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Science and technology

The Department of Science and Technology aims 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 intellectual framework for policy is the National System of Innovation (NSI), in which a set of functioning institutions, organisations, individuals and policies interact in pursuit of a common set of social and economic goals.

The department's budget over the Medium Term Expenditure Framework (MTEF) has seen an increase of 26%, most of which will fund new scientific research infrastructure such as the Centre for High Performance Computing (CHPC).

National System of Innovation

The NSI focuses on the role of technology in economic growth and supports innovation and technology diffusion. Since 1994, institutions such as the National Advisory Council on Innovation (NACI) have been established to advise the Minister of Science and Technology on policy and the allocation of funding.

Some funds allocated to science councils were earmarked to address specific South African problems. The funding of science councils has been substantially reformed: core funding through parliamentary grants is complemented by allocations through a competitive bidding process from the Innovation Fund (IF). The IF applies three major criteria when making its selections: competitiveness, quality of life and environmental sustainability.

Innovation Fund

The IF was created to promote technological innovation; increased networking and cross-sectoral collaboration; and competitiveness, quality of life, environmental sustainability and the harnessing of information technology (IT).

The National Research Foundation (NRF) claims a management and administration fee from the allocated budget for support services rendered.

The IF's strategic objectives include creating a knowledge base in key technology and economic sectors; facilitating the exploitation and commercialisation of research and development

(R&D) results from the existing knowledge base; investing in technological innovations that will benefit South Africa; and supporting historically disadvantaged individuals. The IF enables the expansion and migration of existing industries to new value-added areas, and the establishment of R&D-intensive industries. It fosters the establishment and growth of technology-based small enterprises.

Promoting niche areas

Space science

The department's efforts in space science focus on developing the region as a hub for astronomy and space S&T. Through the Astronomy Geographical Advantage Programme, South Africa continues to promote high-technology investment in space science to ensure that local researchers and students are able to participate at the cutting edge of 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 (USA), New Zealand and the United Kingdom (UK). Salt is the largest single optical telescope in the southern hemisphere.

Astronomy

South Africa has been shortlisted as one of two possible sites for the Square Kilometre Array (SKA). A final decision in this regard is expected in 2008.

The SKA will be the biggest telescope ever built, the only one of its kind worldwide, and the only instrument able to solve the most basic questions of the origin of the Universe and the birth and evolution of stars and galaxies. It will investigate the origin of magnetism in the Universe and will be the most powerful instrument ever to search for extraterrestrial intelligence.

South Africa has assembled a team to build the Karoo Array Telescope (Kat), which will be equal to about 1% of the SKA. The Kat team and researchers in the UK, the Netherlands, Australia and the USA are developing digital signal processing for the telescope, as well as software and innovative telescope antennas, using composites.

The SKA/Kat office was expected to host a major international workshop in December 2006 on wide-field imaging and calibration, which is a key technology for the SKA, and which pushes the boundaries on high-speed computing and software.

The SKA and Kat projects are important for developing high-level skills and expertise in South Africa. The Department of Science and Technology has provided funding for graduate study associated with these projects. By mid-2006, there were

20 students participating in this programme, carrying out research for PhD and MSc degrees at South African universities, as well as two postdoctoral fellows.

Related to the country's bid to host the SKA, a bursary programme provided the first 12 postgraduate recipients with funding in 2004/05. A further 11 recipients were identified for 2006. This programme is being extended to South Africa's partners in the bid – Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique and Namibia.

Biotechnology

The 1996 *White Paper on Science and Technology* set the course for transforming South Africa's S&T system into a better co-ordinated and inclusive system aimed at benefiting all South Africans.

The biotechnology sector is attracting a fast-growing portion of R&D funding. Funding for genetic engineering grew by 360% between 2002 and 2004. Investment growth in the related fields of biochemistry, genetics and molecular biology, microbiology, genetic engineering and biotechnology exceeded 46%.

The Department of Science and Technology is also committed to developing biotechnology in Africa. In August 2005, the Council for Scientific and Industrial Research (CSIR) initiated a southern regional hub of the New Partnership for Africa's Development (Nepad) African Biosciences Initiative. Research related to agriculture, human and animal health, environment and industry is being prioritised.

The National Biotechnology Strategy (NBS), which was launched in 2001, sets the agenda for the development of South Africa's biotechnology industry.

Other initiatives include the establishment of biotechnology regional innovation centres (Brics), namely: BioPAD, Cape Biotech, LIFElab and the Plant Biotechnology Innovation Centre (PlantBio). Brics were created as instruments for implementing the NBS. Their focus areas cover a wide spectrum of the subdisciplines in biotechnology. These include human and animal health, biopharmaceuticals, industrial bioprocessing, mining biotechnology, bioinformatics and plant biotechnology. One of the challenges facing the South African biotechnology sector is the public's lack of understanding and knowledge of biotechnology applications and benefits.

Another programme initiated as a result of the NBS is the Public Understanding of Biotechnology Programme, which provides the South African public with information, enabling them to participate meaningfully in debates about biotechnology and to make informed decisions.

The implementation of the NBS has seen the development of the National Bio-Informatics Network (NBN) in eight universities, investing in technology R&D, infrastructure and teaching. In 2005, 71 students (51% of whom are women and 34% of whom are black) received training in biotechnology-related subjects.

In February 2006, the Department of Science and Technology allocated R11 million to the South African Malaria Initiative (Sami).

Sami was initiated in 2005 by the African Centre for Gene Technologies, a joint venture between the universities of Pretoria and the Witwatersrand, as well as the Council for Scientific and Industrial Research.

The aim is to encourage collaboration between various local malaria researchers and to establish networks with other key players on the African continent.

Sami's research will focus on drug discovery and pre-clinical development of novel potential anti-malarial compounds, new and improved diagnostics and molecular epidemiology and parasite-vector interactions.

Policy and initiatives

South African Research Chairs Initiative (Sarchi)

The Sarchi is a strategic national structural intervention geared towards creating a coherent and national research and innovation system. The initiative is aimed at attracting and retaining qualified researchers to the Higher Education (HE) sector to reverse the country's decline in research output and capacity at publicly funded institutions. It is envisaged that this programme, which has already received R200 million, will produce 210 research chairs by 2010, with the potential to develop targeted research capacity in support of the National Research and Development Strategy (NRDS).

National Research and Development Strategy

The NRDS focuses on three broad areas:

- Innovation, primarily through technology missions: The emphasis is on technological innovation, demonstrating technology, incubating new technology-based businesses and enhancing networks of knowledge workers and organisations in specific areas of technology.
- Strengthening science, engineering and technology (SET), HR and transformation: The emphasis is on establishing centres of excellence (CoEs), establishing and funding networks for Nepad and the Southern African Development Community (SADC), strengthening global science networks, formulating strategies aimed at sourcing new finance for R&D equipment, strengthening institutional and individual research capacity in science focus areas through the NRF, and increasing public understanding and engagement.
- Creating an effective government S&T system: A clear distinction needs to be drawn between the roles of line-function departments and the integrative role of the Department of Science and Technology. This focus area is involved in generating three-year R&D plans for science councils in line with the MTEF process, developing standard-reporting frameworks and a performance-management system for all institutions, and giving the department central responsibility for producing an integrative budget for all S&T initiatives.

The six CoEs are:

- Biomedical Tuberculosis (TB) Research
- Invasion Biology
- Strong Materials
- Birds as Keys to Biodiversity Conservation at the Percy Fitzpatrick Institute
- Catalysis
- Tree Health Biotechnology at the Forestry and Agricultural Biotechnology Institute (FABI).

Advanced Manufacturing Technology Strategy (AMTS)

The AMTS was launched in October 2003.

The Centre for Innovation, focusing on craft and design, opened in July 2006 in Cape Town. The centre is the first of its kind in the world and a state-of-the-art resourced venue aimed at promoting innovative design, product development and process technologies for crafters and designers.

The Cape Craft and Design Institute (CCDI) spearheaded the creation of the centre, together with the Western Cape Provincial Government and the AMTS.

The Centre for Innovation incorporates a fabrication laboratory, sponsored by the Massachusetts Institute of Technology.

The centre's activities are linked to the CCDI's small, medium and micro enterprise (SMME) development and market-access support programmes.

The National Survey on Research and Development R&D 2004/05 found that South Africa spent about R12 billion, or 0,87% of gross domestic product (GDP) on R&D in 2004/05.

The 2004/05 figure represented an improvement on the 2003/04 R&D survey, which recorded R&D expenditure at R10,1 billion, or 0,81% of GDP.

The Department of Science and Technology commissioned the survey. The intensity of R&D expenditure (measured as the percentage of GDP spent on R&D) is a good indication of the competitiveness of a country's economy. Sweden has the highest R&D intensity (3,98% of GDP), followed by Finland (3,48%). The United States of America's R&D expenditure measured 2,68% and the average for the 25 European Union (expanded) member states was 1,82%. South Africa aims to achieve R&D expenditure equivalent to 1% of GDP by 2008.

In South Africa, female researchers comprise 38,3% of the total researchers, compared with 11,6% in Japan, and 29,4% in Norway. In developing countries, Argentina leads the way with 50,9% female researchers.

Most South African R&D is performed in the major research field of engineering sciences (comprising 23,9% of total R&D), followed by the natural sciences (20,8%) and the medical and health sciences (14,8%).

South African National Energy Research Institute (Saneri)

Cabinet approved the establishment of the Saneri in 2004.

The Central Energy Fund will house the institute, jointly run by the departments of minerals and energy and of science and technology. It will conduct research on the energy sector.

The Saneri, through R&D, provides for:

- cost-effective and efficient energy generation, transformation, transport, end-use and decision-support technologies
- energy-technology innovation
- sustainable development and use of energy resources
- improving the quality of life of all South Africans
- promoting and conducting training of energy researchers
- establishing and expanding industries in the field of energy
- commercialising energy technologies resulting from its R&D and innovation programmes.

By May 2006, R20 million had been transferred to the Saneri, and more than R100 million was expected to be invested over the next three years to develop knowledge and applications in this field.

In February 2006, the Department of Science and Technology, through its Overseas Bilateral Co-operation Subprogramme, hosted a national workshop aimed at informing science and technology (S&T) stakeholders about opportunities and funding mechanisms available for use in research and development (R&D).

The subprogramme is responsible for all South Africa's country-to-country S&T engagements outside Africa.

By February 2006, 30 bilateral agreements had been signed, resulting in over 400 R&D projects in areas such as information technology, environmental management and manufacturing management.

These bilateral agreements play an important role in building relations with foreign countries as well as in sharing best practice. Through these agreements, funds are made available to promote R&D in key areas, thus contributing towards the human-capital development agenda.

Pebble Bed Modular Reactor (PBMR) Human-Capital Research and Innovation-Frontier Programme

In support of the Government's vision for the PBMR, the Department of Science and Technology has undertaken to establish a co-ordinated programme to advance skills and innovation frontiers along the entire technology value chain of the PBMR programme. This ranges from basic and applied research of all applicable science and engineering disciplines, to manufacturing and the distinctive aspects of waste management.

The PBMR Human-Capital Research and Innovation-Frontier Programme is a consensus of key stakeholders, including the departments of minerals and energy and of trade and industry; Eskom; the Nuclear Energy Corporation of South Africa; universities, and science councils.

The PBMR programme represents a significant development for South Africa in the field of nuclear S&T.

National Advisory Council on Innovation

The NACI is appointed by the Minister of Science and Technology to advise on the role and contribution of innovation, including S&T, in promoting and achieving national objectives. These include:

- improving and sustaining the quality of life of all South Africans
- developing HR resources for S&T
- building the economy
- strengthening the country's competitiveness in the international sphere.

NACI membership is broadly representative of all sectors and is constituted to ensure a spread of expertise and experience regarding national and provincial interests, scientific and technological disciplines, innovation regarding the needs and opportunities in different socio-economic fields, and R&D in all sectors.

Public understanding of science, engineering and technology (Puset)

The department's efforts in this regard include:

- The South African Reference Group on Women in S&T, established in March 2003. This ministerial body advises on ways to increase the visibility and development of women, and on making science more relevant to the needs of society by incorporating women's needs and expectations.

- The Women in Science Awards, first awarded in 2003, to honour female scientists and their achievements.
- The SET Week project, implemented for the first time in 2000. In May 2006, the National Science Week (NSW) saw events taking place in all nine provinces, including:
  - learner-outreach programmes
  - science competitions
  - public talks and fun runs
  - career exhibitions
  - seminars
  - learner and educator workshops
  - science shows.

NSW 2006 marks year two of the department's five-year NSW plan under the theme *Tomorrow's S&T is in our Youth's Hands*. The plan emphasises South Africa's indigenous knowledge by showcasing provinces' unique geographic and knowledge advantages.

National Nanotechnology Strategy

In April 2006, the Deputy Minister of Science and Technology, Mr Derek Hanekom, officially launched South Africa's National Nanotechnology Strategy.

The strategy recognises the needs of local industry and focuses on the essential building blocks of nanoscience, namely synthesis, characterisation and fabrication. The strategy is aimed at increasing the number of nanotechnology characterisation centres in South Africa with an investment of R170 million over the next three years, with an initial R15 million invested in 2005/06.

Known as 'the technology of the very small' (i.e. 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.

South African industry and researchers have been involved in nanotechnology and the practical application of nanoscience for several years, for example, Sasol's chemical processing by catalysis.

New generations of emerging nanotechnology-based products require that South Africa develops its ability to derive more benefits from global advances in this area. The National Nanotechnology Strategy positions South Africa as a global player in this emerging area and seeks to strengthen government's integrated development focus.

The strategy aims to:

- support long-term nanoscience research that will lead to a fundamental understanding of the design, synthesis, characterisation, modelling and fabrication of nanomaterial
- support the creation of new and novel devices for application in various areas
- develop the required HR and supporting infrastructure
- stimulate new developments in technology missions such as advanced material for advanced manufacturing, nanobiomaterial for biotechnology, precious metal-based nanoparticles for resource-based industries, and advanced material for information and communications technologies (ICTs).

In line with the objectives of the National Research and Development Strategy (NRDS), during the 2006 African Aerospace Defence Show in September 2006, the Department of Science and Technology and Airbus signed a memorandum of understanding (MoU) regarding:

- collaboration on research and development in areas of mutual interest within the aeronautics sector
- human-capital development programmes, which will give opportunities for South Africa's best engineering and science students to complete research projects and receive related on-the-job training at Airbus and its associated European aerospace centres of competence
- assistance in increasing the number of qualified engineers and scientists, and in contributing to the Joint Initiative on Priority Skills Acquisition, as well as the growth and development of the aerospace industry in South Africa.

The MoU is the culmination of ongoing engagements and team work by the Department of Science and Technology, the Council for Scientific and Industrial Research, the implementing unit for the Advanced Manufacturing Technology Strategy and collaboration with the Department of Trade and Industry and the Aerospace Industry Support Initiative.

Information and Communications Technology

The Department of Science and Technology is expected to establish the CHPC to support a diverse base of researchers and scientists, and to facilitate the collaboration and multidisciplinary approach needed to solve complex computational problems.

Its research objectives will provide computing expertise for all research in South Africa in natural science, medicine, engineering and social sciences. Its first major capacity will be located at the University of Cape Town.

The centre will function as a national innovation platform and will deliver a significant return on investment by harnessing the application of high-performance computing for positive social effects, particularly on research into major infectious diseases, such as HIV and AIDS, and promoting advanced manufacturing technology.

Sumbandilasat, South Africa's new low earth-orbiting satellite, was expected to be launched into space from a submarine in Russia in December 2006.

Meaning 'lead the way' in Tshivenda, the name Sumbandila was among the more than 3 000 entries received in a national competition for learners in grades 7 to 12. It was initiated by the Department of Science and Technology and implemented through the South African Agency for Science and Technology Advancement.

Sumbandilasat is part of a multimillion rand, three-year integrated national space programme developed by the department and carried out by the University of Stellenbosch, Sunspace and Information Systems, and the Satellite Application Centre.

The university is responsible for managing the project and training students. Sunspace and Information Systems was tasked with building the satellite, while the Satellite Application Centre was responsible for operations, telemetry, tracking, control and data capturing.

The programme will give South Africa affordable access to space technology and useful data, serving as a research tool to support in monitoring and managing disasters such as floods, oil spills and fires.

The CHPC and the South African Research Network are the backbone of an emerging cyber-infrastructure in South Africa that will support research initiated in other elements of the country's S&T infrastructure, such as the SKA, the NBN and the Global Earth Observation System of Systems (GEOSS).

The GEOSS aims to enable globally co-ordinated earth observations, across a number of domains, to provide better and more reliable data in areas of benefit to society, including agriculture, weather, climate, water, disasters, health, energy, biodiversity and ecosystems.

Tshumisano

The Tshumisano Technology Station Programme (TSP) aims to encourage a closer partnership between technology stations based at participating universities of technology and SMMEs. The Tshumisano Trust, a joint venture between government, the German Agency for Technical Co-operation and the Committee of University of Technology Principals, is generating stronger working relationships between the departments of science and technology and of labour.

By May 2006, there were 10 technology stations operating from the universities-of-technology environment in specific sectors to enrich their R&D, teaching and learning activities with better equipment and more realistic understanding of the industry and its needs. The sectors include chemicals, textiles, electronics, metals processing, mechanical engineering and food technology.

A key objective of these programmes is Black Economic Empowerment (BEE) through new small and medium enterprise (SME) development, and productivity improvement, technical mentoring and innovation services for existing SMEs.

The Tshumisano TSP is advancing technology transfer and skills development to enhance equitable economic development. In this regard, the HE sector has a vital role in supporting SMMEs to become engines of growth.

The TSP supports the following sectors:

- mechanical engineering and chemicals at the Nelson Mandela Metropolitan University in Port Elizabeth
- material and processing at the Vaal University of Technology

- clothing and textiles at the Cape Peninsula University of Technology
- electronics and chemicals at Tshwane University of Technology
- metal casting at the University of Johannesburg
- metal value-adding at the Central University of Technology in Bloemfontein
- reinforced plastics at the Durban Institute of Technology.

By June 2006, the Tshumisano TSP had handled more than 482 projects, trained 134 students in various aspects of technology transfer and supported 356 SMEs in technology applications, of which many are owned and run by African and female entrepreneurs who were previously excluded from the economic mainstream.

The Tshumisano Trust hosted the first All-Africa Diffusion Conference in June 2006. The conference aimed to promote innovative approaches, technology transfer and co-operation among businesses in Africa. There is a special emphasis on how technology transfer and diffusion can alleviate problems within vulnerable small enterprises. These include job- and wealth-creation, food and water security, energy and environmental conservation, and skills development.

Poverty reduction

The Department of Science and Technology believes in a multipronged approach to fighting poverty.

Its poverty-alleviation projects are having positive outcomes in businesses and co-operatives and focus on, among other projects, bee-keeping, paper-making, incorporating African design in clothing and textiles based on natural fibres, and indigenous cattle production. These projects are concentrated in the poverty nodes as identified by government's Integrated Sustainable Rural Development Strategy.

International science and technology co-operation

The strategy to use southern Africa's local (geographical) advantages and efforts to attract large international science-based investments is paying off. Examples include the construction of the High-Energy Stereoscopic System (Hess) observatory in neighbouring Namibia and the Salt in Sutherland in the Northern Cape, as well as winning the bid to host the European Developing Countries Clinical Trials Partnership. Added to this are bold efforts to bolster South Africa's bid to site the SKA in South Africa.

By 2001/02, international funding of R&D in South Africa had grown to 6% from close to zero in 1994. By 2003/04, foreign funding stood at 10% of total R&D funding. International breakthroughs include South Africa's leading role in the European Union's (EU) sixth framework programme, and in implementing Africa's Consolidated S&T Plan of Action.

South Africa is involved in developing an S&T platform in the subregion, through the SADC Ministers' Council on S&T, which is developing a SADC protocol to guide the implementation of the subregional S&T plan.

Developing a high-speed broadband network in the region is a flagship project of the Department of Science and Technology. The UbuntuNet Project is set to link through the South African National Research Network to Europe via the Geant connection to give South Africa and its research community a high-speed network. The first phase of implementing this network began with total funding of R178 million over the MTEF.

The department has successfully leveraged human-capital support through international S&T agreements. This has resulted in jointly funded projects with 16 countries in areas such as agriculture, manufacturing and biotechnology.

South Africa's role at the forefront of Nepad is, to a significant extent, based on its ability to deploy scientific knowledge and technological solutions on the continent.

In 2002, the International Council for Science (Icsu) took a decision to establish four regional Icsu offices in the developing world. In September 2005, the council's Regional Office for Africa was launched in Pretoria. South Africa hosts the office at the premises of the NRF.

The Department of Science and Technology has taken a leadership role in the international process to establish the GEOSS. Acting through the department, South Africa participated in developing the 10-year implementation plan and was elected co-chair of the Group on Earth Observations.

National Research Foundation

With a budget of R1,2 billion for 2006/07, the NRF is a key public entity responsible for promoting and supporting the development of HR for research, technology and innovation in all fields of S&T. The NRF carries out its missions mainly by:

- providing seven unique national research facilities
- promoting science awareness through the South African Agency for Science and Technology Advancement (Saasta)
- making and managing merit-based grants and co-operative agreements with individual researchers, research groups, and institutions locally, regionally and internationally (through the Research and Innovation Support Agency (Risa)
- delivering unique knowledge-management services to the research community.

The NRF focuses on contributing to government's strategy to create wealth and improve citizen's quality of life. Doctoral graduates are the platform upon which social and technical progress, innovation and business performance can flourish.

The key driver for all NRF's activities is the production of large numbers of highly skilled people who can generate new knowledge, develop and use new technologies, and innovate and drive the competitiveness of the country in international world markets.

The NRF regards HR development as a long-term investment in growing the pool of resources by drawing in learners that will become scientists and innovators.

SET education, through pre-tertiary, tertiary and lifelong-learning initiatives, provides the basis for creating the required human capital for South Africa's SET endeavours. Saasta's contribution to the NRF vision is to grow the pool of quality learners who will become the scientists and innovators of the future.

Science-advancement programmes within the NRF reside under three interdependent strategic areas:

- Building the supply of tomorrow's scientists and innovators through education-related programmes.
- Celebrating South African achievements in S&T and building the public's appreciation of the benefits of science through science communication.
- The NRF uses interactive exploration, engagement and exhibitions to instil an enthusiasm about the wonder and application of SET, while encouraging greater public engagement in SET issues. Through a series of integrated programmes, Saasta is developing an infrastructure that supports high-impact activities and all science-promotion sites.

The NRF manages the following research facilities:

It was announced in May 2006 that South Africa would bid for the establishment of a third component of the International Centre for Genetic Engineering and Biotechnology (ICGEB) in the country.

By then, there were only two ICGEB components in the world, stationed at laboratories in Trieste, Italy and New Delhi, India.

The University of Cape Town's Institute for Infectious Diseases and Molecular Medicine would be South Africa's candidate institution to host the major international laboratory.

The Department of Science and Technology plans to set aside R22 million over the next three years for the establishment of the third ICGEB component in South Africa.

Established in 1987 by the United Nations (UN) Industrial Development Organisation, the ICGEB is an intergovernmental organisation that operates in contact with the UN Common System as a centre of excellence for research and training in biotechnology and genetic engineering, focusing on the needs of the developing world.

The ICGEB places major emphasis on health-related research activities as well as on projects aimed at the sustainable application of biotechnology in agriculture.

The main focus for health biotechnology is currently on HIV and AIDS, hepatitis, rotavirus, human papilloma virus, malaria, tuberculosis and, more recently, dengue.

ICGEB's research is aimed at determining the mechanisms related to the infection and the insurgence of diseases.

South African Astronomical Observatory (SAAO) and Southern African Large Telescope

The SAAO is the national research facility for optical/infrared astronomy in South Africa. Its primary function is to further fundamental research in astronomy and astrophysics at national and international level.

In 2005, the SAAO made the transition from the Salt construction phase to the Salt operation phase. By devising a vastly superior spherical aberration corrector, and a variety of other innovations, the SAAO has contributed to making Salt more capable than its prototype, the Hobby-Eberly Telescope in Texas, USA.

From the outset, Salt was conceived as an African facility. With the advent of large-scale facilities such as Salt and the Hess, and other initiatives such as the SKA, Inkaba ye Afrika and ZASat, southern Africa is emerging as a regional space S&T hub.

Hartebeesthoek Radio Astronomy Observatory (HartRAO)

HartRAO is responsible for research and training in radio astronomy and space geodesy in South Africa. The 26-m diameter radio telescope is available for research either as a single, independent instrument, or in global networks of radio telescopes, using the technique of very long baseline interferometry (VLBI).

HartRAO is one of only five permanent fundamental space geodesy stations worldwide and participates in geodetic VLBI through the International VLBI Service, in satellite laser ranging (through the International Laser Ranging Service), and in the Global Positioning System (GPS) (through the International GPS Service). The data are available to the international community.

The radio astronomy group is part of the National Astrophysics and Space Science Programme for postgraduate students. It is involved in developing the SKA and its South African prototype, the Kat.

Research collaborations are in place with southern African countries and overseas institutions.

Hermanus Magnetic Observatory (HMO)

The HMO functions as part of the worldwide network of magnetic observatories. Its core function is to monitor and model variations of the Earth's magnetic field. It is primarily the HMO's scientific achievements, critical location and unique facilities that make it indispensable in the global network of magnetic observatories.

The density of geomagnetic recording stations in Africa is significantly less than in other continental landmasses. The continuous recording stations operated by the HMO are the only operational sources of ground-based geomagnetic field data south of the equator in Africa. The HMO is one of only four geomagnetic observatories whose data is used by the World Data Centre for Geomagnetism in Kyoto, Japan, for measuring geomagnetic storm intensity.

South African Institute for Aquatic Biodiversity (Saiab)

Saiab is an interactive hub focused on serving the nation by generating, disseminating and applying knowledge towards understanding and solving problems concerning conservation and the wise use of African fish and aquatic biodiversity.

Saiab cares for and develops the National Fish Collection, generates knowledge through research on aquatic biodiversity in Africa and trains and

In celebration of the lengthy and distinguished scientific career of 80-year old palaeontologist Prof. Phillip Tobias, the African Genesis Symposium on Human Evolution took place at the University of the Witwatersrand (Wits) in Johannesburg in January 2006. More than 60 eminent scientists from around the world attended.

To coincide with this event, a bust of Prof. Tobias was unveiled at the Cradle of Humankind World Heritage Site near Johannesburg. Prof. Tobias and a team of researchers discovered the fossil specimens that have made the Cradle of Humankind an internationally important site.

Prof. Tobias has received 17 honorary degrees, countless awards and honours, and has published more than 1 000 works, including some 40 books. He is the first and only South African to be honoured with the Fellowship of the Royal Society.

Prof. Tobias is honorary professor of palaeo-anthropology at Wits and honorary professional research associate and director of the Sterkfontein Research Unit.

educates knowledge workers in aquatic biodiversity. It addresses national and international issues in aquatic biodiversity through the priorities set by national and international funding agencies.

Saiab is constructing a new offsite wet-collection facility to house the National Fish Collection. Planning of a new collection-management centre to service the new facility is also under way.

Science challenges for Saiab include a focus on building the flagship African Coelacanth Ecosystem Project, developing biosystematic capacity, and developing an effective and integrated information-management system. Saiab has an active rural outreach programme focused on identifying high-potential candidates for science careers and giving them career-forming experience over one year.

South African Environmental Observation Network (Saeon)

Saeon aims to generate and archive reliable long-term information relevant to the sustainable management of natural resources and habitat over a range of ecoregions and land uses. These include pristine (wild) landscape, partially pristine (managed) landscape, agriculturally (rural) transformed landscape and urban transformed landscape.

Saeon establishes innovative research platforms and information-management systems for long-term multidisciplinary, multi-institutional and participatory ecosystem studies with strong regional and global linkages. These research platforms are co-ordinated as nodes, with the first one – the Ndlovu Node – established during 2004 in Phalaborwa.

The second node covers the coastal-inshore zone and was established in 2006 in Grahamstown. The Saeon Fynbos Node, the Marine-Offshore Node, the Arid Lands Node and the Grasslands/Forests/Wetlands Mosaic Node were expected to be launched in 2006/07. Saeon also runs an innovative education-outreach programme that focuses on educators, learners and post-graduate students.

National Zoological Gardens (NZG)

The NZG was declared a national research facility in April 2004. It has since been engaged in a strategic re-orientation process to align with, and make a contribution to, the NRF's core missions and strategic priorities.

The NZG is changing from being a traditional zoological garden, to becoming a national facility for and an active participant in terrestrial biodiversity research. It has the potential to offer South Africa, Africa and the international community the infrastructure required to conduct world-class and knowledge-generating research.

The NZG houses one of the largest animal collections in the world. It operates three breeding centres and covers an area of over 6 000 ha. The NZG is well-placed as an education platform, receiving close to 600 000 visitors a year.

iThemba Laboratory for Accelerator-Based Sciences (iThemba Labs)

iThemba Labs is a multidisciplinary research centre and provides facilities for:

- basic and applied research using particle beams
- particle radiotherapy for the treatment of cancer and other life-threatening lesions
- the supply of accelerator-produced radioactive isotopes for nuclear medicine and research.

iThemba Labs brings together people working in the medical, biological and physical sciences who are interested in using accelerated particle beams, by providing opportunities for research and postgraduate training in these separate disciplines, and also by stimulating mutual interest in interdisciplinary areas.

iThemba Labs has an 'open door' policy towards training postgraduates and in-service trainees. While postgraduates from universities all over South Africa use the facilities, iThemba Labs proactively participates in building research and postgraduate capacity at historically disadvantaged institutions.

Research and Innovation Support Agency

Risa aims to promote and support research and research capacity in all fields of knowledge and technology, including indigenous knowledge. This is done by:

- investing in knowledge production and promoting basic and applied research, technology development and innovation
- developing research capacity and advancing equity and redress to unlock the full creative potential of the research community
- investing in research infrastructure
- facilitating strategic partnerships and knowledge networks.

Government aims to transform South Africa into a knowledge society that competes effectively in a global system. Much effort has been directed towards ensuring that Risa-supported research focuses on areas that are relevant to South Africa's development challenges in a rapidly changing, highly competitive and knowledge-driven environment.

Risa's granting functions involve:

- advancing and strengthening strategic knowledge
- identifying distinct South African research opportunities
- conserving and managing ecosystems and biodiversity
- promoting economic growth and international competitiveness
- advancing education and the challenges for change
- supporting indigenous knowledge systems (IKS)
- advancing ICT in South Africa
- establishing the socio-political impact of globalisation and the challenge for South Africa
- eradicating poverty.

Within these focus areas, knowledge fields that may be weak are developed together with the research community. Research agendas are established through interaction with the research community and collaboration between disciplines is promoted.

Risa implements the following interventions to achieve its goals:

- Student support through block grants to institutions and two complementary types of postgraduate student support i.e. free-standing scholarships and fellowships awarded directly to postgraduate students for studies locally and abroad; and grantholder-linked bursaries granted to researchers within their NRF support package, and which may be awarded to students selected by the NRF grantholder.
- The Department of Labour, in conjunction with the departments of education and of science and technology, is responsible for ensuring training in scarce skills, both in HE and other training institutions. The Department of Labour allocates resources from the National Skills Fund (NSF) to the NRF for bursaries and scholarships. The NRF created the Scarce Skills Fund (SSF) to promote and support students who study at postgraduate levels in areas where skills are scarce. The SSF also provides funds to postgraduate students with disabilities.
- The Institutional Capacity-Development Programme focuses on linking and assisting institutions that are committed to research through institutional interventions and through funding research areas at institutions.
- Within the focus-area programmes, researchers can obtain two-year and five-year grants in an open competition.
- Staff development at HE institutions is promoted through the Thuthuka Programme, which provides support for researchers in training, women in research and the Research-Development Initiative for Black Academics.
- The Innovation Postdoctoral Fellowship Programme supports and encourages doctoral candidates to embark on further research.
- Equipment grants allow HE institutions to acquire equipment.
- Mobility grants afford students and researchers the opportunity to obtain access to equipment at HE institutions.
- The Sarchi aims to free academics to focus on research, thus increasing the number of world-class researchers and their output to make South Africa internationally competitive. Up to R2,5 million a year can be awarded to a chair to cover salaries, postdoctoral and student awards, and small equipment. The aim is to support 210 chairs by 2010.

In February 2006, French satellite-systems firm Alcatel Alenia Space signed a skills-development agreement with the Council for Scientific and Industrial Research (CSIR) to develop space-science expertise in the country.

The CSIR and Alcatel Alenia Space will co-operate in the space domain to strengthen their respective competencies and knowledge, with the ultimate aim of contributing to socio-economic progress, both in South Africa and France.

- The CoE Programme supports strategic, long-term research by providing secure and stable funding to outstanding researchers and their research groups.
- The Technology for Human Resources for Industry Programme (Thrip) supports projects that address the technology and HR needs of industry on a cost-sharing basis with industrial partners. The programme focuses on increasing participation by SMMEs, BEE entities and black and female researchers and students.
- The S&T Agreements Fund administers agreements that facilitate international research collaboration, specifically with African countries. The Department of Science and Technology is responsible for negotiating binational or multilateral agreements with international partners and for drafting framework programmes. The NRF has an independent responsibility for negotiating bilateral agreements with counterpart agencies.

  These agreements develop relations between the research communities of the intergovernmental and interagency signatories, and establish long-term co-operation between researchers.
- The IF invests in technologies at various stages of development. Some of the funding instruments in the IF fund the 'proof of concept' phase of projects. The IF also provides seed funding for commercialising IF projects and the establishment of technology-based start-up companies. The IF offers commercialisation advice to potential entrepreneurs, and promotes and stimulates the patenting of technologies and products.
- The NRF manages some initiatives linked to the biodiversity science thrust of the NRDS. These include the South African Biodiversity Initiative and the South African Biodiversity Information Facility. The NRF manages the Sea and Coast Programme with the Department of Environmental Affairs and Tourism as a co-investor.

  The NRF also manages the provincial research projects of the Branch: Marine and Coastal Management of the Department of Environmental Affairs and Tourism. These projects have a strong applied research focus, which feeds into the management of marine and coastal resources, including resource allocations for the fishing industry.
- The South African National Antarctic Programme aims to create a demographically balanced Antarctic research programme that strives for high-quality international research, and links to other African countries and interdisciplinary research. The NRF facilitated proposals for funding for 2005 and 2006. Proposals are evaluated within the funding framework of the Antarctic Research Strategy (Aressa), which is organised into five thematic areas. The International Polar Year (2007 to 2008) presents an exciting challenge for polar research and the NRF's calls for proposals in 2005 and 2006 ensured the seamless alignment of the research themes of the Aressa with the research themes of the International Polar Year.

Value-adding services

The NRF generates, acquires and provides information that is useful for the production of new knowledge, such as:

- The Nexus Database System is a database of current and completed research projects and contains information on 137 000 projects in all science domains from 1900 onwards. It includes abstracts of these projects.
- The Research Organisations' Database contains information on research organisations in South Africa.
- The Professional Associations' Database contains information on 180 associations with contact details and disciplines.
- The conference website facilitates access to other conference databases on the Internet that announce forthcoming conferences on all science disciplines.
- The Women-in-Research Database facilitates collaboration between female researchers.
- The NRF Funded Projects Database reflects the grants of the foundation.
- The South African Data Archive is a large data archive of computerised social-science data.

Science councils

The statutory science councils are a key part of South Africa's NSI. Through them, government is able to directly commission research in the interest of the nation, and to support technology development in its precompetitive phase.

Agricultural Research Council (ARC)

The ARC is a statutory body established in terms of the Agricultural Research Act, 1990 (Act 86 of 1990). It comprises research institutes that were previously part of the Department of Agriculture, the oldest of which dates back to 1902.

As the principal agricultural research institution in South Africa, the ARC is committed to agricultural research, technology development and technology transfer within the macro-framework of the agricultural sector, thereby contributing to the quality of life of the people of South Africa.

The ARC's research goals are aligned with the Agricultural Sector Strategy goals.

The ARC's research activities address major government priorities, namely integrated rural development, natural-resource management, job creation, regional integration, urban renewal, HR development, crime prevention, farmer settlement, support-service improvement, infrastructure development, food security and trade development and support.

The ARC comprises the following business units:

Public-support services

ARC-Institute for Soil, Climate and Water (ARC-ISCW)

Established in 1902 as the Division of Chemistry, the ARC-ISCW (in Pretoria, Gauteng) is a leading centre of expertise in the fields of soil science, agrometeorology, spatial modelling, soil-water science, geoinformatics (remote sensing, geographic, spatial and other information systems) and analytical services. It is committed to improving rural livelihoods and agricultural productivity, and to the sustainable use of natural resources, soil, climate and water. The ARC-ISCW is the custodian of the Soil Information Systems, the Agrometeorological Climate Network and Databank, and the Coarse Resolution Satellite Imagery Database.

ARC-Institute for Agricultural Engineering (ARC-IAE)

The core purpose of the ARC-IAE (in Pretoria) is to develop and apply agricultural engineering technology that will contribute to higher yield, higher income and lower input costs for agriculture and related industries in a sustainable way.

The ARC-IAE is active in the agricultural engineering field and focuses on agricultural mechanisation, resource conservation, farm structures, irrigation, alternative energy, aquaculture and product-processing. Research is directed at a wide range of clients, from subsistence farmers using animal traction, to commercial farmers and manufacturers requiring scientific performance evaluations of advanced equipment.

ARC-Plant Protection Research Institute (ARC-PPRI)

The ARC-PPRI (in Pretoria) has the expertise to address agricultural and environmental concerns, through research aimed at promoting economic and environmentally acceptable pest-management strategies.

Fields of expertise include biosystematics, ecology and epidemiology of invertebrates, fungi, pathogenic and useful bacteria, and viruses; the control of plant pests, plant diseases and alien invasive plants; and beneficial organisms such as biological control agents, nitrogen-fixing bacteria and insect pollinators, including bees. The institute is mandated to address plant-protection issues that cut across commodities, affecting many crops and regions. Its research impacts not only on South Africa, but also addresses the needs of other African countries. The ARC-PPRI is the custodian of the South African Rhizobium Culture Collection and the National Collections of Arachnids, Fungi, Insects and Nematodes.

Grain and industrial crops

ARC-Grain Crops Institute (ARC-GCI)

The ARC-GCI (in Potchefstroom, North West) is responsible for research into improving and cultivating grain crops such as maize, sorghum and millet, as well as oil and protein seeds such as sunflower, ground nuts, soybeans, dry beans, cowpeas, sweet white lupin and bambara. Research activities involve plant breeding, evaluation of cultivars and grain quality, plant physiology, plant pathology, nematology, entomology and tillage.

In September 2006, President Thabo Mbeki presented Selig Percy Amoils, Patricia Berjak and Lionel Opie with the Order of Mapungubwe, silver class, for their contribution to the field of science.

ARC Small Grain Institute (ARC-SGI)

The ARC-SGI (in Bethlehem, Free State) concentrates on improving and cultivating small grain crops such as wheat, barley, oats, triticale and rye. Research activities include breeding new cultivars with better resistance to diseases and pests, the national evaluation of cultivars and grain quality, plant physiology, tillage, weed science, plant pathology, entomology and yield potential.

The ARC-SGI is the only institute of its kind that offers one-stop small-grain information, not only to the commercial farmer, but also to new, emerging and small-scale farmers.

ARC-Institute for Industrial Crops (ARC-IIC)

The ARC-IIC (in Rustenburg, North West) is involved in fundamental and applied research in the interest of the cotton and tobacco industries. Research is also conducted on other fibre crops such as hemp, sisal and flax, as well as on finding indigenous fibre crops with economic potential as new alternative crops in rural areas.

Likewise, certain crops are being investigated for their potential as sources of essential oils or household utilities. Research on cassava is directed at its potential as an alternative food source and source of starch for industrial use. Research on pigeonpea and the promotion of this crop as an additional source of protein is being conducted widely in the rural areas.

Horticulture

ARC-Institute for Tropical and Subtropical Crops (ARC-ITSC)

The ARC-ITSC (in Nelspruit, Mpumalanga) is responsible for research into all aspects of the cultivation of tropical and subtropical fruits. Other crops into which production research is conducted include coffee, herbs and spices, medicinal plants, and pecan, macadamia and cashew nuts. Lesser-known exotic crops being evaluated are pitanga, feijoa, annona types, carambola and jaboticaba.

ARC-Roodeplaat Vegetable and Ornamental Plant Institute (ARC-VOPI)

The ARC-VOPI (near Pretoria) concentrates on a wide range of horticultural crops. Research is conducted on commercial vegetables such as onions, potatoes and sweet potatoes. Traditional and indigenous vegetables receiving attention include amaranthus, cassava, plectranthus, Zulu round potato, pigeon-peas, cowpeas and bambara. Research into the production and development of ornamentals and indigenous flora such as fynbos, woody ornamentals and bulbs has led to a new growth industry.

ARC-Infruitec/Nietvoorbij (Institute for Fruit, Vine and Wine)

ARC-Infruitec/Nietvoorbij (in Stellenbosch, Western Cape) does research, development and technology transfer pertaining to the following commodities: deciduous fruit (apples, pears, peaches, plums, apricots and nectarines); grapes (wine, table and raisin); alternative temperate climate crops (cherries, mushrooms, nuts, olives, persimmon, figs, berries and others); brandy; dried fruit and processed fruit. Increasing attention is also being paid to indigenous crops (honeybush tea, rooibos tea and kei-apple) and their general use, processing and health-promoting abilities. The breeding and evaluation of new stone and pome fruit, as well as table-grape cultivars, is a major research effort. Progeny from the various breeding programmes continue to succeed on the local and export markets.

Traceability and authenticity have become major concerns in modern trade, particularly for sophisticated markets in the first world. Developing the ability to analytically prove the authenticity of South African wine and brandy is the goal of a second major research intervention. Data from isotopic and trace-element analyses will be used to compile reference databases for use in authentication and fraud detection.

Livestock

ARC-Onderstepoort Veterinary Institute (ARC-OVI)

The ARC-OVI (north of Pretoria) is responsible for the prevention and control of animal diseases. It also provides a public-health service regarding food safety and security. The institute conducts research, and diagnostic and new-generation vaccine development of livestock diseases. It has six reference laboratories approved by the *Office International des Epizooties* (OIE), namely: rabies, lumpy skin disease, Rift Valley fever, African horse sickness, African swine fever and blue tongue. The Exotic Diseases Division is a high containment facility for diseases such as foot-and-mouth disease and African swine fever. The institute is also the Food and Agricultural Organisation

collaborating centre in Africa for transboundary diseases.

ARC-Livestock Business Division Animal Production (ARC-LBD: Animal Production)

ARC-LBD: Animal Production (in Irene outside Pretoria) comprises seven units, which assist the animal production and products industry to stay abreast of global competition. Animal Genetics and Biotechnology employs DNA technology, genetic characterisation and accelerated reproduction technology to conserve, maintain and enhance genetic variation. Together with the Animal Recording and Improvement Unit, this has assisted the livestock producer in breeding seed stock material to the benefit of genetic resources worldwide.

Cattle breeds such as the Bonsmara and Nguni, Dorper sheep, boerbok goat, Fowls for Africa, South African ostrich and the indigenous Kolbroek pig have become highly sought after in breeding programmes abroad. The Production Systems Unit deals with cattle, small stock, pigs and poultry. The Range and Forage Unit assists in the effective use of rangeland and forage production.

Council for Scientific and Industrial Research

Constituted by an Act of Parliament in 1945, the CSIR is one of the leading scientific and technology research, development and implementation organisations in Africa. It is situated in Pretoria with offices elsewhere in South Africa. The CSIR undertakes and applies directed research and innovation in S&T to improve the quality of life of South Africa's people. Building measurable value into its work through local and international partnerships remains a key component of its endeavours to provide world-class technology.

The CSIR started with a major repositioning process in 2004 to ensure that the organisation delivers on its dual-focus mandate.

As an integral part of its future strategy, the CSIR will address three core areas to provide the foundation for developing and reconfigurating its S&T base:

- building and transforming human capital
- strengthening the S&T base
- performing relevant knowledge-generating research and technology transfer.

With its renewed focus on science and research, the CSIR adopted a new corporate identity in 2006. The essence of shaping a better future through science is captured in a few key concepts: scientific excellence, innovation and quality, skills development, leadership in science, working through partnerships, ensuring transformation, and making a real difference through science.

Knowledge generation and application reside at the core of the CSIR, and are structured into three groupings:

- Emerging research areas (Eras). Such areas could be unique to local circumstances or could be successful internationally and would need to be established for local competitiveness. Some 12 Eras have been identified, with nanotechnology and photonics the first two selected.
- The R&D core. These are operating units that draw together skills from research fields and scientific disciplines to address national S&T needs. The CSIR operating units are:
  - Biosciences
  - Built Environment
  - Defence, Peace, Safety and Security
  - Materials Science and Manufacturing
  - Natural Resources and the Environment.
- National research centres. These facilities will be of strategic importance for African science over at least the next two decades. These currently include the:
  - Meraka Institute (African Advanced Institute for ICT)
  - National Laser Centre
  - National Metrology Laboratory
  - Satellite Applications Centre.

The CSIR Knowledge Services Group manages routine specialised and differentiated services. The nature of this group's operations is commercially driven.

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

Mintek is an autonomous statutory organisation and reports to the Minister of Minerals and Energy. About 35% of the annual budget of R275 million is funded by the State Science Vote, with the balance provided by contract R&D, sales of services and products, technology-licensing agreements and joint-venture operating companies. Mintek has some 480 permanent staff members, over half of whom are scientists, engineers and other technical R&D personnel.

Mintek's objectives are to research, develop and transfer to industry novel and improved techniques for processing, extracting, refining and utilising minerals and mineral products, to:

- enhance the competitiveness of South Africa's minerals industry in the global market
- assist local mining and engineering companies to expand internationally
- promote job creation, economic growth and regional development.

Specific goals are:

- promoting increased beneficiation of South Africa's minerals and mineral commodities by developing competitive and innovative processing technology and equipment
- strengthening South Africa's international position as a supplier of mineral technologies, capital goods and services
- developing regional strategies for the mineral-processing sector, concentrating on value-addition, capacity-building and broad-based development.

Mintek's activities include:

- providing essential services (information, consulting and experimental)
- increasing the competitiveness of the industry by developing appropriate technology to cut costs and improve recoveries
- developing breakthrough process technologies and novel uses for metals and their products
- marketing its commercial products and technologies to industry
- establishing strategic partnerships and joint ventures
- participating in regional development initiatives and SADC activities and projects
- maintaining and expanding international scientific links
- developing the HR potential of the region through education and training activities.

Mintek offers a complete range of process-development services, from preliminary bench-scale investigations to large-scale piloting and integrated flowsheet development in support of bankable feasibility studies. Engineering design, plant construction and commissioning are carried out in conjunction with international partners.

Comprehensive laboratory and piloting facilities for sample preparation, milling, flotation, physical separation, smelting, leaching, pressure leaching, and metal recovery and purification are supported by internationally accredited analytical laboratory and mineralogical services.

To ensure focus and market orientation, Mintek's R&D activities are grouped into programmes that are based largely on industry structure:

- The Gold Industry Programme focuses on developing and introducing improved technologies, such as biotechnology and ion-exchange processes, to simplify processing and increase recoveries, particularly from ores that are difficult to treat. A major joint venture with industry and other research groups is exploring new industrial uses of gold.
- The Platinum-Group Metals (PGMs) Industry Programme aims to increase the cost-effectiveness of PGM production and stimulate industrial demand for PGMs.
- The Ferrous Metals Industry Programme develops products and technical services to increase the cost-effectiveness of ferro-alloy production, as well as stainless steels and other alloys with improved properties.
- The Non-Ferrous Metals Industry Programme includes the processing of aluminium, cobalt, copper, lead, magnesium, nickel and zinc. A major emphasis is on the introduction of cleaner technologies.
- The Industrial Minerals Industry Programme includes the beneficiation and processing of commodities such as heavy minerals, chromite, iron and manganese ores, andalusite, phosphates, fluorite and diamonds. Mintek's research into waste management and environmental problems also falls under this programme.

Promoting industrial growth

Mintek is promoting a number of major new industrial projects based on mineral beneficiation,

using existing and newly developed technologies. These include the recovery of PGMs from metallurgical waste material, ferro-nickel production, and the establishment of a local magnesium industry using a novel thermal production route.

Minerals policy and development

Mintek conducts surveys, evaluations and commodity and market studies to support initiatives by governmental, international, regional or industry associations. It also identifies and evaluates potential development projects, assesses and provides technology, and conducts feasibility studies.

Mintek supports the activities of the SADC Mining Co-ordination Unit and was closely involved in developing the economic growth strategy for Nepad and the African Mining Partnership.

The Sustainable Development Unit co-operates with industry, other research institutions and academia to maintain and enhance the minerals sector's contribution to society. The unit provides services and technologies (in particular by developing and evaluating remediation technologies) and supports policy-makers in South Africa and Africa by providing strategic direction and procedures that promote value addition and sustainable development in the mining industry.

Mintek's Small-Scale Mining (SSM) Division supports the SSM sector by developing appropriate technologies, providing consulting services and training, and promoting sustainable mining, downstream processing and value-addition through integrated development programmes.

Environment

Mintek continues to focus on developing environmentally responsible technologies for the recovery and recycling of metals from metallurgical residues. A major programme is in place to monitor cyanide species after discharge in various locations around gold plants, from both an environmental and a processing point of view.

Mintek's environmental management system is certified as meeting the requirements of the International Organisation for Standardisation (ISO) 14001.

Education

The development of appropriate HR is crucial for the long-term sustainability of the minerals industry. Mintek's educational and training initiatives are provided through a section 21 company that was established to develop and train South Africans from historically disadvantaged communities as technicians, technologists and engineers. The specific programmes include:

- artisanal and SSM training
- the jewellery-manufacturing training programme
- upgrading Mathematics and Science skills

The International Science, Innovation and Technology Exhibition (Insite) was held in September 2006, six years after 119 countries, including South Africa, signed up for the millennium development goals (MDGs) at the United Nations (UN). Signatories aim to:

- eradicate extreme poverty and reduce the number of people who suffer from hunger and malnutrition by half by 2015
- achieve universal primary education
- promote gender equality and empower women by eliminating gender disparities at all levels of education
- reduce the death rate among children under the age of five by two-thirds
- improve maternal health by reducing, by three-quarters, the maternal death rate
- contain and begin to reverse the spread of HIV and AIDS, malaria and other major diseases
- reduce by half the proportion of people without sustainable access to safe drinking water
- develop further open-trading and financial systems that do not discriminate
- in co-operation with the private sector, make available the benefits of new discoveries, especially information and communications technologies.

Insite 2006 focused on three themes that directly affect South Africa's ability to address the MDGs:

- Science and Youth, emphasising educators, learners and careers in science and technology
- Science for Economic Growth, focusing on innovation, discovery and the capacity for science to stimulate economic growth
- Science for Sustainable Development, demonstrating how science can improve South Africans' quality of life and bring them prosperity.

- science promotion (through Minquiz, Mintek Engineering Awareness Programme and grades 11 and 12 girls' programme)
- undergraduate and postgraduate bursary schemes
- in-training programmes for recently qualified engineers and technicians
- specialised advanced technical programmes.

Human Sciences Research Council (HSRC)

The HSRC is South Africa's statutory research agency and conducts research that generates critical and independent knowledge relative to all aspects of human and social development. Alleviating poverty and developing and implementing public policy are central to its research activities. The HSRC's research also extends beyond South Africa's borders through projects and collaborations in other African countries.

As a social-science research organisation committed to making a difference in the quality of life of ordinary people, the HSRC is often commissioned to undertake large-scale research on behalf of government departments at national, provincial and local levels. The organisation also serves the research needs of parastatal organisations and private-sector entities, as well as local and international development agencies to track service delivery, evaluate performance and measure the efficacy of interventions.

The HSRC's collaborative approach to research provides a platform for interaction with research experts in South Africa and abroad. In addition to conducting commissioned research, the organisation proactively disseminates its research findings in peer-reviewed and other publications, and through seminars, lectures and media briefings.

Functioning as a knowledge hub, the HSRC contributes to bridging the gap that often exists between research, policy and action.

HSRC research comprises six interdisciplinary research programmes, namely:

- Child, Youth, Family and Social Development
- Democracy and Governance
- Education, Science and Skills Development
- Social Aspects of HIV, AIDS and Health
- Society, Culture and Identity
- Urban, Rural and Economic Development.

Five cross-cutting research units have been established to interactively contribute to, as well as draw from, the six research programmes to integrate and enhance the work of the HSRC as a whole:

- Capacity Development
- Gender and Development
- Knowledge Systems
- Policy Analysis
- Social Aspects of HIV and AIDS Research Alliance (Sahara), an Africa-wide research network.

The Policy Analysis Unit has a dual mandate. The first is to serve as a think tank and provide a platform for the public discourse of critical social issues. The second is to pursue time-limited and multiyear analyses of specific priority areas. The first two of these focus on education quality and on employment and growth.

Over the last few years, the HSRC has undertaken a rich and varied array of research investigations, averaging 250 projects at any given time. To succeed in its mandate of conducting social-science research that makes a difference, the HSRC guards its reputation as an independent, professional and unbiased research council.

Research programmes

Child, Youth, Family and Social Development

The Child, Youth and Family Development Programme focuses on the life course, from infancy to old age, and aims to develop a clearer understanding of the ways in which these challenges shape and affect individuals and society as a whole throughout the life cycle.

It also strives to promote human and social development through high-quality applied research that addresses the immense challenges posed by social inequality, poverty, violence, HIV and AIDS, and other causes of ill health.

Democracy and Governance

There is an ongoing need to consolidate South Africa's relatively young democracy, to continually improve governance, and to address emerging issues in fresh and substantive ways.

The Democracy and Governance Programme examines issues that contribute to or constrain the growth and development of democracy in South Africa and the rest of Africa.

Education, Science and Skills Development

The work of the Education, Science and Skills Development Programme spans three major social domains in the form of the education system, the NSI and the world of work.

The programme's goal is to produce comprehensive, integrated and holistic analyses of the pathways of learners through schooling, further and HE and into the labour market and NSI.

To deliver effective research within these four fields, the programme has spent much time and energy building a strong network of HE institutions, non-governmental organisations (NGOs) and private-sector research organisations. Through close collaboration with these organisations, the programme has delivered a number of successful research projects, ranging from sectoral studies of skill needs and analyses of key professions, to evaluating transformation in education and the labour market, and monitoring and evaluating educational improvement from a national to classroom level.

Social Aspects of HIV, AIDS and Health

Many of the public-health issues facing South Africa cannot be resolved merely through medical interventions, but need to be addressed at a social and population level as well. The Social Aspects of HIV, AIDS and Health Programme undertakes cutting-edge, innovative research into HIV and AIDS, and public health to contribute to public-policy dialogue and formulation, and to improve health-service delivery.

To achieve these objectives, the programme focuses on research that is policy-relevant and responds to the challenges facing South Africa, while also assessing, monitoring and evaluating HIV. AIDS and health programmes that aim to improve the lives of South Africans.

Society, Culture and Identity

The Society, Culture and Identity Programme researches ways of preserving, strengthening and promoting South Africa's rich cultural and intellectual heritage, while evaluating the progress South Africans have made in living up to their inherent values and knitting together their diverse identities. It investigates ways in which the country's universal citizenship can be developed through respect for the various identities South Africans hold. Within this context, the programme examines issues of identity, language and culture pertaining to South Africa and the African continent.

Urban, Rural and Economic Development

The Urban, Rural and Economic Development Programme is multidisciplinary. Its primary objective is to promote integrated urban and rural development through problem-oriented research, user-driven policy development and ongoing monitoring and evaluation.

With poverty reduction as the unifying theme, the programme's objectives and activities are designed to address key national, regional and Africa-wide underdevelopment challenges and policy priorities, through a collaborative approach to research.

Cross-cutting units

Policy Analysis

The Policy Analysis Unit serves as a think tank and forum for deliberating and analysing public policy on the most critical issues affecting the lives of people in Africa. Under the spotlight are such issues as HIV and AIDS, homelessness, unemployment, skills development, poverty, crime, access to quality education and health services.

Ultimately, the unit will serve as a forum for intellectual dialogue among academics and researchers from various parts of the African continent, and will bring together diverse stakeholders, including policy-makers, programme planners, researchers, NGOs, community groups, donors and multinational agencies to participate in the process of policy scrutiny in critical areas of social development.

The unit's first two national priority initiatives are education quality and employment growth and development.

The HSRC intends, among other things, to increase the pool of competent researchers for human and social sciences in South Africa, and to support the development of black, as well as of female researchers, to enable the organisation to meet its equity targets.

Gender and Development

The Gender and Development Unit recognises the need to retain a gender perspective in HSRC research and operations by assessing the implications for men and women of any planned activity.

Social Aspects of HIV and AIDS Research Alliance

Sahara seeks greater understanding of the epidemic in the hope of contributing to a reduction in the number of new HIV infections and, ultimately, to a reversal in the spread of HIV and AIDS.

The network runs multisite and multicountry research projects in Africa for generating new social-science evidence for prevention, care and mitigation of the impact of the epidemic. It disseminates information through its dedicated website *(www.sahara.org.za)* and publishes an internationally accredited scientific journal, the *Social Aspects of HIV/AIDS Research Alliance Journal.*

Knowledge Systems

The Knowledge Systems Unit conducts primary and secondary research on socio-economic and governance issues as well as the NSI, to facilitate evidence-based decision-making by users of the research.

The unit works with external research users and supports the research programmes of the HSRC, while also building complementary expertise throughout Africa. The key focus areas of the unit involve the design, implementation and analysis of quantitative and qualitative data to enhance the knowledge-management strategies of the HSRC, and to promote social-scientific research and capacity-building throughout South Africa and the African continent.

Medical Research Council (MRC)

The MRC's mission is to improve the nation's health status and quality of life, through relevant research aimed at promoting equity and development.

The MRC is an autonomous body, but reports to the Department of Health. It receives 60% of its budget from the Department of Science and Technology. Its head office is situated in Cape Town, with provincial offices in Pretoria and Durban.

The MRC's research activities are aligned with the health priorities of the nation, and in accordance with the national S&T imperatives and the health priorities defined by the Department of Health. Activities are grouped into the following national programmes:

National Programme for Research in Molecules to Disease

This programme undertakes research on human and microbial genetics, genomics, bio-informatics, cell and molecular biology, tissue engineering, oesophageal cancer, molecular hepatology, micro-bacteriology, and liver and bone disease.

National Programme for Health Systems and Policy Research

The scientists in this programme conduct research on health systems, clinical epidemiology, biostatistics, health policy, the burden of disease and telemedicine.

National Programme for Infection and Immunity Research

The research units in this programme are involved in research into TB, malaria, immunology of infectious diseases, diarrhoeal diseases, inflammation and amoebiasis, genital ulcer diseases, respiration and meningeal pathogens, and South African traditional medicines.

It also incorporates the MRC National HIV and AIDS Lead Programme, whose divisions co-ordinate the South African AIDS Vaccine Initiative; various aspects of biomedical research, including mother-to-child transmission and microbicides; and prevention of transmission through behavioural change. (See Chapter 13: *Health.*)

National Programme for Non-Communicable Disease Research

This programme undertakes research into heart disease (both laboratory, clinical and public-health research), nutritional intervention, diabetes, crime, violence and injury, anxiety and stress disorders, dental issues, medical imaging, chronic diseases of lifestyle and cancer epidemiology.

National Programme for Environment and Development Research

In this entity, research is undertaken into health promotion, health and development, exercise and sports science, occupational and environmental health, alcohol and drug abuse, and technology transfer.

National Programme for Women and Child Health Research

This programme undertakes research into many aspects of women's health, including high blood pressure during pregnancy, healthcare strategies in maternal and infant health, perinatal mortality, gender and health, mineral metabolism and nutritional intervention.

South African National Health Knowledge Network

The South African National Health Knowledge Network was established in 1999 at the MRC with funding from the Government's IF.

The network operates under the trade name SA HealthInfo and is available on the Internet at *www.sahealth-info.org*. It provides a one-stop interactive forum or resource for quality-controlled and evidence-based health-research information.

Council for Geoscience (CGS)

The main functions of the CGS are:

- documenting the surface of the Earth within the borders of South Africa; compiling geological, geophysical, geochemical and other geoscientific information; and publishing this information in the form of maps and documents
- conducting geoscientific research into rocks, minerals, ores, fossils, etc. in South Africa, and publishing research results in national and international journals
- collecting and conserving all geoscientific information and data on South Africa in national collections and electronic databases
- supplying geoscientific services and advice to the national and provincial governments, ensuring informed decisions regarding the optimal and efficient use of the Earth's surface.

The objectives of the CGS are to:

- minimise the geological and geoscientific investment risk for national and international entrepreneurs in the South African mining sector (the quality of available geological information, which is known as the 'geological risk grading', contributes to about 61% of the investment risk in any country)
- supply the country with basic geoscience data to establish a safe, cost-effective physical infrastructure
- supply basic knowledge to ensure safe, cost-effective and environmentally acceptable urbanisation and housing development
- carry out research into raw material needed to clothe, transport, feed and provide shelter for the nation.

To accomplish these functions and objectives, the CGS maintains a specialised workforce, consisting of Earth scientists supplemented by technical, support and administrative staff at its headquarters in Pretoria, as well as at branch offices in the Western Cape, Northern Cape, Limpopo, North West and the Eastern Cape.

The following national institutions are maintained by the CGS:

- The National Geoscience Library in Pretoria is probably the most comprehensive geoscience library in Africa. It includes the Map Library, which contains a collection of South African and African geoscience maps.
- The National Core Library contains a representative stratigraphic-borehole core collection, representing most of the lithological units located within the borders of South Africa. This collection is housed at Donkerhoek, east of Pretoria.
- The Geoscience Museum, in the Transvaal Museum in Pretoria, contains a unique collection of minerals and fossils, catering for the Earth-science education of the public, especially schoolchildren.
- An extensive laboratory, specialising in analysing rock and soil samples, uses various specialised techniques.

Geoscience information and services provided by the CGS are particularly important for sustainable development of the country. In South Africa's arid regions, the management of groundwater resources (both the quantity and quality thereof) is aimed at providing enough clean water to communities. In addition, the CGS has recently established the Environmental Geoscience Unit to provide services in this highly competitive and very important field.

Although South Africa is situated on a relatively stable part of the Earth's crust, the CGS maintains a seismic network for recording such events within the national borders and coastal waters off South

Africa's coastline. This information is available to interested parties and helps mitigate the problems associated with mining-related seismic events.

The CGS is a world leader in the domain of geophysical surveys, using a detection system deployed on light aircraft. This significantly reduces the cost of very high-resolution geophysical data for mineral exploration. A larger aircraft (a Cessna Caravan 208B) has been purchased as it can carry larger sensors, dramatically increasing the CGS' capability to conduct high-resolution geophysical surveys.

The CGS leads an initiative by the Department of Minerals and Energy to assist upcoming mining entrepreneurs, particularly those from historically disadvantaged groups, to exploit South Africa's mineral resources in a cost-effective and environmentally friendly way.

Because the CGS plays a leading role in the SADC, several geoscience publications covering the region have been produced, describing heavy mineral sand, diamond, gold, bauxite and dimension-stone deposits in the region. A seismic hazard map of the region, a lithostratigraphic table comparing the geological formations in the region, and maps of the Kalahari Basin have also been produced. The latest publication in this series is a compilation of copper and cobalt deposits in the SADC region.

In addition to its national responsibilities, the CGS is also active internationally, mainly in Africa. Geological and metallogenic maps of, among other countries, Angola, the Democratic Republic of Congo, Mozambique, Gabon and Morocco have been produced. By mid-2006, major geological mapping projects in Ghana, Mozambique, Madagascar and New Guinea, and the supervision of mapping projects in Mauritania, Mozambique and Madagascar were also under way.

South African Bureau of Standards (SABS)

The SABS was established in 1948 to develop, maintain and disseminate standards in South Africa. Although this core objective has remained unchanged over the years, the mission of the SABS has changed its focus in step with the times. The SABS sees its mission as 'improving the quality of life of all South Africans, through the process of standardisation'.

Standards South Africa (StanSA)

StanSA is the SABS' core function and is responsible for developing, maintaining and disseminating the country's national standards.

Through its main Standards Sales Division in Pretoria, as well as its offices in Durban, Cape Town and Port Elizabeth, all national standards as well as those of the International Electrotechnical Commission, the ISO and a host of other foreign standards are made available to the public.

Regulatory Affairs and Consumer Protection

This division of the SABS is responsible for administrating certain national regulations, mainly on behalf of the Department of Trade and Industry. Legal Metrology forms a part of the division and ensures the protection of consumers against incorrect metrological practices such as the sale of underweight or undersized products. A specific function directed towards providing conformity-assessment services to the SME sector, and other Presidential imperatives and social-responsibility activities, are also located in this division.

South African Bureau of Standards Holdings (Pty) Limited

All the conformity-assessment services of the SABS are located in this company. These include testing products, providing system and product-certification schemes, inspecting consignments and training people in these matters. SABS Holdings is a separate company that competes in the private sector and charges for the services that it renders. This is unlike SABS Regulatory Affairs and StanSA, which recover their costs from monies allocated for those purposes under the Science Budget Vote of the Department of Science and Technology.

A corporate function provides overhead services such as finance, HR, legal, marketing and communication, risk management and IT.

Other scientific and research organisations and structures

Biotechnology Partnership for Africa's Development (Biopad)

Biopad was initiated early in 2003 by a community of biotechnologists and professionals as a means to put South Africa among the world leaders in the application of biotechnology.

Sasol

Sasol is an integrated oil and gas company with substantial chemical interests. In South Africa, these operations are supported by mining coal and converting it into synthetic fuels and chemicals through proprietary Fischer-Tropsch technology.

Sasol also has chemical manufacturing and marketing operations in Europe, Asia and the Americas. Its larger chemical portfolios include polymers, solvents, surfactants and their intermediates, waxes, phenolics and nitrogenous products.

The group explores and produces crude oil in offshore Gabon, refines crude oil into liquid fuels in South Africa, and retails liquid fuels and lubricants through a growing network of retail service centres. During the first quarter of 2004, Sasol started extracting Mozambican natural gas, some of which has been used as feedstock for fuels and chemical production in South Africa since mid-2004.

Sasol is also developing two joint-venture gas-to-liquid plants in Qatar and Nigeria based on its Sasol slurry phase distillate process.

Eskom

Eskom's Technology Services International group is a multidisciplinary industrial laboratory and consulting organisation. It undertakes testing, investigation studies, project management, engineering services and applied research for Eskom and other customers.

Mittal Steel SA

Mittal Steel SA is the dominant steel producer on the African continent, producing 7,1 million tonnes of liquid steel per year. Mittal Steel SA's global standing is further underpinned by it being part of the world's largest steel producer, Mittal Steel Company N.V.

Through this agreement, Mittal Steel SA has access to world-class R&D, best-practice processes, aggressive procurement contracts and international market leverage to ensure the company remains at the cutting edge of the international steel industry.

National Health Laboratory Service (NHLS)

The NHLS is a national network of integrated pathology laboratories countrywide that use common laboratory-management systems and transport networks to facilitate the transport of specimens, referral of tests to reference laboratories and the delivery of results.

The NHLS includes about 250 laboratories, employing some 3 500 people. Their activities comprise diagnostic laboratory services, research, teaching and training, and the production of sera for anti-snake venom and reagents. All laboratories provide diagnostic services to the Department of Health, provincial hospitals, local governments 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, the Poliomyelitis Research Foundation, pharmaceutical companies, private donors and numerous overseas institutions, among others. The NHLS finances a large part of the research programme from the earnings of its laboratory services.

The NHLS teaching programme includes training medical technologists in association with universities of technology. University teaching at both undergraduate and postgraduate level is done through the pathology departments of universities' medical schools.

Bureau for Economic Research

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

African indigenous knowledge is central to the concept of the African Renaissance. It is the knowledge system that informs how African society functions and interacts with people and societies; it provides the founding motivator for people's actions, and the knowledge base for learning and Africa's sustainable development.

In 2004, the Cabinet adopted the Indigenous Knowledge System (IKS) policy that endeavours to contribute to consolidating South Africa's constitutional democracy and to improving the lives, dignity and equality of the country's indigenous and local communities by giving expression to the recognition, promotion, development and protection of IKS.

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

General research areas

Mine-safety research

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.

Energy research

The Chief Directorate: Energy of the Department of Minerals and 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 various organisations in the private sector. Provinces are responsible for farm management and technological development. These activities are aimed at improving managerial efficiency on farms.

The Directorate: Scientific Research and Development in the Department of Agriculture co-ordinates all agricultural R&D activities.

The National Agricultural Research Forum (NARF) co-ordinates agricultural R&D within the national agricultural research system. The NARF also provides a platform for stakeholder consultations on R&D matters.

Biannual meetings are held to debate and agree on research needs, programmes and budgeting. 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

Water research in South Africa is co-ordinated and funded by the Water Research Commission (WRC) in Pretoria. The WRC was established in 1971 through the Water Research Act, 1971 (Act 34 of 1971), following a period of water shortage.

The WRC provides leadership for R&D through the support of knowledge creation, transfer and application. It engages stakeholders and partners in solving critical water-related problems.

It is a networking organisation, linking the nation and working through partnerships.

Being a water-stressed country, South Africa progressively needs to find innovative ways of managing water resources to ensure that the basic needs of its citizens are met, that social and economic development is not restricted through poor quality or a lack of water, and that sustainability of water resources and water-dependent ecosystems is achieved.

The WRC continues to play a leading role in building a sustainable water-related knowledge base in South Africa by:

- investing in water R&D
- building sustainable and appropriate capacity
- developing skills for the water sector
- being adept at forming strategic partnerships to achieve objectives more effectively while making optimal use of the latest available global information/knowledge and other technologies.

The Water Research Act, 1971 established the Water Research Fund, which derives income primarily from levies on water consumption.

In supporting the creation, dissemination and application of knowledge, 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 WRC also calls for specific mechanisms to address key strategic issues of national importance. These issues are dealt with in four cross-cutting domains:

- water and society
- water and the economy
- water and the environment
- water and health.

The organisations most active in water research are:

- universities and universities of technology (56,25% of the total number of contracts)
- professional consultants (16,6%)
- science councils (22,9%)
- water/waste utilities (2%)
- NGOs (2%).

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.

The Division: Water, Environment and Forestry Technology (Environmentek) of the CSIR specialises in research into water quality, including technology to meet effluent and water-quality standards, and to establish reclaimed water as an additional water source. Environmentek is a world leader in research into activated sludge processes and the biological monitoring of water to detect potentially toxic substances. It is also involved in research into the effects of afforestation and veld management on the quantity and quality of catchment water-yield.

Environmental research

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

The programmes comprise subjects such as waste management and pollution, nature conservation, river management, the coastline and marine environment, and the atmosphere.

Some programmes are conducted in collaboration with the NRF, while others are undertaken on behalf of the department by the CSIR and universities.

Research into human-environment interaction sponsored by the department is co-ordinated by the HSRC.

In addition, institutes of the ARC are concerned with environmental research insofar as environmental problems impact on agriculture or are caused by agricultural practices.

The South African Weather Service (SAWS) is a statutory body functioning under the Department of Environmental Affairs and Tourism.

The SAWS delivers public-good services, mainly for the protection of life and property, as well as commercial services to the private sector, as stipulated in the Weather Service Act, 2001 (Act 8 of 2001).

Government funds public-good services while commercial services are paid for by the user. Public-good services include weather and climate forecasting, a weather-disaster warning system, services to subsistence farmers and fishers, the provision of information and advice to government, meeting regional and international treaty and agreement obligations, maintaining a national meteorological library, technical and scientific training in meteorology, and undertaking research to improve services.

In 2005/06, the SAWS issued more than 150 adverse weather warnings. SAWS was expected to spend over R6 million in 2006/07 to expand its weather radar network. The SAWS shares weather radar data with Mozambique and intends to establish a regional weather radar network involving neighbouring countries in the SADC in the long term.

Because lightning causes major damage and loss of life, in 2005/06 SAWS installed the state-of-the-art Lightning Detection Network that covers Lesotho and Swaziland and parts of Namibia, Zimbabwe, Botswana and Mozambique.

Among other activities, the SAWS runs the Global Atmospheric Watch Programme, which measures and monitors greenhouse gas datasets. The SAWS has also rolled out a number of ozone-monitoring stations in the SADC region.

The NRF directs the multidisciplinary Conservation and Management of Ecosystems and Biodiversity Focus Area, primarily in collaboration with universities and museums, to promote and support research into living resources and terrestrial, freshwater, marine, coastal and atmospheric ecosystems.

Some 170 projects are approved annually, and global issues such as climate change and biological diversity are also included. The sustainable use of natural resources is a priority area, resulting in an increase in projects relying on sociology and the humanities. The NRF also supports a range of environmental research network organisations

such as the Arid Zone Ecology Forum, the Fynbos Forum, the Indigenous Plant-Use Forum and the Savanna Ecology Forum.

Fisheries research

Research into South Africa's fish resources, and their conservation and judicious exploitation, is carried out by research personnel of the Chief Directorate: Marine and Coastal Management, a division of the Department of Environmental Affairs and Tourism, and by several universities and NGOs. Research is designed to provide parameters for estimates of stock sizes and sustainable yields for the different fisheries.

Coastal and marine research

The Chief Directorate: Marine and Coastal Management advises on the utilisation 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 the utilisation of marine ecosystems and their resources are guiding objectives in the research and advice provided by the chief directorate.

The NRF supports marine and coastal research in partnership with the Department of Environmental Affairs and Tourism and South African Network for Coastal and Oceanic Research.

The Department of Science and Technology declared June 2006 Antarctica Month to make South Africans more aware of the unique and exciting research done by South African scientists on this frozen continent and the sub-Antarctic islands. The mission of the South African Antarctic Programme (Sanap) is to increase people's understanding of the natural environment and life in the area through appropriate research, science and technology. Sanap research is undertaken in Antarctica, on the Prince Edward islands (including Marion Island and Prince Edward Island), Gough Island and in parts of the Southern Ocean.

Two government departments are joining hands in managing South Africa's Antarctic initiative. The Department of Science and Technology, through the National Research Foundation, is responsible for science research, while the Department of Environmental Affairs and Tourism takes care of logistical management.

The month also marked the 45th anniversary of the first South African National Antarctic Expedition team to over-winter on the ice.

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 can make use of various overseas developments. 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 (manufacture 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 mechanism and microbiology), Tellumat (development of electronic instruments), the Rembrandt Group (development and improvement of tobacco and liquor products), South African Pulp and Paper Industries (wood technology, paper manufacture and water treatment), and Standard Telephones and Cables SA (long-distance transmission of information and lightning protection).

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Medical Research Council
Mintek
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