An Overview of the Department of Science and Innovation's

2020/21 Annual Report

science & innovation

Department
Science and Innovation
REPUBLIC OF SOUTH AFRICA

2030 NDP

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INTRODUCTION

The year under review was overshadowed by the COVID-19 pandemic, which profoundly disrupted livelihoods, public health and economies worldwide, but also brought science, technology and innovation (STI) and the role of the Department of Science and Innovation (DSI) to the fore.

The Department amended its plans and rolled out initiatives to mitigate the impact of the pandemic, coordinating responses to the disaster across the national system of innovation (NSI).

The Department's budget was reduced from R8,7 billion to R7,3 billion to free up funds for government to address the health crisis and the economic fallout that accompanied it. This meant that some targets had to be revised downwards, but, despite these challenges, the DSI was able to achieve most of its targets.

The Department's work and contributions to the National Development Plan (Vision 2030) is based on six outcome-oriented goals – a transformed, inclusive, responsive and coherent NSI; human capabilities and skills for the economy and for development; increased knowledge generation and innovation output; knowledge utilisation for economic development in (a) revitalising existing industries and (b) stimulating research and development-led industrial development; knowledge utilisation for inclusive development; and innovation in support of a capable and developmental state.

A TRANSFORMED, INCLUSIVE, RESPONSIVE, COORDINATED AND EFFICIENT NSI

In the year under review, the Cabinet approved the Decadal Plan on Science, Technology and Innovation (STI) as a government masterplan. The Decadal Plan is premised on advancing a whole-of-government approach and ultimately a whole-of-society approach to innovation in South Africa. The details of the plan are currently being finalised.

HUMAN CAPABILITIES AND SKILLS FOR THE ECONOMY AND FOR DEVELOPMENT

Target human capital development interventions

The National Development Plan sees human capital as central in addressing South Africa's unemployment, poverty and inequality challenges. Part of the DSI's work in this regard is the transformation of the NSI workforce, and the Department has a number of interventions to achieve this, including a task team within the DSI to co-create a robust and evidence-based transformation agenda for the next 10 years and identify reforms and actions to be implemented over the 2020-2025 cycle by DSI and its entities to enhance transformation outcomes.

The breakdown of the postgraduate bursaries and internships awarded through the National Research Foundation (NRF) and other agencies is given below.

	Total beneficiaries	Black people	Women	Black women	People with disabilities	South Africans
BTech/honours and master's students	8 610	7 151	5 346	4 525	18	8 309
Doctoral students	2 961	1 882	1 653	1 148	29	2 442
Total number of students funded	**11 571**	**9 033**	**6 999**	**5 673**	**47**	**10 751**
Interns	**1 085**	**982**	**700**	**557**	**5**	**1 085**

During the period under review the Minister of Higher Education, Science and Innovation approved the migration of the management and implementation of the Internship Programme from the NRF to the Human Sciences Research Council with effect from the 2021/22 financial year.

Increased development of technical and vocational skills for the economy

Through partnerships with the private sector and higher education institutions, artisans and technicians have been trained in the energy and agriculture sectors. For example, the hydrogen fuel cell systems set up at 1 Military Hospital to supplement the energy needed for its COVID-19 response was also used to train unemployed technical and vocational education and training (TVET) college graduates in the deployment, installation and maintenance of such systems.

INCREASED KNOWLEDGE GENERATION AND INNOVATION OUTPUTS

South African researchers' contribution to global scientific output

In 2020/21, over 8 150 research articles were published by DSI/NRF-funded researchers, and the DSI awarded 3 000 research grants through DSI-NRF-managed programmes. Of these, 1 445 (49%) went to black researchers, of which 674 (46%) went to black women. During the 2020/21 financial year, the Department, through the NRF, also awarded 30 research infrastructure grants under the South African Research Infrastructure Roadmap.

Investments toward the identification and protection of intellectual property

The National Intellectual Property Management Office (NIPMO) continued to ensure that potential intellectual property from publicly financed research outputs is identified and used. For example, international patent processes are under way for a remote monitoring system developed by North-West University (NWU), which enables experienced nurses and clinicians to remotely monitor a large fleet of ventilators, of different makes and models, on a single centralised monitoring screen. The NWU Faculty of Engineering also developed a health screening app to assist schools, businesses, and other institutions to easily collect and store health screening information from students, pupils, staff and clients.

Just under R21 million (50%) of all eligible IP rights protection and maintenance costs were refunded following submissions to NIPMO by 23 higher education institutions and science councils. NIPMO expanded its IP Wise® training sessions to TVET colleges around the country, as well as supporting six new offices of technology transfer, and providing funds to the Sefako Makgatho Health Sciences University for the establishment an office of technology transfer.

COVID-19 interventions

Through knowledge generation and innovation outputs, the DSI and its partners contributed to government efforts to contain the spread of COVID-19 pandemic through, among many other things, epidemiological studies and genomic surveillance that placed South African scientists on the international map, working with other countries to find solutions to the pandemic. The KwaZulu-Natal Research Innovation and Sequencing Platform (KRISP) identified the coronavirus beta variant (501Y.V2 or B.1.351).

During the period under review the Department made huge strides in the number of health innovation initiatives funded and supported. Under the DSI's indigenous-knowledge-based technologies programme, the University of the Free State, in collaboration with farmers, made excellent progress in investigating the use of herbal medicines against COVID-19. Of particular interest are two multi-herbal formulations, Product Nkabinde and Phela, and a mono-herbal ingredient coded BD01, which have demonstrated good activity against both the SARS-CoV-2 and MERS-CoV viruses.

KNOWLEDGE UTILISATION FOR ECONOMIC DEVELOPMENT

The DSI funded a number of instruments in support of increased localisation, competitiveness and research and development-led industry development in aerospace, advanced manufacturing, chemicals, mining, advanced metals, ICTs, the Industry Innovation Programme and the sector innovation funds.

Revitalisation of the mining sector

The South African Mining Extraction, Research, Development and Innovation programme developed and launched the Technology Availability Readiness Atlas, a portal aimed at providing the mining industry with access to the capabilities and offerings of local original equipment manufacturers. The main objective is to help increase the market penetration of locally developed mining equipment and technologies.

The CoalCO2 to X Research, Development and Innovation Roadmap highlights that the investments made in green hydrogen production through Hydrogen South Africa can be leveraged to produce value-added products using the green hydrogen and flue gas coming from coal-fired boilers used in electricity generation and other industrial sectors such as cement production and incinerators. It articulates how South Africa can continue to use its abundant coal resources for power generation while also producing commodities such as green ammonia and fertilizers. This will help to reduce greenhouse gas emissions and their negative impact on society and the environment.

Satellite launch capability

In 2014, the School of Mechanical Engineering at the University of KwaZulu-Natal (UKZN) built their own sounding rocket vehicle under the UKZN's Space Propulsion Research Programme (SPRP). Additional funding from the DSI over the years led to the first successful African rocket launch test in March 2020. The altitude reached was 17,9 km. In 2020/21 a further amount of R7,997 million was transferred to the UKZN SPRP for the university to design and develop a launch gantry at the Overberg Test Range. A static test of SAFFIRE (the South African First Integrated Rocket Engine) was recently performed through the Aerospace Systems Research Group.

The DSI investment in the SPRP at UKZN from 2018 to 2021 produced 19 engineers (16 master's degrees and three PhDs). Going forward, SANSA and Armscor will join the programme to provide technical oversight and systems engineering processes.

Big data

The Minister of Higher Education, Science and Innovation approved the National Big Data Strategy for Research, Development and Innovation for implementation. The primary aim of this strategy is to maximise the return on investments in research big data, and realise the economic, social, educational, scientific and industrial beneficiation potential of research big data for South Africa.

The Sector Innovation Fund and Industry Innovation Partnership Programmes

The DSI has continued to implement the Sector Innovation Fund initiative, with ongoing support for horticulture, post-harvest innovation, viticulture, forestry, mineral processing, paper manufacturing and agroprocessing. In addition, the Department's efforts to support innovation-led industrial development include support for four industrial development centres at the CSIR – the Biomanufacturing Industry Development Centre, the Biorefinery Industry Development Facility, the Nanomaterials Industry Development Facility and the Photonics Prototyping Facility.

The sector innovation funds and the industry development centres are both aimed providing the private sector with incentives to increase their investment in research, development and innovation, and thus increase their competitiveness.

Revitalisation of the agricultural sector

Innovation support in the agroprocessing value chain yielded two potential intellectual property products in citrus research during 2020/21. A bilateral research programme with Malawi, including new proactive interventions for diagnostic, surveillance, monitoring and early warning systems (aquaculture health and feed programme), was supported.

KNOWLEDGE UTILISATION FOR INCLUSIVE DEVELOPMENT

Grassroots Innovation Programme and Living Labs

The Grassroots Innovation Programme and Living Labs Programme support the realisation of the STI White Paper policy intent to strengthen the skills in the economy and support social innovation. In this context, the Grassroots Innovation Programme has been instrumental in ensuring an inclusive and responsive NSI characterised by equitable access to knowledge infrastructure, where support for technology product development, commercialisation, IP protection and mentorship is provided to beneficiaries in a manner that encourages the participation of women, youth and people living with disabilities.

Through the Living Labs Programme, the DSI supports 296 beneficiaries through five community-based living labs established in Athlone (Western Cape), KwaMashu and Cato Manor (KwaZulu-Natal), Phuthaditjhaba (Free State) and Bofolo (Eastern Cape). The labs provide a full suite of support and infrastructure to emerging innovators, including design thinking training, solution development, prototype development, intellectual property advice and registration, pitching and investor readiness, and basic enterprise development support.

The Waste Research, Development and Innovation Roadmap

The Waste Roadmap Implementation Unit, based at the Council for Scientific and Industrial Research, participated in a two-year project as an expert group member of the project "Global roadmap to achieve near-zero ocean plastic leakage", which resulted in a publication in the prestigious journal Science. The DSI is taking this work forward by running the global model at a local level to identify the specific intervention strategy that South Africa should adopt to curb ocean plastic leakage, thereby using the scientific knowledge gained towards the development of a key public good in the long term.

The Enviro Champs programme

The DSI supported the Enviro Champs programme implemented by the Duzi Umngeni Conservation Trust under the Presidential Stimulus Package. This provided jobs to 310 previously unemployed young people. The DSI also partnered with the Water Research Commission to place 214 graduates under the Graduate Employment Programme. Some of the graduates were placed with the Enviro Champs to assist in technical data collection, which is contributing to the State of the Rivers Report being prepared by Umngeni Water. Enviro Champs is an example of how citizen science can contribute to the scientific knowledge base.

A recognition of prior learning (RPL) assessment workshop was held in November 2020 in KwaZulu-Natal with the aim of inducting the new members of the KZN Pilot Steering Committee, and finalising the peer-to-peer assessment of Steering Committee members for the domains of ubungoma and ababelethisi. This pilot will facilitate the accreditation of assessors and certification of practitioners in indigenous knowledge systems. In addition, the RPL pilot process was rolled out in North West and Limpopo.

INNOVATION IN SUPPORT OF A CAPABLE AND DEVELOPMENTAL STATE

Innovative technology solutions for effective service delivery

The DSI committed to better alignment of its innovation support interventions with the District Development Model over the Medium Term Strategic Framework period. In order to contribute to improving the capacity of municipalities and enhance the delivery of basic services, the Department was able to expand the number of municipalities participating in the Municipal Innovation Maturity Index (MIMI) during the period under review. The MIMI assessment tool provides critical information on the innovation capabilities and readiness of local government. By providing insight on readiness for the deployment of innovative service delivery technology solutions, MIMI continues to be valuable in informing the efficient deployment of resources for service delivery.

Technology localisation

Many technology stations responded to the COVID-19 pandemic in innovative ways. For example, the Vaal University of Technology (VUT), together with North-West University and the Central University of Technology (CUT), consulted with specialists from other universities and industry to reverse engineer the Bird ventilator, designed in the late 1950s. The CUT has successfully reverse-engineered the various components of the Bird Mark 8 ventilator. VUT has done a critical design review of the original ventilator and determined that almost 60% of the components can be manufactured using additive manufacturing. Collaboration with a local industry partner that could assist with the manufacturing of the high tolerance metal component is currently being explored.

Provision of STI decision-support tools

In terms of tools for Operation Phakisa (Oceans Economy), the DSI continues to support the National Oceans and Coastal Information Management System. The South African National Space Agency (SANSA) provides the satellite data needed to monitor and protect the oceans and coasts and the decision-support tools are improved on a regular basis.

The most advanced South African nanosatellite to date, ZACube-2, was completed and launched in December 2018. The Cape Peninsula University of Technology, with funding from the DSI, is leading a consortium that will develop a South African constellation of low-cost nanosatellites to facilitate a South African Marine Domain Awareness (MDA) Satellite Constellation. The MDA Sat-1 and 2 missions will address the challenge of ocean governance. The primary objective is to provide South Africa with the sovereign capability to monitor maritime communications within its exclusive economic zone, including the use of an automated information system and VHF data exchange system.

Space Weather Regional Centre

South Africa, through SANSA, was appointed as one of the Regional Centres for Space Weather Information by the International Civil Aviation Organisation. The DSI has funded the upgrade of the 24/7 operational space weather information centre.

INTERNATIONAL PARTNERSHIPS

Globally, the DSI continued to participate in a diverse portfolio of international partnerships, which provided a range of opportunities in global research programmes, such as with the European Union, Japan and the BRICS countries (Brazil, Russia, India, China and South Africa).

The DSI engaged in 46 resource-leveraging engagements with a range of international partners and had significant success in forging partnerships on COVID-19 and other areas of collaboration. The European Union, through its General and Sector Budget Support programmes, remained one of the largest contributors during the financial year. The leveraging of partnerships within the South African NSI include a partnership with the Department of International Relations and Cooperation, which made a co-investment of R25 million through the African Renaissance Fund to leverage an international partnership on COVID-19.

The DSI also supported 18 projects related to the African Union's Agenda 2063, such as the African Science Consultation Forum, advancing entrepreneurial universities in Africa and strengthening Africa's medicine manufacturing capacity.

CONCLUSION

Despite the COVID-19 implications and economic constraints, which affected operations and the compensation budget, operational efficiency remained a priority for the DSI. Business processes were adjusted to accommodate COVID-19 protocols and employees were informed of the protocols to ensure that they complied with the measures introduced in the workplace. Using guidelines provided by the Department of Health and other relevant organisations, the Department did everything it could to minimise the impact of the pandemic on its employees and operations. Once more, the DSI received a clean audit from the Auditor-General for both financial and non-financial operations for 2020/21.

The DSI also continued with the implementation of its approved Employment Equity Plan, and achieved female representation of 49,48% at SMS level, and representation of people with disabilities at 3,4% of the total staff complement.

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