Optimal Energy and originally designed by South African-born Keith Helfet.

Collaborating with industry and other R&D institutions, Mintek provides service testwork, process development, consulting and innovative products to clients worldwide.

Human Sciences Research Council (HSRC)

The HSRC conducts research that generates critical and independent knowledge, relative to all aspects of human and social development. Alleviating poverty and developing and implementing policy are central to its research activities.

The HSRC's research also extends beyond South Africa through projects and collaborations in other African countries.

Medical Research Council (MRC)

The MRC conducts research through six national programmes, and collaborates with most of the world's top health-research agencies to improve the nation's health status and quality of life.

The MRC disseminates research information through the National Health Knowledge Network. The council has established the African Biotechnology Information Centre in cooperation with various universities.

The MRC's National HIV and AIDS Lead Programme co-ordinates the South African AIDS Vaccine Initiative.

Agricultural Research Council (ARC)

The ARC is committed to promoting agriculture, and related sectors, through research and technology development and transfer.

Council of Geoscience (CGS)

The CGS supplies the country with geoscience data to establish a safe and cost-effective physical infrastructure.

South African Bureau of Standards (SABS)

The SABS produces, maintains and disseminates standards. It promotes standardisation in business and government, and administers compulsory standards on behalf of the State. It also certifies international quality standards.

Other important research bodies and areas

The National Institute for Tropical Diseases in Tzaneen, Limpopo, continually assesses various malaria-control programmes.

The South African National Antarctic Programme manages three bases, one at Vesleskarvet, Antarctica; a second on Marion Island in the south Indian Ocean; and a third on Gough Island, a British territory in the South Atlantic Ocean.

South Africa is the only African country with a presence in Antarctica, and which is also conducting research there in physics, engineering, Earth sciences, and biological and oceanographic sciences.

The South African base, Sanae IV, is one of the few country bases built on hard rock, as opposed to the ice shelf. The Department of Science and Technology has finalised the Antarctic Research Strategy for South Africa.

Mine-safety research

The Safety in Mines Research Advisory Committee aims to advance mineworkers' safety. It has a permanent research-management office overseeing research in rock engineering, engineering and occupational health.

Energy research

The Chief Directorate: Energy of the Department of Energy manages a policy-directed research programme.

This includes transport energy, renewable energy and energy for developing areas, coal, electricity, energy efficiency, energy economy and integrated energy-policy formulation.

Agricultural research

Agricultural research is conducted by the ARC, several universities and the private sector.

Water research

Water research in South Africa is coordinated and funded by the Water Research Commission in Pretoria.

The organisation's most active partners in water research are:

- universities and universities of technology
- professional consultants
- science councils
- water and waste utilities
- non-governmental organisations.

Coastal and marine research

The Chief Directorate: Integrated Coastal Management of the Department of Environmental Affairs advises on the use of marine living resources and the conservation of marine ecosystems, by conducting and supporting relevant multidisciplinary scientific research and monitoring the marine environment.

Environmental research

The Chief Directorate: Environmental Management of the Department of Environmental Affairs annually finances several research and monitoring programmes.

The programmes focus on, among other things, waste management and pollution, nature conservation, river management, the coastline and marine environment, and the atmosphere.