



South Africa
Yearbook
2020/21

Education, Science and Innovation

Education

The Constitution of the Republic of South Africa, 1996, declares basic education as an inalienable basic human right for all South Africans. In 2015, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) adopted the global education agenda, Education 2030, which is part of the 17 United Nations (UN) Sustainable Development Goals (SDGs) that make up the Agenda 2030 for sustainable development. SDG 4 calls for an “inclusive, quality and equitable education and lifelong opportunities for all”.

The National Development Plan (NDP) states that by 2030 South Africans should have access to education and training of the highest quality, leading to significantly improved learning outcomes. The education system will play a greater role in building an inclusive society, providing equal opportunities and helping all South Africans to realise their full potential.

Education is governed by two national departments, namely the Department of Basic Education (DBE), which is responsible for primary and secondary schools, and the Department of Higher Education and Training (DHET), which is responsible for tertiary education and vocational training.

Accessibility to education has improved significantly over the years, ensuring that South Africans are exposed to education at all levels to ensure that socio-economic challenges in the country are addressed.

The inclusive education system plays a major role in ensuring that there is access to quality basic education for learners with special needs. This system contributes immensely towards the achievement of an inclusive economy and inclusive society.

The Early Childhood Development (ECD) Programme has ensured that the initiative is expanded to all socio-economic levels of society. This programme ensures that school readiness is a priority among South Africans and equal basic education is achieved by government.

Evaluation and research has been a serious deficiency in the country and the education sector, but over the years, with the introduction of monitoring, research and evaluation in the sector, performance has also improved. There is substantial research conducted within the sector which assists in identifying gaps and also creates a platform to monitor the sector through evidence-based evaluations.

The 2020 academic year will be remembered as the year that not only presented major health challenges, but one when the

entire world was engulfed by the by the COVID-19 pandemic. Government, with its education departments and its strategic partners, worked hard to strike a balance between saving lives and the academic year.

Basic education

The DBE is mandated to monitor the standards of education provision, delivery and performance across South Africa, annually or at other specified intervals, to assess compliance with provisions of the Constitution and the National Education Policy.

The functions of the DBE include:

- managing the development, evaluation and maintenance of policy, programmes and systems for ECD in the reception years;
- developing, evaluating and maintaining an accreditation system for providers and trainers;
- developing and maintaining policy concerning programmes, qualifications and assessment for ECD; and
- rendering support to qualifications and quality assurance authorities concerning ECD.

Schooling 2025, the overarching plan for the basic education sector, encapsulates the long-term vision of education priorities, targets and programmes articulated for the sector in the NDP.

Over the medium term, the DBE will continue to focus on improving school infrastructure, providing high-quality learner and teacher support materials, developing skills for a changing world, planning for the migration of the ECD function from the social development sector to the basic education sector, providing support to improve matric completion rates, facilitating the increase in supply of quality teachers, and providing nutritious meals for learners through the National School Nutrition Programme.

Improving school infrastructure

The DBE plans to complete an integrated infrastructure development plan informed by infrastructure delivery and regular maintenance, which is resourced. The School Infrastructure Backlogs Grant is meant to eradicate the basic safety norms backlog in schools without water, sanitation and electricity and to replace those schools constructed from inappropriate material, including mud schools. Through the Accelerated School Infrastructure Delivery Initiative, the

department will build 81 new schools over the Medium Term Expenditure Framework (MTEF), provide sanitation to 1 750 schools and provide water to 100 schools.

The DBE's commitment to ensuring all learners have access to appropriate and safe infrastructure at school is given effect through the Education Infrastructure Grant and the School Infrastructure Backlogs Grant. The Education Infrastructure Grant is transferred to provinces to co-fund the building and maintenance of school infrastructure. The allocation to the Education Infrastructure Grant is R36.7 billion over the MTEF period, whereas the allocation to the School Infrastructure Backlogs Grant is R6.8 billion, of which R2.3 billion is allocated in 2021/22 to build 21 new schools and provide sanitation to 1 000 schools. From 2023/24, the School Infrastructure Backlogs Grant will be incorporated into the Education Infrastructure Grant, ensuring that provinces undertake all infrastructure projects.

In 2020/21, the DBE plans to spend R1.7 billion of the grant's allocation to build 31 new schools, provide sanitation to 691 schools and water to 125 schools, thereby ensuring that all schools have access to water by the end of 2020/21. Cabinet has approved reductions on the grant, amounting to R122.8 million over the medium term. These reductions could result in delays in the completion of projects.

Developing skills for a changing world

To prepare learners for jobs in a changing and increasingly digitised world, the DBE plans to enhance the curriculum by introducing new technical subjects. These new subject choices include coding, robotics and data analytics at primary school level. Several public ordinary secondary schools will be transformed into focus schools over the MTEF period.

In addition to prioritising mathematics, science and aviation, new technology subjects and specialisations will be introduced at these focus schools. This initiative will be funded through the Maths, Science and Technology Grant, which will also provide resources for workshops and laboratories, information and communications technology (ICT) equipment and support to 1 000 schools, including 200 technical high schools and 300 primary or feeder schools over the same period. The grant has a total allocation of R1.3 billion over the medium term.

The Policy on Screening, Identification, Assessment and Support (SIAS) was developed over a period of 10 years through a rigorous process of field testing and consultation. It aims to ensure that all children of school-going age who experience barriers to learning, including people with disabilities, will be able to access inclusive, quality, free, primary and secondary education on an equal basis with other young people in the communities in which they live.

The policy aims to standardise procedures to identify, assess and provide programmes for all learners who require additional support to enhance their participation and inclusion in school, making teachers and parents central to the support processes.

The successful implementation of the Policy on SIAS will be an important step towards meeting the obligations of government in respect of the UN Convention on the Rights of Persons with Disabilities as ratified by Cabinet in November 2007, in terms of ensuring an inclusive education system at all levels.

Implementing a curriculum with skills and competencies for a changing world

This includes implementing the Three Stream Model, Fourth Industrial Revolution, entrepreneurship and focus schools, among others. The department has developed the Coding and Robotics Curriculum for grades R – 9, which was repackaged to ensure proper sequencing and seamless progression from one phase to the next. The repackaging process was completed in 2020.

In partnership with the Department of Communications and Digital Technologies, the DBE has identified 152 sites in 76 education districts to be equipped with virtual classroom infrastructure. Through this initiative, the sector will fully embrace the digital revolution of remote learning. Districts will be able to benefit through curriculum specialists' streamed lessons on digital platforms.

The process of incrementally refocusing the teaching and learning of the previously marginalised African languages in South African schools has led to the introduction of Kiswahili as a second additional language (SAL) in grades 4 – 12 in 90 schools (10 per province). The Curriculum and Assessment Policy Statement (CAPS) for Kiswahili SAL for grades 4 – 9 has been versioned and the Kiswahili Toolkit has been developed for the respective grades.

In the next three years, 54 technical schools will be monitored for the implementation of the CAPS. Nationally, 540 schools will be monitored for implementing compulsory entrepreneurship education and 54 schools will be monitored for piloting and implementing the coding and robotics curriculum. Annual Sector Reports will be produced on the establishment of focus schools per provincial education department. A total of 81 schools will be monitored for utilisation of ICT resources and 307 special schools will be provided with access to electronic devices.

The DBE aims to provide occupationally oriented curricula for 21 subjects, to 74 schools of skill and 13 subjects to 103 ordinary schools, over the MTEF (to pilot in 2021 and 2022).

Planning for the migration of the ECD function

The NDP envisions quality ECD as a priority for South Africa to improve the overall quality of education and the long-term prospects of its future generations. Accordingly, over the

medium term, the DBE will work closely with the Department of Social Development (DSD) and other partners to oversee the migration of the responsibility for ECD from the social development sector to the basic education sector, and the process of introducing two years of compulsory preschool for all children before they enter Grade 1. In 2020/21, the DBE plans to conduct an ECD audit to determine the need across all affected age groups, as well as the quality of provision of these services.

The Government Technical Advisory Centre is supporting the DBE and DSD to ensure a smooth and seamless relocation of ECD delivery from the DSD to the DBE; firstly, by conducting the ECD function diagnostic assessment to determine the resources connected to the ECD function in DSD at national and provincial levels, and any data and assets associated with the ECD function; and secondly, by conducting a readiness assessment for the DBE to receive the ECD function at both national and provincial levels. The diagnostic report was completed in September 2020.

Over the MTEF, the DBE will facilitate the following activities as part of the ECD function shift:

- amendment of the Children's Act, 2005 (Act 38 2005);
- approval of the funding model;
- approved report on the national census conducted on ECD centres;
- a report on the investigation into the ECD service delivery model and its workforce implications; and
- operationalise an online National Qualifications Framework (NQF) Level 4 ECD qualification platform.

To cater for the two years of ECD prior to Grade 1, Section 3 of the South African Schools Act, 1996 (Act 84 of 1996) on compulsory attendance is being amended through the Basic Education Laws Amendment (BELA) Bill to cater for the compulsory attendance of Grade RR by learners turning five years of age and Grade R by learners turning six.

Providing support to improve matric completion rates

In response to the NDP's call to reduce the learner drop-out rate, the Second Chance Programme provides support to matric learners who do not meet the pass requirements of the National Senior Certificate (NSC) examinations. Over the MTEF period, the programme's new policy priority will be to include learners with disabilities. Accordingly, the DBE will use

the existing 23 special schools for the blind and 43 schools for the deaf as sites of support for learners with disabilities in the Second Chance Programme.

In addition, as a measure to support the performance of all learners, the DBE will develop a web-based system that will allow multiple users to upload subject support for learners to access. The programme will provide support in subjects such as mathematics, science, accounting and languages, facilitate the establishment of 80 face-to-face centres, and appoint more than 800 teachers and 80 centre managers to teach after school hours and over weekends.

The programme is allocated R183.2 million over the medium term. However, Cabinet-approved reductions, amounting to R67 million over the MTEF period, are likely to affect its expansion.

Facilitating an increase in the number of quality teachers

Over the medium term, the DBE plans to continue facilitating an increase in the number of newly qualified teachers in mathematics, science and technology in various phases. This is expected to be achieved by providing 37 500 Funza Lushaka bursaries to prospective teachers.

The number of bursary awards is expected to be maintained at 12 500 per year over the MTEF period. This is on condition that general increases in university costs do not exceed average annual increases in allocations to the bursary scheme of approximately 5% over the same period.

While prospective Funza Lushaka bursary recipients may qualify for fee-free funding at universities, the DBE expects the demand for Funza Lushaka bursaries to remain unchanged as the guarantee of employment provided by the bursary's work-back provision remains a strong incentive. The bursary scheme was allocated R4.1 billion over the MTEF period.

Providing meals for learners

The National School Nutrition Programme is directly aligned with the NDP's priority of eliminating poverty and supporting food security. Accordingly, in each year over the medium term, nine million learners in 19 950 quintile 1 to quintile 3 schools, as well as identified special schools, will be provided with meals through the programme.

The programme is funded through the National School Nutrition Programme Grant, which is allocated R24.3 billion over the MTEF period. The decrease in schools covered by the programme over the medium term is mainly due to the closing and merging of small schools. Reductions approved by Cabinet on the grant amounting to R123.1 million over the medium term will not affect the current provision of meals to learners in quintile 1 to quintile 3 schools. However, the programme's extension to include breakfast and provide meals to selected learners in quintile 4 and quintile 5 schools will be slower.

On 6 November 2020, Basic Education Minister Angie Motshekga received a donation of 30 laptops from the Ambassador of Belgium, Didier Vanderhasselt, at Spa Park Primary School in Bela Bela.

The DBE and the European Union (EU) run an education for employment programme together with the departments of Higher Education and Training, and Employment and Labour. The purpose of the programme is to support government efforts to improve the quality of basic education, vocational training and job placement services, from early childhood, through teen years until the skills needed for the world-of-work are acquired.

The programme will support the DBE towards access to quality ECD.

Implementing standardised assessments

The DBE plans to improve quality and efficiency through the implementation of standardised assessments – to reduce failure, repetition and dropout rates, and introduce multiple qualifications such as the General Education Certificate (GEC) before the Grade 12 exit qualification. The policy framework for the introduction of the GEC has been drafted and submitted to Umalusi for review and approval. Work has been commissioned on a blueprint for assessment options that will inform learners, teachers, parents and the system about the suitability of learners to undertake an academic, vocational or occupational track in senior secondary schools (grades 10 – 12).

The department has drafted the National Assessment Framework (NAF) to coordinate all assessments conducted in the general and further education and training (FET) bands. A basket of purpose-driven assessments from school entry (Grade R) to Grade 9 has been designed for implementation. A significant intervention of the NAF is the roll-out of the Systemic Evaluation initiative, targeted at establishing key learner competencies in mathematics and languages at the end of grades 3, 6 and 9, and determining the enabling school and system support factors that contribute to the improvement of learning outcomes. The DBE will work towards implementing the first cycle of the Systemic Evaluation initiative, which is scheduled for 2022.

These assessment programmes and the country's participation in international benchmark assessments (such as the Trends in International Mathematics and Science Study (TIMSS) 2019, Progress in International Reading Literacy Study 2021 and Southern and Eastern Africa Consortium for Monitoring Educational Quality V), will be implemented accordingly, during the medium term. In addition, the assessments and public examination system in the FET band are also being reviewed so that they can be aligned with the NAF.

The TIMSS 2019 results were released in December 2020. Through the Examinations and Assessments unit, the DBE will facilitate the quality assurance of school-based assessment (SBA) in the FET band and facilitate the high quality and standardised marking of the NSC, provision of the reliable instrument for the NSC and provision of reliable data and feedback on the NSC examinations.

The NAF replaces the Annual National Assessment as an indicator reflecting performance objectives. The programmes linked to the NAF will enable the generation of a national report on the monitoring of learning outcomes each year over the MTEF.

Promoting social cohesion, health and school safety

The DBE continues to implement enrichment and school safety programmes in collaboration with various partners and government departments. These programmes promote physical activity, literacy, arts and culture through education enrichment.

Over the MTEF, the department will use allocated resources to monitor and support the implementation of sport, social cohesion, arts and culture, and school safety programmes in districts. It also plans to host national enrichment programmes that support learners.

The department will monitor the implementation of the school safety, social cohesion and sports and enrichment programmes in 75 education districts. Due to the limited number of professionals such as social workers and psychologists in the sector, the department will continue to build the capacity of learner support agents through the implementation of the Guide for Learner Support Agents (LSAs) and schools on providing psychosocial support to learners. Additional skills will be provided to LSAs through a partnership to provide training on the Common Elements Treatment Approach in 2021.

The HIV and AIDS Life Skills Education Conditional Grant is utilised to support the implementation of the DBE's National Policy on HIV, Sexually Transmitted Infections and Tuberculosis for Learners, Educators and Support Staff in South African Public Schools.

Legislation

The DBE derives its mandate from the following legislation:

- the National Education Policy Act, 1996 (Act 27 of 1996), which inscribed into law the policies, legislative and monitoring responsibilities of the Minister of Basic Education, and the formal relations between national and provincial authorities;
- the South African Schools Act, 1996 (Act 84 of 1996), which promotes access to quality education and democratic governance in the schooling system, and makes schooling compulsory for children aged seven to 15, to ensure that all learners have access to quality education without discrimination; and

- the Employment of Educators Act, 1998 (Act 76 of 1998), which regulates the professional, moral and ethical responsibilities of educators, as well as the competency requirements for teachers.

Budget

The initial overall 2020/21 budget allocation for the DBE before adjustments was just over R25.3 billion. However, after the adjustments, the department's overall budget allocation was reduced to over R23.2 billion.

The COVID-19 pandemic has brought with it the biggest shocks to global education systems since the Second World War. The DBE has reprioritised considerable amounts of its budget towards responding to infection control, school rearrangement, curriculum recovery and emergency space and sanitation requirements. The DBE has provided emergency water and sanitation assistance, as well as guidance to provinces on the need for digital oversight and monitoring of activities. Some activities have had to be suspended and some performance expectations amended.

The DBE's total expenditure is set to increase at an average annual rate of 7.2%, from R23.4 billion in 2020/21 to R28.8 billion in 2023/24. Transfers and subsidies account for an estimated 82.6% of this amount, increasing at an average annual rate of 8.9%, from R18.8 billion in 2020/21 to R24.2 billion in 2023/24. Cabinet-approved reductions of R1.6 billion over the medium term are effected on the School Infrastructure Backlogs Grant (R413.3 million); the Funza Lushaka Bursary Programme (R254.8 million); and transfers to provinces (R209.2 million) for various conditional grants, including the HIV and AIDS (life skills education) Grant (R61.4 million).

The Department sets aside funds to implement three social cohesion and equity programmes, namely:

- National Schools Moot Court, which gives learners an opportunity to test the extent to which constitutional values may find expression within the judiciary system;
- iNkosi Albert Luthuli Oral History Programme, in which learners document their local historical events and anniversaries, discovering unsung heroes and heroines and communities as part of promoting nation-building and unity; and
- Evaluation of Textbooks, which attempts to identify areas in textbooks that depict discrimination, stereotypes, sexism, cultural discrepancies and misrepresentation.

Entities

South African Council for Educators (SACE)

The SACE aims to enhance the status of the teaching profession through registering educators appropriately, managing professional development and promoting a code of ethics for all educators. It was established in terms of the SACE Act, 2000 (Act 31 of 2000).

Before their employment, educators are required to register with the SACE, which has a register of about 500 000 educators. The council has strengthened entry requirements by checking applicants' professional standing.

The SACE has a number of programmes that promote the development of educators and enhance the status and image of the teaching profession. These include:

- the Professional Development Portfolio Project, which aims to encourage educators to reflect on their practice and take responsibility for their own professional development;
- teacher education and development research activities;
- setting up the Continuing Professional Teacher Development (CPTD) System;
- celebrating World Teachers' Day to acknowledge the work of educators; and ensuring that educators adhere to the SACE Code of Professional Ethics, and
- the CPTD System, which recognises professional development undertaken by educators on their own initiative.

The council's total budget for 2020/21 was R107.3 million. For the council to continue to fulfil these obligations, expenditure is expected to increase from R105.3 million in 2020/21 to R106.5 million in 2023/24 at an average annual rate of 0.4%. Likewise, revenue is projected to increase at an average annual rate of 0.4%, from R105.3 million in 2020/21 to R106.5 million in 2023/24. The council derives 79.2% of its revenue through membership fees.

There has not been an increase in membership fees since 2017 and, as the council does not expect a change in its number of members over the medium term, revenue from this source is expected to remain at R84.1 million in each year of the MTEF period. The remainder of the council's revenue is derived through interest on investments and transfers from the DBE for the management of the CPTD System.

Umalusi Council for Quality Assurance in General and FET

The Umalusi Council for Quality Assurance in General and FET derives its mandate from the NQF Act, 2008 (Act 67 of 2008) and the General and FET Quality Assurance Act, 2001 (Act 58 of 2001). As an external and independent quality assurance body, the council's mandate is to set and maintain standards in general and FET through the development and management of the General and FET Qualifications Sub-framework.

It is tasked with the certification of the following qualifications:

- Schools: the NSC.
- Technical and vocational education and training (TVET) colleges: the National Technical Certificate (Level N3) and the National Certificate Vocational.
- Adult learning centres: the General Education Training Certificate – Adults.

To issue learners with certificates that are credible, the council:

- develops and evaluates qualifications and curricula to ensure that they are of the expected standard;
- moderates assessment to ensure that it is fair, valid and reliable;
- accredits providers of education and training, as well as assessment;
- conducts research to ensure educational quality; and
- verifies the authenticity of certificates.

To fulfil its obligations, the council's expenditure is expected to increase at an average annual rate of 5.2%, from R166.4 million in 2020/21 to R193.7 million in 2023/24. The council is set to derive 78.1% (R422.3 million) of its revenue over the MTEF period through transfers from the DBE, with the remainder coming through interest on investments, fees charged for the certification and accreditation of private institutions, and the provision of verification services.

Role players

Provincial departments of education

The role of the DBE is to translate government's education and training policies and the provisions of the Constitution into a national education policy and legislative framework.

The DBE works closely with provincial education departments to ensure that provincial budgets and strategies are in line with and support national policies. The national department shares a concurrent role with the provincial education departments for

basic schooling and ECD, but it is the responsibility of each provincial education department to finance and manage its schools directly.

District offices are the provincial education departments' main interface with schools. Not only are they central to the process of gathering information and diagnosing problems in schools, but they also perform a vital support and intervention function.

This includes organising training for personnel, dealing with funding, resourcing bottlenecks and solving labour-relations disputes. District offices are key to ensuring that school principals remain accountable to provincial education departments and that accountability lines within the school, to the principal and school governing body, are maintained.

Equity in education expenditure between and within provinces is achieved through the equitable division of national revenue between provinces, making use of the Equitable Shares Formula, the National Norms and Standards for School Funding, and the national post-provisioning norms.

The norms are progressive, with 60% of a province's non-personnel expenditure going to the poorest 40% of learners in public schools. The poorest 20% of learners receive 35% of non-personnel resources, while the richest 20% receive 5%.

Council of Education Ministers

The council, comprising of the Ministers of Basic Education, and Higher Education and Training, as well as the nine provincial members of the executive councils for education, meets regularly to discuss the promotion of the national education policy, share information and views on all aspects of education in South Africa and coordinates action on matters of mutual interest.

Heads of Education Departments Committee

The committee comprises the Director-General (DG) of the DBE, the deputy DGs of the national department and the heads of provincial departments of education.

The purpose of the committee is to facilitate the development of a national education system, share information and views on national education, coordinate administrative action on matters of mutual interest and advise the DBE on a range of specified matters related to the proper functioning of the national education system.

National Education Evaluation and Development Unit (NEEDU)

The NEEDU ensures effective evaluation of all educators based on the extent to which learner performance improves. Its core responsibilities include:

- providing the Minister of Basic Education with an independent account of the state of schools, including the quality of teaching and learning at all schools;
- providing an independent account on the development needs of the school education system;
- accounting for the attainment of the standards by all schools through a monitoring and evaluation system;
- identifying, on a system-wide basis, the critical factors that inhibit or advance school improvement and making focused recommendations for redressing problem areas that undermine school improvement;
- proposing appropriate sanctions to ensure that schools offer effective education for all learners;
- strengthening internal evaluation capacity within schools in ways that inform and complement external evaluation;
- monitoring the different levels of school support and the extent action is considered on proposed interventions, whether in the form of developmental support or disciplined action;
- reviewing and assessing existing monitoring, evaluation and support structures and instruments regularly, to ensure clarity and coherence in the way schools and teachers are assessed and supported;
- providing schools with evidence-based advice on how to pursue school improvement in their particular context; and
- promoting school improvement through the dissemination of good practice.

The NEEDU completed its first five-year cycle of systemic evaluations by identifying, on a system-wide basis at school, district and provincial levels, the factors that inhibit or advance school improvement. The findings were in the following areas:

- Reading: Teachers in the 134 rural schools visited did not have a good method to teach foundational level learners how to read. Actions taken include a Reading Advisory Committee to advise on reading matters, prioritising reading support in the provinces, and piloting the Early Grade Reading Assessment.
- Curriculum delivery: Gaps such as the development and implementation of provincial literacy and numeracy were observed in curriculum delivery. Actions taken included asking

for learners' books to monitor quality of writing and holding school management teams and principals accountable for curriculum delivery.

- Use of learning and teaching support materials: Most learners in primary schools did not have sufficient learning and teaching support materials, as well as textbooks for mathematics and languages due to an ineffective retrieval system from previous learners. Actions taken included developing policies that ensured that textbooks were retrieved from schools that did not have a good retrieval system.
- Time management: Many schools experienced time management issues such as tardiness and absenteeism by learners and teachers, while some teachers did not follow the time allocated to subjects on the timetable. Actions taken included monitoring of time management in schools by district and provincial officials. The DBE and the Minister of Basic Education engaged district and provincial officials in a discourse on time management.
- Assessment: Teachers in most schools were not able to construct/set assessment items of good quality. Learners perform well in SBAs but poorly in common and international assessments. Teachers assess what they have taught, not what they ought to have taught. Few schools had school improvement plans that were informed by assessments. Actions taken by the DBE included aligning provincial education department school improvement plans with DBE plans. Subject committees and SBA workshops were conducted in provinces to train advisors in setting up quality tasks.
- Special schools: The preliminary findings indicated that special schools did not have a systemic way of admitting learners and different curricula were used in each special school. Findings at school level were presented to districts and provincial education departments to take necessary actions.

During the second five-year cycle (2017 – 2021), the focus shifted to development to ensure the system-wide impact of the NEEDU's findings.

Education Labour Relations Council (ELRC)

The ELRC serves the public education sector nationally. It is a statutory council, initially established by the Education Labour Relations Act, 1993 (Act 146 of 1993), but draws authority from the Education Labour Relations Act, 1995 (Act 66 of 1995).

The main purpose of the council is to maintain labour peace

within public education through processes of dispute prevention and resolution.

These include collective bargaining between the educator unions and the DBE as the employer. The ELRC also conducts various workshops to increase the level of awareness and understanding of sound labour-relations procedures.

Educator unions

Educators are organised into six educator unions:

- National Professional Teachers' Organisation of South Africa.
- National Teachers' Union.
- South African Teachers' Union.
- Professional Educators' Union.
- Cape Professional Teachers' Association.
- South African Democratic Teachers' Union.

There is an existing labour relations framework agreement between the DBE and unions. It encompasses both traditional areas of negotiation and issues of professional concern, including pedagogy and quality-improvement strategies.

An agreement was reached on the Framework for the Establishment of an Occupation-specific Dispensation (OSD) for educators in public education. The OSD provides for dual career paths, where educators and specialists in classrooms can progress to levels where they earn salaries that are equal to, or higher than, those of managers without moving into management/supervisory posts.

It also provides for a new category of posts for teaching and learning specialists and senior learning and teaching specialists, as well as the creation of a cadre of education managers at school and office level.

Education during COVID-19

The COVID-19 pandemic brought heightened uncertainty to the education space. Government set out an evolving plan of action to ensure that the academic year was not lost. This included a phased approach to opening schools which were closed in March 2020, the postponement of the May/June examinations and digital curriculum support.

Back to school phased approach

The closing of schools in March 2020, due to the COVID-19 pandemic, necessitated the need for government to revise the original school calendar which would have ended on 4 December 2020.

The education sector, health experts and the Coronavirus National Command Council worked together to ensure that the DBE complied with set COVID-19 protocols before schools could reopen. These included sanitation measures, availability of water, provision of masks and social distancing in schools.

Once schools were given the greenlight for compliance, learners returned to the classroom in a phased and staggered approach, starting with the exit stage grades, which are grades 7 and 12. The return of learners was dependent on the preparedness of schools. The DBE also postponed the May/June Matric rewrite examinations, which were due to be written by more than 350 000, mainly part-time candidates, from 4 May 2020.

The DBE had not been able to complete its preparations, which included the printing and distribution of question papers, the appointment of invigilators, markers and the general readiness in marking centres, due to lockdown restrictions.

TeacherConnect application (app)

In September 2020, the DBE launched the TeacherConnect app – a free real-time-based mentorship platform available via WhatsApp. The app allows users to connect, be a helpdesk, and provide learning and mentoring through real-time dashboards. The app is also integrated with Health Check – a COVID-19 digital risk assessment and mapping tool that enables the Department of Health (DoH) to track and monitor potential cases.

The platform offers a one-stop digital solution for teachers and learners in the time of the COVID-19 pandemic. It was expected to assist in the phased reopening of schools. The tool is also expected to help government to align with the DoH's protocols on screening, testing and linkages to care. It also places non-pharmaceutical measures in the hands of the schooling community, teachers, non-teaching staff, parents and learners.

To make use of the app, teachers, parents and learners can log into the platform to answer a few questions relating to COVID-19 symptoms and risk. Teachers and school communities are required to do the health screen test all the time. Before entering the school premises, learners and staff should show that they have completed the daily health check and are cleared to continue to the school premises. Those classified as moderate or high risk are entered into the DoH's tracking and tracing process.

The app was endorsed by the director of the UNESCO regional office for Southern Africa Professor Hubert Gijzen – an important factor in light of the global education coalition, a

flagship intervention driven by the UNESCO, which is aimed at protecting the right to education, under unprecedented disruption and beyond. The endorsement by the UNESCO confirms that South Africa is on the right track to protecting and supporting the most powerful influence on education – the teachers.

To access the app, teachers, parents and learners should save the Teacher Connect app number: 060 060 3333.

Woza Matrics 2020 Catch-up Campaign

The prevalence of the COVID-19 pandemic in 2020 resulted in changes in the education sector landscape. In the history of education, schools had only closed for holidays as per the school calendar but 2020 was an exception, with more learning days lost. As such, the Matric Class of 2020 faced unparalleled disruptions to their schooling and learning schedules since March 2020. Due to the COVID-19 national lockdown, South Africa's 13 million learners, including some 1.2 million matriculants, fell behind on the curriculum coverage and they risked severe skills deficiency well beyond 2030, if a catch-up plan was not put in place.

To address the challenge, the DBE launched the Woza Matrics 2020 Catch-up Campaign, a unique partnership that provided academic support to the Class of 2020. About 400 000 of these Matric learners were Second Chance Matric Programme learners. The innovative Woza Matrics 2020 Catch-up Campaign provided examination preparation support to all matriculants. It also provided much-needed guidance on managing stress and anxiety, thus promoting the well-being of learners.

The 2020 World Teachers' Day was celebrated under the theme; "Teachers: Leading in crisis, reimagining the future". The day was used to celebrate the teaching profession worldwide, taking stock of achievements and drawing attention to the voices of teachers, who are at the heart of efforts to attain the global education target of leaving no one behind.

The COVID-19 pandemic has significantly added to the challenges faced by already over-extended education systems throughout the world.

In view of the pandemic, the celebrations took place online. Celebrations included the opening ceremony and the UNESCO-Hamdan Prize Awards ceremony on 5 October, and the closing ceremony on 12 October.

There was a series of national, regional and global events throughout the week. Basic Education Minister Motshekga gave a virtual address on and drew awareness to South African teachers working in unfavourable conditions generated by environmental factors such as the prevalence of crime, poverty and burden of diseases.

The Class of 2020 was offered targeted support aimed at ensuring that all learners receive maximum opportunities to succeed. Schools also provided specific learner support programmes to address specific performance results or trends.

Matric 2020 results

The combined exam, which involved full-time and part-time candidates, started on 5 November 2020, with more than one million candidates writing together at the same time. The exams took place at 8 200 exam centres in all provinces, with 80 000 invigilators. A total of 216 question papers were written, with more than 10 million scripts printed. The sector appointed 45 000 markers at 180 marking centres.

The total number of candidates, who registered for the 2020 NSC exams was 725 034, comprising 607 226 full-time candidates and 117 808 part-time candidates. In addition to the full-time and part-time candidates who enrolled for the 2020 NSC exams, the DBE combined the November 2020 NSC examinations with the June 2020 NSC examinations. This increased the number of candidates who wrote the combined 2020 November exams to a record of more than one million (1 054 321) candidates.

The 2020 NSC overall pass rate, with the progressed learners included, was 76.2% – a decline of 5.1% from the record pass rate of 81.3% achieved by the Class of 2019.

The overall number of candidates who achieved Bachelor passes was 210 820 – an improvement of 13.3% from the previous year. This represented 36.4% of the total number of candidates who wrote the 2020 NSC exams.

Of the 65 499 progressed learners who wrote the requisite seven subjects during the 2020 NSC examinations, 24 244 passed and 3 026 achieved Bachelor passes.

A total of 1 757 learners with special education needs passed the 2020 exams and 943 achieved Bachelor passes.

Curriculum Recovery Plan

To make up for lost time due to COVID-19, government has come up with a three-year curriculum recovery plan. As part of the plan, from 2021, the DBE will be implementing recovery annual teaching plans (ATPs) from Grade R to 12. The basis of the recovery ATPs is the trimmed curriculum, including the learning losses to be recovered in each grade, based on the learning losses in the previous grade.

The start of the COVID-19 pandemic led to lost learning time as schools shutdown and ultimately reopened with several changes to the schooling environment, which included social distancing protocols, rotational attendance and the intermittent closure of schools due to increased localised infections.

To mitigate the impact of lost time, the recovery process will occur over a three-year period, straddling 2021 to 2023, to gradually recover the learning losses, while building on foundational content required for the next grade. The multi-year recovery plan also ensures that the impact of further learning losses are minimised.

The recovery ATPs focus mainly on core and fundamental content knowledge, skills, attitudes and values required in each grade and subject, to ensure deep learning and content mastery as opposed to superficial learning.

To assist in the recovery plan, the basic education sector will receive 300 000 young employees in schools. This is part of the Presidential Employment Stimulus Programme to create 200 000 employment opportunities for education assistants, and 100 000 for general school assistants. This will be accomplished through the Basic Education Employment Initiative (BEEI).

The BEEI seeks to address COVID-19 academic disruption, as well as address some of the lingering systemic challenges. Education assistants will support teachers in the classroom and provide extra support to learners. General school assistants will help schools to comply with COVID-19 protocols, while ensuring that teaching and learning take place in a safe, secure and hygienic environment.

The 300 000 employment opportunities were targeted at young people, to strengthen capacity in schools, at least until the end of March 2021.

In planning its recovery plan, the DBE published a proposed staggered school calendar for 2022, in which coastal and inland provinces open schools on different dates.

Higher Education, Science and Innovation

The DHET and the Department of Science and Innovation (DSI) report to the Ministry of Higher Education, Science and Innovation but exist as separate votes.

Higher Education and Training

The NDP envisages that by 2030, South Africans should have greater access to post-school education and training (PSET)

opportunities through a system that is responsive to their needs. The DHET's vision is to have an integrated, coordinated and articulated PSET system for improved economic participation and the social development of youth and adults. The *White Paper for Post-School Education and Training, 2014*, points out that the PSET system is an important institutional mechanism that must be responsive to the needs of society.

The system should be inclusive and cut across state boundaries, ethnic, gender, disability, class and socio-economic status, and national and religious identities, to achieve a united human race based on human dignity. This is supported by Priority 2 (education, skills and health) of government's 2019 – 2024 Medium Term Strategic Framework (MTSF).

Over the medium term, the DHET will work with the South African Qualifications Authority (SAQA) and the three quality councils – Umalusi, Council on Higher Education (CHE) and the Quality Council for Trades and Occupations – to develop an enabling environment for a well-articulated PSET system. This includes the revision of the policy environment, work with institutions to ensure that programmes have clear articulation pathways, and that the public is informed of articulation pathways and options. The department, SAQA and the three quality councils will work together to ensure that qualifications have built-in articulation possibilities and are communicated to the public. On an annual basis, the DHET will provide progress reports on the implementation of articulation in the PSET system.

Over the medium term, the DHET will also focus on expanding access to higher education institutions by implementing a five-year plan for the enrolment of students at these institutions, and updating guidelines for the implementation of its bursary scheme for students from poor and working-class backgrounds.

As part of its focus on improving performance in higher education institutions, the department will seek to implement university capacity development plans, eradicate the certification backlog in TVET colleges, and conduct advocacy campaigns on the use of open-access learning and teaching support materials in community education and training colleges.

Transforming universities and increasing student financial aid

Over the medium term, the DHET will focus on transforming the higher education sector into a high quality, demographically representative system that provides students and staff with

opportunities for access and success. To support transformation in the sector, the department will implement the University Capacity Development Programme at a projected cost of R1.1 billion in 2020/21, the Historically Disadvantaged Institutions Development Programme (HDI-DP) at a projected cost of R536.3 million in 2020/21, and the Infrastructure and Efficiency Programme at a projected cost of R2.8 billion in 2020/21.

These programmes are intended to increase student access; enhance staff development, particularly in teaching, research and leadership; and enhance management and curriculum development in priority areas in the university system by increasing allocations to universities with a high proportion of students and staff from historically disadvantaged population groups.

Ensuring that universities have adequate infrastructure for learning and student accommodation is pivotal for the sector over the medium term. However, spending in this regard has been slow due to delays in procurement, and poor performance by contractors and implementing agents. The DHET will prioritise the resolution of these issues over the medium term through the implementation of the Macro Infrastructure Framework to improve the delivery of infrastructure within the sector. Despite Cabinet approving reductions of an estimated R621.3 million over the MTEF period on allocations for university infrastructure in the University Education programme, R8.8 billion is allocated in the University Subsidies subprogramme for spending on university infrastructure. This allocation is expected to contribute to the department's aim of developing 200 000 new university beds by 2026.

The University Education Programme constitutes 68.3% (R252.6 billion) of the department's budget over the medium term. Transfers of government subsidies to 26 universities through grants constitute the bulk of spending in this programme, and are projected to increase at an average annual rate of 5.3%, from R42.4 billion in 2019/20 to R49.4 billion in 2022/23.

These transfers are intended for operational costs such as compensation of employees and the maintenance of assets related to university teaching, and learning and research activities. Transfer payments to the National Student Financial Aid Scheme (NSFAS) for bursaries to support undergraduate students from poor and working-class backgrounds in universities and TVET colleges are expected to amount to R109.6 billion over the medium term. These are set to increase

at an average annual rate of 7.7%, from R30.5 billion in 2019/20 to R38.2 billion in 2022/23, despite R899.2 million of Cabinet's approved reductions to the programme being on the scheme's allocation for TVET colleges.

The Historically Disadvantaged Institutions Development Programme

The programme is fully described in the draft HDI-DP Framework that has been fully consulted with historically disadvantaged institutions in the university sector. The HDI-DP Framework seeks to address challenges that threaten the viability and sustainability of historically disadvantaged institutions and will draw on the Historically Disadvantaged Institutions Development Grant as a resource. It will also draw on a range of other institutional, department and partner resources.

The Framework sets the following strategic priority areas for development focus:

- strengthen institutional management and governance systems,
- improve institutional infrastructure and facilities,
- enhance effective staff recruitment, development and retention,
- strengthen the academic enterprise, and
- leverage locality and community.

The notion of universities as anchor institutions will be a key feature of the programme. Once it is presented and approved, the DHET plans to roll out its full implementation in the next five years.

Funding for the missing middle

Addressing the dearth of funding for the missing middle students was a priority for the 2020/21 financial year. In working towards a financial aid system that is inclusive of missing middle students, it would be necessary to explore the possibility of a loan scheme for the higher education sector, within the funding constraints, and working with private sector partners and other government departments, taking into account work already done.

Ensuring the sustainability and effective administration of the NSFAS would also be key to the success of the financial aid system.

Student accommodation

Plans are underway to develop and finalise a multi-faceted and comprehensive strategy for student housing. The strategy will include a range of possibilities for increasing the availability of student housing on and off university and TVET campuses.

This will include accelerating the Student Housing Infrastructure Programme, which is already underway, through which university- and college-owned housing will be developed, leveraging private sector investments and development potential, as well as developing a policy framework on the accreditation of private student accommodation. The norms and standards for student housing for the PSET system is also expected to be developed and implemented.

Establishing universities

Over the next five years, the system is expected to expand to provide additional spaces in higher education. In order to enhance the planned expansion in terms of the current enrolment plans of institutions, two new institutions will be established – a university for crime detection in Hammanskraal and a university for science and innovation in Ekurhuleni.

The Higher Education Act of 1997 allows for new institutions to be established as either higher education colleges or university colleges. This decision will be dependent on the outcome of a feasibility study, followed by a development plan for each new institution. Once funding is secured, the new institutions can be established as either a university college or a higher education college.

Over a period of time, a university college may be established as a fully-fledged university once it has met requirements to be established as such.

Expanding access to TVET colleges and improving their performance

Expanding access to skills programmes that address the labour market's need for intermediate skills that include practical components is one of the DHET's key mandates. Over the medium term, the department will work towards improving the quality of the PSET system by establishing more entrepreneurship hubs to enable TVET college students to realise their potential and become actively engaged in the economy, either through employment in the labour market or self-employment.

While the enrolment projections in TVET colleges are held constant over the next five years in order to eliminate funding gaps, the DHET is committed to expanding provision in the TVET college system through the development of comprehensive proposals involving a diversity of stakeholders and modalities of delivery, and to grow the number of students who can access vocational education and training. However, growth in the TVET college core programmes must take cognisance of the number of opportunities available to students for work-integrated learning.

Among these proposals will be the provision of open learning opportunities, primarily in the form of e-learning, as a key strategy towards reaching out and expanding access to students in remote locations, as well as to those already in employment. Furthermore, it is becoming evident that highly responsive and quality short skills programmes will grow in demand as organisations seek to reskill and upskill employees to meet rapidly changing workplace practices and standards.

Colleges will, therefore, partner with a diversity of stakeholders to deliver fit-for-purpose training in order to meet these localised needs. Programme diversification will constitute the cornerstone of expansion of the TVET system. The DHET will work collaboratively with the DSI to leverage the innovation service points already in existence nationally, for the enhancement of skills development in TVET colleges. Initial engagements will focus on augmenting and modernising current provision in TVET colleges through innovation and creativity to prepare students for the world of real work in a 21st Century context.

To facilitate this, teaching and learning support plans will be implemented in TVET colleges. Transfer payments to 50 colleges, in the TVET System Planning and Institutional Support subprogramme, are projected to increase at an average annual rate of 6.5%, from R11.6 billion in 2019/20 to R14 billion in 2022/23. This increase is despite Cabinet's approved reduction on allocations to the TVET programme of R2.6 billion over the MTEF period. The transfers include R1.2 billion for the operationalisation of three new TVET college campuses and R2.9 billion for the TVET Infrastructure Efficiency Grant.

Spending on compensation of employees accounts for an estimated 52.8% (R23.1 billion) of the TVET programme's budget of R43.7 billion over the medium term, increasing at an average annual rate of 5%. The TVET component accounts for an estimated 57.4% (more than 19 000) of the total number of personnel in the DHET.

Establishing and operationalising centres of specialisation

Establishment and operationalising centres of specialisation in TVET colleges is a critical project for which the DHET continues to engage employers to work with young people as apprentices. The project aims to provide fully qualified artisans for a range of sectors in the economy, including high-technology manufacturing, the creative industries, computer software and aerospace engineering.

Developing artisans

Over the medium term, the DHET aims to improve the public skills development system by managing the performance of service-level agreements with sector education and training authorities (SETAs) more effectively, and by providing funding to trade and quality assurance institutions for occupational qualifications. These institutions play a pivotal role in increasing the number of qualified artisans by rolling out skills programmes, learnerships, internships and apprenticeships, and by establishing partnerships with TVET colleges, universities and the labour market to provide opportunities for workplace experience.

Through the SETAs, over the medium term, 93 000 new artisans are expected to be registered for training and 75 000 artisan learners are expected to qualify. For this purpose, R347.8 million over the medium term is allocated.

Income generated through the skills development levy, which is collected from employers by the South African Revenue Service (SARS) and transferred to SETAs and the National Skills Fund (NSF) as a direct charge against the National Revenue Fund, contributes significantly to key performance areas of the public skills development system, including artisan development. This transfer is in the Skills Development programme, and is projected to increase at an average annual rate of 5.8%, from R18.6 billion in 2019/20 to R22 billion in 2022/23.

In August 2020, the Department of Public Works and Infrastructure signed a training agreement following the provision of R66 million to the Agricultural Sector Education Training Authority (AgriSETA) to train 400 Expanded Public Works Programme (EPWP) participants to become artisans. This was part of the NSF to provide training through the EPWP on skills programmes, learnerships and artisan development programmes over a multi-year period.

AgriSETA was responsible for sourcing relevant workplaces for all 400 trainees in artisan development, as well as to certify all accreditation requirements of training and appointment of service delivery agents for the duration of the project.

The project aligns to the National Skills Development Strategy (NSDS) 3 and the National Skills Development Plan 2030 which prioritise artisan development to address technical skills shortages.

Strengthening governance of the community education and training sector

The DHET recognises that improving the community education and training sector is key for development as it has the potential to provide students with access to a comprehensive range of programmes that lead to part and full qualifications and employment opportunities, including entrepreneurial opportunities. To ensure that the sector rises to its potential, the DHET will continue to prioritise the development and training of lecturers in community education and training colleges and learning centres by enabling them to upgrade their qualifications, with a particular focus on mathematics and science. The DHET has also strengthened its recruitment policies so that only qualified lecturers are employed in the sector.

Expenditure in the Community Education and Training programme is expected to increase at an average annual rate of 9.1%, from R2.1 billion in 2019/20 to R2.8 billion in 2022/23, with 93.4% of this spending earmarked for compensation of employees. About 39.2% of the department's personnel, mainly community education and training educators, are in this programme, in 3 276 community learning centres throughout the country.

Establishing the Imbali Education Precinct

The Imbali Education Precinct will be made up of an interconnected network of education and support institutions that will work together in a locality for the mutual benefit of all involved – to create seamless, enhanced, quality education pathways from early childhood education to higher education for the community it serves.

Some progress has been made in implementing the Imbali Education Precinct Development Plan, mostly on the Indumiso Campus of the Durban University of Technology (DUT) through the allocation of existing resources, including significant

infrastructure developments, and the development of a range of new teacher education programmes for TVET and community education and training college lecturers. However, there has been slow progress for a range of reasons, including changed leadership at DUT and a lack of on-the-ground champions.

A project team and project office will be established to take the work forward over the next five years. The idea and model of the development of education precincts will be tested in terms of the Imbali Project. It is envisaged that, over the next 10-year period, at least three such precincts will be developed across the country. This approach will support the District Development Model.

South African Institute for Vocational and Continuing Education and Training

Colleges must evolve into institutions that are highly responsive to the mid-level skills demands in the labour market. This requires expert and accurate planning in identifying much-needed skills sets, identifying appropriate modalities of skills training and delivery, efficient turnaround times in the development and delivery of occupational curricula, and vastly expanding the opportunities for work-based experience and learning through stakeholder engagements and partnerships.

The DHET will, in partnership with the German government, seek to strengthen the TVET system through:

- sectorial coordination and cooperation to implement governance and policy through the facilitation of cooperation agreements between the public and private sectors that build on existing initiatives and take forward new initiatives.
- private sector engagement by assisting partner organisations to increase the level of private sector representation in decision-making bodies and to promote systematic stakeholder dialogue.
- the implementation of reformed vocational and technical skills development to support the provision of demand-oriented skills development to youth by promoting on-the-job or work-based training approaches, the training of vocational teaching personnel, and strengthening the quality of artisan training in centres of specialisation.

Reviewing the NSF

The *White Paper for Post-School Education and Training, 2014*, enunciates that the NSF will be responsible for skills

development aligned to national development strategies and priorities, including building linkages within the skills system and providing funds for government strategies such as youth programmes, building small businesses and cooperatives, and rural development. It will also fund research and innovation that is not confined to a particular sector.

Coupled with the White Paper and other government strategic policy instruments, is the establishment of the new Ministry of Higher Education, Science and Innovation, which necessitates a review of policy and systems. On the other hand, the DSI has introduced the *White Paper on Science, Technology and Innovation*, which is critical in ensuring that science, technology and innovation enable inclusive and sustainable South African development in a changing world.

With the rising unemployment rate, especially among the youth, and sluggish economic growth, prioritisation and focused skills development interventions that support national policies need urgent attention and resourcing. To this end, the Minister of Higher Education, Science and Innovation intends to undertake a review of the NSF – to evaluate the general operations of the NSF, including, but not limited to its efficiency and relevance regarding the country's national priorities.

Legislation

Key policies and legislation relating to Higher education and training in South Africa include:

- the Continuing Education and Training Act, 2006 (Act 16 of 2006), which provides for the regulation of continuing education and training, the establishment of governance structures for, and the funding of, public TVET colleges and community education and training colleges, the registration of private colleges, and the promotion of quality in continuing education and training;
- the Higher Education Act, 1997 (Act 101 of 1997), which provides for a unified national system of higher education;
- the NQF Act, 2008 (Act 67 of 2008), which provides for the NQF, the SAQA and quality councils for the issuing and quality assurance of qualifications required by the sub-frameworks of the NQF;
- the NSFAS Act, 1999 (Act 56 of 1999), which provides for the granting of loans and bursaries to eligible students attending public higher education and training institutions, and the subsequent administration of such loans and bursaries;
- the Skills Development Amendment Act, 2008 (Act 37 of 2008),

which enables the creation of the National Skills Authority, sector education and training authorities, the establishment of the Quality Council for Trades and Occupations, and the regulation of apprenticeships, learnerships and other matters relating to skills development; and

- the Skills Development Levies Act, 1999 (Act 9 of 1999), which provides for the imposition of skills development levies.

Budget

For the 2020/21 financial year, the DHET was allocated a total of R107 000 116 Billion. The budget appropriation was as follows:

- University education: R79 177 737 billion,
- TVET: R13 074 170 billion,
- Skills development: R300 141 million,
- Community education: R2 513 980 billion,
- Planning, policy and strategy: R198 069 million,
- Administration: R445 503 million, and
- National Skills Fund: R2 258 102 million.

The department has a budget of R358 billion over the medium term, of which 90.4% is earmarked for transfers and subsidies to departmental agencies and accounts, and higher education institutions that provide access to more than 6.5 million students. These funds will be used to build a high-quality, demographically representative higher education sector that provides students and staff with opportunities for access and success.

Cabinet has approved reductions to the department's baseline, amounting to R24.6 billion over the MTEF period, to be effected on transfers and subsidies (R19.6 billion), compensation of employees (R4.6 billion), and goods and services (R290.2 million). These reductions include R6.8 billion on the allocation to the NSFAS for loans and bursaries, R5 billion on university subsidies and R947.1 million on TVET college infrastructure grants.

The reductions to university subsidies will likely lead to a decrease in the number of first-year enrolments at universities. Although this will have a longer-term impact on the number of new graduates emerging from the system, it is necessary to ensure that institutions remain sustainable and are able to offer quality education, and is expected to be offset by improvements in the throughput rate at universities. Although a decrease in first year enrolments at universities and TVET colleges will begin to offset the reductions to the NSFAS, they will result

in fewer students who enter higher education being able to access support in 2021.

The sector may also need to consider revising its policy positions on supporting poor and working-class students in higher education and training, including the maximum allowances for accommodation, transport and food, and halting funding for second qualifications.

Although the reduction to TVET college infrastructure grants could lead to delays in beginning new projects, it will ensure that funding is more closely aligned with the sector's capacity to spend.

National Skills Development Strategy

The key driving force of the NSDS 3 (2011 – 2020) was improving the effectiveness and efficiency of the skills development system. It promoted the linking of skills development to career paths, career development and promoting sustainable employment and in-work progression. The emphasis was particularly on people who did not have relevant technical skills or adequate reading, writing and numeracy skills to enable them to find employment.

The strategy promoted partnerships between employers, public education institutions, TVET colleges and universities and private training providers to ensure that cross-sectoral and intersectoral needs were addressed.

The NSDS 3 was guided by, and measured against, several key developmental and transformation imperatives, such as race, class, gender, geographic considerations, age differences, disability, and HIV and AIDS.

The NSDS 3 addressed the scope and mandate of the SETAs. The SETAs facilitated the delivery of sector-specific skills interventions that helped achieve the goals of the strategy, address employer demand and deliver results.

The strategy emphasised the relevance, quality and sustainability of skills training programmes focusing on eight goals, namely:

- establishing a credible institutional mechanism for skills planning, and ensuring that the national need in relation to skills development is researched, documented and communicated to enable effective planning across all economic sectors;
- increasing access to occupation-specific programmes targeting intermediate and higher-level professional qualifications;

- promoting the growth of a public TVET college system that is responsive to sector, local, regional and national skills needs and priorities;
- addressing the low level of youth and adult language and numeracy skills to enable additional training;
- encouraging better use of workplace-based skills development;
- encouraging and supporting cooperatives, small enterprises, worker-initiated non-governmental organisation and community-training initiatives;
- increasing public-sector capacity for improved service delivery and supporting the building of a developmental state; and
- building career and vocational guidance.

Entities

Council on Higher Education

The CHE is a statutory body established in terms of the Higher Education Act of 1997, as amended. The council is mandated to advise the Minister responsible for higher education on all matters pertaining to higher education; develop and manage the higher education qualifications sub-framework; and develop and implement a suite of policies and criteria to facilitate the implementation of the framework and sub-framework, and protect their integrity.

Over the medium term, the council will continue to focus on becoming a recognised centre for information and policy analysis on higher education, and on advising the Minister by researching and monitoring the higher education sector. As the council's main outputs are research, quality assurance, knowledge and advisory services, and monitoring and evaluation, spending on compensation of employees accounts for an estimated 48.2% (R115.3 million) of its total budget of R251.8 million over the medium term. The number of personnel is expected to remain at 49.

Transfers from the DHET account for an estimated 86% of the council's revenue over the medium term. These are set to increase at an average annual rate of 14%, from R56.1 million in 2020/21 to R83.1 million in 2023/24, due to the transfer to the council increasing by R60 million over the MTEF period to enable it to implement its approved quality assurance framework. The remainder of the council's revenue is set to be derived through interest on investments and fees charged for accreditation services provided to private higher education institutions.

National Skills Fund

The NSF was established in 1999 in terms of Section 27 of the Skills Development Act, 1998 (Act 97 of 1998). The fund focuses on national priority projects identified in the NSDS, projects related to the achievement of the purposes of the Act, as determined by the DG of Higher Education and Training, and any activity undertaken by the Minister of Higher Education, Science and Innovation to achieve a national standard of good practice in skills development.

The fund will continue to invest in skills development initiatives of national priority that contribute to improving economic participation and social development. It will seek to do this over the medium term by funding the education and training of a targeted 114 000 learners, in occupations in high demand, through an allocation of R9 billion. These funds will also be used to enable the post-school education and training system to provide more training facilities to increase the number of training opportunities available.

The fund's main source of revenue is the Skills Development Levy, which is collected by the SARS and transferred to the fund as a direct charge against the National Revenue Fund. Its total revenue is projected to increase at an average annual rate of 25.7%, from R2.2 billion in 2020/21 to R4.3 billion in 2023/24, mainly due to the projected increase in revenue from the Skills Development Levy after the sharp decline in economic activity in 2020/21 as a result of the COVID-19 pandemic.

National Student Financial Aid Scheme

The NSFAS was established in terms of the NSFAS Act of 1999, as amended. The scheme is responsible for providing loans and bursaries; developing criteria and conditions for the granting of loans and bursaries to eligible students in consultation with the Minister of Higher Education, Science and Innovation; raising funds; recovering past loans; maintaining and analysing a database of funded students; undertaking research for the better use of financial resources; advising the Minister on matters relating to student financial aid; and undertaking other functions assigned to it by the Act or the Minister.

Over the MTEF period, the scheme aims to provide loans and bursaries to around 1.3 million undergraduate university students and almost one million TVET college students. To qualify, students must be from households with a combined annual income of less than R350 000, and less than R600 000 for students with disabilities.

Bursaries cover tuition fees, prescribed study materials, meals, accommodation and transport costs. An amount of R108.8 billion has been allocated for this purpose, over the medium term. The scheme is confident that it will meet these targets despite Cabinet-approved reductions of R6.8 billion over the medium term on its allocation for loans and bursaries.

Transfers from the DHET constitute an estimated 92.2% of the scheme's total revenue over the period ahead, increasing at an average annual rate of 1.5%, from R34.8 billion in 2021/22 to R36.7 billion in 2023/24. The balance of R9 billion is set to be derived mainly through transfers from the DBE for the Funza Lushaka teacher bursary programme, the NSF, SETAs and other government departments; and interest on investments. Revenue from these sources is expected to decrease over the MTEF period, leading to a 1.2% decrease in overall revenue over the period ahead.

In March 2021, Cabinet agreed that funding should be reprioritised from the DHET budget, to ensure that all deserving NSFAS students receive funding support for the 2021 academic year.

This decision was taken in the context of funding cuts and the impact of the COVID-19 pandemic. Following this decision, the NSFAS would be able to release funding decisions, and the registration process at public universities would continue as planned.

The NSFAS qualifying students were affected by delays, as universities had agreed to extend the registration period to ensure that students without funding decisions would not be prevented from accessing a place that they qualify for.

Cabinet also agreed that a comprehensive review of the student funding policy of government was urgently required. The purpose of this process would be to look carefully at the funding requirements to support students in financial need in the PSET system, to model the holistic requirements of students, including those from poor and working class backgrounds, as well as the missing middle.

Quality Council for Trades and Occupations

The Quality Council for Trades and Occupations was established through the Skills Development Act of 1998. It is mandated to oversee the development and maintenance of the occupational qualifications sub-framework in the NQF, and advise the Minister of Higher Education, Science and Innovation on all policy matters concerning occupational standards and

qualifications. The council's quality assurance role and its management of the occupational qualifications sub-framework contribute to the post-school sector's broader imperative of providing access to education and training of the highest quality that leads to significantly improved learning outcomes.

Over the medium term, the council will focus on overseeing the conversion of national accredited technical education diploma qualifications into occupational qualifications that have greater industry relevance, and developing and submitting new occupational qualifications to the SAQA for registration. These activities will be funded at a projected cost of R183.7 million over the medium term, comprising an estimated 58.4% of total expenditure. The council will also intensify its quality assurance functions for occupational qualifications by evaluating, assessing and verifying the qualifications provided by registered providers at an estimated cost of R6.9 million over the MTEF period.

The council expects to derive 72.7% (R224.2 million) of its revenue over the MTEF period from SETAs for the provision of quality assurance for skills and training programmes, and 27.3% (R84.4 million) through transfers from the DHET. Revenue is expected to decrease at an average annual rate of 4%, from R124.6 million in 2020/22 to R110.2 million in 2023/24, driven mainly by the negative impact of COVID-19 on income from the Skills Development Levy.

Sector education and training authorities

The Skills Development Act of 1998 mandates SETAs to implement national, sector and workplace strategies to develop and improve skills in the South African workforce, provide learnerships that lead to recognised occupational qualifications, and fund skills development. The authorities derive their objectives directly from the NSDS, which aims to increase access to occupationally directed programmes, promote the growth of public TVET colleges, address low levels of youth and adult literacy and numeracy skills, and encourage the better use of workplace-based skills development.

Over the MTEF period, SETAs plan to spend R47.9 billion on various programmes, focusing on providing workplace placement for unemployed graduates and internships for students; providing full bursaries to students from poor families to cover tuition, learning materials, accommodation and living allowances; and collaborating with TVET colleges to strengthen their capacity to deliver specific programmes.

SETAs support artisan development through skills development centres, which aim to address skills shortages identified by occupational teams working on strategic infrastructure projects. The sector plans to train an estimated 68 000 artisans over the medium term through this initiative at a projected cost of R4.7 billion. The SETAs expect to derive 88.9% (R45 billion) of their revenue through the Skills Development Levy, which is collected by the SARS and transferred to them as a direct charge against the National Revenue Fund. The remainder is set to be derived through interest on investments. Total revenue is projected to increase at an average annual rate of 12.6%, from R12.3 billion in 2020/21 to R17.5 billion in 2023/24, mainly due to the projected increase in revenue from the Skills Development Levy after the sharp decline in economic activity in 2020/21 as a result of the COVID-19 pandemic.

South African Qualifications Authority

The institution is a statutory body established in terms of the SAQA Act, 1995 (Act 58 of 1995) and exists under the NQF Act of 2008, as amended. Its mandate and goals are to advance the objectives of the NQF, coordinate the higher education qualifications and occupational qualifications sub-frameworks, and oversee the further development and implementation of the NQF.

Over the medium term, the authority plans to streamline its structure to better deliver on its mandated functions; automate processes to achieve greater efficiency; begin to generate income through other streams; and prepare to implement the NQF Amendment Act, 2019 (Act 12 of 2019) once the President proclaims it. Compensation of employees accounts for an estimated 71% (R316.1 million) of the authority's total projected expenditure over the medium term, increasing at an average annual rate of 4.6%, from R95.7 million in 2020/21 to R109.4 million in 2023/24.

Transfers from the DHET account for an estimated 55.1% (R247.2 million) of the authority's revenue, and are expected to increase at an average annual rate of 4.7%, from R72.5 million in 2020/21 to R83.2 million in 2023/24. Revenue from the evaluation of foreign qualifications, and fees from professional bodies and the verification of national qualifications are expected to increase at an average annual rate of 18.9%, from R41.3 million in 2020/21 to R69.4 million in 2023/24.

Total revenue is expected to increase at an average annual rate of 8.2%, from R124.6 million in 2020/21 to R157.8 million in 2023/24.

Universities

South Africa's higher education landscape comprises the following institutions:

- Cape Peninsula University of Technology
- Central University of Technology, Free State
- Durban Institute of Technology
- Mangosuthu University of Technology
- National Institute for Higher Education, Northern Cape
- National Institute for Higher Education, Mpumalanga
- Nelson Mandela Metropolitan University (NMMU)
- North-West University
- Rhodes University
- Sefako Makgatho Health Sciences University
- Sol Plaatje University, Northern Cape
- Tshwane University of Technology
- University of Cape Town (UCT)
- University of Fort Hare
- University of the Free State
- University of Johannesburg
- University of KwaZulu-Natal
- University of Limpopo
- University of Mpumalanga
- University of Pretoria
- University of South Africa
- University of Stellenbosch
- University of Venda
- University of the Western Cape
- University of the Witwatersrand
- University of Zululand
- Vaal University of Technology
- Walter Sisulu University, Eastern Cape

Science and Innovation

The 2020/21 financial year was the first under the DSI's new five-year strategic plan, which saw the department begin to implement a new policy that has replaced the *1996 White Paper on Science and Technology*. The revised mandate of the DSI is articulated in the *2019 White Paper on Science, Technology and Innovation*.

The White Paper increased the scope for science, technology and innovation in support of South Africa's inclusive development. This revision in policy has attempted to firm up policy efforts in areas where the DSI has encountered

challenges in implementation. The new strategic plan has adopted six outcomes, which the department will pursue between 2020/21 and 2024/25. These are:

- a transformed, inclusive, responsive and coherent National System of Innovation;
- increased knowledge generation and innovation outputs;
- knowledge utilisation for economic development in revitalising traditional industries and stimulating research and development (R&D)-led industrial development;
- knowledge utilisation for inclusive development; and
- innovation in support of a capable and developmental state.

The *1996 White Paper on Science and Technology* introduced the concept of the National System of Innovation – a set of interacting organisations and policies through which the country creates, acquires, diffuses and puts into practice new knowledge to help achieve individual and collective goals. A coordinated and efficient national system of innovation will help South Africa achieve its national development priorities by promoting change through innovation, enabling all South Africans to enjoy the economic, sociopolitical and intellectual benefits of science, technology and innovation.

The NDP also identifies science, technology and innovation as a primary driver of economic growth, job creation and socio-economic reform. Central to this identification is the emphasis of the *2019 White Paper on Science, Technology and Innovation* on the themes of inclusivity, transformation and partnerships. The White Paper is aimed at improving policy coherence, developing human capabilities, expanding knowledge, improving innovation performance and increasing investment. The work of the DSI is pivotal in realising these goals, particularly the initiatives it champions for innovation in the challenging fields of energy, food security, poverty alleviation and health care.

The implementation of the Strategic Plan on Transformed, Inclusive, Responsive Coherent National System of Innovation will be strengthened through the finalisation of the Decadal Plan 2020 – 2030, that will define specific missions which will be pursued collectively by the National System of Innovation in support of national priorities.

The DSI will introduce the Sovereign Innovation Fund, during the 2020/21 financial year, to support knowledge utilisation for economic development in revitalising traditional industries and stimulating R&D-led industrial development.

Once fully operational, the Sovereign Innovation Fund

will serve as a new financing instrument between the public and private sectors. Its overall objective will be to harvest and commercialise South African technology innovations for deployment in national and international markets.

Over the medium term, the DSI will focus on producing new knowledge, generating and exploiting knowledge and innovation for inclusive economic development, health care innovation, developing human capital, building and maintaining infrastructure for research and innovation, and championing innovation in the energy sector.

Developing high-end human capital

High-end, innovative human capital is key to the development of a globally competitive, expanded and transformed national system of innovation that is responsive to South Africa's developmental needs, in line with the imperatives articulated in the *2019 White Paper on Science, Technology and Innovation*. Accordingly, R15.3 billion over the medium term is allocated to the R&D and Support programme for the development of human capital through the provision of postgraduate bursaries and scholarships, internships, support for emerging and established researchers, and strategic instruments such as the South African Research Chairs Initiative.

This expenditure is designed to attract and retain talent in research and innovation at South African public universities and centres of excellence, which act as hubs to tackle persistent and emerging challenges in critical areas such as health, food security, human development, energy and biodiversity. To date, the DSI has established 239 research chairs and 14 centres of excellence.

Through the National Research Foundation (NRF), which is allocated R1.9 billion over the same period for human capital development, the DSI aims to award 9 600 and 32 500 bursaries to doctoral and postgraduate students, respectively.

Generating and exploiting knowledge and innovation

In its efforts to generate and exploit knowledge and innovation that is in line with government's priorities for inclusive economic growth, the DSI plans to invest R5.8 billion over the medium term in the development of industry, particularly in high-potential fields such as aerospace, advanced manufacturing, chemicals, advanced metals, mining and NRF; the creation of instruments to increase the competitiveness of SMMEs; and youth, by fully

funding and co-funding 1 454 master's and doctoral students, and 590 interns over the medium term.

An estimated R3.4 billion of this amount, in the Sector Innovation and Green Economy subprogramme, is earmarked for advancing technology-based interventions intended to enhance South Africa's economic competitiveness and increase exports. The DSI plans to do this by creating an environment in which government can effectively partner with industry to co-fund research, development and innovation. Of this R3.4 billion, R123.6 million is expected to be invested in a range of ICT initiatives such as artificial intelligence, nanotechnology, quantum computing and biotechnology. Activities related to advancing the development of a joint industry-government mining R&D hub will be funded through an allocation of R1.2 billion over the medium term.

The DSI is set to receive an additional R1.2 billion over the medium term to set up the Sovereign Innovation Fund, which is expected to leverage co-investment by the public and private sectors to address gaps in technology commercialisation. The fund will be designed to complement and enhance existing funding instruments, and provide large-scale funding for the development and maturation of radical innovations and emerging industries.

To ensure that publicly funded intellectual property is protected, commercialised and used, the DSI plans to spend R166.5 million over the MTEF period. Over the same period, R622.9 million is allocated for spending on bio-innovation activities in the manufacturing, health and agricultural sectors, as well as in developing indigenous knowledge applications. To intensify South Africa's intellectual property portfolio, the department also aims to produce 180 innovation products such as patents, prototypes, and technology demonstrators and transfer packages. These activities will be carried out by the Technology Innovation Agency, with an allocation of R138.4 million over the medium term.

Investing in infrastructure for research and innovation

The DSI's research infrastructure roadmap is intended to provide a strategic framework for planning, implementing, monitoring and evaluating the provision of research infrastructure necessary to create and maintain a competitive and sustainable national system of innovation. Accordingly, the department aims to improve the outcomes and quality

of research by providing and increasing access to research equipment and facilities through an allocation of R3.4 billion over the medium term, in the Basic Science and Infrastructure subprogramme.

A significant portion of this investment is earmarked for the ongoing implementation of roadmap projects in the thematic areas of humans and society; health, biological and food security; earth and environment; materials and manufacturing; energy; and physical sciences and engineering.

The National Integrated Cyberinfrastructure System (NICIS) supports the successful and sustainable implementation of national projects such as the MeerKAT and the Square Kilometre Array (SKA), as well as large research infrastructure required for the processing and transmission of large amounts of data dependent on the presence of a robust cyberinfrastructure system. In this regard, R3.6 billion is allocated over the medium term for the Council for Scientific and Industrial Research (CSIR) to implement the system. The MeerKAT telescope is expected to add 20 antennae in 2021/22 to its current array of 64, at a cost of R800 million.

The National Space Strategy is intended to ensure that South Africa captures a reasonable share of the global space market. This involves engaging in economic activities related to manufacturing components that go into earth's orbit or beyond. To implement the strategy, R670.7 million is allocated over the MTEF period.

For scientific research in strategic areas defined by South Africa's geographic advantage, such as palaeosciences, astronomy, climate change, indigenous knowledge, and marine and polar research, R782.5 million over the MTEF period.

Legislation

The DSI is governed by the following legislation:

- the Intellectual Property (IP) Rights from Publicly Financed Research and Development Act, 2008 (Act 51 of 2008), provides for the more effective use of IP emanating from publicly financed R&D, through the establishment of the National Intellectual Property Management Office (NIPMO), the IP Fund, and offices of technology transfer at institutions;
- the Technology Innovation Act, 2008 (Act 26 of 2008), intends to promote the development and exploitation in the public interest of discoveries, inventions, innovations and improvements, and for that purpose establishes the Technology Innovation Agency;

- the South African National Space Agency (SANSa) Act, 2008 (Act 36 of 2008), establishes the SANSa to promote space science research, cooperation in space-related activities and the creation of an environment conducive for the development of space technologies by industry;
- the Natural Scientific Professions Act, 2003 (Act 27 of 2003), establishes the South African Council for Natural Scientific Professions, and legislates the registration of professional natural scientists, natural scientists-in-training, natural science technologists and natural science technologists-in-training;
- the NRF Act, 1998 (Act 23 of 1998), establishes the NRF to promote basic and applied research, as well as the extension and transfer of knowledge in the various fields of science and technology;
- the National Advisory Council on Innovation (NACI) Act, 1997 (Act 55 of 1997), establishes the NACI to advise the Minister responsible for science and innovation on the role and contribution of science, mathematics, innovation and technology in promoting and achieving national objectives;
- the Africa Institute of South Africa (AISA) Act, 2001 (Act 68 of 2001), establishes the AISA to promote knowledge and understanding of African affairs by encouraging leading social scientists;
- the Human Sciences Research Council (HSRC) Act, 2008 (Act 17 of 2008), provides for the HSRC, which carries out research that generates critical and independent knowledge relative to all aspects of human and social development;
- the Scientific Research Council Act, 1988 (Act 46 of 1988), refers to the activities of the CSIR, one of the leading scientific and technological research, development and implementation organisations in Africa, which undertakes directed R&D for socio-economic growth in areas including the built environment, defence, the environmental sciences, as well as biological, chemical and laser technologies;
- the Astronomy Geographic Advantage Act, 2007 (Act 21 of 2007), provides for the preservation and protection of areas in South Africa that are uniquely suited to optical and radio astronomy, and for intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas;
- the Geoscience Amendment Act, 2010 (Act 12 of 2010), amends the Geoscience Act, 1993 (Act 100 of 1993), to mandate the Council for Geoscience to be the custodian

of geotechnical information; to act as a national advisory authority in respect of geohazards related to infrastructure and development, and to undertake exploration and prospecting research in the mineral and petroleum sectors;

- the South African National Research Network (SANReN), which is responsible for the roll-out of a high-speed broadband network to all academic and research institutions in the country, was awarded a private electronic communications network licence exemption under the Electronic Communications Act, 2005 (Act 36 of 2005); and
- the Science and Technology Laws, Amendment Act, 2014 (Act 7 of 2014), seeks to, among other things, streamline the process for the nomination and appointment of members of the boards or councils of such entities as well as the filling of vacancies on the boards.

Budget

For the 2020/21 financial year, the DSI was allocated R7.4 billion. The budget appropriation was as follows:

- Technology Innovation: R1.4 billion,
- International Cooperation: R116,8 million,
- R & D and Support: R3.9 billion,
- Socio-economic Innovation: R1.7 billion, and
- Administration: R314 million.

Expenditure is expected to increase at an average annual rate of 8.3%, from R7.3 billion in 2020/21 to R9.2 billion in 2023/24. Of the DSI's total expenditure over the MTEF period, 93.5% (R25.6 billion) is allocated for transfers to entities for investment in key focus areas. Spending on compensation of employees, the department's second-largest cost driver, decreases at an average annual rate of 0.3%, from R362 million in 2020/21 to R358.4 million in 2023/24.

This is due to budget reductions approved by Cabinet, amounting to R1.7 billion over the MTEF period, effected mainly on compensation of employees by means of natural attrition and not filling vacant posts; selected goods and services items such as travel and subsistence, and venues and catering; and transfers to public entities.

Entities

Academy of Science of South Africa (ASSAf)

The academy was established in terms of the ASSAf Act, 2001 (Act 67 of 2001), as amended, to promote outstanding

achievements in all fields of scientific inquiry, recognize excellence, and provide evidence-based scientific advice to government and other stakeholders. Over the medium term, the academy aims to achieve enhanced national capacity to produce and publish research, provide evidence-based policy advice to government, and increase the quality and visibility of South African research publications.

Expenditure is expected to increase at an average annual rate of 2.2%, from R33.4 million in 2020/21 to R35.6 million in 2023/24, driven mainly by the growing importance and use of digital platforms as a consequence of the COVID-19 pandemic. Transfers from the DSI, which account for 95.2% (R101 million) of the academy's revenue, are expected to increase at an average annual rate of 2.4%, from R31.6 million in 2020/21 to R34 million in 2023/24.

Council for Scientific and Industrial Research

The CSIR was established in 1945 and is governed in terms of the Scientific Research Council Act of 1988. The council fosters industrial and scientific development in the national interest, through multidisciplinary research and technological innovation to improve the ability of the State to efficiently deliver basic services, in fields such as health, education, social security, energy and shelter, to all South Africans, and in so doing, reduce inequality.

Over the medium term, the council will focus on conducting high-quality and relevant research, pursuing technological innovation to foster industrial and scientific development, and building on industrial development opportunities.

The council's ability to generate its own revenue is directly related to its ability to attract and retain the requisite expertise and skills to deliver favourable research outcomes. As such, spending on compensation of employees accounts for an estimated 56.7% (R6.2 billion) of the council's expenditure, increasing at an average annual rate of 6.4%, from R1.8 billion in 2020/21 to R2.2 billion in 2023/24.

The council derives its revenue from transfers from the DSI; contracts for research; income earned from local, international, and public sector and private sector projects; and IP and technology transfers. Transfers from the DSI account for 23% (R2.5 billion) of the council's total projected revenue, increasing at an average annual rate of 3.7%, from R781.2 million in 2020/21 to R872.3 million in 2023/24.

In October 2020, the council commemorated 75 years of existence. For seven and a half decades the CSIR dedicated its resources to improving the quality of life of South Africans through ground-breaking research, development and innovation.

Some of the most impactful CSIR innovations and inventions throughout the decades include the first radar in South Africa (1945), the first microwave electronic distance measurement equipment, the tellurometer (1954), as well as the contribution of CSIR research to the invention of the lithium-ion battery in the 1980s.

The council's 75-year anniversary came as the world faced the biggest pandemic in a century, COVID-19. The organisation still managed to support the country in its efforts to curb the spread of the virus, demonstrating its uniqueness and relevance. It collaborated with a number of local partners to produce local ventilators that were rolled out nationwide to patients showing respiratory distress in the early phase of COVID-19 infection.

In January 2021, the CSIR was recognised as a top employer in South Africa by the Top Employers Institute Programme, which certifies organisations based on the participation and results of their Human Resource Best Practices Survey. The survey covers six human resource domains consisting of 20 topics such as people strategy, work environment, talent acquisition, learning, well-being, and diversity and inclusion, among others.

The CSIR hosted the 7th Biennial Conference from 11 to 12 November 2020 under the theme; "Touching lives through innovation". The conference brought science and technology solutions to help put South Africa's economic recovery under the spotlight.

The virtual conference was attended by local and international experts in various fields, including health, advanced agriculture and food, manufacturing, mining, defence and energy.

Load-shedding is one of the factors that has had a negative impact on the South African economy. The CSIR has performed an in-depth analysis of the South African power system to assess the extent to which load-shedding is expected to continue, the magnitude thereof, and the options and solutions that are available to reduce and mitigate load-shedding.

The conference provided a scientifically informed perspective on the likelihood and extent of load-shedding over the next three to five years and provided some practical options for mitigation.

Human Sciences Research Council

The HSRC was established in 1968 to undertake, promote and coordinate research in human and social sciences. The council is mandated to initiate, undertake and foster strategic, basic and applied research in human sciences; and address developmental challenges by gathering, analysing and publishing relevant data, especially through projects linked to collaborative programmes oriented towards the public sector. The council's research outputs are widely disseminated to support policy development at all levels of government. As such, over the medium term, the council will continue to focus on producing research that serves the public; contributing to good governance and public service delivery; helping to address the challenges of poverty, inequality and inclusive development; and building the capacity of scholars and researchers.

As a research institute, human capital plays a central role in the council's work. As such, spending on compensation of employees accounts for an estimated 55.3% (R1.1 billion) of the council's budget. Expenditure on compensation of employees is expected to increase at an average annual rate of 5.1%, from R319.7 million in 2020/21 to R371.5 million in 2023/24. The council receives 55.1% (R1.1 billion) of its revenue through transfers from the DSI, increasing at an average annual rate of 4%, from R324.6 million in 2020/21 to R365.5 million in 2023/24. The remaining revenue is generated through research contracts and grants from national and international agencies, government departments and private sector foundations.

National Research Foundation

The NRF is mandated to support research through funding, the development of human resources and the provision of research facilities to enable knowledge creation, innovation and development in all fields of science and technology. It is also mandated to promote indigenous knowledge.

The foundation currently supports approximately 4 000 research-productive and internationally recognised researchers. The productivity and quality of the knowledge produced by researchers who are funded by the foundation has been significant over the past five years. In this regard, over the MTEF period, the foundation will continue to drive excellence underpinned by the strength of the South African science system with a strong emphasis on transformation, innovation and sustainability.

Estimated capital expenditure of R5 billion in the National Research Infrastructure Platforms Programme, over the medium term, is earmarked primarily for the SKA, specialised equipment at iThemba Laboratory for Accelerator-Based Sciences (LABS) for the isotope facility project, and the extension of the MeerKAT telescope.

The foundation derives its revenue primarily through a parliamentary grant, contract funding from the DSI and other government institutions, and income generated by sales and interest. Contract funding accounts for almost 75% (R14.4 billion) of the foundation's revenue over the period ahead. Revenue received from the DSI is expected to increase at an average annual rate of 6.3%, from R3.7 billion in 2020/21 to R4.4 billion in 2023/24.

The NRF Strategy 2020 will enable the organisation to intensify and strengthen African and global networks to position South Africa in the international arena in order to drive the knowledge economy.

In identifying a five-year strategy that supports the execution of its mandate, the organisation took stock of past performance and the realisation of its previous strategy, the NRF Vision 2015. In the NRF Strategy 2020, the fund places renewed emphasis on the agency function of the NRF and its role as a policy implementer within the National System of Innovation. Playing a critical integration role across the National Science System, the NRF has the ability to catalyse societally beneficial R&D in support of knowledge generation, human capacity development and innovation.

Through the NRF Strategy 2020, the organisation will:

- continue to stimulate transformation across the sector through the use of targeted funding instruments;
- continue to support excellence with relevance – support knowledge generation that continues to have a positive impact on the quality of life of the people of South Africa;
- leverage off the NRF brand to accelerate engagement between countries on the African continent and globally; by funding human capacity development and knowledge generation for the benefit of Africa and the world; and
- practice the highest standards of corporate governance, fiscal management and compliance, whilst ensuring business efficacy. The core intent will remain an unwavering commitment to the transformation of the research landscape and a focus on excellence, thereby ensuring global relevance.

The foundation approaches the implementation of the NRF Strategy 2020 as an evolutionary process and will continue to develop customised instruments to address new challenges. In doing so, the NRF will engage within and beyond government-funded programmes and include the private sector in its endeavours to address the planned initiatives as set out below.

South African National Space Agency

The agency was established in terms of the SANSA Act of 2008, as amended, to promote the peaceful use of space, foster international cooperation in space-related activities, and facilitate the creation of an environment conducive to space technology and industrial development. In addition to continuing its focus on these priorities, over the medium term, the agency will focus on broadening the suite of products and services available in the space sector, and contributing to promoting socio-economic development across Africa.

Currently, more than 30 government departments and entities use national geospatial data for planning, monitoring and decision making.

As the agency relies on highly skilled and professional personnel to fulfil its mandate, compensation of employees accounts for an estimated 45.1% (R465.9 million) of expenditure over the medium term. Expenditure on personnel increases at an average annual rate of 1.2%, from R150.4 million in 2020/21 to R155.7 million in 2023/24. Transfers from the DSI account for an estimated 76.6% (R706 million) of the agency's revenue over the MTEF period. Additional revenue is generated by services rendered to government institutions and other organisations, mainly international clients in the space sector.

Technology Innovation Agency

The Technology Innovation Agency Act of 2008, as amended, mandates the agency to serve as a key institutional intervention to bridge the innovation gap between R&D outcomes from higher education institutions, science councils, public entities and private companies. This with the purpose of intensifying the effect of technological innovation in the economy. Over the medium term, the agency will continue to focus on bridging the innovation gap between R&D goals, and supporting technologies within the national system of innovation.

As human resources are central to the agency's operations, compensation of employees is its largest cost driver, accounting for an estimated 19.7% (R329.3 million) of expenditure over the MTEF period. Goods and services is the second-largest

spending area, accounting for 9.1% (R150.9 million) of expenditure over the same period. The agency derives 79.9% (R1.4 billion) of its revenue from the DSI, increasing at an average annual rate of 3.9%, from R410.3 million in 2020/21 to R460.1 million in 2023/24. Other sources of income include co-funding partnerships, and interest and royalties earned.

Role player

South African Council for Natural Scientific Professions (SACNASP)

The SACNASP's mandate is to provide a credible professional registration and regulatory body that allows natural scientists to establish, direct, sustain and ensure a high level of professionalism and ethical conscience in the natural scientific professions sector. Their conduct should be internationally acceptable and in the broad interest of the community as outlined in the SACNASP Code of Conduct.

In 2021, South Africa was elected as an International Civil Aviation Organization (ICAO) designated Regional Space Weather Centre. The announcement came after the country received excellent audit results from ICAO.

South Africa, through the South African National Space Agency, has been designated to provide space weather information that is now an adopted standard by ICAO for all aviation requirements.

The country has been given three years to upgrade its current limited capacity to meet ICAO's requirements. The requirements include 24-hours/seven-day operations with an established team of trained forecasters and specialist space researchers. It has also been granted permission to collaborate with the Pan-European Consortium for Aviation Space Weather User Service.

The designation affords South Africa an opportunity to grow its science and engineering technology and innovation sector, and puts the country on the map as a global player in space science.

Policy mandate and programmes

Technology Innovation

The programme aims to enable R&D in space science and technology, energy security and the bioeconomy, and in the emerging and converging areas of nanotechnology, robotics, photonics and indigenous knowledge systems (IKS), to promote the realisation of commercial products, processes and services. It also promotes the protection and utilisation of IP, technology transfer and technology commercialisation through the implementation of enabling policies and interventions along the entire innovation value chain. Its subprogrammes include:

- Space Science, which supports the creation of an environment conducive to the implementation of the national space strategy and South African earth observation strategy, and that addresses the development of innovative applications and human capital to respond to national priorities and support socio-economic development.
- Hydrogen and Energy, which provides policy leadership in research, development and innovation initiatives in the energy sector. This subprogramme plays a key role in developing a sustainable and globally competitive South African energy knowledge base and industry.
- Bio-innovation, which leads the implementation of the national bio-economy strategy.
- Innovation Priorities and Instruments, which supports and strengthens the innovation policy package aimed at creating and sustaining an enabling environment for innovation, technology and development, and the commercialisation of publicly funded R&D initiatives.
- NIPMO – the implementing agency established to provide for the more effective use of IP emanating from publicly financed R&D.

International Cooperation and Resources

The programme strategically develops, promotes and manages international partnerships that strengthen the National System of Innovation. It enables an exchange of knowledge, capacity and resources between South Africa and its international partners, with a focus on building capacity to support science, technology and innovation in Africa. It also supports South African foreign policy through science diplomacy. Its subprogrammes include:

- Multilateral Cooperation and Africa, which advances and facilitates South Africa's participation in bilateral science,

technology and innovation cooperation initiatives with other African partners; in African multilateral programmes, especially those of the Southern African Development Community and African Union; and in broader multilateral science, technology and innovation and innovation partnerships, with a strategic focus on South-South cooperation.

- International Resources, which works to increase the flow of international funding into South African science, technology and innovation initiatives, as well as African regional and continental programmes, through concerted efforts to promote foreign investment and the fostering of strategic relations with partners such as the EU, as well as foundations and philanthropic organisations and the multinational private sector.
- Overseas Bilateral Cooperation, which promotes and facilitates South Africa's cooperation in bilateral science, technology and innovation agreements with partners in Europe, the Americas, Asia and Australasia, especially for human capital development and collaborative research and innovation; and secures support for joint cooperation with other African partners.

South Africa is regarded by many countries and private sector partners as a preferred and privileged partner for international cooperation. On average, approximately 15% of annual R&D funding in South Africa comes from international investors.

Research, Development and Support

The programme provides an enabling environment for research and knowledge production that promotes the strategic development of basic sciences and priority science areas through the promotion of science human capital development, and the provision of research infrastructure and relevant research support, in pursuit of South Africa's transition to a knowledge economy. Its subprogrammes include:

- Human Capital and Science Promotions, which formulates and implements policies and strategies that address the availability of human capital for science, technology and innovation; provide fundamental support for research activities; and contribute to the development of a society that is knowledgeable about science, critically engaged and scientifically literate.
- Science Missions, which promotes the development of research, the production of scientific knowledge, and the development of human capital in fields of science in which South Africa enjoys a geographic advantage.

- Basic Science and Infrastructure, which facilitates the strategic implementation of research and innovation equipment and facilities to promote knowledge production in areas of national priority, and sustain innovation led by research and development.
- Astronomy, which supports the development of astronomical sciences around a new multiwavelength astronomy strategy, and provides strategic guidance and support to relevant astronomy institutions in the implementation of strategic astronomy programmes.

Socio-economic Innovation Partnerships

The programme enhances government's growth and development priority areas through targeted science and technology-based innovation interventions, and the development of strategic partnerships with other government departments, industry, research institutions and communities. Its subprogrammes include:

- Sector Innovation and Green Economy, which provides policy, strategy and direction for research and the development-led growth of strategic sectors of the economy; and supports the transition to a green economy.
- Innovation for Inclusive Development, which supports the development of science and technology-based innovations for tackling poverty, including the creation of sustainable jobs and human settlements, and the enhanced delivery of basic services.
- Science and Technology Investment, which leads and supports the development of indicators and instruments for monitoring investments in science and technology, the performance of the National System of Innovation, and ways of strengthening policy.
- Technology Localisation, Beneficiation and Advanced Manufacturing, which funds technology and innovation development programmes to advance strategic, sustainable economic growth for the medium and long term; sector development priorities; and service delivery.

National research facilities

The national research facilities managed by the NRF are clustered on the basis of their areas of specialisation aligned to the science missions of the National Research and Development Strategy.

South African Astronomical Observatory (SAAO)

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

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

Hartebeesthoek Radio Astronomy Observatory (HartRAO)

The HartRAO is a national facility of the NRF. Its radio astronomy research focuses on stellar evolution, pulsars and masers; and its space geodesy research uses space-based techniques to study the earth. The facility is also used by university students for carrying out research. It also undertakes science awareness programmes for schools and the general public.

South African Institute for Aquatic Biodiversity (SAIAB)

A national facility of the NRF, the SAIAB is famous for its association with the discovery of the enigmatic coelacanth and is internationally recognised for ichthyological research, dynamic research staff and active postgraduate school. The SAIAB provides unique skills and infrastructure support in marine, estuarine and freshwater ecosystems research, molecular research, collections and bioinformatics.

South African Environmental Observation Network (SAEON)

The SAEON is a business unit of the NRF and serves as a national platform for detecting, translating and predicting environmental change through scientifically designed observation systems and research. The SAEON also captures and makes long-term datasets freely accessible, and runs an education outreach programme. The SAEON has six nodes dispersed geographically across the country.

National Zoological Gardens (NZG)

The NZG is a rapidly transforming facility reporting to the NRF. It owns an impressive animal collection, conservation centres, the Centre for Conservation Science and the NZG Academy.

The NZG is well placed as an education and awareness platform for visitors comprising educators, learners, students, special interest groups and the general public.

iThemba LABS

iThemba LABS is the continent's largest facility for particle and nuclear research as well as one of only a handful of facilities in the world producing radionuclides for commercial, research and medical applications. In addition, its facilities include a full radiotherapy clinic for the treatment of certain cancers using both proton and neutron therapy.

The facility has secured government support to finance its strategic flagship project, the South Africa Isotope Facility (SAIF) – an initiative that seeks to secure future sustainability of the facility by procuring a dedicated 70 Mega electron-volt cyclotron accelerator to boost the production rate of a range of accelerator-based radioisotopes.

The strategic vision of the facility is to configure its radioisotope production division and establish the SAIF in a flagship project geared to triple the current radioisotope income. The move is set to establish the facility as a formidable international entity with a secure market niche in the accelerator-based radiopharmaceutical sector.

An annual average of more than 155 000 patients worldwide benefit from cancer diagnostic radioisotopes produced using the separated sector cyclotron particle at iThemba LABS.

Infrastructure projects Square Kilometre Array

The multibillion-rand SKA, to be hosted in South Africa and Australia, will eventually extend into eight African countries and will be the world's biggest telescope. It is also one of the biggest-ever scientific projects and multinational collaborations in the name of science. The SKA organisation is progressing well, and South Africa continues to play an active role in the project. It was one of seven countries (with Australia, China, Italy, the Netherlands, Portugal and the United Kingdom (UK)) that signed a treaty establishing the SKA Observatory in March 2019.

South Africa is also working on getting the SKA Observatory treaty ratified by Parliament. The SKA Observatory is an intergovernmental organisation tasked with the construction and operations of the SKA radio telescope. The quality of astronomy infrastructure will allow world-class research.

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

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

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

The SKA project will also have unprecedented data-connectivity needs. Meeting the advanced technological and engineering needs of this project will result in significant local skills development, revolutionise science and technology research and enable innovative new businesses and employment in the science, technology and engineering fields. Aside from the benefits to African science, Big Data Management and Analytics capabilities could be the biggest spin-off from the SKA project. The innovations, skills development and commercial potential emerging as a result of the project are huge. The potential is not just academic – the taxpayer-funded IP is developed to a point where it is ready to become commercialised and benefit the economy.

Human capital development is already taking place as a result of the SKA project, with bursaries and scholarships being granted to allow students to learn the necessary cutting-edge science, technology, mathematics and engineering skills to support the project. Because the SKA is a long-term project, over decades its effect will increase.

The Centre for High Performance Computing is a member of the international SKA Science Data Processing Consortium. With funding from the DSI, it is also supporting eight African SKA partner countries through an initiative where they have

installed its new supercomputer to provide 1 000 teraflops (one petaflop) of computing power to researchers. The facility was upgraded to meet the growing demand for use by university and industrial researchers. The SKA remains a major platform for cutting-edge innovation in domains such as supercomputing the high-speed transmission and processing of massive data sets.

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

Two engineering consortia have been hard at work at their sites in Murchison, Western Australia, and the Northern Cape, South Africa, respectively, designing all the essential infrastructure required for the construction of this complex global project to get under way. This includes access roads, power, water and sanitation, buildings, antenna foundations, and the communication, security and site monitoring equipment required to support the SKA telescope.

The South African consortium, Infrastructure South Africa, was led by the South African Radio Astronomy Observatory, which designed, built and operates the 64-dish SKA precursor telescope, the MeerKAT.

Following the successful review of the key infrastructure components of the SKA – considered a major engineering victory – the project will now move on to the bridging phase.

National Integrated Cyberinfrastructure System

The NICIS promotes scientific and industrial development through the provision of high-performance computing capability, high-speed network capacity and a national research data infrastructure integrated hierarchically into globally connected systems and into local system systems, providing seamless access for the research and education communities of South Africa. It is a national initiative of the DSI and is implemented by the CSIR.

The Centre for High Performance Computing is one of three pillars of the NICIS. It provides massive parallel processing capabilities and services to researchers in industry and academia. The other main pillars are the South African National Research Network, which provides high-speed connectivity and advanced networking services, and the Data Intensive Research Initiative of South Africa, which implements services that enable sound data management practices and support efficient data-driven scientific and engineering discoveries.

The NICIS is the national or Tier 1 platform to provide e-infrastructure, tools and services to enable sustainable e-research, human capital and research capacity and skills development; and effective delivery of e-learning.

The implementation of the following projects of the NICIS continued during the 2020/21 financial year:

- a multi-institutional national e-science postgraduate teaching and training programme – to be expanded in terms of the disciplines covered and institutions being added;
- increasing the number of awards of the e-research support programme;
- additional regional Tier 2 data nodes being established; and
- the big data strategy being implemented.

The DSI, in cooperation with the CSIR, has commissioned the set-up of a core situational awareness platform. The centre, led by the DoH, provides near real-time analytics and dashboards on the COVID-19 outbreak per province, district, local municipality and ward.

The centre is housed in a secure facility at the CSIR in Pretoria and provides a central situational awareness, giving a single view of the reality of the spread of COVID-19 across the country.

The centre is one of several projects that the DSI is working on in support of government's response to the pandemic. Among the centre's capabilities is the Command and Control Collaborator (Cmore) app – a mobile visualisation platform used by community health workers to record screening data and symptoms in the field and transmit the information to the centre.

The Cmore app enables a near-live display of the results of the work being conducted by government's Household Screening and Testing Programme. The data and insights generated by the centre provide significant input for decision making by the National Coronavirus Command Council.

South African Research Infrastructure Roadmap (SARIR).

Through a joint agreement between South Africa and the EU, the SARIR Framework was developed as the basis for prioritising the development of national research infrastructure needs. The SARIR is a high-level strategic and systemic intervention to provide research infrastructure across the entire public research system, building on existing capabilities and

strengths, and drawing on future needs. This roadmap will provide guidance to the DSI on the strategic development, acquisition and deployment of research infrastructure as a necessary enabler for research, development and innovation.

The SARIR is intended to provide a strategic, rational, medium- to long-term framework for planning, implementing, monitoring and evaluating the provision of research infrastructure necessary for a competitive and sustainable national system of innovation. It also provides a basis for discussion concerning financing future infrastructure for research in South Africa, and for participating in joint international research infrastructure. The roadmap was developed through a bottom-up process driven from within the national research community, moderated at a technical level by an expert steering committee and aligned with national research priorities through strategic moderation by the DSI. The implementation of the SARIR will continue over the MTSF period, with all 13 research infrastructures approved in the first phase of the roadmap being implemented.

Information and communications technology

The DSI is leading the implementation of the national ICT Research, Development and Innovation Strategy. The strategy's main purpose is to create an enabling environment for innovation and manufacturing facilities and resources in South Africa.

The Centre for High-Performance Computing (CHPC), SANReN and the Very Large Databases are the three pillars of cyberinfrastructure that the DSI supports. Hosted by the UCT and managed by the CSIR's Meraka Institute, the CHPC was the first of its kind in South Africa and is making scientific supercomputing a reality for the country.

A major project for SANReN is the national backbone network, which aimed to connect all major metros in the country with a 10 gigabyte per second link.

SANReN, linking 215 research sites, consists of 1 500 kilometres (km) of dark fibre and 5 000 km of managed bandwidth. This network is complimented by significant international broadband capacity on the West Africa Cable System and the east coast SEACOM system, ensuring that the DSI's projects support competitive research and innovation as it prepares the national innovation system for the future.

SANReN connects more than 200 sites from Thohoyandou to Cape Town, including all the main campuses of all South African universities and most public research institutions, as well as global projects such as the SKA and the MeerKAT.

Indigenous knowledge systems

The IKS Policy serves as a guide for the recognition, understanding, integration and promotion of South Africa's wealth of indigenous knowledge resources. One of the areas of action identified by the policy is the protection of indigenous knowledge and the holders of such knowledge against exploitation. This includes ensuring that communities receive fair and sustained recognition and, where appropriate, financial remuneration for the use of this knowledge.

The indigenous knowledge of many communities embodies a deeply spiritualised and ancient relationship with the Earth's systems and cycles. Traditional songs and languages, clothing, architecture, foods, motifs, daily rituals and mythological epics contain local survival information. Moreover, the diversity of indigenous cultures provides unique insights into how to live harmoniously within nature.

By sharing indigenous stories of vulnerability and adaptation, people learn how communities share ideas on how ancestral wisdom is being incorporated into climatic adaptation strategies. By cherishing the value of indigenous knowledge, people can discover how best to adapt to a changing climate.

The DSI has three IKS priorities:

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

A major achievement was to put in place an information infrastructure that would hold IKS in oral format.

In addition, two UK-South Africa bilateral research chairs have been awarded for research into food security – one co-hosted by the universities of the Western Cape and Pretoria, and the other based at the NMMU.

The DSI has also established indigenous knowledge studies centres of excellence at some of the country's universities. The centres will play a defining role in generating highly qualified HR capacity in IKS.

In April 2020, a team of international astronomers uncovered unusual features in the radio galaxy ESO 137-006 using MeerKAT data. ESO 137-006 is a fascinating galaxy residing in the Norma cluster of galaxies, and one of the brightest objects in the southern sky at radio wavelengths.

The classical picture of a radio galaxy consists of an active galactic nucleus (hosting a growing supermassive black hole), shooting out two jets of plasma filled with particles that move at speeds close to that of light. The material within the jets eventually slows down and billows out, forming large radio lobes. ESO 137-006 is characterised by two such lobes of very bright radio emission.

The nature of these unusual features is unclear. It is possible that these features may be unique to ESO 137-006, because of its harsh environment, but it is equally possible that these features are common in radio galaxies but, so far, the teams have been unable to detect them due to sensitivity and resolution limits. According to the team that made his discovery, which is composed of collaborators from South Africa and Italy and is partly funded by the European Research Council, further observations and theoretical efforts are required to clarify the nature of these newly discovered features.

Natural resource development

To reinvigorate the South African mining sector and to harness the vast amounts of existing and potential opportunities for industrial and manufacturing growth, it is crucial for the country to create the technologies and mining methods to push mining deeper in a commercially viable manner. South Africa needs a competitive mining industry.

This will only be possible if science and innovation play the quintessential role of changing the cost and exploitation horizons of the sector. None of the existing mining stakeholders (publicly funded research institutions, private sector companies, universities, unions or government) have the scale to impact the situation alone in the long run. To achieve this, a critical mass of science and knowledge to push the frontiers of mining will require a national effort consisting of deep partnerships and collaborations across institutions and industries.

Women in science awards

Following the suspension of big public events due to the COVID-19 pandemic, the DSI cancelled the 2020 South African Women in Science Awards (SAWiSA) and instead held webinars to celebrate women's achievements in science while engaging challenges limiting the participation and success of women in science and research.

The webinar series featured previous SAWiSA award winners, who gave updates on research work, and engaged on specific topics related to the participation and experiences of women in science, research and innovation. Every year since 2003, the DSI has held the SAWiSA to recognise the achievements of prominent women scientists and encourage the participation of women in research. The awards are held in August as part of National Women's Month celebrations, which take place to honour the women who marched to the Union Buildings in 1956 to protest the apartheid system's pass laws.

