



The Department of Science and Technology (DST) executes its mandate through the implementation of the 1996 White Paper on Science and Technology, the national research and development strategy and the Ten-Year Innovation Plan (TYIP). The plan aims to make science and technology a driving force in enhancing productivity, economic growth and socio-economic development.

The department's strategic goals are to:

- develop the innovation capacity of the national system of innovation to contribute to socio-economic development
- enhance South Africa's capacity for generating knowledge to produce world class research outputs and turn some advanced findings into innovation products and processes
- develop appropriate human capital in the science, technology and innovation sector to meet the needs of society
- build world class infrastructure in the science, technology and innovation sector to extend the frontiers of knowledge, train the next generation of researchers, and enable technology development and transfer as well as knowledge exchange
- position South Africa as a strategic international research and development and innovation partner and destination through the exchange of knowledge, capacity and resources between South Africa and its regional and other international partners, thus strengthening the national system of innovation.

To attract young people to science, the DST invested R497 million to implement a coordinated approach to science education, science awareness and science communication. The programmes – run through the South African Agency for Science and Technology Advancement (Saasta) – are expected to reach about 350 000 learners and about 12 500 to 13 000 teachers per annum.

## Legislation

The DST is governed by the following legislation:

- Intellectual Property Rights from Publicly Financed Research and Development (IPR) Act, 2008 (Act 51 of 2008): Provides for the more effective use of intellectual property emanating from publicly financed research and development, through the establishment of the National Intellectual Property Management Office (Nipmo), the Intellectual Property Fund, and offices of technology transfer at institutions.
- Technology Innovation Act, 2008 (Act 26 of 2008): Intended to promote the development and exploitation in the public interest of

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discoveries, inventions, innovations and improvements, and for that purpose establishes the Technology Innovation Agency (TIA).

- South African National Space Agency (Sansa) Act, 2008 (Act 36 of 2008): Establishes the Sansa to promote space science research, cooperation in space-related activities, and the creation of an environment conducive to the development of space technologies by industry.
- Natural Scientific Professions Act, 2003 (Act 27 of 2003): Establishes the South African Council for Natural Scientific Professions, and legislates the registration of professional natural scientists, natural scientists-in-training, natural science technologists and natural science technologists-in-training.
- National Research Foundation (NRF) Act, 1998 (Act 23 of 1998): Establishes the NRF to promote basic and applied research, as well as the extension and transfer of knowledge in the various fields of science and technology.
- National Advisory Council on Innovation (Naci) Act, 1997 (Act 55 of 1997): Establishes the Naci to advise the Minister of Science and Technology on the role and contribution of science, mathematics, innovation and technology in promoting and achieving national objectives.
- Africa Institute of South Africa (Aisa) Act, 2001 (Act 68 of 2001): Establishes the Aisa to promote knowledge and understanding of African affairs by encouraging leading social scientists.
- Human Sciences Research Council (HSRC) Act, 2008 (Act 17 of 2008): Provides for the HSRC, which carries out research that generates critical and independent knowledge relative to all aspects of human and social development.
- The Scientific Research Council Act, 1988 (Act 46 of 1988): Refers to the activities of the Council for Scientific and Industrial Research (CSIR), one of the leading scientific and technological research, development and implementation organisations in Africa, which undertakes directed research and development for socio-economic growth in areas including the built environment, defence, the environmental sciences, and biological, chemical and laser technologies.
- Astronomy Geographic Advantage Act, 2007 (Act 21 of 2007): Provides for the preservation and protection of areas in South Africa that are uniquely suited to optical and radio astronomy, and for intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas.

**i**In August 2014, the 19th World Congress of the International Federation of Automatic Control (IFAC) took place in Cape Town under the theme: "Promoting automatic control for the benefit of humankind." IFAC aims to promote the S&T of automatic controls in theory and application. It provides a platform for collaboration between individuals, organisations and institutions concerned with automatic control systems, by allowing experts in related fields to exchange ideas. Since 1960, the congress has been held every three years and attracts academia, industry professionals, students and organisations involved in automation.

- The Science and Technology Laws, Amendment Act, 2014 (Act 7 of 2014) seeks to, among other things, streamline the process for the nomination and appointment of members of the boards or councils of such entities as well as the filling of vacancies on the boards.
- The Geoscience Amendment Act, 2010 (Act 12 of 2010), amends the Geoscience Act, 1993 (Act 100 of 1993), to mandate the Council for Geoscience (CGS) to be the custodians of geotechnical information; to act as a national advisory authority in respect of geohazards related to infrastructure and development; and to undertake exploration and prospecting research in the mineral and petroleum sectors.
- Sanren, which is responsible for the roll-out of a high-speed broadband network to all academic and research institutions in the country, was awarded a private electronic communications network licence exemption under the Electronic Communications Act, 2005 (Act 36 of 2005).
- New science and technology legislation that was adopted in 2014 included:
- Science and Technology Laws Amendment Act, 2014 (Act 7 of 2014).

## Policy mandate and strategies

The DST's major policy documents are the White Paper on Science and Technology of 1996, the 2002 National Development Research Strategy (NRDS), the New Strategic Management Model for South Africa's Science and Technology System (2004) – with its Policy on Governance Standards for Science, Engineering and Technology Institutions and Framework for the Development of a National Science and Technology Expenditure Plan – and the 2007 TYIP.

The DST is the custodial coordinator for the development of the national System of Innovation (NSI) and influences this system through key strategies such as the NRDS and the TYIP. The latter, particularly, seeks to contribute to the transformation of the South African economy into a knowledge-based economy, in which the

production and dissemination of knowledge will lead to socio-economic benefits and enrich all fields of human endeavour.

## National Research and Development Strategy

The NRDS as the basis for the NSI and requires performance and responses in three key areas, enhanced innovation; providing science, engineering and technology human resources (HR) and transformation; and creating an effective government science and technology system.

A prime objective of the NSI was to enhance the rate and quality of technology transfer from the science, engineering and technology sector by providing quality HR, effective hard technology transfer mechanisms, and creating more effective and efficient users of technology in the business and government sectors.

The White Paper also set out the institutions to be established to promote the development of a well-functioning NSI. These were to be the national Ministry and DST, the National Advisory Council on Innovation, the NRF, the Innovation Fund, and national research facilities managed by government.

The NRDS is aimed at being a key enabler of economic growth alongside other strategies, such as the HR Development Strategy, the Integrated Manufacturing Strategy and the Strategic Plan for South African Agriculture.

## Ten-Year Innovation Plan

The TYIP is aimed at assisting to establish a knowledge-based economy for South Africa, in which the production and dissemination of knowledge lead to economic benefits and enrich all fields of human endeavour.

The missions and platforms under the NRDS were expanded under the TYIP to include grand challenges in space science and technology, energy security, human and social dynamics in development, global change, and the bio-economy.

The responsibility for addressing the grand challenges is spread across many government departments.

The TYIP also set long-term goals based on the grand challenges it identified. They included:



The Minister of Science and Technology unveiled a R30 million “cleanroom” facility at Mintek’s Nanotechnology Innovation Centre in Johannesburg in April 2015. The facility allows for the manufacture of devices that permit the rapid diagnosis of illnesses such as malaria. The department said early diagnosis and treatment of such diseases can help save lives and having the “cleanroom” is a major step towards disease control in South Africa.

- becoming one of the top three emerging economies in the global pharmaceutical industry, based on innovative use of South Africa’s indigenous knowledge and rich biodiversity
- deploying satellites that provide a range of scientific, security and specialised services for all spheres of government, the public and the private sector.
- achieving a 25% share of the global hydrogen and fuel cell market with novel platinum group metal catalysts.
- becoming a world leader in climate science and responding effectively to the multiple challenges associated with global and climate change.
- meeting the 2014 millennium development goal to halve poverty.

The department has set indicators for each of these goals.

## National Nanotechnology Strategy

Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering.

Microscopy – the technical field of using microscopes to view samples and objects that cannot be seen with the unaided eye – was a boon to emerging research areas such as nanotechnology. This was aligned with the objectives of the National Nanotechnology Strategy. The growth of microscopy is essential to help government expand its research capabilities in important health- and economy related fields. The NRF has been supporting the microscopy community.

In November 2014, the Minister of Science and Technology officially opened the Centre for Nanotechnology Innovation at Rhodes University in Grahamstown placing the institution at the forefront of international nanotechnology research.

The centre will house new nanotechnology equipment called time of flight-secondary-ion-mass-spectrometer (TOF-SIMS) bought through a R17-million investment from the DST and the NRF.

The centre would become one of the most advanced facilities of its kind in a university environment in South Africa.

The TOF-SIMS is used to examine thin films and provide surface composition of these films. It is also used for the study of surface characteristics of nanoparticles.

The equipment could be used in the fields of pollution treatment, green chemistry, forensic sciences and biotechnology, and could be geared

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The Chinese automotive manufacturer First Automotive Works (FAW), launched its R600-million assembly plant in Zone 2 of the Coega Development Corporation's (CDC) Industrial Development Zone (IDZ) in July 2014, and the plant was opened by President Jacob Zuma. FAW's decision to build the plant in South Africa is significant as it is one of the biggest manufacturing investments by a Chinese entity in the country. It created Chinese investor confidence in South Africa, inspiring further Chinese investments in the country. Chinese manufacturers Powerway Engineering (R127-million) and Powerway Photo Voltaic (R666,6 million) have confirmed their investments in the IDZ, bringing the total sum of Chinese investment in the IDZ to R1,394 billion.

towards energy and sustainable development.

TOF-SIMS could benefit industries such as aerospace, automotive, biomedical, biotechnology, telecommunications, pharmaceuticals, data storage and defence.

The centre is a national facility that would be used by Eastern Cape universities, the Nelson Mandela Metropolitan University (NMMU); Walter Sisulu University; the University of Fort Hare; the University of KwaZulu-Natal; the University of the Western Cape; the University of Johannesburg; the North West University; as well as other South African institutions, such as the CSIR; Mintek.

It would also aid international researchers from countries such as China, Kuwait and Turkey.

A second major investment in nanoscience in the Eastern Cape would see the NMMU receive an ultra high-resolution transmission electron microscopy facility, making the Eastern Cape a significant nanotechnology hub.

TshepisoSat, South Africa's first nano-satellite, coincidentally took a photograph of Earth, from 600 km in space. It also took a photo of the sun. In November 2013, TshepisoSat (Code name ZA-CUBE1) was successfully launched. TshepisoSat was designed and built by Cape Peninsula University of Technology postgraduate students to monitor space weather. The tiny 1,2 kg cube will travel 6-billion kilometres in space before re-entry into the Earth's atmosphere. The 10-m long antenna deployed in February 2014 and sent radio signals, which assisted research on the ionosphere. Ionosphere density and composition is important for high frequency communications.

## National biotechnology Strategy

In January 2014, the DST launched the South African Bio-economy Strategy, positioning bio-innovation as essential to the achievement of government's industrial and social development goals.

This science-based Bio-economy Strategy, which had been approved by Cabinet in November 2013, would replace the National Biotechnology Strategy, which had been in place since 2001. The strategy would create an enabling environment that would allow government departments, industry, venture capital firms and other stakeholders to move forward with initiatives to meet the challenges and embrace the opportunities of the future.

The bio-economy concept is much broader [than that of the biotechnology strategy], looking at the entire value chain in a range of areas of possibility and opportunity, in response to South Africa's priority areas of need.

Through the Bio-economy Strategy, bio-innovation would be used to generate sustainable economic, social and environmental development. The DST 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 (IPAP), the National Development Plan (NDP) and the New Growth Path (NGP).

A draft implementation plan for the strategy was completed by August 2014, after which it was passed through the DST and National Treasury's processes.

There were some regulations that did not support the Bio-economy Strategy that had to be dealt with in such a way that the people of the country were still protected, but without hampering development.

## Budget and funding

The DST's budget allocation for 2014/15 was R6,47 billion. The largest portion of the budget, R3,5 billion, was allocated to research and development (RTD). Of this, R1,7 billion is to be spent on research grants and bursaries.

The primary allocations of the R&D infrastructure budget are: R159 million for the scientific equipment category implemented by the NRF through the national equipment and nanotechnology equipment programmes, R105 million towards specialised facilities and R91 million to the national facilities of the NRF. A further R24 million has been made available in the high end infrastructure category for lithium battery development and titanium additive manufacturing laboratories, and a primary titanium pilot plant.

## Role players

### Academy of Science of South Africa (ASSAf)

ASSAf was inaugurated in May 1996 by the former President of South Africa and patron of the academy, Nelson Mandela. It was formed in response to the need for an academy of science congruent with the dawn of democracy in South Africa – activist in its mission of using science for the benefit of society.

The mandate of the ASSAf encompasses all fields of scientific enquiry and it includes the full diversity of South Africa's scientists. The Parliament of South Africa passed the Academy of Science of South Africa Act, (Act 67 of 2001), which came into operation in May 2002.

ASSAf represents the country in the international community of science academies.

Since its inception, ASSAf has grown from a small, emergent organisation to a well-established academy.

In January 2015, ASSAf launched a consensus study, the State of Green Technologies in South Africa. The overall aim of the study, which was commissioned by the DST, is to document green technologies being used in South Africa; to identify gaps in and opportunities for the use of these technologies; and to make recommendations to promote the growth of green technologies.

Transitioning to a green economy is one of the key imperatives of government, as highlighted in the NDP. The use of green technologies is an integral part of the green economy, making this study both timely and important.

### Africa Institute of South Africa

Aisa was first established in 1960 as a non-profit organisation. It is a statutory body following the Africa Institute of South Africa Act, 2001 (Act 68 of 2001).

South Africa and Africa have undergone fundamental changes in the past decade and Aisa has been at the forefront of research and training on African affairs. Through the Aisa campus, an annual training programme that educates students from universities in research methodologies, Aisa has contributed to fostering a new generation of research specialists. Aisa has also been able to produce some of the finest research on contemporary African affairs by having its dedicated and highly qualified researchers conduct field research every year throughout Africa.

This means that all research output is based on first hand empirical evidence.

Aisa has also become involved in community outreach programmes by doing all it can to

In 2014, 25-year-old Mandla Maseko from the district of Mabopane, near Pretoria, became the first black African in space. Maseko spent a week at the Kennedy Space Academy in Florida where he skydived and undertook air combat and G-force training. While there he met and posed for pictures with astronaut Buzz Aldrin, who was the second man ever to set foot on the moon after Neil Armstrong as part of the 1969 Apollo 11 space mission.

provide maps and other resources to underprivileged schools in rural South Africa. Aisa has undertaken to promote knowledge creation as a fundamental part of development and growth for Africa and as such aims to encourage research as a career choice for young people as they leave school.

As Africa changes and development becomes ever more important, especially in the globalised world economy, Aisa will continue to produce research of the highest standard.

By working with the best researchers and guided by the highest standards, Aisa will contribute to development and knowledge creation for all Africa.

### Council for Scientific and Industrial Research

The CSIR is one of the leading science and technology research, development and implementation organisations in Africa. The CSIR's main site is in Pretoria, Gauteng, and it is represented in other provinces of South Africa through regional offices. In 2015, the CSIR will be 70 years old.

The generation and application of knowledge reside at the core of the CSIR. This takes place in domains such as biosciences; the built environment; defence, peace, safety and security; materials science and manufacturing; and natural resources and the environment.

Emerging areas of research include science, explored by the CSIR, that could be unique to local circumstances or successful internationally and need to be established for local competitiveness. Examples include nanotechnology, synthetic biology and mobile autonomous intelligent systems.

The CSIR houses specialist research facilities of strategic importance for African science. These include information and communications technology (ICTs); laser technology, and space-related technology.

Research and development activities include intellectual property (IP) management, technology transfer (for commercial gain as well as for social good), knowledge dissemination and impact assessment.

Consulting and analytical services include forensic fire investigations, food and beverage

analysis, environmental testing, engineering forensics, wire rope testing, mechanical testing, fire and explosion tests, sports technology and analysis, and project management.

## Human Sciences Research Council

The HSRC was established in 1968 as South Africa's statutory research agency and has grown to become the largest dedicated research institute in the social sciences and humanities in Africa, doing cutting-edge research in areas that are crucial to development.

The council conducts large-scale, policy-relevant, social-scientific research for public sector users, non-governmental organisations and international development agencies.

Research activities and structures are closely aligned with South Africa's national development priorities. The HSRC's integrated research programmes provide single points of entry – complete with a critical mass of researchers – for interdisciplinary and problem-orientated research in the following areas:

- democracy, governance and service delivery
- economic performance and development
- education and skills development
- social aspects of HIV/AIDS, STIs and TB
- human and social development
- population health, health systems and innovation.

The HSRC's mandate is to inform the effective formulation and monitoring of government policy; to evaluate policy implementation; to stimulate public debate through the effective dissemination of research based data and fact-based research results; to foster research collaboration; and to help build research capacity and infrastructure for the human sciences.

## National Advisory Council on Innovation

The National Advisory Council on Innovation Act, 1997 (Act 55 of 1997) mandates Naci to advise the Minister of Science and Technology and, through the Minister, the Cabinet, on the role and contribution of innovation (including science and technology (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:

- coordination and stimulation of the NSI
- promotion of cooperation within the NSI
- structuring, governance and coordination of the S&T system
- revision of the innovation policy

- strategies for the promotion of all aspects of technological innovation
- identification of R&D priorities
- funding of the S&T system.

## National Research Foundation

As an independent government agency, the NRF promotes and supports research in all fields of knowledge. It also conducts research and provides access to national research facilities. The NRF provides services to the research community, especially at higher education institutions and science councils, with a view to promoting high-level human capital development. The NRF aims to uphold excellence in all its investments in knowledge, people and infrastructure.

The NRF consists of three divisions namely: Research and Innovation Support and Advancement Agency (Risa), which constitutes the research support and promotion agency of the NRF; Saasta, which provides and manages cross-cutting activities that advance science and technology in various communities in South Africa; and the national research facilities that undertake research in specific research fields.

Through Risa, the NRF:

- invests in knowledge, people and infrastructure
- develops the workforce, particularly previously disadvantaged men and women, to help all researchers unlock their full creative potential
- facilitates partnerships and knowledge networks
- supports and provides science and technology information to guide and steer strategic decisions.

Through Saasta, the NRF:

- steers young minds towards careers in science and technology
- interacts with the public on science, engineering and technology issues
- communicates the advances of science and technology to the public.

Through the national research facilities, the NRF:

- provides access to unique technologies, research methods and information

**i** The Department of Science and Technology initiated the Innovation Bridge Technology Showcase and Matchmaking event. Technology-based companies, industry and funding partners, showcased their expertise under one roof. The event was held in Pretoria February 2015, to allow local and international technology-based companies, entrepreneurs and financiers to scout for technology solutions and investment opportunities. The inaugural event included policy dialogues, plenary discussions, technology exhibitions and demonstrations with up to 75 technologies from more than 30 publicly funded organisations.

- provides state-of-the-art research platforms
- offers access to networking opportunities and international collaboration.

The NRF aims to contribute to the knowledge economy in South Africa by attaining at least 1% of global R&D output by 2015.

In April 2015, the NRF and the South African Environmental Observation Network (Saeon) launched the Agulhas System Climate Array, an international oceanographic project, at the Nelson Mandela Metropolitan University.

The project was launched in partnership with the (DEA) Department of Environmental Affairs Ocean and Coasts. The aim of the launch was to showcase the benefits of this large monitoring array in terms of climate research and long-term monitoring, and also the value of scientific collaboration at the intergovernmental department level, between universities and science groups and at the international marine science community level.

### **South African National Space Agency**

Sansa was created to promote the use of space and cooperation in space-related activities while fostering research in space science, advancing scientific engineering through the development of South Africa's human capital and providing support to industrial development in space technologies.

The objectives of Sansa are 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
- foster international cooperation in space-related activities.

Sansa continues to provide state-of-the-art ground-station services to many globally recognised space missions, such as the Nasa and Indian Space Research Organisation Mars missions, and Nasa's Orbiting Carbon Observatory-2, which is giving scientists a better idea of how carbon is contributing to climate change, answering important questions about where carbon comes from and where it is stored.

### **Technology Innovation Agency**

The TIA was established with the objective of stimulating and intensifying technological innovation to improve economic growth and the quality of life of all South Africans by developing

In January 2014, Seemahale Telecoms announced that it was ready to start manufacturing its Android smartphones and tablets in South Africa. With the Independent Communications Authority of South Africa and Vodacom's testing under its belt, Seemahale was ready to take orders for its devices and begin manufacturing. Seemahale plans to start out with a five-inch smartphone and 10.1-inch tablet at price points of R2 500 and R3 500 (including VAT) respectively. Once their first two devices were launched, they aim to launch a low-cost four-inch smartphone and a 7.86-inch tablet with a dual-SIM model. The four-inch Android smartphone will cost less than R1 200, but the 7.86-inch tablet's price was unconfirmed at less than R3 000.

and exploiting technological innovations.

Its core business objective is to support the development and commercialisation of competitive technology-based services and products. The agency primarily uses South Africa's S&T base to develop new industries, create sustainable jobs and help diversify the economy. It invests in the following technology sectors: advanced manufacturing, agriculture, industrial biotechnology, health, mining, energy and ICT.

The agency seeks to achieve its mandate by providing financial and non-financial support to its stakeholders, namely science councils, public entities, higher education institutions, private research institutions and entrepreneurs.

Since 2010 TIA has disbursed a total of R1,2 billion on project contracts and grants. The agency has supported close to 6 838 small and medium enterprises in accelerating technical innovation through technology development at a cost of R286 million. The services provided by TIA have enabled the enterprises to be more competitive and productive. The agency has also funded the placement of 501 interns in various sectors, including at offices of technology transfer and in venture capital companies.

### **National Intellectual Property Management Office**

Nipmo aims to ensure that recipients of funding from a government funding agency assess, record and report on the benefit to society of IP emanating from publicly financed research and development. Recipients must protect IP emanating from publicly financed research and development from appropriation and ensure that it is available to the people of South Africa.

A recipient must identify commercialisation opportunities for IP emanating from publicly financed research and development.

### **Agricultural Research Council (ARC)**

The ARC is the principal agricultural research

institution in South Africa. It conducts fundamental and applied research with partners to generate knowledge, develop human capital, and foster innovation in agriculture by developing technology and disseminating information. It also commercialises research results.

The ARC's functions are carried out through 11 research institutes whose activities are grouped under five divisions:

- field crops (grain and industrial crops)
- horticulture
- animal production and health
- natural resources and engineering
- technology transfer.

The ARC is also responsible for maintaining national assets and undertaking programmes or rendering services that are required from time to time by the department and other stakeholders.

## 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. Working closely with industry and other research and development institutions, Mintek provides service testwork, process development and optimisation, consulting and innovative products to clients worldwide.

Mintek is an autonomous statutory organisation, which reports to the Minister of Mineral Resources. About 35% of the annual budget is funded by the State Science Vote, with the balance provided by contract R&D, sales of products and services, technology licensing agreements, and joint-venture private-sector companies. Mintek has about 780 permanent staff members, more than half of whom are scientists, engineers and other technical research and development specialists.

## Medical Research Council (MRC)

The MRC is an independent statutory body that coordinates health and medical research activities throughout South Africa. The MRC's objectives are:

- promoting the health and quality of life of the population of South Africa
- performing such functions as may be assigned to the MRC by or under the MRC Act, 1991 (Act 58 of 1991).

The MRC is a science council and therefore also a science, engineering and technology institution.

## Council for Geoscience

The CGS is the legal successor of the Geological Survey of South Africa, which was formed in

1912 by the amalgamation of three former surveys, the oldest of which – the Geological Commission of the Cape of Good Hope – was founded in 1895.

## South African Bureau of Standards (SABS)

The SABS is a statutory body that operates as the national institution for the promotion and maintenance of standardisation and quality in connection with commodities and the rendering of services. The SABS:

- publishes national standards, which it prepares through a consensus process in technical committees
- provides information on national standards of all countries as well as international standards
- tests and certifies products and services to standards
- develops technical regulations (compulsory specifications) based on national standards, and monitors and enforces compliance with such technical regulations
- monitors and enforces legal metrology legislation
- promotes design excellence
- provides training on aspects of standardisation.

To maximise its service delivery to the industries it serves, the SABS aligned its activities with seven different industry sectors, each housing the whole range of the SABS services pertinent to a particular industry.

This change ensures easy access to products, faster reaction and turnaround times, and the creation of centres of knowledge excellence that will be easily available to clients.

The seven industry sectors are:

- chemicals
- electrotechnical
- food and health
- mechanical and materials
- mining and minerals
- services
- transportation.

## Eskom

Eskom's Technology Services International group is a multidisciplinary industrial laboratory and consulting organisation. It undertakes testing,

**i** In January 2015, South Africa hosted a capacity-building programme on minerals processing and beneficiation that will benefit countries belonging to the Non-Aligned Movement (NAM). The DST, in collaboration with the NAM Science and Technology Centre, initiated a training programme to address the skills gap in the minerals beneficiation value chain in the NAM member countries.

investigation studies, project management, engineering services and applied research for Eskom and other customers.

### Sasol

Sasol's culture of innovation began in the 1950s when it developed its unique blend of coal gasification and Fischer-Tropsch (FT) technology for its original coal-to-liquids operations at Sasolburg. It has since evolved these operations into fully fledged R&D facilities that form the heart of the Sasol technology R&D group.

Focused FT R&D in the 1980s and 1990s led to the development of the low temperature FT Sasol Slurry Phase process used at Sasolburg, and the high-temperature Sasol Advanced Synthoil™ process used at Secunda.

Sasol Technology's Fuels Technology Division carries out work concerning fuels, lubricants, heating-fuel and road-binding material, research and development, and new product formulation and testing.

In addition, Sasol opened the Sasol Fuels Application Centre (SFAC), a state-of-the-art engine and exhaust emission testing and research facility in Cape Town. The SFAC enables Sasol to conduct sea-level engine and emission tests in line with international standards.

### ArcelorMittal

ArcelorMittal is a global steel-maker, with an industrial presence in 27 countries. It is the leader in all major global markets, including automotive, construction, household appliances and packaging. The group is a leader in research and development, and technology, holds sizeable captive supplies of raw material, and operates extensive distribution networks.

### National Health Laboratory Service (N HLS)

The NHLS has 265 laboratories and employs about 6 500 people. Their activities comprise diagnostic laboratory services; research, teaching and training; and producing sera for anti venom, reagents and media. All laboratories provide laboratory diagnostic services to the Department of Health, provincial hospitals, local authorities and medical practitioners.

Research conducted by the NHLS covers a wide spectrum of activities in all pathology disciplines. Grants in support of research are made by the MRC, the Cancer Association of South Africa, the South African Sugar Association, Poliomyelitis Research Foundation, pharmaceutical companies, private donors and

Preliminary estimates for the the first phase of the Square Kilometre Array (SKA) radio telescope in the Karoo put the potential net foreign inflow into South Africa, for SKA phase one only, at close to R18 billion over the lifetime of the project. Construction is expected to begin in 2017 and conclude in 2024, at an estimated cost to the 10 SKA member countries of €1.5-billion. South Africa, meanwhile, has begun erecting the 64 antennas that will make up the MeerKAT radio telescope, the country's precursor to the SKA, at the SKA South Africa site outside Carnarvon in the Northern Cape.

a number of overseas institutions.

A large part of the research programme is financed by the NHLS itself from the earnings of its laboratory services.

### Bureau for Economic Research (BER)

The BER at the University of Stellenbosch, in the Western Cape, is an independent economic research organisation. It renders a service to organisations ranging from small one-person businesses to policy makers at the highest level of government.

### 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.

Control methods are assessed and recommendations are made to the appropriate authorities regarding equipment, insecticide usage and application. A malaria-reference service is also provided. Malaria tests are carried out by the institute, and statistical analysis of data pertaining to the programme is undertaken.

### Institute for Economic Research on Innovation (Ieri)

Ieri was established as a public-good research organisation with a core competence in the analysis of systems of innovation. Its mandate is to provide research, capacity-building and

community engagement in this field of study. Its tasks involve:

- conducting research into the political economy and policy dimensions of innovation and development
- contributing thought-leadership on the relationship between knowledge and development across economic, social and political domains
- building capabilities and competencies in the understanding of the political economy and policy dimensions of innovation and development
- focusing across local, provincial, national, regional and international geographies.

## Institute for Security Studies (ISS)

The ISS works towards a stable and peaceful Africa characterised by sustainable development, human rights, the rule of law, democracy, collaborative security and gender mainstreaming.

The ISS realises this vision by:

- undertaking applied research, training and capacity-building
- working collaboratively with others
- facilitating and supporting policy formulation
- monitoring trends and policy implementation
- collecting, interpreting and disseminating information
- networking at national, regional and international levels.

## South Africa's National Energy Development Institute (Sanedi)

The DST and the Department of Energy are joint custodians of Sanedi and assist in providing political and strategic focus for the company.

The institute is entrusted with the coordination and undertaking of public interest energy research, development and demonstration.

As such, it is responsible for enabling and implementing the energy technology roadmaps, which support long-term energy policies developed by the Department of Energy.

## Safety in Mines Research Advisory Committee

The activities of the Safety in Mines Research Advisory Committee are aimed at advancing the safety of workers employed in South African mines.

The committee is a statutory tripartite subcommittee of the Mine Health and Safety Council.

It has a permanent research-management office managing the rock engineering, engineering and mine occupational health fields of research.

## National Agricultural Research Forum (NARF)

The NARF coordinates agricultural research and development in the national agricultural research system.

Efforts are made to ensure that the bulk of research serves the needs of small-scale producers.

Research initiatives have been integrated into the various industries in line with the overall objectives of each agricultural sector.

## Water Research Commission (WRC)

The WRC was established in 1971 following a period of water shortages. The WRC is responsible for:

- promoting coordination, cooperation and communication in the area of water research and development

**i** In June 2014, a Cape Town astronomer, Roger Deane, and a team of South African-funded researchers have discovered a trio of closely orbiting supermassive black holes in a galaxy more than 4-billion light years away - confirmation of the country's fast-growing expertise in the field of radio astronomy. Square Kilometre Array. South Africa funded the research leading to the discovery, which has been published in the scientific journal *Nature*.

- establishing water-research needs and priorities
- stimulating and funding water research according to priority
- promoting the effective transfer of IT
- enhancing knowledge and capacity-building within the water sector.

The WRC focuses on five key strategic areas:

- water-resource management
- water-linked ecosystems
- water-use and waste management
- water use in agriculture
- water-centred knowledge.

The main areas of research are surface hydrology, groundwater, hydrometeorology, agricultural water use, water pollution, municipal effluents, industrial water and effluents, drinking water, membrane technology, water ecosystems, hydraulics, mine-water management, water policy, developing communities and the transfer of technology.

## Institute for Water Research

The Institute for Water Research is a multidisciplinary research department of Rhodes University in the Eastern Cape. Its main objective is to contribute to sustainable water-resource management in southern Africa.

This is achieved through scientific research into the structure and function of aquatic ecosystems; the application of research through specialist consultancy services; tertiary-level teaching and training; capacity-building for community development; and service on national and international management and policy-making committees.

## South African National Biodiversity Institute (Sanbi)

The Sanbi's biodiversity research comprises collaborative programmes set up to promote and catalyse knowledge about biodiversity.

The broad scope of research includes the origins, composition and functioning of biodiversity, its conservation and sustainable use, ecosystem services, and biodiversity responses to major drivers such as climate change. The research is organised into three divisions:

- Applied Biodiversity Research
- Biosystematics Research and Biodiversity Collections
- Climate Change and Bio-Adaptation.

## Coastal and marine research

The NRF supports marine and coastal research in partnership with the DEA and the South African Network for Coastal and Oceanic Research.

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

Sustainable use and the need to preserve future options in using marine ecosystems and their resources are guiding objectives in the research and advice provided by the chief directorate.

## National research facilities

The seven national research facilities managed by the NRF are clustered on the basis of their areas of specialisation aligned to the science missions of the NRDs.

### South African Astronomical Observatory (SAAO)

SAAO is the national centre for optical and infrared astronomy in South Africa. Its prime function is to conduct fundamental research in astronomy and astrophysics by providing a world-class facility and by promoting astronomy and astrophysics in southern Africa.

The SAAO contributes to South Africa's future development by creating and disseminating scientific knowledge; providing research infrastructure; and providing an interface between science and society. It is also responsible for managing the operations of the South African Large Telescope (Salt).

### Hartebeesthoek Radio Astronomy Observatory (HartRAO)

The HartRAO is a radio astronomy observatory located in a natural bowl of hills at Hartebeesthoek just south of the Magaliesberg mountain range, Gauteng. It is the only major radio astronomy observatory in Africa.

HartRAO is mainly used for continuum radiometry, spectroscopy, pulsar timing and interferometry but also works together with radio telescopes on other continents as well as the orbiting Highly Advanced Laboratory for Communications and Astronomy radio telescope to perform very long baseline interferometry.

### South African Institute for Aquatic Biodiversity (Saib)

Situated in Grahamstown in the Eastern Cape, Saib is an internationally recognised centre for the study of aquatic biodiversity.

Saib runs a number of large, interdisciplinary and multi-institutional programmes.

The research facility is directed at fish taxonomy, systematics, genetics, phylogeography, biology, ecology, ethology, conservation, and fisheries management.

### South African Environmental Observation Network

Saeon maintains 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 our understanding of ecosystems and our ability to detect, predict and react to environmental change.

The core research programme distinguishes between anthropogenic and natural change as well as unravels the relations between social and ecosystem change.

### National Zoological Gardens (NZG)

Inspired conservation of wildlife through understanding, knowledge and connection, as the vision and mission statements, reflect a commitment by the NZG to bridge the gap between nature and humanity.

This is done by providing a platform on which humanity can gain knowledge about, cultivate a better understanding of and connect with nature in general, but wildlife in particular.

### iThemba Laboratory for Accelerator-Based Sciences

iThemba LABS is a multidisciplinary facility aiming to become the leading African organisation for research, training and expertise in accelerator-based science and technologies.

The infrastructure is based at two sites, namely in the Western Cape, on Old Faure Road, and in Gauteng, on the campus of the University of the Witwatersrand.

iThemba LABS is the only facility in Africa that provides accelerator-based radio isotopes for nuclear medicine, and also the only facility in Africa for specialist cancer treatment using protons and neutrons. This treatment is offered to those who have cancer that do not respond to traditional treatments like chemotherapy and radiotherapy. Patients referred by State hospitals are treated free of charge, and over the past 25 years, 1 800 patients have been treated.

## Programmes and projects

### Alternative energy solution

In November 2014, the DST officially launched

the innovative 2,5 kW hydrogen fuel cell power generator prototype unit at the University of the Western Cape (UWC).

The generator demonstrates South Africa's innovative capabilities in the emerging hydrogen and fuel cell technologies space.

The prototype was developed by the HySA Systems Integration and Technology Validation Centre of Competence (HySA Systems) in collaboration with Hot Platinum (Pty Ltd), a local company involved in power management and control electronics.

The partners have been testing the unit at the Cape Flats Nature Reserve, on the UWC campus in Bellville.

All electrical power used in the reserve is generated from a bank of hydrogen cylinders, instead of from the national grid. The cylinders release hydrogen in the presence of a platinum catalyst (mined in North West) and a series of proton exchange membranes.

The hydrogen fuel cell power generator unit uses hydrogen to generate electrical power, with water vapour the only by-product. In this way electricity is produced in an environmentally friendly way without pollution or noise.

Furthermore, hydrogen can be used to produce electricity in remote areas that do not have access to the national grid. The decentralisation of energy generation by using hydrogen fuel cell systems is one of the few possibilities for providing efficient and cost-effective access to electricity.

The South African Government has rolled out several energy and energy-efficiency programmes and initiatives, such as HySA, with an emphasis on alternative energy opportunities and off-grid renewable energy solutions.

South Africa is one of the primary suppliers of platinum group metals to the world, but not much beneficiation is being done in the country.

The rise of hydrogen fuel cell technologies in various markets is about to change the global platinum landscape with the anticipated increase in platinum usage in this emerging market. There were significant opportunities for South Africa to partner with international fuel cell producers. These partnerships have the potential to make the country an established hub for the production of fuel cell components.

## Research, Development and Innovation (RDI)

This is at the heart of the department's efforts to drive innovation in scientifically strategic areas.

The programme has five subprogrammes:

- space science and technology
- hydrogen and energy
- biotechnology and health innovation

- innovation planning and instruments
- radio astronomy advances.

## Space science and technology Square Kilometre Array

The SKA Project could act as a catalyst for science, technology and engineering business opportunities, jobs and innovation, and has the potential to put Africa on the map as a world Big Data and Analytics Hub.

The multi-billion rand SKA, to be hosted in South Africa and Australia, will extend into eight African countries and will be the world's biggest telescope. It is also one of the biggest-ever scientific projects and multinational collaborations in the name of science.

The radio telescope should be operationally mature by 2020.

With thousands of linked radio wave receptors in Australia and in southern Africa, the SKA radio telescope will constantly scan space and feed the data to astronomers around the world.

The amounts of data being collected and transmitted by the SKA in a single day would take nearly two million years to play back on an iPod. This means the project requires supercomputing power and Big Data Management and Analytics capabilities on an unprecedented scale. The SKA is working with the world's most significant ICT powerhouses on the project.

One aspect of the project will see the Netherlands Institute for Radio Astronomy and IBM collaborating to research extremely fast, but low-power exascale computer systems, data transport and storage processes, and streaming analytics that will be required to read, store and analyse all the raw data that will be collected daily.

The SKA project will also have unprecedented data connectivity needs. Meeting the advanced technological and engineering needs of this project will result in significant local skills development, revolutionise science and technology research and enable innovative new businesses and employment in the science, technology and engineering fields.

Aside from the benefits to African science, Big Data capabilities could be the biggest spin-off from the SKA project.

The innovations, skills development and commercial potential emerging as a result of the project are huge. The potential is not just academic – the taxpayer-funded IP is developed to a point where it is ready to become commercialised and benefit the economy.

Human capital development is already taking place as a result of the SKA project, with bursaries and scholarships being granted to allow students to learn the necessary cutting-edge

science, technology, maths and engineering skills to support the project. Because the SKA is a long-term project over decades, its effect will increase.

Going forward, there will be a strong drive to leverage the SKA as a spearhead for other programmes – including next generation high performance computing challenges and Big Data challenges.

Since 2005, the African SKA Human Capital Development Programme has awarded close to 400 grants for studies in astronomy and engineering from undergraduate to post-doctoral level, while also investing in training programmes for technicians.

Astronomy courses are also being implemented in other African countries, including Kenya, Mozambique, Madagascar and Mauritius. Career opportunities will increase substantially and new business opportunities will emerge.

The project has already changed the world's view of South Africa's scientific capability.

This project is a once-in-a-lifetime combination of science and engineering in South Africa.

In 2014, R647 million was allocated for the SKA Project. Preparing for the huge amounts of data produced by the MeerKAT, the SKA is also preparing South Africa to play a leading role in Big Data.

Many students have been awarded grants by the SKA Project. The success rate of the programme has been very high, with 36 doctoral degrees, 95 master's degrees, 59 honours degrees, 58 BSc and BEng degrees and 16 national diplomas awarded. The SKA is also supporting the training of artisans, and has awarded 42 bursaries to students from the Karoo, 16 of whom are already employed by SKA South Africa.

## Space science

Through Sansa, the country's capacity to design, build, maintain and possibly even launch satellites is being developed. As part of the four-country African Resource Management Constellation, South Africa has begun work on the ZA-ARMC1 satellite; R232 million has been budgeted over the next three years for this project. This satellite will enhance Africa's ability to monitor and manage its precious natural resources.

In January 2014, the DST paid the second tranche of the purchase price for satellite company Sunspace, bringing to an end the embattled company's ordeal to pay creditors. The department offered to buy Sunspace for R55 million, and paid the first R27,5 million instalment in August 2013. The department's purchase of the satellite manufacturing company

was the only viable solution after it hit a difficult period due to a lack of government support. Sunspace is involved in low-earth orbit satellite development, design, building, integration, testing and commissioning.

Sunspace's employees moved to Denel, which has created a unit to host the intellectual property and capabilities, based in Stellenbosch.

Denel has since created Spaceteq, incorporating Sunspace, which aims to develop a multispectral, high-resolution Earth-observation satellite called EO-Sat1, for operation by 2017.

The DST's bid for Sunspace was agreed to by the majority of stakeholders who voted on the business rescue proposal, a situation the satellite maker found itself in as it was unable to pay creditors, and has not paid staff for more than two years.

## Information and communications technology

The DST is leading the implementation of the national ICT RDI Strategy. Its main purpose is to create an enabling environment for the advancement of ICT RDI in South Africa.

South Africa's research capacity in the ICT field has become a strong competitive advantage.

The ICT RDI Strategy aims to achieve a marked increase in advanced human resource capacity, promote world-class research and build robust innovation chains for the creation of new high-tech ICT small enterprises. Implementing the strategy demands partnership involving government, the private sector, higher education institutions and science councils.

The Meraka Institute of the CSIR manages and coordinates the implementation of the strategy. An important envisaged outcome is a vibrant, sustainable and innovative indigenous ICT industry that addresses a significant portion of the country's ICT needs and attracts investments by overseas-based multinational ICT corporations in RDI and manufacturing facilities and resources in South Africa.

The Centre for High-Performance Computing (CHPC), Sanren and the Very Large Databases are the three pillars of cyber-infrastructure that the DST supports. Hosted by the University of Cape Town and managed by the CSIR's Meraka Institute, the CHPC was the first of its kind in South Africa and is making scientific supercomputing a reality for South Africa.

A major project for Sanren is the national backbone network, which aims to connect all major metros in the country with a 10 gigabyte per second link. On completion, the network will reach about 200 sites. The overall network architecture will consist of a national backbone

connecting Durban, Pretoria, Johannesburg, Bloemfontein, Cape Town, Port Elizabeth and East London; with metro rings in Johannesburg, Tshwane, eThekweni and Cape Town.

## Indigenous knowledge systems (IKS)

The Indigenous Knowledge System Policy serves as a guide for the recognition, understanding, integration and promotion of South Africa's wealth of indigenous knowledge resources.

One of the areas of action identified by the policy is the protection of indigenous knowledge and the holders of such knowledge against exploitation.

This includes ensuring that communities receive fair and sustained recognition and, where appropriate, financial remuneration for the use of this knowledge.

The indigenous knowledge of many communities embodies a deeply spiritualised and ancient relationship with the Earth's systems and cycles.

Traditional songs and languages, clothing, architecture, foods, motifs, daily rituals and mythological epics contain local survival information.

Moreover, the diversity of indigenous cultures provides unique insights into how to live harmoniously within nature.

By sharing indigenous stories of vulnerability and adaptation, people learn how communities share ideas on how ancestral wisdom is being incorporated into climatic adaptation strategies.

By cherishing the value of indigenous knowledge, people can discover how best to adapt to a changing climate.

The DST has three IKS priorities:

- The development of a regulatory environment for the protection of IKS.
- The development of the National Recordal System for the collection, recording, documenting, storage and management and dissemination of IKS in communities in the nine provinces of the country. Until orally transmitted and rapidly disappearing indigenous knowledge is recorded, it will be difficult to protect. The National Recordal System is the largest fingerprint initiative of the region to document and record indigenous knowledge.
- Applied research, specifically bio-prospecting activities. An example would be how, with funding from the NRF, the MRC is developing the Moritela Tshwene Tea Project near Zeerust in North West, with the aim of producing a nutritional herbal tea for the commercial market.

The DST has put in place validation systems within its science system to ensure that indigenous knowledge products are safe and backed by the best science in the world.

To give further impetus to these critical initiatives, the department has set aside a dedicated fund to support research into indigenous knowledge.

Two indigenous knowledge research chairs have been awarded as part of the country's Research Chairs Initiative (SARChI).

The DST also established indigenous knowledge studies CoEs at the universities. The CoEs will play a defining role in generating highly qualified HR capacity in IKS.

## Private-sector involvement

South Africa's gold-mining industry works at deeper levels and under more difficult conditions than any other mining industry in the world.

The research into gold mining conducted by the CSIR's Mining Technology Group is concerned primarily with ensuring the health and safety of the workforce.

It includes those working in the areas of rock engineering and the underground environment.

Mining Technology's coal-mining research takes place on a smaller scale than that of gold mining, because the coal-mining industry is able to make use of various developments overseas.

Areas in which research is undertaken include strata control, mining, maximising the extraction of coal, and the underground environment.

Research is also carried out by a large number of industrial companies with facilities to meet their specific needs.

The more important ones are the:

- Anglo American Corporation of South Africa (applied metallurgy, processing of precious metals, base metals and coal)
- Agricura (synthesis and testing of veterinary remedies, insecticides, herbicides and entomology)
- Cullinan Holdings (refractories and electrical porcelain)
- De Beers Industrial Diamond Division (manufacturing and application of synthetic diamonds and other super-hard material)
- Johannesburg Consolidated Investment Company (metallurgy, mineralogy, chemistry and chemical engineering)
- National Chemical Products (chemistry, microbiology and animal nutrition)
- Metal Box Company of South Africa (corrosion mechanisms and microbiology)
- Tellumat (develops electronic instruments)
- Rembrandt Group (develops and improves tobacco and liquor products)
- South African Pulp and Paper Industries (wood technology, paper manufacturing and water treatment)
- Standard Telephones and Cables South Africa (long-distance transmission of information and lightning protection).

## Natural-resource development

South Africa's fluorspar chemicals sector has enormous economic potential. The DST has implemented a fluoro-chemicals development programme targeting human-capital development, new business formation and novel processes and products. The department secured a commitment of R60 million for the period 2013 to 2015 from the competitiveness fund. By 2014, additional 100 companies were processing products.

Over the next three years, the department will allocate more than R100 million to the titanium initiative, R50 million of which will come from the economic competitiveness fund.

## Human-capital development

The DST's Human-Capital and Science Platforms Subprogramme conceptualises, formulates and implements programmes aimed at developing and renewing science, engineering and technology human capital to promote knowledge generation, protection and exploitation.

South African universities train more and more scientists each year, with whose help the country will be able to spend R45 billion on research and development by 2014, thus reaching its target for gross expenditure on research and development of 1,5% of GDP.

Food security and access to clean water remain among government's top priorities – the department is therefore also focusing on using science and technology to ensure that existing water supplies are clean and is playing an active role in ensuring food security into the future.

To this end, seven of the 60 new research chairs initiated by the department will serve the areas of rural development, food security and land reform, bringing the total of such chairs to 10.

## International cooperation

The DST is not only entrusted with the overall coordination of national research and innovation initiatives in South Africa, but is also responsible for overseeing and facilitating South Africa's international scientific and technological cooperation.

The International Cooperation and Resources Programme of the department is tasked with facilitating and nurturing bilateral scientific cooperation with countries in Africa, Europe, the Americas and Asia.

The same programme nurtures multilateral scientific cooperation with the African Union, the UN system, donor agencies and foundations, global research infra-structure projects, and

multinational companies, as well as focused strategic partnerships, such as with the European Union (EU).

The department has three international offices, located at South Africa's diplomatic missions in Tokyo, Moscow and Brussels, dedicated to promoting cooperation with Japan, the Russian Federation and the EU.

The DST has also seconded an official to the secretariat of the SADC in Gaborone, Botswana.

Many of South Africa's national science councils or other public-funded research and technology organisations also have dedicated teams working on international cooperation. These include the NRF, which is responsible for the implementation of international science and technology cooperation agreements.

In February 2014, the DST hosted the first Brazil, Russia, India, China and South Africa (BRICS) science, technology and innovation (STI) Ministerial meeting, in Kleinmond, in the Western Cape.

During the BRICS STI meeting the Ministers identified and discussed mutual interests and future directions of cooperation in STI within the framework of BRICS. This was aimed at enhancing the ability of each country to address the challenges of global competitiveness and leadership in frontier sciences and new technologies. It also promotes equitable growth and sustainable development through strategic cooperation.

The BRICS Ministers tabled a memorandum of understanding (MoU). The MoU strengthened cooperation between the five countries in STI. The MoU also addressed common global and regional socio-economic challenges through appropriate funding and investment instruments, using shared experiences and complementarities; the co-generation of new knowledge and innovative products; services and processes; and promoting joint BRICS partnerships with other strategic actors in the developing world.

A visit to the SKA site in Carnarvon, where the 64-dish MeerKAT radio telescope – the precursor to the SKA – was being constructed, was also included in the agenda for the Ministerial meeting.

## African Network on Drugs and Diagnostics Innovation (Andi)

Andi is based in Addis Ababa, Ethiopia, at the UN offices of the Economic Commission for Africa. Its board agreed that five regional hubs were to be created to support regional research initiatives, with South Africa offering to host the southern hub.

Andi evaluated African research initiatives on

drugs and diagnostics, and identified 35 CoEs throughout Africa that were to receive priority attention. Fifteen of these are in South Africa.

All the centres are tasked with researching responses to the most intractable health burdens of the continent, from malaria and tuberculosis to river blindness. Many of these are diseases of the poor and invisible. Their researchers do not receive funding or intellectual support from established agencies – Andi's aim is to reverse this.

It provides support to innovation in quality water provision that is community-led and -based through various agencies. It supported the development and use of new energy-efficient and attractive construction materials through the CSIR-led infrastructure innovation programme – 410 houses were built in Kleinmond, creating an integrated suburb.

It supports rural-based poverty alleviation initiatives in Limpopo, the Eastern Cape and KwaZulu-Natal. Another facet of Andi is the Ketlaphela/Lonza initiative that built a plant to manufacture active pharmaceutical ingredients for antiretroviral (ARV) production.

The departments of science and technology, trade and industry, economic development and health collaborated on this initiative to secure a significant proportion of the ARV market for local producers.

## Women in Science Awards

Top South African women scientists were honoured at the Women in Science Awards ceremony in Johannesburg in August 2014. The DST hosts these awards annually to reward outstanding female scientists and researchers, and encourage younger women to follow their example. The top awards went to:

- Prof. Priscilla Baker – Winner in the Distinguished Women Scientists Category in Physical and Engineering Sciences.
- Prof. Marina Rautenbach Baker – Winner in the Distinguished Women Scientists Category in Physical and Engineering Sciences.
- Prof. Jeanet Conradie Baker – Runner-up in the Distinguished Women Scientists Category in Physical and Engineering Sciences.
- Professor Leila Patel – Winner in the Humanities and Social Sciences category.
- Professor Marie Poggenpoel – Winner in the Humanities and Social Sciences category.
- Professor Naydene de Lange – Runner-up in the Humanities and Social Sciences category.
- Ms Tlhompho Gaoshebe awarded Fellowship in the Master's Degree Category.
- Ms Caroline Pule awarded a Fellowship in the Doctoral Degree Category.
- Ms Mpho Ivy Raborife awarded a Fellowship in the Doctoral Degree Category.
- Ms Kwezikazi Mkentane awarded a Fellowship in the Doctoral Degree Category.
- Ms Cynthia Joan Henley-Smith awarded a Fellowship in the Doctoral Degree Category Indigenous Knowledge Systems.
- Theresa Beelders awarded a Fellowship in the Doctoral Degree Category Indigenous Knowledge Systems.
- Dr Puleng Segalo – Winner in the Distinguished Young Women Scientists Category in Human and Social Sciences.
- Professor Matseliso Mokhele – First runner-up in the Distinguished Young Women Scientists Category in Human and Social Sciences.
- Professor Petro du Preez – Second runner-up in the Distinguished Young Women Scientists Category in Human and Social Sciences.
- Dr Nosipho Moloto – Winner in the Distinguished Young Women Scientists Category in Physical and Engineering Sciences.
- Ms Lungile Sitole awarded a Fellowship in the Doctoral Degree Category.
- Ms Kgothatso Nhlegetwa awarded a Fellowship in the Master's Degree Category.
- Ms Nosipho Dlamini awarded a Fellowship in the Master's Degree Category Indigenous Knowledge Systems.
- Ms Jinal Nomathemba Bhiman, awarded Fellowship in the Doctoral Degree Category.
- Ms Faatimah Mansoor awarded Tata Scholarships in the category Master's Degree.
- Ms Anna Hlabe awarded Tata Scholarships in the category Master's Degree.
- Ms Maletsabisa Tšabi Molapo Mampholo awarded Tata Scholarships in the category Doctoral Degree.
- Fortunate Nonhlaphela Yende-Zuma awarded Tata Scholarships in the category Doctoral Degree.
- Ms Beverly Mmakatane Mampholo awarded Tata Scholarships in the category Doctoral Degree.
- Ms Grace Ngubeni awarded Tata Scholarships in the category Masters Degree.
- Prof. Genevieve Langdon – First runner-up in the Distinguished Young Women Scientist



