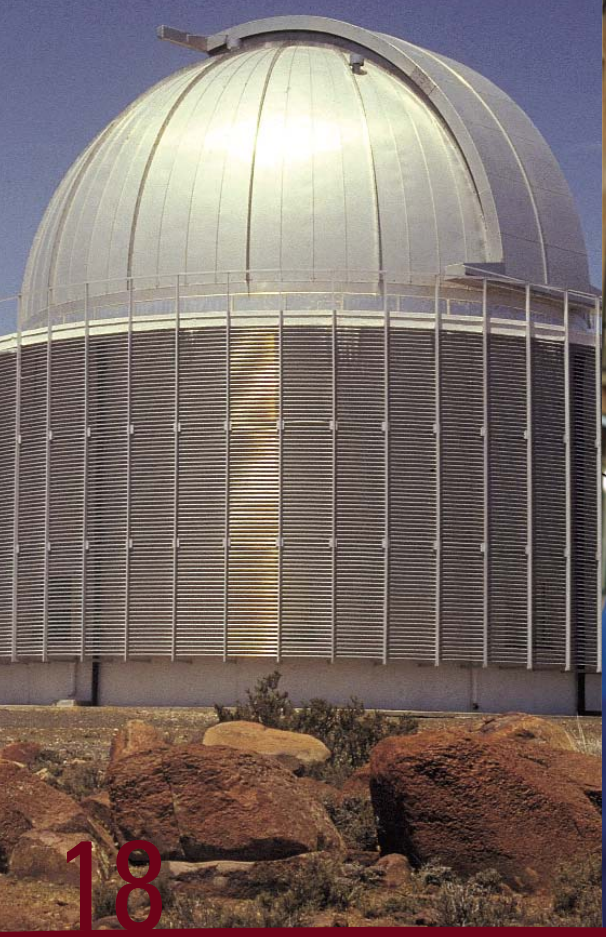

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Science and technology

Policy and funding

The vision of the Department of Science and Technology is 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.

National S&T policy is the responsibility of the Minister of Science and Technology.

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 the pursuit of a common set of social and economic goals.

The Science budget vote represents core funding for key science councils and national research and development (R&D) financing programmes. It has grown at an average annual rate of 9,2% over the period 2000/01 to 2003/04, with above-average increases in expenditure for the Medical Research Council (MRC), the Innovation Fund (IF), the National Research Foundation (NRF) and the Africa Institute of South Africa.

Growth in the Science budget increased at an annual average rate of 12,5% over the 2004 Medium Term Expenditure Framework (MTEF) period.

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 on policy and the allocation of funding.

Some funds allocated to the 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 with allocations through a competitive bidding process from the IF. The IF applies three major criteria when making its selections: competitiveness, quality of life and environmental sustainability. Projects funded from the IF have led to new businesses, products and services in the marketplace.

National Research and Development Strategy

The National R&D Strategy focuses on three broad areas:

- Innovation enhancement, 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 the New Partnership for Africa's Development (NEPAD) and Southern African Development Community (SADC); strengthening global science networks; formulating strategies aimed at sourcing new financing for R&D equipment; strengthening institutional and individual research capacity in science focus areas through the NRF; and increasing public understanding and the number of public engagement activities.
- Creating an effective government S&T system: There needs to be a clear distinction 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.

Advanced Manufacturing Technology Strategy

The Advanced Manufacturing Technology Strategy was launched in October 2003 and resources are being allocated towards its implementation. Planning is underway for developing innovation programmes in the energy, mining and mineral-beneficiation domains of resource-based industries.

National Technology Transfer Strategy

The National Technology Transfer Strategy has been completed and should be implemented from 2004/05. This Strategy is based on the inevitable role that technology plays in wealth creation and in addressing the challenges of social development.

National Energy Research Institute (NERI)

The Cabinet approved the establishment of the NERI in 2004.

The Institute, which will be jointly run by the departments of Minerals and Energy and of Science and Technology, will conduct research on the energy sector.

The Ministry of Science and Technology is leading the high-level strategy formulation process for the operational function of the Institute. The objectives of the NERI will, through R&D, provide for:
- cost-effective and efficient energy generation, transformation, transport, end use and decision-support technologies
- energy technology innovation
- sustainable development and utilisation of energy resources
- improvement of the quality of life all South Africans
- promoting and conducting training of energy researchers
- the establishment and expansion of industries in the field of energy
- commercialisation of energy technologies resulting from its Research Development and Innovation programmes.

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 whole technology value chain of the PBMR Programme, ranging 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. This Programme is around four years ahead of any other high-temperature gas-cooled reactor programme in the world. To maintain this competitive edge, there needs to be rapid development of the research and skills base in South Africa.

This fast-track five- to 10-year Programme is aimed at achieving the following:

- utilising and co-ordinating existing capacity and instruments to grow a critical research and skills base to support the PBMR Programme for a sustainable nuclear industry in South Africa
- promoting new programmes at universities to stimulate innovation and high-calibre intellectual capacity in PBMR-specific science and engineering disciplines, with a special focus on historically disadvantaged individuals
- stabilising attitudes towards nuclear technology in society, through the creation of awareness programmes.

National Advisory Council on Innovation

Government has a constant need for informed advice on the development and implementation of S&T policy and the stimulation of innovation. The NACI is responsible for carrying out inquiries, studies, policy research and consultations with regard to the functioning of the NSI, as requested by the Minister of Science and Technology.

The Council enables the Department of Science and Technology to consolidate and develop the NSI in an informed and proactive manner. It provides a focused mechanism to access and target critical S&T research and information for the purpose of socio-economic development.

The members of the NACI are broadly representative of government and the higher education (HE), business and non-profit 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 Science and Technology, which was 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, which were first awarded in 2003, honour female scientists and their achievements.
- The SET Week project, which was implemented for the first time in 2000. In May 2004, it took place simultaneously in all nine provinces. Some of the key activities included interactive exhibitions, science shows, workshops, theatres and career-information sessions.

The main objective of the SET Week is to inform the community about the achievements in SET and persuade young people, in particular, to pursue scientific careers that would contribute towards the development of South Africa's economy. SET Week also promotes public awareness and appreciation of the role in and contribution of S&T to people's lives.

National Biotechnology Strategy (NBS)

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

The NBS was launched in 2001. It sets the agenda for the development of South Africa's biotechnology industry. This Strategy led to the establishment of the Biotechnology Regional Innovation Centres (BRICs), which champion innovation in biotechnology and stimulate the development of the biotechnology industry.

The Indigenous Knowledge Systems Policy and Bill will come into effect in the coming Medium Term Expenditure Framework. The Policy builds on initiatives already in place, such as the National Language Policy, the promotion and copywriting of indigenous music and art forms, and the Traditional Health Practitioners Bill.

The Department received proposals by consortia comprising academic institutions, private institutions and research councils to form three BRICs representing specific regions in the country. The BRICs promote R&D, entrepreneurial services, technology platforms, intellectual-property management and business incubation. Each Centre specialises in specific areas of technology within the national development imperatives, local expertise and market opportunities:

- Biopad BRIC in Gauteng focuses on animal health and industry/environmental-related biotechnology
- Ecobio BRIC in KwaZulu-Natal focuses on human health and bioprocessing, with a plant biotechnology focal area to contribute to plant biotechnology
- Cape Biotech Initiative BRIC in the Western Cape focuses on human health and bioprocessing.

These Centres combine business, academic and research capabilities to target areas that are directly relevant to South Africa's needs, as well as providing a platform for global economic participation. The key areas of activity include human health, industrial biotechnology, food security and agricultural production. These activities complement existing strategies in Information and Communications Technology (ICT) and new developments to support the advanced manufacturing industry.

Another Programme initiated as a result of the NBS is the Public Understanding of Biotechnology (PUB) Programme. The PUB Programme provides information to the public to enable South Africans to participate meaningfully in debates about biotechnology and to enable them to make informed decisions.

Godisa Programme

The departments of Science and Technology and of Trade and Industry, with the support of the European Union (EU), launched the Godisa National Incubation Programme in 2001. The Godisa Programme aims at encouraging technology transfer and capacity-building to enable small business to compete in the global economy.

Godisa aims to address:

- outdated technologies employed by small, medium and micro-enterprises (SMMEs)
- the low engagement rate of SMMEs in value-adding activities
- the high failure rate in the start-up of SMMEs
- poor access to facilities for testing and promoting SMMEs.

Godisa supports eight technology-transfer centres in five provinces, focusing on a multitude of technology platforms and markets, such as biotechnology, life sciences, medical devices, software, embedded systems, fine and performance chemicals, small-scale miners, and hydroponics for cut-flower exports. This technology has very real local and international benefits and leads directly to job creation, increased levels of competency and enhanced international competitiveness.

The Department of Science and Technology has partnered with the NRF to implement and manage the CoEs Programme. On 29 July 2004, the final six CoEs to be funded by the Department were launched.

As identified in the National R&D Strategy, CoEs are aimed at stimulating sustainable excellence in research and effecting the capacity-building of highly qualified HR.

Funding for the Programme has been budgeted at R15 million a year from 2003/04 to 2005/06, with plans to increase this amount as the Programme develops.

The establishment of the Timbali Technology Incubator under the Godisa Programme stems from opportunities that were identified in the Mbombela Investment Strategy and the report on the South African Floriculture Cluster.

Timbali is responsible for creating the technology basis that will focus on the establishment and development of a financially feasible export-based cut-flower industry in the Mbombela region in Mpumalanga.

This will be achieved through technology transfer to flower-growers selected from the local historically disadvantaged community, with emphasis on training in horticulture, business, finance and mentoring.

Tshumisano

The *Tshumisano* partnership programme, which aims to bring a closer partnership between stations based at participating universities of technology and SMMEs, has doubled its SMME client base from 206 in 2002/03 to just over 400 SMMEs with about 1 000 development projects in 2003/04. This was expected to grow to a target of 800 small and medium enterprises (SMEs) in 2004/05.

By June 2004, there were nine *Tshumisano* stations operating out of 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 their 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 SME development, and productivity improvement, technical mentoring and innovation services for existing SMEs.

Poverty-Reduction Programme

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

Its poverty-alleviation projects have had positive outcomes in businesses and co-operatives focused on, among other projects, bee-keeping, paper-making, African design incorporation in clothing and textiles based on natural fibres, and indigenous cattle production. These projects are concentrated in the poverty nodes as identified by the Government's Integrated Sustainable Rural Development Strategy (ISRDS) and, by June 2004 had yielded over 2 900 jobs and employed 1 675 women, 862 youth and 68 people with disabilities.

International science and technology co-operation

Science is an increasingly global activity and international funding for South African science rose from essentially nil in 1994 to 6% in 2002.

The Department of Science and Technology is committed to building strong international relations. It manages over 30 S&T bilateral agreements with various countries and is a key player in many multilateral fora, including the Commonwealth; the African, Caribbean and Pacific Group of States; the EU; and the Organisation for Economic Co-operation and Development.

The main areas of S&T co-operation between South Africa and its international partners are material science; manufacturing technology; biotechnology; environmental management; sustainable exploitation of natural resources and minerals; medical research and public health; engineering science and advancement of technologies; water-supply projects; and agriculture, Mathematics and Science education.

The NRF manages the implementation of the agreements, which range from 60 active projects with France to eight projects with the People's Republic of China. Other countries with which active projects are underway include Belgium, Germany, Hungary, Sweden, Poland, Italy, India, Norway, Nigeria, the Russian Federation, the United Kingdom (UK) and the United States of America (USA).

South Africa celebrated 10 years of science and technology (S&T) in the country by hosting a three-day international Innovation, Science and Technology (IST) Fair from 1 – 3 November 2004 at Gallagher Estate, Midrand.

The theme for the Fair was *Sustainable Development, Science and Technology – Challenges Ahead.*

The main objective of the Fair was to showcase the S&T partnerships established since 1994. The Fair also provided a platform to create a marketplace for IST with international players, offered goods and services in the areas of IST, focused on IST solutions for the developing world, and promoted IST partnerships for global sustainable development.

The Fair comprised a collection of country-level stands exhibiting goods and services from all parts of the world covering IST aspects such as research and development, equipment, new advances in S&T, experimental models, high-tech inventions, prototypes, interactive displays, etc.

Seminars and conferences were held to exchange ideas and to enhance the role IST plays in sustainable development.

A number of positive international developments for South Africa include the signing of crucial co-operation agreements with countries like Japan, Korea, Brazil and Malaysia; the development of a solid science platform in the trilateral India-Brazil-South Africa engagement; and the leveraging of significant new funds for South African and African S&T from international agencies and foreign countries.

The 2004/05 financial year was characterised by the intensified implementation of these agreements and plans, and an increase in South Africa's S&T footprint on the world stage. South Africa was expected to sign S&T agreements with Argentina, Australia, Chile, Romania and Kenya. Further bilateral collaboration was explored in Asia and Eastern Europe.

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. Following the inaugural conference in Johannesburg in November 2003, South Africa now chairs the African Minister's Council on Science and Technology, as the policy co-ordination body.

The work plan for 2004/05 included the expansion of the African Institute of Mathematical Science. The Department was also expected to increase the number of nodes of the African Laser Centre and launch new CoEs in the 12 flagship programmes in Africa's five regions.

The Southern African Large Telescope (SALT) at Sutherland in the Northern Cape is a multimillion-Rand project involving Germany, Poland, the USA, New Zealand and the UK.

Upon its completion in December 2004, SALT will be the largest single optical telescope in the southern hemisphere.

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 support technology development in its pre-competitive phase.

National Research Foundation

The NRF is the key public entity responsible for supporting the development of HR capacity for research, technology and innovation in the fields of S&T. Within the context of the national R&D and NEPAD objectives, the NRF sees itself as a major player in the education and training of a new generation of scientists able to handle South Africa's and the African continent's needs.

The NRF provides services and grants to support research and postgraduate research training, vital to the development of S&T in South Africa. It is the NRF's vision to be a key instrument in the creation of an innovative and knowledge-driven society where all citizens are empowered to contribute to a globally competitive and prosperous South Africa.

The four corporate core missions of the NRF are to develop and support:

- high-quality HR in aggressively increasing quantities
- the generation of high-quality knowledge in prioritised areas that are responsive to national and continental development needs
- the utilisation of knowledge, technology transfer and innovation to ensure tangible benefits to society
- the provision of state-of-the-art research infrastructure that is essential to facilitating the development of high-quality HR and knowledge.

Cross-cutting corporate strategic priorities include redressing and ensuring equity in race and gender; adhering to quality; internationalising research, focusing on Africa; positioning the NRF within the NSI; and transformation.

Thrusts identified by the NRF for 2004 – 2007 include: positioning the NRF as a knowledge organisation within the NSI, fostering diversity and transformation in the NSI, supporting big science activities, and driving organisational transformation and growth.

With a growth of 25% in its budget, from R766 million in 2003/04 to R956 million in 2004/05, the NRF is becoming a major player in the NSI. This budget includes ring-fenced funds, and funding for the national research facilities and CoEs. It excludes funds for the IF and Technology and Human Resource for Industry Programme (THRIP).

South Africa's Square Kilometre Array (SKA) bid

The SKA is a US $1-billion international project to create a radio telescope with a receiving surface of a million m^2, 100 times larger than the biggest receiving surface now in existence. This huge surface will be composed of many small antennas, with peripheral antennas as far as 1 000 km from the core. The signals received by these antennas will be combined to form a single big picture. This will require complex computing and information-processing systems. The result will be an instrument capable of probing the secrets of the very early universe.

South Africa, with the NRF as the lead agency, is gearing up to bid to become a host country for the SKA radio telescope, proposing to host the core array of the SKA, or part of the peripheral array. A major drive is underway to promote the competitive advantage of South and southern Africa for capital-intensive big science initiatives among the international community. The decision on the siting of the SKA telescope will most likely be made in 2006 and the success of SALT gives hope that South Africa will be favourably considered. The Northern Cape is considered to be one of the best potential locations for the SKA.

The South African SKA Steering Committee has submitted a preliminary bid proposal and the bidding process is expected to take two to three years to finalise. Construction will hopefully start in 2010 and the SKA should start operating in 2015.

Research and Innovation and Support Agency (RISA)

The NRF's RISA has a suite of funding programmes that are in line with South Africa's priorities and needs.

Focus Area Programme

The Focus Area Programme's high-level research themes are:

- Challenge of Globalisation
- Conservation and Management of Ecosystems and Biodiversity
- Distinct South African Research Opportunities
- Economic Growth and International Competitiveness
- Education and the Challenges for Change
- Indigenous Knowledge Systems
- ICT and the Information Society in South Africa
- Sustainable Livelihoods and the Eradication of Poverty
- Unlocking the Future: Advancing and Strengthening Strategic Knowledge.

Collectively, these themes provide a broad framework for researchers across the spectrum of disciplines (the natural, social and human sciences, engineering and technology) to pursue their research interests, taking into account the macro-environment as well as relevant national developments.

Research Capacity Development (RCD)

Institutional and RCD programmes focus on boosting historically Black universities and universities of technology that are committed to the research process. In addition, the *Thuthuka* Programme supports individual researchers. It comprises researchers in training, women in research, and research development for Black academics.

South Africa hosted the South Africa-Japan Science Forum in May 2004 in Pretoria.

The main objectives of the Forum were to:

- promote excellence in all aspects of collaboration between the two countries
- ensure that collaborative activities contribute significantly to the national strategies for social equity, poverty alleviation and economic development in a constructive and sustainable manner
- work closely with research institutions, private organisations and government structures to develop appropriate policy and support for the National System of Innovation of the two governments
- build a network of researchers which encourages bilateral, multilateral and multidisciplinary collaboration in the areas identified
- use the Forum as a platform to regularly host meetings, symposia and conferences to promote dialogue between researchers
- strengthen the facilities and other resources for science and technology education in the further and higher education sectors.

All the NRF's RCD initiatives aim to boost the output of high-level Black HR (both academics and research students at all HE institutions); develop a postdoctoral research culture; strengthen weak, yet critically important disciplines; improve gender equity; and renew outdated research equipment.

Student support

The NRF provides two complementary types of postgraduate student support, namely:

- free-standing bursaries, scholarships and fellowships
- grantholder-linked bursaries.

Free-standing bursaries, scholarships and fellowships are awarded directly to students on a competitive basis, while grantholder-linked bursaries are granted to researchers within their NRF support package and may be awarded to students selected by the NRF grantholder. The NRF offers a limited number of travel grants for research abroad.

Knowledge Management (KM)

The NRF's KM Directorate includes Information and Strategy Advice, the Evaluation Centre and the Information Technology (IT) Department. KM, including records management, and expanding communities of practice, is high on RISA's agenda. It aims to ensure a co-ordinated and efficient KM system that facilitates the achievement of RISA goals, including optimal governing structures for maximum integration and synergy.

International Science Liaison (ISL)

The ISL aims to forge and maintain strategic and intellectual alliances between individuals, institutions and organisations in science research communities nationally and internationally to support the international competitiveness of the country.

Innovation Fund

The IF, a policy instrument of the Department of Science and Technology, was created to promote technological innovation; increase networking and cross-sectoral collaboration; and competitiveness, quality of life, and environmental sustainability to harness IT. The IF's budget increased to R171 million in 2004/05. The NRF claims a management and administration fee from the allocated budget for support services rendered.

The strategic direction of the Fund identified a series of new funding initiatives that seek to enhance innovation in South Africa. They are:

- technology missions to support the development of long-term, high-risk, market-driven and enabling technology that will benefit an existing economic sector
- the technology-advancement programme to promote innovation in new technology frontiers
- various competitive initiatives to promote entrepreneurship through the commercialisation of the innovative ideas of young entrepreneurs; and to promote R&D collaboration and entrepreneurship within the business and research community, emphasising networking among racial groups and across cultures
- the IF Commercialisation Office to offer a comprehensive service with respect to patent applications and technology transfer for publicly funded research
- seed and start-up financing for the development of a product or prototype, proof of concept and initial marketing.

In March 2004, Nomathemba Kontyo (16) arrived home from Atlanta, United States of America (USA), where she represented South Africa and Africa at a National Aeronautical Space Agency (NASA) facilitated research project.

Nomathemba, a Grade 11 Mathematics and Science learner from Fezeka Senior Secondary School in Gugulethu, was a finalist in the International Essay Writing Competition on the topic *Mars and Other Celestial Bodies*.

The competition was hosted by the US-based NASA and was open to learners from all over the world.

Afterwards, the Department of Trade and Industry enrolled Nomathemba for the Techno-Girl Programme, which encourages girls to take up a career in Technology and Science. Techno-Girl is part of the Technology for Women in Business (TWIB) Programme, driven by the Department of Trade and Industry.

Nomathemba was also awarded an honorary trophy – making her a TWIB ambassador.

Technology for Human Resources for Industry Programme

The THRIP is managed by the NRF, advised by the THRIP Board, and sponsored by the Department of Trade and Industry. The Programme supports projects that address the technology and HR needs of industry on a cost-sharing basis with industrial partners.

In 2004/05, THRIP implemented its new five-year strategic plan. The Programme is better aligned with key strategies that government is using to guide R&D, such as to increase competitiveness, grow the economy, create jobs, eradicate poverty and provide equity within South Africa.

THRIP is focusing on increasing participation by SMMEs and BEE entities. It is embarking on a vigorous advertising and marketing campaign targeted at industry in general, and specifically small and medium industries. Other key performance areas that will be addressed are participation by historically disadvantaged institutions, and by Black and women students.

The MTEF budget allocation for THRIP was R135 million for 2004/05. The NRF claims a management and administration fee from the allocated budget for support services rendered.

Science and Technology Agreements Committee (STAC)

The Department of Science and Technology negotiates bilateral or multilateral agreements with international partners. The NRF manages the agreements which serve to develop scientific relations between the research communities of the intergovernmental signatories. The year 2004 saw the launch of at least four new intergovernmental agreements (with Switzerland, Iran, Algeria and the UK), bringing to 18 the number of agreements managed by the NRF on behalf of the Department of Science and Technology. An independent evaluation of STAC-related activities will be conducted during 2004/05. The STAC budget for 2004/05 increased to R23,9 million.

Scarce Skills Development Fund

To address the shortage of skills required for national development and competitiveness, government passed the Skills Development Act, 1998 (Act 97 of 1998), as a framework for realising this objective. 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 HR and other training institutions, especially in S&T. To deliver on this objective, the Department of Labour recommends the allocation of resources from the NSF for bursaries and scholarships. The NRF has become the implementing agency for the Department of Labour for the provision and support of scarce skills at postgraduate levels in the fields of S&T.

Biodiversity programmes

The NRF manages two initiatives linked to the biodiversity science thrust of the National R&D Strategy, namely the South African Biodiversity Initiative (SABI) and the South African Bioinformatics Facility (SABIF). The budget allocation for SABI in 2004/05 was R1,5 million and for SABIF some R1,7 million.

Indigenous Knowledge Systems (IKS)

Similar to STAC, the NRF receives a ring-fenced grant for IKS from the Department of Science and Technology in support of research and human resource development (HRD) in the field of indigenous knowledge. IKS has been identified as a focus area within RISA, and all IKS activities have been integrated into RISA activities.

RISA does, however, report separately to the Department of Science and Technology on the outcomes of this programme. The programme will be reviewed by the Department of Science and Technology in 2004/05. The ring-fenced IKS grant from the Department amounts to R10 million annually.

Additional initiatives

- CoEs: The NRF has taken on management responsibility for CoEs. The Department of Science and Technology has entrusted the NRF with establishing these Centres to stimulate research, generate high-quality HRD, and to make meaningful impact on key national and international R&D issues.

- CoEs in Industrial Research and Development (CEIRD): The Department of Trade and Industry has recognised the need for greater innovation and skills development and will fund Centres that focus on national priorities and sectors for which the Department of Trade and Industry is the primary custodian. Managed by the NRF, CEIRD will maximise co-operation and synergies with other relevant NRF programmes.
- Chairs of Entrepreneurship and Enterprise Development (CEED): Following international trends of funding endowed chairs at HE institutions to provide leadership and guidance in a specialist field, the Department of Trade and Industry has decided to support endowed CEEDs.
- Postgraduate bursaries for the disabled made possible through a grant of R5 million per year by the Department of Labour from the National Skills Fund.
- The NRF manages the Mathematics and Science Teachers' Training Programme to enhance the teaching skills of Science and Mathematics educators. A budget of R20 million was allocated for this initiative in the 2004/05 financial year.

South African Agency for Science and Technology (SAASTA)

There is an opportunity for enhanced integration of science outreach activities at the various national research facilities of the NRF, and for closer collaboration in terms of encouraging grantholders, bursars and industry partners to become more actively involved in science communication and advancement. To pursue these objectives effectively, the NRF's corporate communication and public relations activities are located within SAASTA.

Programme expansion in SAASTA is only possible through increased funding via partnerships. Already, project funding has been secured for the PUB Programme. For 2004/05, some R10,8 million was allocated to SAASTA from the Parliamentary Core Grant with additional income expected to be generated through contracts.

National research facilities

National research facilities are important elements of South Africa's research infrastructure. Recent developments also require the creation of multilocational networks of institutions that collaboratively contribute to the provision of an urgently needed research infrastructure and are accessible to the research community on a competitive basis.

The following national facilities are managed by the NRF:

- South African Astronomical Observatory (SAAO)
- Hartebeesthoek Radio Astronomy Observatory (HartRAO)
- Hermanus Magnetic Observatory (HMO)
- South African Institute for Aquatic Biodiversity (SAIAB)
- iThemba Laboratory for Accelerator-Based Sciences (iThemba LABS)
- Pretoria National Zoological Gardens
- South African Environmental Observation Network (SAEON) (by mid-2004, it had not yet been declared a national research facility).

South African Astronomical Observatory and Southern African Large Telescope

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. The SAAO's research excellence is underpinned by strong technical competencies in certain niche areas.

The SAAO contributes to the future development of South Africa through the creation and dissemination of knowledge, HRD, the provision of research infrastructure, and providing an interface between science and society. It maintains a number of telescopes at Sutherland, where the SALT is situated.

The astronomical commissioning of SALT will be accomplished with the instrument Salticam, which the SAAO had been contracted to build. The instrument was completed in 2004. During 2004/05, the urgent restructuring of SAAO Sutherland will take place to facilitate the SALT commissioning phase.

Marked growth is expected in the number of postgraduate students at the SAAO. The flagship National Astrophysics and Space Science Programme, run by a consortium of eight South African

universities and three national research facilities, graduated its first class of Master of Science students in mid-2004. As the postgraduate student enrolment in astronomy at universities increases, student training at SAAO is expected to increase in importance.

Hartebeesthoek Radio Astronomy Observatory

HartRAO is the national research facility for research and training in radio astronomy and space geodesy in South Africa. It provides facilities for South African and foreign scientists to participate in research using the facilities at HartRAO. The radio telescope is available 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. It participates internationally in geodetic VLBI, satellite laser ranging and Global Positioning System research.

Hermanus Magnetic Observatory

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. Besides its core function of providing geomagnetic field information, the scope of the HMO's activities includes fundamental and applied space physics research, and the provision of geomagnetic field-related services on a commercial basis. HMO is growing its efforts in HRD, especially science-outreach programmes for school educators and learners, and postgraduate student training and research capacity-building.

South African Institute for Aquatic Biodiversity

The SAIAB serves as a research hub for aquatic biodiversity in southern Africa by housing and developing the national fish collection and associated resource collections as research tools and sources of aquatic biodiversity data. It also generates knowledge on aquatic biodiversity through interactive and collaborative scientific research, and disseminates scientific knowledge at all levels.

The SAIAB is focusing on developing HR capacity and skills to handle the research demands arising from the global biodiversity crisis and, in particular, national biodiversity legislation. It is developing an effective aquatic-biodiversity information centre that connects the generation and development of aquatic-biodiversity knowledge products by SAIAB to the demands of the user community and public.

Ongoing research and collection-based projects include the African Coelacanth Ecosystems Programme and SADC aquatic biodiversity contract projects, while new research initiatives include a freshwater biodiversity conservation programme and the Southern Ocean Fish Diversity Project.

iThemba Laboratory for Accelerator-Based Sciences

iThemba LABS provides modern research facilities to users in science, medicine and industry. iThemba LABS has established itself as a major commercial centre for radiation medicine and is forging strategic partnerships with the private and public sectors to leverage capital, skills and the expertise required for an initiative of this magnitude.

By establishing a major oncology centre, iThemba is creating more space for training in physics and radiation sciences. The Major Radiation Medicine Centre (MRMC), as the proposed oncology centre is known, was endorsed by leading international oncologists during a visit to iThemba LABS. The MRMC will become the centrepiece of cancer control in southern Africa and an internationally recognised centre of excellence in cancer treatment, research and training. iThemba LABS will invest in equipment for therapy, while initial 'seed money' funding of R10 million is required for the MRMC project.

It is the primary centre of expertise in radiation medicine and nuclear S&T in South Africa.

Pretoria National Zoological Gardens

The Pretoria National Zoological Gardens was declared a national research facility in April 2004.

The transfer of the Pretoria National Zoological Gardens to the NRF aims to strengthen the funding of the Zoo's scientific research functions and enhance its ability to do research in the conservation of South Africa's biodiversity. The Zoo will redefine and reposition itself as one of the leaders in the breeding and research of endangered species. This will enhance its position as a globally competitive institution and further the goals of the South African Government to improve PUSET.

The Pretoria Zoo, as it is popularly known, is the only zoo in South Africa with national status and is rated as one of the top zoos in the world, attracting thousands of local and international visitors annually. The facility extends over an area of about 80 hectares. It has breeding centres in Mokopane in Limpopo and Lichtenburg in the North West, where especially endangered animal species are bred. (See chapter 9: *Environmental management*.)

South African Environmental Observation Network

SAEON is being developed as a South African observation and research network to address the sustainable management of natural resources and habitat over a range of eco-regions and land users.

SAEON establishes and maintains nodes (environmental observatories, field stations or sites) linked by an information-management network to serve as research and education platforms for long-term studies of ecosystems that will provide for incremental advances in the understanding of ecosystems and the ability to detect, predict and react to environmental change. SAEON will bring about better cohesion between national and international research programmes and will ensure that data is archived and accessible as a national asset for generations to come.

Agricultural Research Council (ARC)

The ARC is a statutory parastatal body established in terms of the Agricultural Research Act, 1990 (Act 86 of 1990). It is committed to the promotion of agriculture and related sectors through research, and technology development and transfer.

Through its wide network of research institutes and experimental farms, the ARC provides a strong scientific base and a broadly distributed technology-transfer capacity for the entire agricultural industry in South Africa. In support of national and household food security, ARC research empowers both commercial and resource-poor farmers.

Farmers are provided with appropriate technologies to improve production. Training of farmers and agricultural extension staff in new technologies is an integral part of the ARC's activities.

Rural development

The ARC collaborates with government and the Independent Development Trust in the development of government's ISRDS.

The ARC advises the M-17 group of Ministers under the chairpersonship of the Deputy President on the development of a planning tool, based on geographic information systems.

To share information and assess the use-options of resources in a particular area, the South Africa Integrated Spatial Information System is being developed to provide a user-friendly framework for informed decision-making.

The impact and wide scope of the ARC's sustainable rural development thrusts are evident in all provinces. The ARC empowers people through research, information and appropriate training that address economic and social challenges.

ARC-generated technologies also underpin SMMEs that aim to create new job opportunities through agribusiness. Its research impacts on agriculture and related disciplines such as applied S&T, health and nutrition, food safety, education, the environment and natural-resource conservation.

Partnerships

The ARC interfaces with national, provincial and local governments as well as various agricultural unions and farmers' associations in South Africa. Apart from research collaboration with these stakeholders, the ARC also partners other science councils.

The ARC is active in over 65 regional networks and has 137 research projects with international partners, involving one or more countries.

The ARC is also active in international collaboration, especially with universities in the USA, UK, Europe, Australia, New Zealand and Africa. It has Memoranda of Understanding with numerous scientific role-players in other countries.

The ARC's institutes have localised research and demonstration trials at about 40 sites. These include strategic research farms and satellite stations located within some provincial departments of Agriculture.

ARC Institute for Soil, Climate and Water

This Institute in Pretoria, Gauteng, promotes the characterisation, sustainable utilisation and protection of natural resources.

Research activities cover soil science, agrometeorology, water utilisation and analytical services.

ARC Institute for Agricultural Engineering

Situated in Pretoria, the Institute is active in 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. Innovative energy sources and applications are developed for rural areas.

ARC Plant-Protection Research Institute

The ARC Plant-Protection Research Institute in Pretoria concentrates on national agricultural and environmental problems. It is committed to the promotion of economic and environmentally acceptable pest control. Research focuses on biosystematics, ecology and epidemiology of vertebrates, as well as fungi, and pathogenic and useful bacteria and viruses.

The Institute researches the control of pests and invasive plants through effective pesticide management, as well as biological and integrated control strategies. A variety of services are provided.

The Institute also houses the Plant Genetic Resource Unit.

ARC Grain Crops Institute

This Institute, situated in Potchefstroom, North West, is responsible for research into the improvement and cultivation of grain crops such as maize, sorghum and millet, as well as oil-and-protein seeds such as sunflower, ground-nuts, soya beans, dry beans, cowpeas, sweet white lupin and bambara. Research activities involve plant-breeding, evaluation of cultivars, grain quality, plant physiology and other production factors.

ARC Small Grain Institute

The ARC Small Grain Institute in Bethlehem, Free State, concentrates on the improvement and cultivation of small grain crops such as barley, wheat, oats, triticale and rye. Research activities include plant-breeding, evaluation of cultivars, grain quality, plant physiology, tillage, weed science, plant pathology, entomology and yield potential.

ARC Institute for Industrial Crops

This Institute in Rustenburg, North West, is involved in all fundamental and applied research in the interest of the tobacco and cotton industries. Research is also conducted on other fibre crops such as hemp, sisal and flax that have potential as new crops in rural areas.

ARC Institute for Tropical and Subtropical Crops

The ARC Institute for Tropical and Subtropical Crops in Nelspruit, Mpumalanga, is responsible for research into all aspects of the cultivation of tropical and subtropical fruits.

Other crops on which production research is conducted include tea, coffee, spices such as ginger, 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

Situated outside Pretoria, this Institute concentrates on a wide range of horticultural crops. Research is conducted on commercial vegetables such as onions, potatoes, tomatoes and sweet potatoes.

Traditional and indigenous vegetables receiving attention include amaranthus, cassava, plectranthus, Zulu round potato, pigeonpeas, cowpeas and bambara.

Research on 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

ARC Infruitec/Nietvoorbij in Stellenbosch, Western Cape, is responsible for research on the cultivation and post-harvest technology of deciduous fruit.

Other assigned crops are berry fruits, tree-nut crops, *rooibos* tea, honeybush tea, dates, olives, kiwi fruit and hops. It is also responsible for research on the cultivation of table, raisin and wine grapes, as well as on the production of wine and brandy.

ARC Animal-Improvement Institute

The ARC Animal-Improvement Institute at Irene, near Pretoria, provides the livestock industry with technologies for the improved quality of animals.

It has established genetic and physiological methods to identify and study superior breeding material to improve the efficiency of the national herd.

ARC Animal Nutrition and Animal Products Institute

Situated at Irene, near Pretoria, this Institute develops environment-friendly technologies to promote animal production through improved nutrition.

Research is conducted on beef and dairy cattle, sheep, pigs, goats and poultry. The Institute also evaluates technologies to enhance the quality of meat and dairy products.

ARC Onderstepoort Veterinary Institute

The ARC Onderstepoort Veterinary Institute, north of Pretoria, is responsible for the prevention and control of animal diseases. It also provides a public health service with regard to animal products such as milk, meat and eggs.

The Institute conducts research on specialised diagnostics, parasitology, toxicology and related disciplines. Various vaccines and other biological products are developed and produced. The Institute also houses a high-security facility for research into infectious diseases such as foot-and-mouth disease and African swine fever. It serves as a regional centre for diagnostic services, advice and training.

ARC Range and Forage Institute

The Institute, situated in Pretoria, focuses on the development of holistic and integrated land-use strategies. It provides guidelines for sustainable livestock and rangeland management systems.

Council for Scientific and Industrial Research

The CSIR, established in 1945, is the largest community and industry-directed scientific and technological research, development and implementation organisation in Africa. It undertakes approximately

In 2004, the Department of Science and Technology and the Council for Scientific and Industrial Research (CSIR) produced a recipe book called *South African Indigenous Foods*, which reflects the rich traditions of generations of South African women.

The book was the result of a poverty-alleviation project and was selected as a gift for guests at the inauguration of President Thabo Mbeki on 27 April 2004.

Dishes such as *morogo* (an indigenous green leafy vegetable), mealie bread, *polokwe* (fresh mealie balls), *semphemphe* pudding (wild melon pudding), *mabele* porridge (sorghum porridge), *masonja* (mopani worms and ground peanut dish), and *isigwampa* (a vegetable and mealie dish) are featured.

The recipes were collected as part of a project aimed at commercialising and promoting South African indigenous foods, and was funded by the Department of Science and Technology and implemented by CSIR Food, Biological and Chemical Technologies.

While some dishes and beverages were the starting point for new products that are being commercialised, the recipe book contains a broader range of dishes prepared by generations of women.

Copyright of the book has been ceded to IndiZAFoods, the Section 21 company created to facilitate the commercialisation of the indigenous food products. Proceeds from the sale of the book will be re-invested into community initiatives.

10% of all research and development work on the continent.

As a key provider of information and technology solutions, the CSIR plays an integral part in the development of South Africa as a nation and the SADC. It undertakes market-driven research, and development and technology transfer:

- in support of its clients in both the public and private sectors
- to meet community needs and improve the quality of life of all South Africans in a cost-effective and ethical manner.

The CSIR's eight operational divisions are responsible for its research, development and implementation activities that provide technology solutions and information across a broad range of technologies, such as aeronautical systems, building, communications, development, food, information, infrastructure, manufacturing, materials, mining, textiles and the environment.

It has a staff complement of 3 300 scientists, engineers, technicians, sociologists and support staff.

The CSIR has a wide variety of clients and stakeholders, ranging from the private sector, government, public enterprises and national safety and security establishments, to development structures such as non-governmental organisations (NGOs), funding agencies and the labour sector.

The CSIR Head Office is situated on the Scientia site in Brummeria, Pretoria, and is represented in each of the nine provinces.

Mintek

Mintek, South Africa's national mineral-research organisation, was established in 1934 to ensure the sustainability and growth of the minerals industry through technology development and transfer. This role has expanded internationally, and today Mintek 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 on six continents.

Mintek is an autonomous statutory organisation and reports to the Minister of Minerals and Energy. About 35% of the annual budget of R256 million is funded by the State, 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 novel and improved techniques to industry for processing and extracting, refining, and utilising minerals and mineral products to:

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

Specific goals include:

- 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 achieves its objectives in the following ways:

- providing essential services (information, consulting and experimental)
- increasing the competitiveness of 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 educational 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 steel, stainless steel and ferro-alloy production, as well as improved alloys.
- 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 a major R&D effort towards the beneficiation of titaniferous raw material, which constitutes one of the country's most significant mineral resources. Mintek's research into waste management and environmental problems also fall under this Programme.

Promoting industrial growth

Mintek is promoting a number of major new industrial projects based on mineral beneficiation, and utilising both existing and newly developed technologies.

These include the recovery of PGMs from chromite tailings, the production of ferronickel and electrolytic manganese dioxide, and the establishment of a local magnesium industry using a novel thermal-production route being developed in conjunction with industry partners.

Regional development

Mintek carries out 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.

Mintek's Small-Scale Mining Division provides experimental and consulting services, with an emphasis on the transfer of knowledge and skills. The overall purpose is to assist these operations to function more efficiently and economically, and to ensure sustainability.

The Division also proactively searches for opportunities from which artisanal and small-scale miners can benefit. The aim is to establish small-scale mineral-beneficiation projects with the emphasis on adding maximum value to raw material by manufacturing end-products.

Environment

Mintek continues to focus on the development of 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. In 2003, a new metals-recycling project was launched to smelt stainless-steel plant dust and other wastes, using DC arc smelting technology. The valuable metals nickel and chromium are recovered into an iron alloy for recycling to the stainless steel-making process.

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

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 set up with the aim of developing technicians, technologists, engineers and others with appropriate skills from historically disadvantaged communities. The specific programmes include:

- Artisanal and Small-Scale Mining Training
- Jewellery Manufacturing
- Upgrading of Mathematics and Science Skills
- 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 dedicated to the applied social sciences. It has about 130 researchers, mainly specialists, 30 interns and 110 support staff. Its revenue is derived roughly equally from its parliamentary grant and from earnings through tenders, commissions, and local and international foundation grants.

The HSRC conducts social-science research concerned with all aspects of development and poverty alleviation in South Africa, the region and in Africa.

Research programmes

The organisation's research is organised into 10 interdisciplinary programmes.

Assessment, Technology and Education Evaluation (ATEE)

The ATEE Research Programme focuses on the monitoring and evaluation of education change at national, provincial, district, school and classroom levels. It also develops instruments and techniques for assessing individuals in the worlds of work and play. ATEE provides valuable information to address quality, equity, access, and redress issues for transforming the education and training sector.

Child, Youth and Family Development (CYFD)

The CYFD Research Programme is dedicated to national social development through innovative research that has significant intervention and policy implications.

It works in seven priority areas:

- early childhood development and intervention, including nutrition, psycho-social development, health, illness and pre-school education
- rights and protection, including violence and abuse, child labour, children and youth in care, and law and justice as it affects children, youth and families
- socialisation and learning, including language and literacy, schools, neighbourhoods and social identity
- youth development, including civic engagement, work, livelihoods and life skills, subcultures and network
- risk and resilience, including context and determinants, risk behaviours, prevention, and intervention to reduce high-risk conditions and behaviour
- sexuality and reproductive health, including HIV and AIDS, teenage pregnancy and parenthood, sexual violence, gender and relationships
- families and households, including family formation and security, dissolution and coping, roles and responsibilities, culture and values, and the impact of HIV and AIDS.

Democracy and Governance (D&G)

The D&G Research Programme explores contributions to and constraints upon democratisation in

South Africa and the African continent. Researchers evaluate the policies, institutions and impact of government, business and civil society with regard to their capacity to reduce inequality and poverty, while empowering communities to promote local, national and regional sustainable development. The Programme has three major thrusts, namely democratisation, local government and delivery, and public service and development.

Employment and Economic Policy Research (EEPR)

The EEPR Programme seeks to improve and disseminate an understanding of the nature and causes of persistent unemployment and underemployment.

This work feeds directly into strategy and action by enabling public and private interventions. To ensure relevance and uptake, each new step involves critical stakeholder groupings and government departments.

The Research Programme focuses on integrated employment studies and labour-market and industry analyses.

Human Resource Development

The HRD Research Programme undertakes research in the area of HRD, orientated largely towards the creation of an improved information and analysis infrastructure to support government decision-making in the area of HRD.

The South African Medical Research Council (MRC) will host the African office of the Assembly of the European and Developing Countries Clinical Trials Partnership (EDCTP).

The Partnership will have two offices, one in The Hague in the Netherlands and the other in Cape Town.

The Partnership's aim is to develop new treatment options to fight HIV, AIDS, tuberculosis and malaria.

The EDCTP, established in 2003 by 14 European Union member states and Norway, aims to improve the quality of research in relation to these diseases.

The African office, under the auspices of the MRC, will represent the EDCTP in Africa and will provide administrative and promotional support for the Partnership.

The new office was expected to start operating in the second quarter of 2004.

Its primary focus is the study of the pathways of learners from school into further education and HE, and the world of work.

Integrated Rural and Regional Development (IRRD)

The IRRD Research Programme is a multidisciplinary research programme with the primary objective of promoting rural development in South and southern Africa.

It achieves this through user-driven policy, monitoring and evaluation, and problem-orientated research. With poverty reduction as the unifying, overarching theme, the Programme's objectives, orientation and activities are designed specifically to address key national, regional and Africa-wide policy priorities.

There are four distinct, but interlocking, subprogrammes:

Knowledge Management

The KM Research Programme covers three overlapping domains:

- Information Society
- NSI Studies
- Knowledge-Intensive Research Organisations.

Social Aspects of HIV, AIDS and Health (SAHA)

The SAHA Research Programme conducts policy-relevant research in South and southern Africa. Its extensive regional network makes it possible to mobilise an alliance of key stakeholders, policy-makers, programme planners, researchers, NGOs and donors to address HIV and AIDS, using evidence arising from collaborative research.

The SAHA offers technical support to its partners, jointly develops implementation strategies, and shares information on the monitoring and evaluation of programmes.

Surveys, Analysis, Mapping and Modelling (SAMM)

The SAMM Research Programme is a cross-cutting entity that brings together the HSRC's capacity in surveys, quantitative and qualitative analy-

ses, geographical information systems, statistical and econometric modelling, and data management. It supports the organisation's move from previous fixed research groups and disciplines to flexible, user-driven and responsive research programmes.

Social Cohesion and Integration (SCI)

The SCI Research Programme deals with religion, arts and culture, the social aspect of science, the media and public discourse. In essence, it analyses the social fabric of a developing country.

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 national 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 under the philosophy of Essential National Health Research. Activities are grouped into the following six 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, microbacteriology, 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, burden of disease and telemedicine.

National Programme for Infection and Immunity Research

The research units in this Programme are involved in research on tuberculosis, 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 group undertakes research on 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 on 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 on 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.

It operates under the tradename *SA HealthInfo* and is available on the Internet (*www.sahealthinfo.org*), providing 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:

- the systematic documentation of the surface of the Earth within the borders of South Africa; the compilation of geological, geophysical, geochemical and other geoscientific information; and the publication of this information in the form of maps and documents
- geoscientific research on rocks, minerals, ores, fossils, etc. in South Africa, and the publication of research results in national and international journals
- the collection and conservation of all geoscientific information and data on South Africa in national collections and electronic databases
- the supply of geoscientific services and advice to the national and provincial governments, to ensure 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 on 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 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 on the African continent. It includes the National Geoscience 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 analyses rock and soil samples, using various specialised techniques.

The geoscience information and services provided by the CGS are particularly important for sustainable development of the country. In South Africa's arid region, the management of groundwater resources (both the quantity and quality thereof) is aimed at providing enough clean water to communities.

Although South Africa is located on a relatively stable portion of the Earth's crust, the CGS maintains a seismic network for the recording of seismic events within the national borders and the coastal waters off South Africa's coastline. This information is available to interested parties and serves to help mitigate the problems associated with mining-related seismic events.

The Council 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.

Through its membership of the National Steering Committee of Service-Providers to the

Small-Scale Mining Sector, the CGS helps mining entrepreneurs, particularly those from historically disadvantaged groups, to exploit South Africa's mineral resources in a cost-effective and environmentally friendly way.

The CGS plays a leading role in the SADC and as a result of this co-operation, 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. A geological map of the region is in preparation.

In addition to its national responsibilities, the CGS is also active internationally, mainly in Africa. Geological and metallogenic maps of, among others, Angola, the Democratic Republic of Congo, Mozambique, Gabon and Morocco have been produced. The supervision of projects in Mauritania and Mozambique is also underway.

South African Bureau of Standards (SABS)

The SABS was established in 1948 with the purpose of developing, maintaining and disseminating standards in South Africa. Although this core reason has remained unchanged over the years, the mission of the SABS has changed with the years to provide different focus relevant to the times. The SABS currently sees its mission as 'improving the quality of life of all South Africans, through the process of standardisation'.

Standards South Africa (StanSA)

This is the core function of the SABS and it carries the responsibility for the development, maintenance and dissemination of 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 the SABS is responsible for the administration of 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 the provision of conformity-assessment services to the SME sector, and other Presidential imperatives and social responsibility activities is also located in this division.

South African Bureau of Standards Holdings (Pty) Ltd.

All the conformity assessment services of the SABS are located in this company. These include the testing of products, the provision of system and product certification schemes, the inspection of consignments and the training of people in these matters. SABS Holdings is a separate company, which competes in the private sector and charges for the services that it renders, 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

Although the Sasol Group is best known for its

petrol, diesel, kerosene, liquid petroleum gas, power paraffin, illuminating paraffin, fuel oils and gas, it is also a major producer of ethylene, propylene, ammonia, phenols, sulphur, road tar, pitch, creosote, alcohols, ketones, solvent blends, alpha olefins, fertilisers, explosives and waxes.

Sasol Technology's R&D Division is responsible for the R&D function of the Sasol Group.

Continuous R&D in recent years has enabled Sasol to launch two major, more cost-effective technological innovations: the Sasol Advanced Synthol Process and the Sasol Slurry Phase Distillate (SSPD) Process. The SSPD process technology evolved from Sasol's extensive expertise in the field of low-temperature FischerTropsch process technology.

Besides the production of high-quality and more environmentally friendly diesel, the proprietary technology can also manufacture high-quality kerosene and naphtha from natural gas.

Iscor

The technology arm of the minerals and metals company Iscor Limited, ITEC, provides technical and research support for the company.

Areas of operation include minerals beneficiation, new extraction methods, and high-temperature metallurgical processes. ITEC is also involved in environmental control through research into novel warp recycling and the effective use of waste material.

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.

National Health Laboratory Service (NHLS)

The NHLS conducts research into the prevention and treatment of human diseases.

The NHLS comprises about 240 laboratories countrywide, including the former South African Institute for Medical Research, the National Institute for Virology, the National Centre for Occupational Health, all provincial diagnostic pathology laboratories (excluding those in KwaZulu-Natal), and tertiary laboratories used by universities' medical schools. It has approximately 4 000 employees and consists of four divisions: Research, Diagnostic Laboratory Services, Production (serum and laboratory reagents), and Teaching and Training. The NHLS conducts medical research as well as pathology laboratory tests for all provincial hospitals, excluding those in KwaZulu-Natal. Research is conducted on diseases and health dangers that are of specific importance to South Africa.

Bureau for Economic Research

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

National Institute for Tropical Diseases

The National Institute for Tropical Diseases in Tzaneen, Limpopo, is responsible for the ongoing assessment of the malaria-control programmes carried out by various authorities in South Africa.

Control methods are assessed, and recommendations made to the appropriate authorities with regard to 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

Antarctica and islands research

Scientific endeavour has for over 40 years been the primary justification for a human presence in Antarctica. The Antarctic Treaty is one of the world's most successful treaties. It was signed in 1959 and its purpose is to ensure that Antarctica is only used for peaceful purposes. It covers the entire area south of latitude 600° S – 10% of the world's land surface and 10% of its oceans. By mid-2004, 46

countries were signatories to the Treaty, representing 80% of the world's population. South Africa is one of the original 12 signatories to the Antarctic Treaty and plays a leading role in Antarctic matters.

The Department of Environmental Affairs and Tourism provides logistical support to the annual science programme which is conducted in Antarctica and on Marion and Gough islands. The Department, through the South African National Antarctic Programme (SANAP) undertakes a massive logistical exercise every year in its effort to supply and maintain three scientific bases: SANAE IV, Antarctica; Marion Island in the South Indian Ocean; and Gough Island, a British territory in the South Atlantic Ocean.

As a founding member of the Scientific Committee on Antarctic Research, South Africa has contributed on various levels to the international Antarctic community. This has been done through scientific collaborations such as the Southern Hemisphere Auroral Radar Experiment with the UK and the USA and the Seismology Project with Germany.

South Africa hosted, for the first time, the 27th Antarctic Treaty Consultative Meeting in May 2004. Linking the Meeting to the celebration of 10 years of South Africa's democracy, South Africa promoted itself as a platform for increased international scientific co-operation. Modern facilities at SANAE IV and Marion Island, together with increases in scientific funding, provide opportunities for such collaboration.

The scientific research functions of SANAP were transferred from the Department of Environmental Affairs and Tourism to the Department of Science and Technology in 2003.

Mine-safety research

The activities of the Safety in Mines Research Advisory Committee are aimed at the advancement of the safety of workers employed on 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 fields of research, namely rock engineering, engineering and mine occupational health.

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 research and development activities.

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 particular 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. It was deemed to be of national importance to generate new knowledge and to promote the country's water research purposefully, owing to the view held that water would be one of South Africa's most limited resources in the 21st century.

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 a lack of or a poor quality of water, and that sustainability of water resources and water-dependent ecosystems is achieved.

The WRC performs the following functions:

- promoting co-ordination, co-operation and communication in the area of water R&D
- establishing water-research needs and priorities
- stimulating and funding water research according to priority
- promoting the effective transfer of information and technology
- enhancing knowledge and capacity-building within the water sector.

The Water Research Act, 1971 provides for the establishment of 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 utilisation 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 (44,3% of the total number of contracts)
- consultants (31,8%)
- the CSIR (7,6%)
- water boards (6,9%)
- the ARC (3,1%)
- universities of technology (5,1%)
- municipalities (1%).

The main areas of research are surface hydrology, groundwater, hydrometeorology, agricultural water utilisation, 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 IT.

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 on 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 on 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 Department's National Environmental Potential Atlas (ENPAT) provides a visual overview of South Africa's environmental resources. The most important advantage of ENPAT is that environmental implications of land-use decisions are available before any actions are initiated. ENPAT-National contains two main data types, namely environmental and population data. The Atlas also identifies possible conflict areas in the utilisation of natural resources.

The South African Weather Service functions under the Department of Environmental Affairs and Tourism.

The Weather Service 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).

Public-good services are funded by government 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.

The Weather Service operates the Global Atmosphere Watch (GAW) station, situated at Cape Point in the Western Cape. The GAW is an initiative of the World Meteorological Organisation and serves as an early warning and forecasting system for changes in the background chemical composition and related physical characteristics of the atmosphere.

Atmospheric-ozone monitoring at Irene, near Pretoria, is maintained throughout the year.

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 on living resources and the 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 a growth of 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, the South African Network for Coastal and Oceanic Research (SANCOR) and the Savanna Ecology Forum.

Fisheries research

Research into South Africa's fish resources, 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 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 SANCOR.

Private-sector involvement

South Africa's gold-mining industry works at deeper levels and under more difficult circumstances than any other mining industry in the world. The research on gold-mining conducted by the CSIR's Mining Technology is concerned primarily with ensuring the health and safety of the workforce, and includes 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 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 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).

Acknowledgements

BuaNews
Council for Geoscience
Department of Environmental Affairs and Tourism
Department of Science and Technology
Estimates of National Expenditure 2004, published by National Treasury
Human Sciences Research Council
Medical Research Council
Mintek
National Department of Agriculture
National Health Laboratory Service
National Research Foundation
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