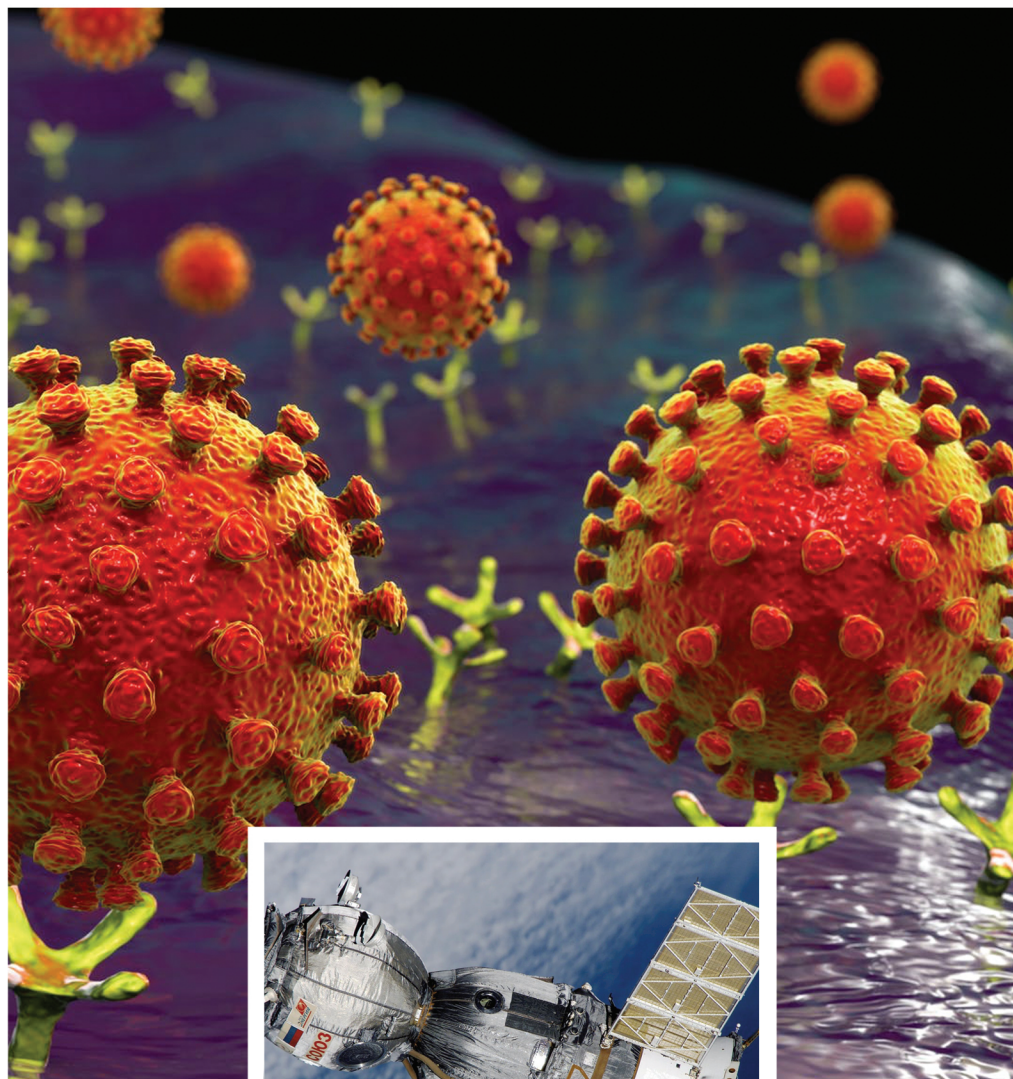




REVISED STRATEGIC PLAN

2020 - 2025



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

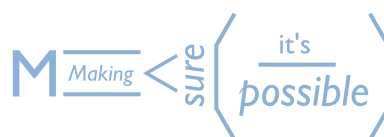
DEPARTMENT OF SCIENCE AND INNOVATION

REVISED 2020-2025 STRATEGIC PLAN



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



Department of Science and Innovation

Revised Strategic Plan

2020-2025

The revised 2020-2025 Strategic Plan for the Department of Science and Innovation is compiled with the latest available information from departmental and other sources.

Some of this information is unaudited or subject to revision.

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Annual performance plans for each financial year

within the performance cycle will also be published on

www.dst.gov.za.

ISBN 978-0-621-50122-3

RP60/2022

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MINISTER'S FOREWORD



Dr BE Nzimande, MP
Minister of Higher Education,
Science and Innovation

The **National Development Plan**, as the overarching government framework for the socio-economic transformation of South Africa, has been divided into five-year implementation plans, the second of which is the 2019-2024 Medium-Term Strategic Framework (MTSF). In supporting the economy and employment, the period 2018-2023 marks phase two in the use of STI in laying the foundations for more intensive improvements in the productivity where innovation across state, business and social sectors start to become pervasive.

As part of the **2019-2024 Medium-Term Strategic Framework**, the Department's focus and commitments are mainly on priorities 2 and 3 and the associated outcomes over the medium-term, which is *Economic transformation and job creation and Education, skills and health*. On the Apex Priority 2: *Economic transformation and job creation*, the Department is contributing on Improving competitiveness through ICT adoption – GERD and IP

commercialisation; Investing for accelerated inclusive growth – Skills Priority Plan led by the Department of Higher Education and Training (DHET) and supported by the Department and on Industrialisation, localisation and exports – Masterplans developed for all national priority sectors. On the Apex Priority 3: *Education, skills and health*, the Department is contributing to Expanding access to post-school education and training (PSET) opportunities, Improving success and efficiency of the PSET system, Improving the quality of provisioning within the PSET system and Ensuring the PSET system is responsive to the needs of industry and society as a whole.

Work on the **Decadal Plan** underway, which implements the 2019 White Paper on Science Technology and Innovation (The White Paper) vision, namely STI 'enabling inclusive and sustainable South African development in a changing world'. The Decadal Plan emphasises four societal grand challenges or SGCs namely: climate change; future-proofing education and skills; re-industrialising the modern economy; and future of society, as well as two STI priorities (health innovation and energy innovation). It proposes the new strategic management model, budget coordination and innovation compact as critical components of the new NSI governance architecture.

Science, technology and innovation have significant **transformative potential**. For developing countries, STI, and specifically innovation, can support economic growth and employment, create livelihoods at grassroots level, and improve government performance and service delivery. While innovation is not the only factor in faster economic growth, industrialisation and inclusive development, it remains a significant and vital catalyst. However, in South Africa, there is a need to view innovation through the prism of the triple challenge of poverty, inequality and unemployment (PIU). Particularly, it is necessary to plan interventions aimed at significantly upscaling the impact of innovation to address this triple challenge and thereby improve the quality of life of citizens.

It is envisaged that over time, the STI system will pivot towards the Decadal Plan's **STI priorities** and, consequently, all NSI actors would have to plan for this transition. Innovation is thus envisaged to:

- support the **modernisation of key sectors of the economy** (agriculture, mining and manufacturing) by driving competitiveness and productivity improvements and, ultimately, higher GDP contributions;
- explore opportunities presented by emerging innovation concepts of the **circular and digital economy** as new sources of economic growth;
- harness the capabilities built by NSI over the years to drive innovation across several sectors (such as the health and energy sectors) to support the **development of a capable and entrepreneurial state**;
- **address the SGCs** in the areas of climate change and environmental sustainability (SGC 1); future-proof education and skills (SGC 2); and a secure, safe and equitable society (SGC 3).

The White Paper advocates a purposeful approach to increasing STI's impact on addressing the socio-economic growth and development challenges South Africa faces, considering environmental sustainability. This approach is anchored in the NDP ambitions for South Africa and the SDGs.

Furthermore, the concept of **inclusive innovation or innovation for inclusive** development, in which all citizens share in the benefits, is central to the White Paper. This encapsulates a broader view of actors, forms of innovation and spatial footprint of innovation. It means supporting communities and civil society to innovate; embracing a more diverse knowledge system (that includes indigenous knowledge systems (IKS) and addresses the "de-colonisation of knowledge"); as well as using innovation to improve service delivery, government decision-making, educational outcomes and broadband access. Inclusive innovation improves science literacy and awareness, as well as the demographic representation of all aspects of the NSI. For example, utilising IP from

publicly funded R&D to establish new firms and support SMMEs can change the ownership profile of the economy. Given this backdrop, new STI-centred ideas need to deliver transformative outcomes in South Africa. South Africa has to use its science and innovation capabilities to build the resilience of society.

South Africa is facing a crisis of **Gender-based violence (GBV)** and proposes the **Research on Poverty, Inequality and Unemployment (PIU)** – through the South African Research Chairs Initiative (SARChI) and the Centre of Excellence (CoE) programme. The DSI will establish an impartial and trusted platform to promote inclusive debate on PIU and deliberate on a vision of a people-centred, inclusive and sustainable society. To ensure research translates into impact on policy and practice, we need to better understand how to deliver robust evidence to the right actors, at the right time and in the right way. The CoE will also be at the forefront for recommending strengthened national data systems to realise the full potential of the data revolution to transform the lives of poor people.

The DSI will build a comprehensive research programme focused on measuring and explaining trends in poverty, inequality and labour market outcomes, geared to improving the interface between research and policy by producing cutting-edge research for inclusive growth and economic transformation in South Africa.

Strategic governance of the NSI is key, as set out in this Decadal Plan, will include the high-level inclusive structures to set the agenda for the NSI, namely an annual Presidential STI Plenary involving all NSI actors (government, academia, industry, civil society), as well as a Science and Innovation IMC. An agreement across government on initiatives to improve the enabling environment for innovation, e.g. an Innovation Compact is critical including a mechanism to enable the use of the budget to improve coordination, e.g. an STI Public Budget Coordination, and equally important, is the harmonised set of incentives and instruments to improve coordination at the sector and programme level, e.g. RDI Plans, and Public Private Sector

Partnerships (PPPs) to leverage the capabilities and resources of the private sector. **Science Diplomacy is key in Stimulating STI and trade synergies** especially on **science-related initiatives to specific innovation and commercialisation initiatives.**

On innovation and support of a capable state there are a several ongoing policy and technology initiatives across government designed to transform the public sector towards a capable state, including decision-support tools to support the functioning and performance of municipalities and government departments in areas such as energy, sanitation, procurement, spatial planning, human settlements, service delivery, infrastructure, risk and disaster management, health, climate change, education and crime prevention. The Decadal Plan seeks to prioritise the further deployment of decision-support tools and data analytics capability initiatives to support the capable state project.



Dr BE Nzimande, MP

**MINISTER OF HIGHER EDUCATION, SCIENCE
AND INNOVATION**

DEPUTY MINISTER'S REMARKS



**Mr B Manamela, MP
Deputy Minister of
Higher Education, Science and Innovation**

The new era of science, technology and innovation (STI) policy is geared towards increasing the responsiveness of our national system of innovation (NSI) and strengthening its contribution to the resolution of South Africa's socio-economic challenges.

For this reason, the new era of STI policy places greater emphasis on technology and innovation deployment, and the harnessing of innovation in support of a capable state and improved service delivery.

It further emphasises the importance of inclusivity, transformation, partnerships to address policy coherence, the development of human capabilities, knowledge expansion, innovation performance, and increased investment that will result in the economic, socio-political and intellectual benefits of STI being enjoyed by all South Africans.

For the 2020-2025 Strategic Plan period, the Department of Science and Innovation (DSI) will work with the Department of Higher Education and Training (DHET) on the implementation of the Historically Disadvantaged Institution Development Programme, an intervention aimed at the holistic development of the country's historically disadvantaged institutions (HDIs).

This will be done, among others, through student, staff and infrastructure development support. Through the DSI-DHET joint task team, the DSI and the National Research Foundation (NRF) will align their instruments to those proposed in the HDI Development Programme. In addition to starting new tailor-made initiatives to support the HDIs, the DSI and NRF will ring-fence a certain quota of awards and grants for HDIs.

A key component of the HDI Development Programme is the United States-South Africa Higher Education Network, which operates in a triad including one HDI, one historically advantaged university and one United States university. The main purpose of the initiative is to increase the percentage of PhD-qualified staff at HDIs. Given the relatively low levels of PhD-qualified teaching and research staff in our universities (currently at 45%), and therefore limited research and supervisory capacity, the Department will reorient its international partnership networks towards enhancing doctoral and research training.

Further to this, a strong partnership between the DSI, the Department of Basic Education (DBE) and provincial education departments will act as a catalyst for identifying and nurturing the young talent required to build a science, technology, engineering and mathematics (STEM) human capital pipeline, while advancing the goals of the DSI-led science engagement programme.

For this reason, the feasibility of an interdepartmental model for establishing and managing science centres will be tested over the next five-year period. A test case will be the Albertina Sisulu Science Centre in Cofimvaba in the Eastern Cape, a partnership initiative involving the

DSI, the DBE, the Eastern Cape Department of Education and Intsika Yethu Local Municipality.

In addition, the DSI will continue to prioritise women in support programmes targeting researchers and innovators. Current empirical data shows that women, youth and people with disabilities continue to be under-represented in our science and research system.

Currently, the Department mainstreams transformation through set quotas in its instruments, such as bursary support and research grant holders. Going forward, in collaboration with its entities and key stakeholders, the DSI will develop a comprehensive transformation framework to address inequities in gender, race and spatial distribution throughout the system.

To advance innovation policy, the DSI will continue to strengthen its participation in leading-edge innovation policy programmes, including the Transformation Innovation Policy Consortium, the Mission-Oriented Innovation Network, and various programmes looking at the interface between innovation policy and the Sustainable Development Goals.

To achieve knowledge utilisation for inclusive development at district level, and contribute to the building of a capable state, an enabling environment for using innovation and knowledge to achieve inclusivity will have to be created at district level.

This will require increased access to intellectual property arising from publicly funded research by youth entrepreneurs and SMMEs. The DSI will support youth entrepreneurs in scaling up successfully demonstrated technology solutions that can improve service delivery. Appropriate resources and innovation instruments will be made available in the District Development Model (DDM) context.

Further to this, the DSI will prioritise the implementation of its youth innovation incentives programme to support youth enterprises and entrepreneurs, as well as innovation for local economic development. This will include the implementation of innovation for inclusivity programmes in partnership with industry stakeholders and other government departments in catalytic areas for inclusive

development.

Such areas include information and communications technology, system-wide e-hailing applications, the 4th industrial revolution, special economic zones, circular economy and renewable energy technologies, and mission-oriented areas such as the future of society, the future of work and the future of education.

Through the Regional Innovation Support Programme (RISP), the DSI will support the DDM by means of interventions aimed at creating innovation ecosystems that advance inclusivity. These interventions will increase the spatial footprint of innovation in the provinces, thereby supporting district municipalities to enable innovation for socio-economic development.

To this end, the DSI will seek to understand provincial growth and development strategies, district development profiles, planned socio-economic infrastructure projects at district level, and existing local economic development strategies and initiatives. The Department will then link innovation with these ongoing initiatives at district level.

These and other strategic interventions are aimed at enhancing the performance of our national system of innovation and increasing its capacity to address the interconnected challenges of poverty, unemployment and inequality, with a view to enabling the government to achieve the objectives of our country's Economic Reconstruction and Recovery Plan.



Mr B Buti Manamela, MP

**DEPUTY MINISTER HIGHER EDUCATION,
SCIENCE AND INNOVATION**

ACCOUNTING OFFICER'S STATEMENT



Dr Phil Mjwara
Director-General of Science and Innovation

The **Decadal Plan** has three mutually reinforcing aims, namely, pivoting the NSI towards making an increased positive impact on SA's socio-economic and environmental priorities, maintaining equilibrium between a focus on impact (e.g. inclusive innovation) and continued investment to develop the system (e.g. in systemic enablers such as knowledge creation and institutions) and transformative role of innovation

Science, technology and innovation (STI) are critical to a competitive and sustainable economy and for addressing societal challenges. The Science Technology and Innovation **Decadal Plan (Decadal Plan)** has a dual purpose of pivoting of the National System of Innovation (NSI) towards making an increased positive impact on South Africa's socio-economic and environmental priorities, and maintaining equilibrium between impact (e.g. inclusive innovation) and continued investment and development of the NSI. The latter includes systemic enablers such

as human resource development, institution building, infrastructure, knowledge production and international collaboration.

The review of the NRDS and TYIP suggested that the DSI should pursue the notion of "grand societal challenges" as a framing principle for the development of high-level interventions in the next decadal plan. The review study recommends that the **DSI retain the science missions** of the NRDS, the palaeosciences, astronomy, marine and Antarctic research and indigenous knowledge systems (biodiversity). The review has shown that the specific focus on and funding of these fields has produced demonstrable gains in scientific knowledge output, human resource capabilities and infrastructure.

It is recommended that South Africa continues to pursue the implementation of both the **high technology platforms** (biotechnology, ICT and advanced manufacturing) and grand societal challenges (the bioeconomy, space science and technology, energy security, climate change, and human and social dynamics) as prioritised under the NRDS and TYIP, respectively. However, the review suggests that it is crucial for the government to refine the technology missions to ensure continued relevance, to align them with technological advances, and to make sure that the concept of missions is given its full meaning.

The Decadal Plan identifies **three Societal grand challenges (SGCs)** that capture the core domains for STI priorities and associated interventions and these are Climate change and environmental sustainability; Future proof education and skills; and a secure, safe and equitable society.

The innovation for inclusive development (IID) agenda is about government creating an environment for innovation that enables all sectors of society to enjoy equality and equity in access to RDI knowledge infrastructure; participate in creating and actualising innovation opportunities; and sharing in the benefits of science, technology and innovation to advance their own development goals. The proposed interventions in support

of innovation for inclusive development are targeted at three impact areas, viz. the change in livelihoods for youth entrepreneurs, women and people with disabilities; improved access to market and income opportunities for grassroots innovators; and the efficient use of scientific knowledge and tools in providing evidence-based decision support to improve service delivery.

To improve access to livelihoods opportunities, it is envisaged that at least 10% of beneficiaries belonging to the designated categories of youth entrepreneurs, women and people with disabilities, would be supported through IID programmes. The realisation of income opportunities for grassroots innovators would be implemented through the implementation of several interventions across the innovation value chain – from ideation, product and commercialisation to market access – aimed at the creation of sustainable and profitable innovation-based enterprises. In this regard, about 500 grassroots innovators are targeted for support with various technical and business development interventions by 2030.

To enable inclusive growth and employment opportunities for the unemployed, the youth and the participation of SMMEs and women in the NSI, RDI initiatives and programmes are needed for local economic development, grassroots innovation and programmes designed to support youth innovators and entrepreneurs, and businesses in a manner that creates employment.

In this regard, the Decadal Plan proposes further strengthening of the ongoing **Grassroots Innovation Programme**. The STI interventions envisaged under this programme include the establishment of a national institution to coordinate grassroots innovation interventions; to expand the programme to provincial innovation systems and forums, establishing partnership for unlocking technology transfer and localisation opportunities and market access for grassroots innovators. On **Gender-based violence (GBV)**, the department proposes the **Research on Poverty, Inequality and Unemployment (PIU)**, which will demonstrate the vital role that rigorous research, scientific innovation and

new knowledge plays. The DSI will establish a dedicated CoE to focus on the complex interrelationship between poverty, inequality and unemployment and convene a community of practice comprising SARCHI Chairs and COEs working in the PIU knowledge field. It will also provide dedicated funding for monitoring and evaluating interventions aimed at addressing the complex challenges of PIU. The envisaged CoE will play a vital role in documenting the pathways that individual researchers and research projects have taken to achieve impact; how research programmes and knowledge managers can build networks, broker knowledge and synthesise evidence; and how bodies of research have been brought together to ensure impact.

Science knows no borders

Science Diplomacy is an enabler to improve opportunities for technology diffusion to benefit small firms and promote commercialisation of IP filed in South Africa by technology start-ups and SMMEs that have been supported in kind or financially by the DSI, within foreign markets. It is imperative to promote the commercialisation of publicly funded IP beyond South Africa's borders and to make innovation and economic diplomacy the conduits for driving industrialisation and economic competitiveness.



Dr Phil Mjwara

Director-General of Science and Innovation

OFFICIAL SIGN-OFF

It is hereby certified that this Strategic Plan –

- was developed by the management of the Department of Science and Innovation under the guidance of the Minister of Higher Education, Science and Innovation;
- considers all the relevant policies, legislation and other mandates for which the Department of Science and Innovation is responsible;
- accurately reflects the impact, outcomes and outputs which the Department of Science and Innovation will endeavour to achieve over the period 2020-2025.

Ms Gugulethu Zwane DDG: Institutional Planning and Support	
Ms Nombuyiselo Mokena DDG: Corporate Services	
Mr Mmboneni Muofhe DDG: Technology Innovation	
Mr Daan du Toit DDG: International Cooperation and Resources	
Prof. Yonah Seleti Acting DDG: Research Development and Support	
Mr Imraan Patel DDG: Socio-economic Innovation Partnerships	
Mr Robert Shaku Acting Chief Financial Officer	
Dr Phil Mjwara Accounting Officer	
Mr B Manamela, MP Deputy Minister	
Dr BE Nzimande, MP Executive Authority	

ABBREVIATIONS

4IR	Fourth Industrial Revolution
APP	Annual Performance Plan
ASSAf	Academy of Science of South Africa
AU	African Union
BRICS	Brazil, Russia, India, China and South Africa
CSIR	Council for Scientific and Industrial Research
DDM	District Development Model
DHET	Department of Higher Education and Training
DPME	Department of Planning, Monitoring and Evaluation
DSI	Department of Science and Innovation
EPMO	Enterprise Project Management Office
EU	European Union
FTE	Full-Time Equivalent
GERD	Gross Expenditure on Research and Development
HDI	Historically Disadvantaged Institutions
HEI	Higher Education Institution
HSRC	Human Sciences Research Council
HySA	Hydrogen South Africa
ICT	Information and Communication Technology
IP	Intellectual Property
ISI	Institute for Scientific Information
KAT	Karoo Array Telescope
MTEF	Medium Term Expenditure Framework
MTSF	Medium-Term Strategic Framework
NACI	National Advisory Council on Innovation
NDOH	National Department of Health
NDP	National Development Plan
NEET	Not in Employment, Education or Training
NICIS	National Integrated Cyberinfrastructure System
NIPMO	National Intellectual Property Management Office
NRF	National Research Foundation
NSI	National System of Innovation
QLFS	Quarterly Labour Force Survey
R&D	Research and Development
RDI	Research, Development and Innovation

SACNASP	South African Council for Natural Scientific Professions
SADC	Southern African Development Community
SADiLaR	South African Centre for Digital Language Resources
SAHPRA	South African Health Products Regulatory Authority
SANReN	South African National Research Network
SANSA	South African National Space Agency
SAPRIN	South African Population Research Infrastructure Network
SASTEP	South African Sanitation Technology Programme
SDG	Sustainable Development Goals
SMME	Small, Medium or Micro-Enterprises
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
TIA	Technology Innovation Agency
TVET	Technical and Vocational Education and Training
TYIP	Ten-Year Innovation Plan
UCDP	University Capacity Development Programme

OUR MANDATE

PART

A

1. Constitutional Mandate

Not applicable

2. Legislative Mandates

Academy of Science of South Africa Act, 2001

Establishes the Academy of Science of South Africa (ASSAf) to promote common ground in scientific thinking across all disciplines, including the physical, mathematical and life sciences, as well as the human, social and economic sciences; to encourage and promote innovative and independent scientific thinking; to promote the optimum intellectual development of all people; to advise and facilitate appropriate action in relation to the country's needs, opportunities and challenges; and to link South Africa with high-level scientific communities within the Southern African Development Community, the rest of Africa and internationally.

Astronomy Geographic Advantage Act, 2007

Provides for the preservation and protection of areas in South Africa uniquely suited to optical and radio astronomy, and for intergovernmental cooperation and public consultation on matters concerning such areas.

Human Sciences Research Council Act, 2008

Provides for the continued existence of the Human Sciences Research Council (HSRC), which carries out research that generates critical and independent knowledge relative to all aspects of human and social development.

Income Tax Act, 1962

Section 11D of the Income Tax Act gives the minister responsible for science and innovation authority to approve scientific and/or technological research and development (R&D) undertaken or funded in South Africa by the private sector for a 150% tax deduction on qualifying R&D expenditure.

Intellectual Property Rights from Publicly Financed Research and Development Act, 2008

Provides for the more effective use of intellectual property emanating from publicly financed R&D through the establishment of the National Intellectual Property Management Office (NIPMO), the Intellectual Property Fund and offices of technology transfer at higher education institutions and science councils.

National Advisory Council on Innovation Act, 1997

Establishes the National Advisory Council on Innovation to advise the minister responsible for science and technology and, through the minister, the Cabinet, on the role and contribution of science, mathematics, innovation and technology in achieving national objectives.

National Research Foundation Act, 1998

Establishes the National Research Foundation (NRF) to promote basic and applied research and human capital development in the various fields of science and technology and to coordinate the implementation of the DSI-led science engagement programme.

Natural Scientific Professions Act, 2003

Establishes the South African Council for Natural Scientific Professions (SACNASP) and legislates the registration of professional natural scientists, scientists-in-training, technologists and technologists-in-training.

Protection, Promotion, Development and Management of Indigenous Knowledge Act, 2019

Provides for the protection, promotion, development and management of indigenous knowledge; the establishment and functions of the National Indigenous Knowledge Systems Office; the registration of indigenous knowledge and the management of rights of indigenous knowledge communities; the recognition of prior learning; and the facilitation and coordination of indigenous knowledge-based innovation.

Scientific Research Council Act, 1988

Refers to the activities of the Council for Scientific and Industrial Research (CSIR), which undertakes R&D for socio-economic growth.

Science and Technology Laws Amendment Act, 2014

Amends the Scientific Research Council Act, 1988, the National Research Foundation Act, 1998, the Academy of Science of South Africa Act, 2001, the Natural Scientific Professions Act, 2003, the Human Sciences Research Council Act, 2008, the Technology Innovation Agency Act, 2008, and the South African National Space Agency Act, 2008, so as to harmonise the processes for the appointment of the chairpersons of the boards of the entities reporting to the Minister; to streamline the processes for the appointment of members of the boards and of the chief executive officers of the entities; to provide for the filling of vacancies on the boards; to provide for the qualification requirements for membership of the boards and the disqualification of members of the boards; to provide for the extension of the term of office of members of the boards; to provide for the dissolution and reconstitution of the boards; and to provide for matters connected therewith.

South African National Space Agency Act, 2008

Establishes the South African National Space Agency (SANSA) to promote space science research, cooperation in space-related activities, and the creation of an environment conducive to industry's development of space technologies.

Technology Innovation Act, 2008

Establishes the Technology Innovation Agency (TIA) to promote the development and exploitation of discoveries, inventions, innovations and improvements in the public interest.

3. Policy Mandates

The following are the policies, strategies and plans the Department plans to continue implementing over the 2020-2025 medium-term planning horizon:

National Development Plan, 2011

The country's long-term vision which provides a broad strategic framework to guide key government choices and actions, and focuses on the critical capabilities needed to transform the economy and society.

2019-2024 Medium-Term Strategic Framework (MTSF)

Provides seven priorities which the sixth administration will focus on during the medium-term planning period in mitigating against the persisting triple challenge of poverty, inequality and unemployment faced by the country through three National Development Plan Pillars, namely

- achieving a more capable state;
- driving a strong and inclusive economy;
- building and strengthening the capabilities of South Africans.

Budget Prioritisation Framework

Aims to guide the allocation of budget towards the achievement of government priorities by establishing a systematic basis for making strategic choices among competing priorities and limited resources in order to better optimise the budget as a key lever for driving the National Development Plan (NDP).

District Development Model

Aims to improve coherence and impact of government service delivery and development by using existing legal framework for coordinating and aligning development priorities and objectives between the three spheres of government.

South African Economic Reconstruction and Recovery Plan

Aims to stimulate equitable and inclusive economic growth through its nine interventions, to reconstruct and reignite the South African economy in three phases namely:

- Phase 1: Engage and preserve, which includes a comprehensive health response to save lives and curb the spread of the COVID-19 pandemic;
- Phase 2: Recovery and reform, which includes interventions to restore the economy while controlling health risks;
- Phase 3: Reconstruct and transform, which entails building a sustainable, resilient and inclusive economy.

4. Institutional Policies and Strategies Governing the Five-year Plan

White papers

- White Paper on Science, Technology and Innovation, 2019
- White Paper for Post-School Education and Training, 2013

Strategies and plans

- Human Resources Development Strategy, 2001
- National Strategy for Mathematics, Science and Technology Education, 2001
- National Research and Development Strategy, 2002
- Bio-economy Strategy, 2003
- National Water Resources Strategy, 2004
- National Nanotechnology Strategy, 2005
- Advanced Manufacturing Technology Strategy, 2006
- South African Earth Observation Strategy, 2008
- National Space Strategy, 2010

- Science Engagement Strategy, 2015
- Multiwavelength Astronomy Strategy, 2015
- Human Capital Development Strategy for Research Innovation and Scholarship, 2016
- Marine and Antarctic Research Strategy, 2016
- Human Capital Development Strategy for Research, Innovation and Scholarship, 2016
- South African Additive Manufacturing Strategy, 2016
- Innovation for Inclusive Development Strategy, 2018
- Science, Technology and Innovation Decadal Plan, 2021

Roadmaps

- South African Solar Energy Technology Roadmap, 2010
- ICT Research, Development and Innovation Roadmap, 2013
- Water Research, Development and Innovation Roadmap, 2015
- Waste Research, Development and Innovation Roadmap, 2015
- South African Research Infrastructure Roadmap, 2016

5. Relevant Court Rulings

None.

OUR STRATEGIC FOCUS

PART

B



1. Vision

Increased well-being and prosperity through science, technology and innovation.

2. Mission

To provide leadership, an enabling environment, and resources for science, technology and innovation in support of South Africa's inclusive development.

3. Values

Professionalism

The Department will seek to be professional and deliver top-class performance to both internal and external stakeholders.

Innovation

The Department will seek to be innovative in solving problems, and enhancing effectiveness and efficiency.

Ethical behaviour

The Department and its employees are consistent in their actions, and responsible, accountable and transparent in dealing with public funds, property and other resources.

Knowledge sharing

The Department is a knowledge organisation and its employees will share and use knowledge in a constructive way to ensure that the Department contributes to the building of a robust and productive knowledge economy.

4. Situational Analysis

The strategic planning horizon between 2020/21 and 2024/25 and the process of revising the DSI planning instruments was informed by the requirements of the Public Finance Management Act, the National Treasury Regulations and the Department of Planning, Monitoring and Evaluation's revised Framework for Strategic Plans and Annual Performance Plans. The DSI conducted a comprehensive analysis of its performance and organisational environment to ensure that it responds optimally to the key challenges faced by the national system of innovation (NSI), as well as the national imperative to address poverty, unemployment and inequality, taking into account the 2019-2024 MTSP apex priorities, the South African Economic Reconstruction and Recovery Plan, and the COVID-19 pandemic.

The purpose of the analysis was to identify and assess critical areas of the DSI's contribution to the changed government agenda, aligned to the three pillars of the NDP and the seven apex priorities of the 6th administration, to reprioritise interventions, and to set out defined performance measures that would accelerate service delivery. The DSI also identified critical success areas and notable challenges in the previous financial year, which assisted in developing appropriate remedial strategies going forward.

The disruptive onset of the SARS-CoV-2 pandemic and the subsequent lockdown affected plans and operations in both the public and private sectors in South Africa, including the NSI. The impact, particularly during Lockdown Alert Levels 5 and 4, slowed, and in some cases halted, various targeted interventions set out in strategic and annual performance plans.

This initiated the revision of the fiscal framework of the government for the 2020/21 financial year. In terms of section 10 of the Money Bills Amendment Procedure and Related Matters Act, 2009, government institutions were required to revise strategic and annual performance plans to incorporate revised budget figures, reduced baselines, reprioritisations and, in some instances, reallocations. This had far-reaching implications for the NSI strategic and annual performance plans over the MTSP period.

Following requests made by the Department of Planning, Monitoring and Evaluation (DPME) in relation to the revision of the MTSP, the Department of Science and Innovation (DSI), in consultation with its public entities, submitted inputs into the revision of medium-term targets. The inputs focused mainly on downscaling targets and reprioritising objectives in line with confirmed and projected cuts to fiscal resources pronounced by the National Treasury.

During the 2020/21 financial year, the signing of delivery agreements between the President and ministers provided another key step in enhancing performance in line with government priorities. In May/June 2021, the DSI used a new "thinking framework" for revising and re-tableting its 2020-2025 Strategic Plan, incorporating new performance information including targets in other NSI strategic and annual performance plans. Inputs arising from Ministerial, DSI Exco, DSI Extended Exco budget programme and strategic sessions between June and September 2021 were used to ensure alignment between the science, technology and innovation (STI) policy mix and planning instruments, and delivery in line with the signed delivery agreement.

4.1 External environmental analysis

South Africa's political transition is known as one of the most remarkable political feats of the past century. The new dispensation in 1994 inherited an ailing science and technology system, with challenges that included the financial consequences of the termination of apartheid technology missions (such as military dominance in the subcontinent and energy self-sufficiency) by the apartheid government between 1990 and 1994, as well as the strategic risks faced by the Southern African Development Community (SADC) from a human, economic and security perspective.

The evolution of planning in government follows reflections on South Africa's development since the advent of democracy, such as the 25-year review conducted the DPME in 2018 and a report, jointly authored by the World Bank, the DPME and Statistics South Africa, titled "Overcoming Poverty and Inequality in South Africa: An assessment of Drivers, Constraints and Opportunities" published in the same year.

(a) Sustainable Development Goals

As a member of the United Nations, South Africa is committed to the 2030 Agenda for Sustainable Development, agreed to by all members of the United Nations in 2015, which sets out 17 Sustainable Development Goals (SDGs). The 2030 Agenda recognises the role and contribution of STI in the implementation of all 17 SDGs, with dedicated programmes of support emerging from the STI community. In implementing the 2030 Agenda, the STI community's contribution includes research to strengthen evidence-informed decision making, and providing innovative solutions to ensure that no one is left behind, e.g. equitable access to basic services (water, energy, education and health). The DSI supports various initiatives to help municipalities localise the SDGs.

South Africa has a national working group to develop an integrated and harmonised national approach to the implementation and monitoring of the SDGs. The working group, led by Statistics South Africa, published a self-assessment report, "South Africa's Voluntary National Review", in 2019. The report evaluated what had been done and determined the remaining obstacles to ridding South Africa of extreme poverty. The Department has supported the working group by coordinating the NSI to achieve maximum impact from efforts to achieve the SDGs, by identifying strategic partnerships and mobilising resources, assisting in the development of indicators at regional and national level, and crystallising the role of STI in the implementation of interrelated and complex SDGs, i.e. SDGs 2, 6 and 7.

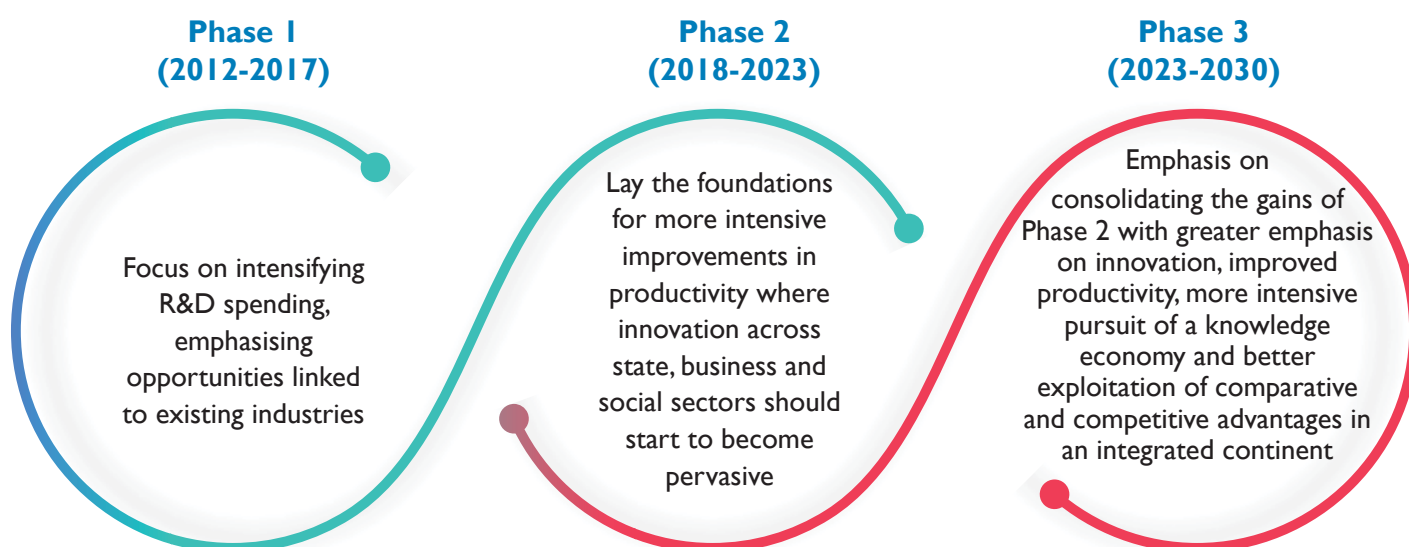


Figure 1: The phases of STI application and uptake as proposed in the NDP

(b) National Development Plan

The NDP, adopted in 2012, proposes a multidimensional framework to bring about a virtuous cycle of development with progress in one area supporting advances in others. It recognises the role of STI in accelerating economic transformation in South Africa and improving the country's global competitiveness. The NSI is the principal tool for creating new knowledge, applying knowledge in production processes, and disseminating knowledge through teaching and research collaboration. Acknowledging that economic development occurs over time and that innovation-influenced growth is realised through the incremental achievement of certain policy imperatives, the NDP chapter on "Economy and Employment" proposed entrenching the contribution of STI to economic growth in phases. These phases and the anticipated outcomes are summarised below:

The NDP also acknowledges the contribution of science, technology and innovation in achieving various social development priorities, including health, education, sustainable human settlements, environmental management, transport, etc. The NDP is clear that advances in technological innovation and the production of new knowledge are critical to growth and development, and achieving a competitive and sustainable economy will require a strong and effective national system of innovation, which must contribute to transformation.

(c) 2014-2019 Medium-Term Strategic Framework

Over the previous MTSF period of 2014 to 2019, the DSI directed the bulk of its investment to the following outcomes:

- Outcome 4: Decent employment through inclusive economic growth.
- Outcome 5: A skilled and capable workforce to support an inclusive growth path.
- Outcome 6: An efficient, competitive and responsive economic infrastructure network.
- Outcome 7: Vibrant, equitable, sustainable rural communities contributing towards food security for all.
- Outcome 10: Protect and enhance our environmental assets and natural resources.

The performance of the DSI against its 2014-2019 MTSF indicators is reflected in Table I below.

Outcome	Indicator	MTSF target	Performance	Comments
Outcome 4	% increase in the rand value of investment by government and the private sector in R&D partnerships	50% increase in the rand value of investment when compared to 2013	Not achieved	The actual extent of the impact of the partnerships over the MTSF has not been determined.
	% of all procurement of those products capable of being manufactured locally on a commercially feasible basis	75% procurement of those products capable of being manufactured locally on a commercially feasible basis by 31 March 2019	No data	No data is available.
	Improved efficiencies achieved through reduction turnaround time providing final decision to R&D tax income	Final decision of R&D tax incentive application provided within 90 days	Not achieved	Capacity constraints and initial backlog affected overall performance.
	Emerging/new industry sector and cross-cutting intervention towards growth, employment creation and higher income for the poor households under way	All emerging/new industry sector and cross-cutting interventions being implemented	Identification and evaluation of at least 5 candidate initiatives • Aeroswift • Fluorochemicals Expansion Initiative • Titanium • Hydrogen SA • Battery precursor materials • Mining RDI	The indicator did not adhere to the SMART principles, which made it difficult to measure progress over the MTSF.
Outcome 4	Institutional mechanism for the strategic management of public funding for research, development and innovation	Improved institutional arrangements in place	Introduction of a budget coordination mechanism approved by Cabinet in 2017	The Interministerial Committee on STI approved the governance instruments proposed in the STI Decadal Plan, i.e. the budget coordination mechanism, innovation compact and strategic management model. These will be incorporated into the government's budget and planning processes from the 2023/24 financial year. In the meantime, the DSI is finalising details of the implementation with the National Treasury, DPME and other relevant parties.
	GERD to GDP (high-level impact (or outcome) indicator)	1,5% by 2019	Not achieved	This was an impact target. GERD was at 0,69% of GDP in 2019/20.

Outcome	Indicator	MTSF target	Performance	Comments
Outcome 5	Total broadband capacity provided by the South African National Research Network (SANReN) per annum	3 500 Gbps total available broadband capacity provided by SANReN by 31 March 2019	Achieved	The indicators committed to under Outcome 5 were exactly the same as those in the 2015-2020 Strategic Plan. The targets were related purely to activities funded directly by the DSI with little (if any) external influence.
	Number of postgraduate students and postdoctoral fellows funded through the Department	27 411 master's students	Achieved	
		15 209 doctoral students	Achieved	
		3 682 postdoctoral fellows	Achieved	
	Number of infrastructure grants awarded	330 research infrastructure grants awarded to higher education institutions, science councils, national facilities of the NRF and museums by March 2019	Achieved	
	Number of ISI-accredited research articles published by National Research Foundation-funded researchers as reflected in the NRF project reports	33 700 ISI-accredited research articles published by NRF-funded researchers by 31 March 2019	Achieved	
	Total number of researchers awarded research grants through NRF-managed programmes as reflected in the NRF-project report	22 032 researchers awarded research grants through NRF-managed programmes as reflected in the NRF-project report by 31 March 2019	Achieved	
Outcome 6	Number of MeerKAT antennas installed	64 MeerKAT antennas installed by 31 March 2018	Achieved	None

Outcome	Indicator	MTSF target	Performance	Comments
Outcome 10	Functional climate change research network formalised through memorandum of understanding	Research report and MoU developed	Achieved	None
	Biennial reports to Cabinet on state of climate change science and technology	Two biennial reports approved by Cabinet by March 2019	Not achieved	The first report was approved in 2016. The second report was finalised in 2019 but not approved by Cabinet as the change in administration affected the Cabinet agenda.
	Rand value of public and private sector investment in research and development to support a green economy	300% increase in the rand value of investment in R&D made in 2011	Not achieved	Target was set with no baseline data and was unattainable owing to the scale of investment already directed to the green economy.

Table 1: 2014-2019 MTSF commitments and performance by 31 March 2019

(d) Alignment to the 2019-2024 Medium-Term Strategic Framework

The NDP, as the overarching government framework for the socio-economic transformation of South Africa, has been divided into five-year implementation plans, the second of which is the 2019-2024 MTSF. In supporting the economy and employment, the period 2018-2023 marks the second phase in the use of STI in laying the foundations for more intensive improvements in productivity, where innovation across state, business and social sectors start to become pervasive.

The 2019-2024 MTSF is premised on three pillars with seven associated priorities. Over the medium-term period, the DSI will pursue its STI mandate and contribute to the following national priorities as outlined in the 2019-2024 MTSF, reporting on the following apex priorities:

National Development Plan Pillars	2019-2024 MTSF Apex Priorities	Outcome	Intervention	Action/commitment
Pillar 1: Achieving a more capable State	Apex Priority 1: A capable, ethical and developmental state	No commitment	None	Leverage South Africa's political influence and science diplomacy to conceptualise and secure international funds through EU and AU research and innovation funding instruments.
				Enhance the evidence base and decision-support tools to support key government functions including planning, risk and vulnerability assessment, environmental management, etc.
				Enhance social science research for a capable, ethical, and developmental state, including continued updating of essential longitudinal data sets required for planning and implementation.
Pillar 2: Driving a strong and inclusive economy	Apex Priority 2: Economic transformation and job creation	Industrialisation, localisation and exports	Master plans developed for all national priority sectors by end 2021 – DSI supporting	The DSI participates in the master plans for the following: • Aerospace and defence. • Oceans Economy. • Forestry, agriculture and agroprocessing. • Cannabis, sugar industry, health economy. • Renewable energy and gas. • ICT and the digital economy. • Steel.
				Continue strengthening the Technology Stations Programme to provide technological support to firms, especially SMEs.
				Continue strengthening the Technology Localisation Implementation Initiative to strengthen the local technological capabilities of firms, to leverage public and general procurement and to increase the level of local production.
		Investing for accelerated inclusive growth	Skills Priority Plan developed by 2020 – led by DHET and supported by the DSI	The DSI will provide (i) high-end skills (master's and PhDs) requirements and (ii) intermediate skills requirements in support of RDI priorities and programmes identified in the STI Decadal Plan as inputs into the Skills Priority Plan.

National Development Plan Pillars	2019-2024 MTSF Apex Priorities	Outcome	Intervention	Action/commitment
Pillar 3: Building and strengthening the capabilities of South Africans		Improved quality and quantum of investment	Increase investment in GERD	Increase investment to advance GERD to 1,1% of gross domestic product.
		Increase investment in GERD	Produce an annual R&D survey	Produce an annual R&D survey to monitor investment in GERD and to support policy action.
			Produce an annual report on R&D tax incentives	Support efforts within government and industry aimed at increasing GERD to meet target of 1,1% of GDP by 2024 (budget coordination activities, IMC, continued support and capacitating R&D tax incentive).
	Apex Priority 3: Education, skills and health	Competitive and accessible markets	Commercialisation of publicly funded intellectual property	35 disclosures licensed for the first time received from publicly financed research and development institutions and recipients as reported to NIPMO.
		Expand access to post-school education and training (PSET) opportunities	Increased number of black lecturers supported through the New Generation of Academics Programme (nGAP)	12 200 PhD students awarded bursaries as reflected in the reports from the NRF and other relevant entities.
		Provide improved quality of post-school education and training		24 400 pipeline postgraduate students awarded bursaries through NRF and DSI-managed programmes as reflected in the NRF and DSI project reports.
				Proportion of university lecturers who hold doctoral degrees (gender, race, disability and age)
			Proportion of university lecturers who hold doctoral degrees	3 000 emerging researcher grants to improve percentage of PhD-qualified staff (gender, race, disability and age).
		A responsive post-school education and training system	Conduct intellectual property awareness sessions (IP Wise) at technical and vocational education and training (TVET) colleges	20 intellectual property awareness sessions at TVET colleges.
			Users from the education and research sector supported through the SANReN	1,3 million users (from the university and post-school sectors, national research facilities, science councils, and all public research-performing institutions) supported by SANReN by 31 March 2024.

Table 2: 2019-2024 MTSF DSI commitments and expected performance by 31 March 2024

(e) *Triple challenge of poverty, inequality and unemployment*

The April 2018 World Bank Systematic Country Diagnostics Report on South Africa asserts that, although South Africa has made significant progress since 1994, its economic transition from a system of exclusion under segregation remains incomplete. In the period from 1994 to 2018, poverty significantly declined, but the extent of inequality remained extremely high. Using different measures, South Africa consistently emerges as one of the most unequal countries in the world. In fact, in the period 1994 to 2006, inequality increased.

This is demonstrated by findings of widening wealth inequality, the labour market being split into two extremes, with a small number of people in highly paid jobs mainly in the formal sector, but most people getting by through often informal and far lower paying jobs. Income polarisation is distinguishable through the high concentration of low-income earners, very few high-income earners and small number of middle-income earners. Inequality of opportunity is also high and can be measured by the influence of race, parental education and occupation, and gender and locality of birth. It is arguable that certain policies introduced by the democratic government have exacerbated the extent of inequality. The World Bank further states that lack of skills is one of the key constraints to reducing poverty and inequality in South Africa.

South Africa's high unemployment rate remains its key challenge and the country's economy struggles to create sufficient employment opportunities. The results of the Statistics South Africa Quarterly Labour Force Survey (QLFS) for the third quarter of 2021 show that the number of employed persons decreased by 660 000 to 14,3 million in the third quarter of 2021. These changes resulted in the official unemployment rate increasing by 0,5 percentage points, from 34,4% in the second quarter of 2021 to 34,9% in the third quarter of 2021, the highest since the introduction of the QLFS in 2008. According to the expanded definition of unemployment, it increased by 2,2 percentage points to 46,6% in quarter 3 of 2021 compared to quarter 2 of 2021. The official unemployment rate increased in seven of nine provinces. (In KwaZulu-Natal and the Northern Cape it decreased by 3,8 percentage points and 3,2 percentage points, respectively.) The largest increases were recorded in Mpumalanga (up by 2,3 percentage points), followed by Limpopo (up by 2,1 percentage points), Gauteng and Free State (up by 1,6 percentage points each). The Eastern Cape recorded the lowest increase, with 0,3 of a percentage point.

Year-on-year, the official unemployment rate increased by 4,1 percentage points. The official unemployment rate increased in all nine provinces, with the largest increase recorded in Mpumalanga (up by 9,7 percentage points), followed by the North West (up by 7,4 percentage points), Limpopo (up by 6,2 percentage points) and the Western Cape (up by 4,7 percentage points). The Eastern Cape recorded the lowest increase (1,6 percentage points) in the official unemployment rate during the period.

Compared to quarter 3 of 2020, the percentage of young persons aged 15 to 34 years who were not in employment, education or training (NEET) increased by 3,0 percentage points from 43,0% to 46,0% (out of 20,5 million) in quarter 3 of 2021. The NEET rate for males increased by 2,5 percentage points, while for females the rate increased by 3,5 percentage points in quarter 3 of 2021. In both quarter 3 of 2020 and 2021, more than four in every 10 young men and women were not in employment, education or training.

DIRECT CONTRIBUTION		
Poverty	Inequality	Unemployment
Innovation-enabled local economic development Pilot three community-based agroprocessing plants that have the potential to catalyse systematic local development (e.g. traditional medicines, cosmeceuticals, nutraceuticals) by 2017 <i>Performance comment</i> – The Moringa agroprocessing plants in Tooseng (Limpopo) and Hammanskraal (Gauteng) have been completed. The Department, in partnership with the Agricultural Research Council, the University of Venda and the Limpopo Department of Agriculture, funded the development of a community-based agroprocessing facility for indigenous crops and Moringa at Makonde village, outside Thohoyandou. Products (capsules, soup, yoghurt, teas and vitamin water) are being processed and commercialised. Ensure that STI poverty-alleviation initiatives are demand-driven and informed by local economic development priorities and local comparative advantages <i>Performance comment</i> – Five honeybush co-operatives and agroprocessing facilities were assisted by the Department during the period under review. The co-operatives have 42 beneficiaries, more than 50% of whom are women. The Department also actively engaged the Department of Cooperative Governance and Traditional Affairs to ensure that the revised National Framework for Local Economic Development recognises and harnesses innovation. Mainstream applied indigenous knowledge-based R&D (traditional medicines, cosmeceuticals and nutraceuticals), including innovation and local manufacturing, to support commercialisation models for sustainable livelihoods	Transformation of the scientific workforce in terms of race and gender <i>Performance comment</i> – A modest Technology Stations Programme scale-up conducted in the last performance period (an investment of R33 million) was used to support new beneficiaries and broaden the geographical footprint. Innovations to enhance standard of living In partnership with the Department of Basic Education, leverage innovative technologies to improve access to and the quality of basic education for children with special needs, prioritising the visually or hearing impaired <i>Performance comment</i> – The Department funded the development and piloting of an ICT maturity assessment tool to guide provincial education departments in assessing readiness and prioritising schools for the deployment of ICTs. The initiative focused on children with special needs and provided an e-health solution that enables rapid and timely screening for disability and learning challenges. The Eastern Cape Department of Health adopted this solution to enhance the efficiency of its operations. In partnership with the Eastern Cape Department of Education, the Department of Water and Sanitation, and the Bill & Melinda Gates Foundation, provide innovative and appropriate off-grid sanitation technologies for rural and peri-urban areas <i>Performance comment</i> – Through the TECH4RED projects in the Eastern Cape and the North West, the Department was able to demonstrate innovative technology solutions that enabled access to basic services (mainly sanitation and energy) for mainly rural schools.	Economic growth • Help grow companies' turnover • Support small, medium and micro-enterprises (SMMEs) through technology localisation initiatives and the Technology Stations Programme • Help increase technological competitiveness through R&D partnerships at sector and firm-level • Grow new local industries through the Emerging Industries Action Plan <i>Performance comment</i> – Through the South African Sanitation Technology Programme (SASTEP), the Department enabled the recognition of innovative sanitation technologies as an emerging industry, which has been incorporated into the Industrial Policy Action Plan. This emerging industry has enabled at least two technology localisation opportunities. The lessons learnt from SASTEP were incorporated into South Africa's input on the new global standards on sanitation. The Department's investment in SASTEP also supported the new standard for non-sewerage (off-grid) sanitation, SABS 30500. This is an important development for the Presidential Sanitation Appropriate for Education (SAFE) initiative and the sanitation sector as a whole in South Africa. Initiatives to improve the technology-based competitiveness of the established primary economic sectors

DIRECT CONTRIBUTION		
Poverty	Inequality	Unemployment
<i>Performance comment</i> – The CSIR is the coordinating hub for the IK-based Nutraceuticals Platform. The Maggi Morogo Noodles product was developed in a partnership between the CSIR, the Agricultural Research Council, the Universities of Fort Hare and Venda, local communities and Nestlé. The products are now being sold in all South African retail stores. Clinical studies on an anti-wrinkle oil extract from an indigenous plant were completed, with the candidate product proving safe and effective in reducing human skin wrinkles after just two weeks.	Low-pour flushes sanitation technology-enabled access to decent sanitation services in selected schools of the Nciba circuit in the Eastern Cape, 800 low pour flush units were piloted in KwaZulu-Natal, the Eastern Cape, Mpumalanga and the Northern Cape. Evidence generated from the pilot projects was used in influencing sanitation policy. The revised policy is open, supports and is aligned to innovation. The low pour flush solution received a SAB Foundation social innovation award. Through the Bill & Melinda Gates Foundation partnership, the Caltech innovative sanitation unit is being piloted in eThekweni as a communal off-grid solution, key to providing decent sanitation services in informal settlements.	New R&D-led industry development initiatives, such as Hydrogen South Africa, the Fluorochemicals Expansion Initiative, the Titanium Beneficiation Initiative and the Advanced Manufacturing Technology Strategy <i>Performance comment</i> – The Department has provided funding and other support to five technology stations located at universities of technology. The technology stations provide support in the areas of electronics, chemicals, and advanced tooling at the Tshwane University of Technology) and, in metal casting, processing energy and the environment at the University of Johannesburg. Over the last three years, these stations have supported more than 1 766 SMEs.

INDIRECT CONTRIBUTION			
Poverty	Inequality	Unemployment	
Postgraduate bursaries <i>Performance comment</i> – by 31 March 2020, 13 859 PhD students had been awarded bursaries through NRF and DSI-managed programmes, and a total of 54 405 pipeline postgraduate students have received bursaries through NRF and DSI initiatives. South African Research Chairs Initiative <i>Performance comment</i> – by 31 March 2020, 238 research chairs had been awarded. In addition, five new communities of practice were established, in agriculture, health, biodiversity, marine research and economics. The communities of practice provide a platform for research chairs to stretch their focus beyond fundamental research, towards contributing to the formulation of evidence-based policy and translational research.	Targeted postgraduate bursaries (for black people and women) and funding to support young and emerging researchers <i>Performance comment</i> – The demographic targets for black (80%) and women (55%) students supported were exceeded at honours and master's level, but at a doctoral level more needs to be done to achieve equity in the distribution of bursaries, scholarships and fellowships. The Thuthuka Research Grant was established to provide support for emerging researchers in full-time, permanent or fixed-term contract appointments at public universities and research institutions. A total of 562 grant-holders were funded, 471 (84%) of which were black, 91 (16%) white and 359 (64%) women.	R&D infrastructure Manufacture (including assembly, integration and testing) and launch Earth observation satellite (EO-Sat I), in addition to the ZACube-2 satellite Manufacture and launch South Africa's first indigenous CubeSat constellation to provide automatic identification system services to Operation Phakisa (Oceans Economy) and Africa	

INDIRECT CONTRIBUTION		
Poverty	Inequality	Unemployment
Centres of excellence <i>Performance comment</i> – The centres of excellence continued to make an impact in health, social development, biodiversity and manufacturing. The Centre of Excellence in HIV Prevention, established at the University of KwaZulu-Natal, has contributed significantly to the generation of new knowledge in this critical health area and contributed to relevant international and national policies.	Using technology to identify and test the use of technology to improve service delivery and demonstrate better standards of living, such as the use of wireless mesh networks to bridge the digital divide <i>Performance comment</i> – The Innovation Partnership for Rural Development Programme demonstrated innovative water, sanitation and energy solutions that were able to provide access to these basic services for previously unserved rural communities. A new cooperative-based connectivity model has been developed and profiled internationally. The model positions cooperatives as connectivity providers and does not require complex infrastructure to execute. The model has the potential to positively disrupt the connectivity space in a manner that enables more actors and accelerates access for unserved communities. The Department is working with the contracted implementing agent and other partners to ensure that the model is financially viable and sustainable. A differentiated pricing structure (funded by the Department) is used by the Technology Stations Programme to help enable SMEs and potential entrepreneurs to access the services of the technology stations, which will aid in maturing their innovative ideas or technologies.	<i>Performance comment</i> – As part of spacecraft development efforts, ZACube-2 was launched into space on 27 December 2018. The primary objective of the project, is to demonstrate maritime domain awareness applications, specifically vessel tracking services in the South African Exclusive Economic Zone in support of Operation Phakisa (Oceans Economy). MeerKAT/Square Kilometre Array radio astronomy telescope <i>Performance comment</i> – The 64-antenna MeerKAT radio telescope was completed and commissioned for science operations. At the launch, a panorama obtained with the new telescope was unveiled. This revealed extraordinary detail in the region surrounding the supermassive black hole at the centre of the Milky Way, proving the MeerKAT to be one of the best scientific instruments in the world.

Table 3: A summary of the Department's contribution to the reduction of poverty, inequality and unemployment in 2015-2020

(f) *South African Economic Reconstruction and Recovery Plan*

In February 2020, the government committed to combatting government debt and decreasing public spending. However, given the government's need to respond to COVID-19 pandemic, this was not possible. South Africa's debt-to-GDP in 2020 amounted to approximately 69,45% of GDP and is projected to increase to 82,99% by 2026. According to a 2010 World Bank study, countries whose debt-to-GDP ratios exceeds 77% for extended periods experience slowed economic growth. Specifically, every percentage point above the 77% threshold costs countries 0,017 percentage points in economic growth. For emerging countries, every percentage point above 64 percent slows growth by up to 0,02 percentage points each year.

The South African Economic Reconstruction and Recovery Plan sets out a plan for the country's economy, which has over time worsened owing to sustained low levels of growth and investment for the past five years, averaging 1,5% per annum; revenue leakages which impacted negatively on resource mobilisation; and a series of downgrades by international credit ratings agencies, including for state-owned enterprises. These challenges are compounded by the increasing budget deficit, the rising stock of debt and the constraints the COVID-19 pandemic caused in the fiscal space. To break the stranglehold of these challenges, South Africa needs a plan that will help the country take advantage of the opportunities presented by the global economy, which has also been affected by the pandemic.

The latest estimates concerning economic growth outlook in South Africa vary, but all paint a grim picture. Former Finance Minister Tito Mboweni stated during his reviewed budget speech in June 2020 indicated that tax revenue is expected to fall by R300 billion and highlighted that government medium-term fiscal policy in 2021 budget will be framed on two policy objectives (i) *promoting economic recovery*; and (ii) *returning the public finances to a sustainable position* by focusing on the following:

- Extending temporary support in response to COVID-19.
- Narrowing the budget deficit and stabilising debt.
- Exercising continued restraint in non-interest expenditure growth while improving the composition of expenditure.

The July 2021 riots in KwaZulu-Natal and Gauteng have also affected the economy and GDP growth. The National Treasury presentation on the economic impact of the recent unrest to the Select Committee on Finance shows that the cost of the unrest exceeded R20 billion in KwaZulu-Natal alone, with the impact on national GDP estimated at R50 billion.

STI/RDI interventions have a paramount role to play in supporting economic growth and social development. Concerted efforts and long-term investment in research, development and innovation (RDI) in South Africa over the years could be leveraged to contribute to economic recovery in three areas, namely –

- to revitalise and modernise existing industries and/or sectors of the economy;
- to create new sources of growth (circular economy, digital economy and 4IR) and stimulates R&D-led industrial development;
- to support a capable and developmental state over the medium-term.

(g) SARS-CoV-2 pandemic

On 23 March 2020, the President declared a national disaster and announced measures to combat the spread of the coronavirus in South Africa, including the closure of South Africa's borders and restrictions on movement for all citizens to reduce the rate of infections. Having to balance the decision between a humanitarian crisis or an economic one, from 1 June 2020, the 6th administration introduced a five-level risk-adjusted strategy, where restrictions change according to threat level. Level 5 was a hard national lockdown, while Level 1 allows most commercial and social activity to resume with additional health and safety protocols in place.

The decision to implement strict social distancing measures and limit non-essential business has had a large impact on South Africa's economy. The lockdown forced a reduction in production and a slowdown in non-essential business, impacting household spending patterns. The global disruption to production and supply chains and the effect of uncertainty on the commercial environment and financial markets have also aggravated the negative impact on the economy.

The lockdown, coupled with a R500 billion (US\$26 billion) stimulus package to prepare the healthcare sector and protect jobs, resulted in a need for higher public spending, and exacerbated existing economic challenges, including government debt. To cover the stimulus package and other government deficits, South Africa had to tap into the international debt market, approaching the International Monetary Fund, the World Bank, the African Development Bank and the Brazil, Russia, India, China and South Africa (BRICS) partnership. Budget cuts were introduced across government and public entities, affecting the compensation budget and goods and services. Restrictions in international and domestic travel and other activities limited due to lockdown protocols, such as catering and venue hire, led to savings. The impact has been felt across sectors, particularly retail and hospitality, but heavy industries like construction, mining and manufacturing have also recorded productivity losses. Government continues to observe all the basic health protocols, and the national countrywide vaccine drive is under way.

4.2 Internal environmental analysis

In 1994, the democratic state inherited an ailing science and technology system, with challenges that included the financial consequences of the termination of apartheid technology missions (such as military dominance in the subcontinent and energy self-sufficiency) by the apartheid government between 1990 and 1994, as well as the strategic risks faced by the SADC from a human, economic and security perspective. Reflection on the contribution of science technology and innovation in the past 25 years is primarily on the basis of pronouncements in the National Development Plan of 2012 on the enabling nature of STI in accelerating development. Assessing the role of STI in South Africa's growth and development would be incomplete in the absence of a discussion on the Department tasked with advancing the STI agenda for and in South Africa.

(a) *White Paper on Science and Technology, 1996*

In 1996, the White Paper on Science and Technology was adopted, introducing the notion of an NSI. The intention was to improve the lives of all the country's people through science, technology and innovation. This would be achieved "through progressively increasing economic growth and enhanced participation in the economy" and "through the innovative and pervasive personal and social development of the nation's people. The White Paper was augmented in 2002 by the National Research and Development Strategy and the 2008-2018 Ten-Year Innovation Plan (TYIP). The

adoption of these new policy instruments for STI post-1994 was informed by the need to develop an STI system that responded to the needs of all South Africans under the democratic dispensation.

The Department of Science and Technology (now the Department of Science and Innovation), which had previously been a chief directorate in the Department of Arts, Culture, Science and Technology, was established in 2004. The period from 2005 to 2018 was marked by the introduction of a series of sectoral policies. These included the Bio-economy Strategy, the Advanced Manufacturing Technology Strategy, the Hydrogen and Fuel Cell Technologies Research, Development and Innovation Strategy, the Intellectual Property Rights from Publicly Financed Research and Development Act, and the establishment of new institutional players such as the Technology Innovation Agency and the National Advisory Council on Innovation (NACI).

These sectoral policies leveraged off the strengths of the national system of innovation, but also sought to create competitiveness and development in line with global technological advancements. At a macro level, the Department obtained Cabinet approval for the TYIP. The TYIP presented five grand challenges that the country sought to be addressed in the period 2008-2018, namely the bioeconomy (dubbed Farmer to Pharma at the time), Space Science and Technology, Energy Security, Global Change (including climate change), and Human and Social Sciences.

(b) Reviews of the existing science, technology and innovation policy mix

The continued evolution of STI policy was informed by ministerial reviews of the STI institutional landscape in 2010 and 2012, and the 2017 National Advisory Council on Innovation review of the 1996 White Paper. The review assessed performance against the vision, high-level goals and various specific initiatives set out at the time, such as policy formulation and resource allocation; regulatory policy; financing at performance level; human resource development and capacity building; and science and technology infrastructure. The review found that much improvement had been made but more needed to be done in certain areas. Key achievements and ongoing weaknesses between 1996 and 2016 are summarised below.

Key achievements	Prevailing weaknesses
New national department responsible for science established	Interdepartmental coordination leading to greater policy cohesion and the achievement of culture of innovation in government
New actors: NACI, NRF, TIA, SANSA and research facilities	Human resource development
Regulatory policy: Intellectual Property Rights from Publicly Funded Research and Development Act	Promotion of an information society
Incentives introduced: R&D tax incentive, Technology and Human Resources for Industry Programme, Support Programme for Industrial Innovation	Use of government incentives for innovation
Infrastructure: Square Kilometre Array, national facilities established/expanded	Transformation across the NSI

Figure 2: Key achievements and prevailing weakness at policy level determined by a review of the 1996 White Paper

The review of the 1996 White Paper also presented an analysis of the performance of the system measured through certain scientific outputs. This is set out in the table below.

Metric	1996	2016	Direction
Business expenditure on R&D: GERD (%)	41,5	47,1	↗
Basic research (%)	19,6	24,5	↗
Expenditure on R&D on engineering and technology (%)	41,7	25,8	↘
Expenditure on R&D on health (%)	6,9	17,3	↘
Expenditure R&D Social Science & Humanities (%)	13,8	14,8	↗
HEI STEM enrolment (%) (1996; 2014)	23,7	29,6	↗
Degrees awarded to Black students (1996; 2014)	38 383	145 831	↗
PhD graduates	630	1 576	↗
Foreign university students (%)	<1	8	↗
Foreign PhD graduates (%)	n/a	20	↗
FTE Researchers (excl. PhDs and postdoctoral fellows)	12 102	11 624	↘
Female researchers (%)	n/a	42,3	↗
GERD (2010 Rand)/FTE researcher (R'000)	844	1 848	↗
HEI researcher/PhD enrolment	1,4	1.0	↘
Black researchers, government sector (%)	<3	±55	↗
TVET enrolment	n/a	154 960	
Articles (Web of Science Core) 1995; 2015	3 233	12 251	↗
Articles, books, conference proceedings, fractional	2 351	9 679	↗
International co-authorship (%)	30	49	↗
Top 1% most highly cited 2003-2013	n/a	3	
ZA h index, Web of Science (1996-2000; 2006-2010)	162	192	_____
World share of publications (fractional); rank	0,38 (31)	0,44 (45)	↗
US Patent awards	105	144	↗
Patent Cooperation Treaty applications (WIPO)	390	442	↗
Trademark applications (ZA resident)	7 051	19 522	↗
Trademark applications (ZA abroad)	11	5 694	↗
Plant cultivars in force, world share %; rank	n/a	2710; 2;6;8	↘
High technology exports % of total exports	5	6	_____
Global Competitiveness Index; Basic requirements; Innovation	n/a	56; 89; 37	↘
Global Innovation Index	n/a	60	↘

Table 4: Performance of the system from 1996 to 2016

In 2016, the National Research Foundation commissioned the Centre for Research, on Evaluation, Science and Technology (CREST) to undertake a comprehensive assessment of the state of the South African research enterprise. The insights of the CREST study, published in 2019, are summarised below.

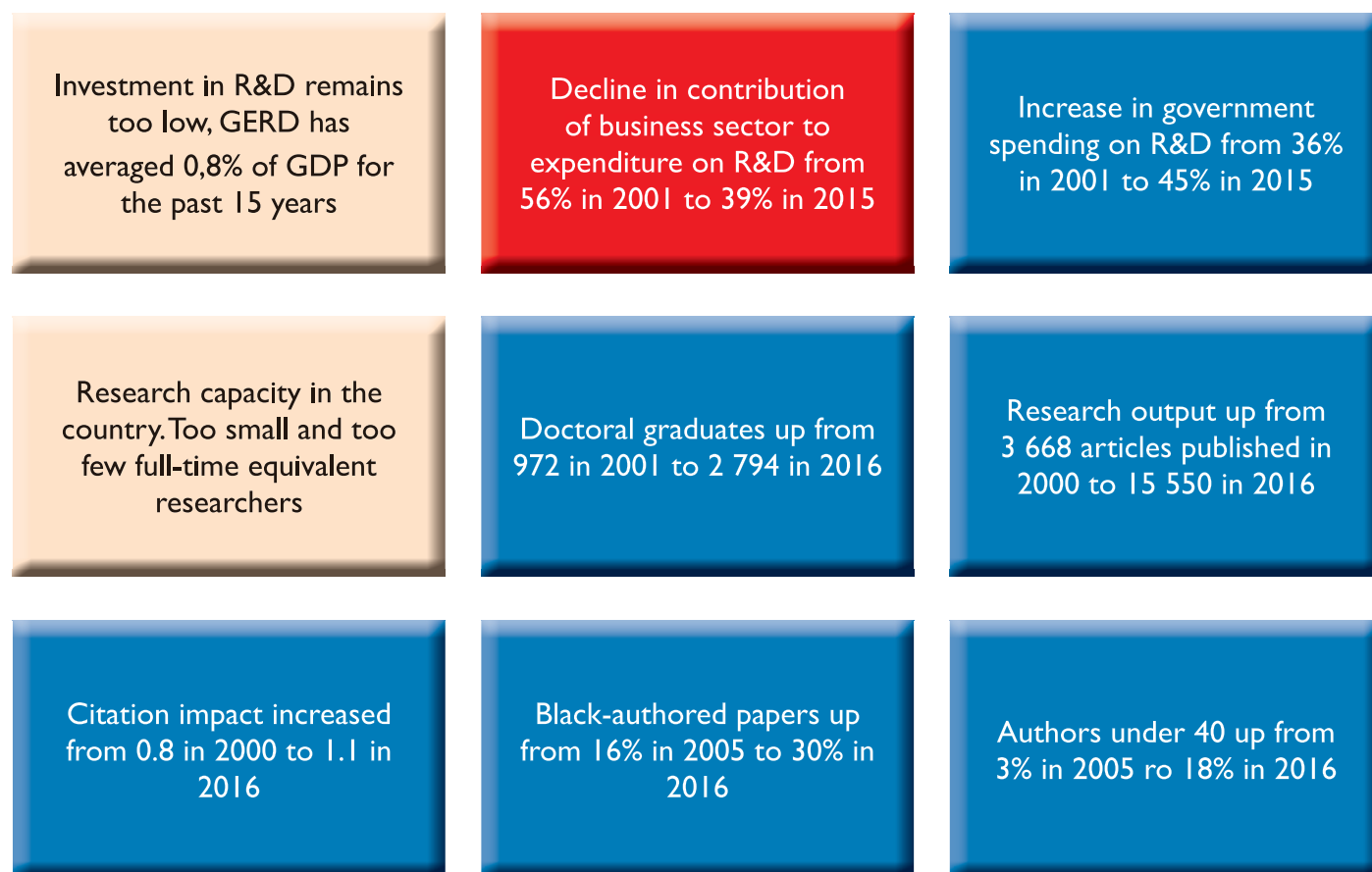


Figure 3: Summary of CREST study findings on the state of the South African research enterprise

The reviews of the 1996 White Paper and 2019 CREST publication both indicate that the national system of innovation is yet to realise its full potential. The NSI needs to be better coordinated to respond to national imperatives and increase its contribution to socio-economic transformation.

(c) White Paper on Science Technology and Innovation, 2019

The continued evolution in STI policy recently saw the adoption of a new White Paper on Science, Technology and Innovation and the 2021-2031 Science, Technology, and Innovation Decadal Plan in March 2019 and March 2021, respectively, to enhance the DSI's mandate, responsibilities and opportunities for STI in support of inclusive development in South Africa. The new era of STI policy is targeted at increasing the responsiveness of the NSI and its contribution to socio-economic imperatives and national priorities. It places greater emphasis on technology and innovation deployment, the use of innovation in support of a capable state and service delivery, inclusivity, transformation, partnerships to address policy coherence, the development of human capabilities, knowledge expansion, innovation performance and increased investment that will result in the economic, socio-political and intellectual benefits of STI being enjoyed by all South Africans.

The White Paper draws from what worked in the past and introduces a number of policy shifts, including the following:

- Increasing the focus on inclusivity, transformation and linkages in the national system of innovation (NSI).
- Enhancing the innovation culture in society and government.
- Improving policy coherence and budget coordination across government.

- Developing a more enabling environment for innovation.
- Developing local innovation systems.
- Supporting social and grassroots innovation.
- Expanding and transforming the research system.
- Developing human capabilities.
- Accelerating the implementation of the pan-African STI agenda.
- Increasing investment in the NSI.

(d) 2021-2031 Science, Technology and Innovation Decadal Plan

The new era of STI policy mix is targeted at increasing the responsiveness of the NSI and its contribution to socio-economic imperatives and national priorities. It places greater emphasis on technology and innovation deployment and the use of innovation in support of a capable state and service delivery improvement. The Department is currently developing an implementation plan for the 2019 White Paper on STI called the 2021-2031 Science, Technology and Innovation Decadal Plan, which is informed by various reviews, including the 2030 South Africa Foresight Exercise for Science, Technology and Innovation. The foresight study identified nine STI domains for particular focus, namely, (i) the circular economy, (ii) education for the future, (iii) sustainable energy, (iv) the future of society, (v) health innovation, (vi) high-tech industrialisation, (vii) ICTs and smart systems, (viii) nutrition security and (ix) water security. Other reviews that inform the Decadal Plan are the 2020 NACI reviews on the 2002 National Research and Development Strategy, the Ten-Year Innovation Plan (2008-2018), and the Higher Education, Science, Technology and Innovation Institutional Landscape Review. The strengths and weaknesses of the NSI and the efficacy of the existing policy mix were analysed to increase the NSI's contribution in achieving South Africa's national development agenda through the implementation of the policy intents of the 2019 White Paper on STI in a changing world.

For this aim to be realised, the Decadal Plan will address the implementation of intervention to meet the following goals for the national system of innovation:

- An inclusive and coherent NSI.
- An enabling innovation environment.
- Increased and transformed human capabilities.
- An expanded and transformed research system.
- Significantly increased funding for STI.

To realise the potential contribution of innovation to South Africa's socio-economic ambitions, the Decadal Plan prioritises a suite of systemic enablers such as (i) increased funding, (ii) joint programming and coordination, (iii) high-level and technical skills for the economy, (iv) transdisciplinary knowledge creation, (v) increased linkages between government and business, and (vi) improved monitoring and evaluation.

Over the medium term, the STI Decadal Plan intends to harness the pervasive and inclusive nature of innovation to respond to several White Paper policy imperatives, in particular policy intents aimed at supporting innovation in modernising and revitalising key strategic sectors of the South African economy (manufacturing through high-tech applications; agriculture through smart, digital and precision agriculture, agroprocessing and value additions including crop improvement in support of competitiveness; mining through new and emerging technological advances and mining value-chains). It will also focus on innovation in support of the energy and health sectors to harness and build

innovation capabilities within the NSI in support of a developmental, capable and entrepreneurial state, as well as exploiting emerging STI priorities presented by emerging innovation concepts of the circular and digital economy as new sources of economic growth. Moreover, the proposed STI priorities seek to provide RDI responses to several industry master plans aimed at supporting sector growth, investment, competitiveness, job creation and contributing to the country's GDP.

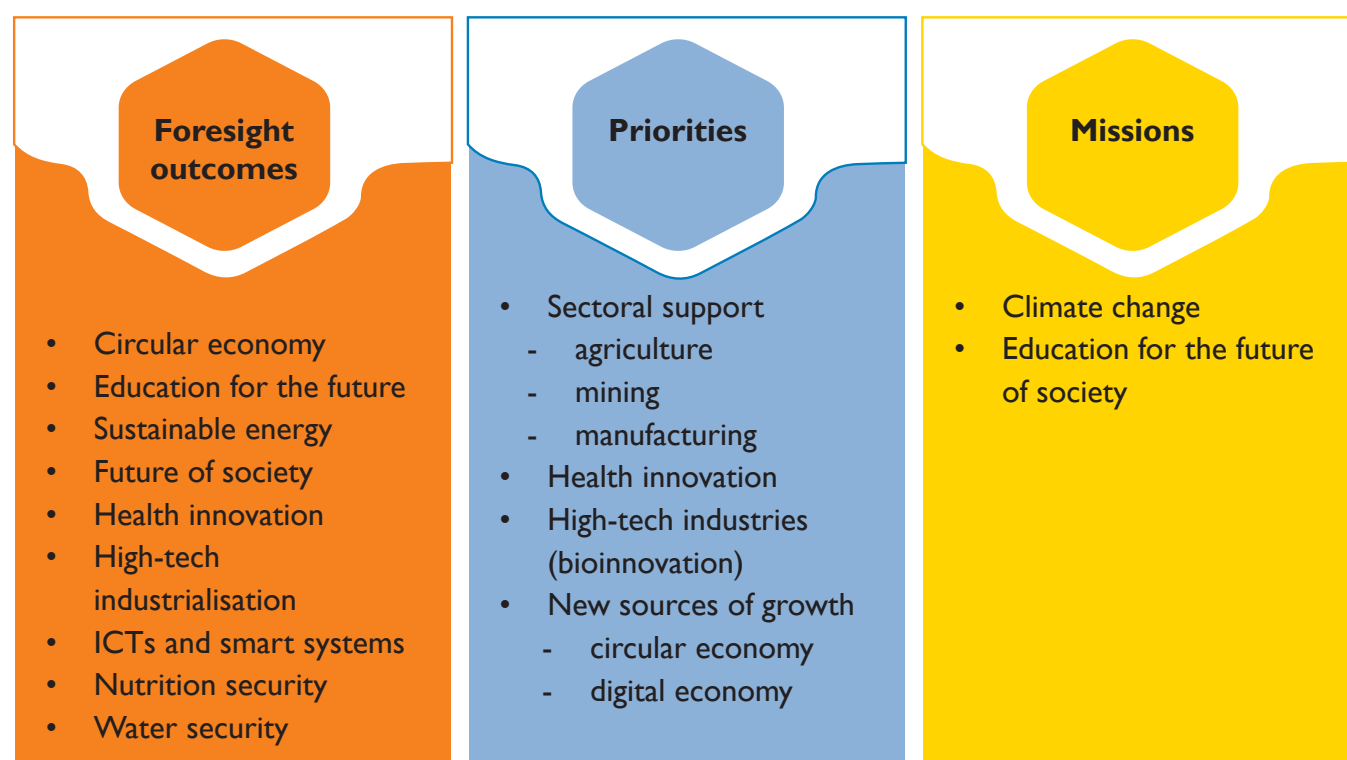


Figure 4: A conceptual framework linking Decadal Plan priorities with those in the STI foresight study

e) *The NSI and DSI response to the COVID-19 pandemic*

When the COVID-19 pandemic reached South Africa in March 2020, the DSI-funded South African Population Research Infrastructure Network (SAPRIN) illustrated the benefit of having a population platform in place to react quickly to the scientific and social challenges posed by this global threat. By the beginning of April 2020, SAPRIN had an approved COVID-19 surveillance protocol in place and, by mid-April, surveillance started in three of the SAPRIN Health and Demographic Surveillance System nodes. The surveillance contributed to the HSRC study of the social impact of non-pharmaceutical measures to contain the pandemic and SAPRIN published a joint analysis of the surveillance in the Agincourt (Bushbuckridge District, Mpumalanga), DIMAMO (Capricorn District, Limpopo) and AHRI (uMkhanyakude District, KwaZulu-Natal) nodes in May 2021. The COVID-19 surveillance infrastructure forms the basis for externally funded studies on the interaction between HIV, TB and COVID-19 and research into COVID-19 immune mechanisms in the presence of HIV and TB infections. The impact of COVID-19 on access to health care has also been explored. Studies on a household cohort embedded in the Agincourt node in collaboration with the National Institutes of Communicable Disease provided valuable insights into SARS-CoV-2 transmission dynamics. Key results from SAPRIN COVID-19 surveillance have been reported to government oversight and policymaking bodies, including the National Policy Data Observatory Anchor Institutions Platform, the DPME's Workstream on Research, Oversight and Monitoring of the COVID-19 Vaccination Programme, and the Director Generals' Technical Task Team on COVID-19 vaccines.

The DSI-funded South African Centre for Digital Language Resources (SADiLaR), in collaboration with the City of Tshwane and the Pan South African Language Board, created a specialised list of COVID-19 terminology. The City of Tshwane officially published the COVID-19 multilingual terminology list as an open source in July 2021. Being able to accurately convey information in all official languages ties in with South Africa's Constitution and the enabling role of research infrastructure.

A mobile application, known as AwezaMed, which works on any Android smartphone and features localised speech technology (speech recognition, machine translation and text-to-speech) developed by the SADiLaR CSIR Node, is aimed at bridging the language barrier in COVID-19 triage. It enables a healthcare provider to access a phrase in English, translate it into any of the official languages and play the phrase in the selected language. The content of the application was developed in collaboration with health experts and is aimed at supporting healthcare workers to communicate with patients at healthcare facilities, especially during COVID-19-related screening and triage.

The OpenStack Cloud hosted by the National Integrated Cyberinfrastructure System (NICIS) continues to provide services for important systems, including health systems and in support of the COVID-19 initiatives in the country. The OpenStack Cloud provides computational and data support to the national Department of Health (NDOH) for its dashboards, including much-needed data analysis for decision-making processes.

The NICIS OpenStack Cloud currently hosts the following projects:

- The NDOH Digital Electronic Vaccination Certificate system.
- CSIR support to NDOH CMORE deployment for COVID-19 household screening by community health workers using mobile devices in the field. The project was expanded to support all provinces.
- Projects collect movement data from telecommunication companies to identify COVID-19 hotspots for the NDOH using aggregated mobile locations.
- The geolocation of students' location off campus and network coverage profiles.

NICIS is also involved in the Data Science Research Group, which is tasked with developing a pharmacovigilance data analytics platform for the South African Health Products Regulatory Authority (SAHPRA) funded by Clinton Health Access Initiative. The aim of this project is to assist SAHPRA with monitoring the safety of the COVID-19 vaccines, which involves providing analytics and detecting safety signals using spontaneous reporting of adverse events following immunisation. The development of the dashboard for data visualisation is also one of the key deliverables in this project.

The Department's budget allocation for 2020/21 was revised downwards from R8 797 393 to R7 362 088. An amount of R324 175 million was redirected to COVID-19-related responses. The pandemic has been an opportune time for the South African science system to demonstrate its relevance and support of national priorities and South Africa's socio-economic imperatives. Entities such as the CSIR and the HSRC, as well as other platforms and programmes established or supported by the Department, have responded to the situation in a variety of ways, including the development of continuous positive airway pressure solutions under the guidance of the National Ventilator Project, the deployment of DSI-funded infrastructure to expand testing facilities, and the manufacturing of molecular biology enzymes, reagents and testing kits. The South African Radio Astronomy Observatory provided systems engineering and project management support for the design and manufacture of ventilators.

In managing the budget cuts, the Department attempted to absorb them internally as far as possible, in areas least likely to affect delivery on its mandate. The budget cuts have impacted the Department's plans in the following broad areas:

- Infrastructure (the Square Kilometre Array, the National Integrated Cyberinfrastructure System and the South African Research Infrastructure Roadmap).
- Human capital development programmes that support established researchers (the South African Research Chairs Initiative, the centres of excellence and research grants).
- Human capital in designated areas of advanced manufacturing, aerospace, chemicals, mining, ICTs and the Industry Innovation Programme, including the Sector Innovation Fund and the green economy.
- Science awareness initiatives.
- The generation of knowledge and innovation products.

The following interventions across the NSI are part of the employment stimulus:

- Health promotion agents (1 000 beneficiaries) to be implemented by the HSRC.
- Enviro Champs (300 beneficiaries) to be implemented by the Duzi Umngeni Conservation Trust.
- Water Graduate Employment Programme (450 beneficiaries) to be implemented by the Water Research Commission.
- Experiential learning programme (189 beneficiaries) to be implemented by the CSIR in partnership with the Southern African Society for Cooperative Education.

The Department introduced a new output performance indicator in 2020/21 financial year, "number of Presidential Youth Employment Initiative beneficiaries" with a target of 1 700 beneficiaries, and secured ring-fenced funding of R44,9 million from the employment stimulus fund. This was supplemented by savings to facilitate effective implementation of the programme and to exceed the target of 1 700.

(f) Organisational environment

Internally, the Department is organised into five budget programmes to deliver on its mandate and contribute to the 2019-2024 MTSF Apex Priorities, as well as the recently launched South African Economic Reconstruction and Recovery Plan, through six institutional outcomes with the associated 18 outcome indicators over the medium term.

The budget programmes are organised as follows:

- Programme 1: Administration.
- Programme 2: Technology Innovation.
- Programme 3: International Cooperation and Resources.
- Programme 4: Research Development and Support.
- Programme 5: Socio-economic Innovation Partnerships.

The DSI is supported in the execution of its mandate by the following entities, agencies/science and councils:

- The National Research Foundation.
- The Technology Innovation Agency.
- The South African National Space Agency.
- The Council for Scientific and Industrial Research.
- The Human Sciences Research Council.
- The National Advisory Council on Innovation.
- The Academy of Science of South Africa.
- The South African Council for Natural Scientific Professions.
- The National Intellectual Property Management Office.

The DSI is a national department with no concurrent functions. This allows for congruence in execution as its mandate is driven centrally by the Executive Authority and Accounting Officer with limited potential dilution of messaging and intent of objectives at the provincial and local government level. Science, technology and innovation are transversal issues that influence and define success in a broad range of sectors. Over the strategic plan period 2015-2020, the DSI implemented projects, programmes and initiatives that contributed to a variety of economic sectors such as agriculture, mining and minerals beneficiation, manufacturing, water and sanitation, energy, ICTs, and health.

The DSI is associated with excellence and high levels of performance. The Department's expenditure has been consistently above 90% since its inception. It was 98,4% for the 2020/21 financial year. For the third year running, the Auditor-General delivered an unqualified audit opinion without any findings (a clean audit) on the DSI's financial statements, while an Audit Committee report expressed satisfaction with the manner in which the Department had conducted its affairs. The DSI achieved 87%, or 40 out of 46, of its targets, with just six targets (13%) not achieved, demonstrating its commitment to service delivery. Furthermore, in October 2020, the DSI Accounting Officer received the Best Director-General of the Year Award from the Auditor-General of South Africa.

As on 31 January 2022, the DSI had a total staff establishment of 379 employees, with an overall vacancy rate of 24,65% of which 22,11% is at Senior Management Service level. As a result of the policy shift proposed in the new White Paper on STI, the Decadal Plan, the DSI is advancing a structural review of the current 2014 approved organisational structure over the medium term.

The DSI has embraced and excelled in exercising compliance oversight and consists of credible, stable and well-reputed entities and agencies that fall under its Ministry. The Department has also been diligent in appointing boards and councils to exercise fiduciary responsibility and governance over its entities. While not having a concurrent function is identified as a strength, it may also weaken the execution of the Department's mandate. The lack of a provincial and local government footprint means the DSI relies on staff at national level to identify and build the relations necessary to integrate STI into provincial and local government agendas.

The name of the Department was changed from the Department of Science and Technology to the Department of Science and Innovation through a notice in the *Government Gazette* in June 2019, and the Ministries of Higher Education and Training and Science and Innovation were merged, introducing some additional opportunities to review synergies in the mandates of the two departments and align complementary functions and operations.

MEASURING OUR PERFORMANCE

PART



1. Impact Statement

Impact statement	South Africa's sustainable and inclusive development enabled and enhanced through science, technology and innovation
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2. Measuring Outcomes

Achieving a more capable state				
NDP Pillar I	A capable, ethical and developmental state			
MTSF Apex Priority I				
Outcome:	Outcome indicators	Baseline	5-year target	
A transformed, inclusive, responsive and coherent NSI Outcome Statement: <i>Expand, transform and enhance the responsiveness of the NSI</i>	Outcome Indicator 1: Number of formalised partnerships between different category actors of the NSI that advance Decadal Plan priorities	New indicator	10	
	Outcome Indicator 2: Number of STI missions introduced and adopted by Cabinet to crowd in resources and capabilities across the NSI	New indicator	5 missions introduced and adopted by Cabinet to crowd in resources and capabilities across the NSI	
	Outcome Indicator 3: Percentage of STI investment support by government, domestic business, non-governmental sector and foreign/ international sources that advances GERD towards 1,1% of GDP	0.62%	1,1%	
	Outcome Indicator 4: Number of approved strategies that give effect to the agreed dimensions of transformation to be effected in the NSI	New indicator	3	
	Outcome Indicator 1: Number of demonstrators that have successfully introduced a new way of delivering a service	172	420	
Innovation in support of a capable and developmental state Outcome statement: <i>Increase the use of innovation as an enabler in the delivery of efficient services and access to government programmes</i>	Outcome indicator 2: Number of district/ metropolitan municipalities supported with technology-based applications as part of the District Development Model	New indicator	5	

Achieving a more capable state				
A capable, ethical and developmental state				
NDP Pillar 1	Outcome indicators	Baseline	5-year target	
MTSF Apex Priority 1 Outcome: Knowledge utilisation for inclusive development Outcome statement: <i>Expand the use of scientific knowledge (as evidence) in support of innovation for societal benefit and public good</i>	Outcome Indicator 1: Number of grassroots innovations whose commercialisation has been facilitated by the support/access of the multi-tiered support package provided by the DSI and its entities	100	180	
	Outcome Indicator 2: Number of grassroots innovators provided access to publicly financed IP (innovative solutions and/or patents, rights, and designs) by the DSI	New indicator	250	
Driving a strong and inclusive economy				
Economic transformation and job creation				
NDP Pillar 2	Outcome indicators	Baseline	5-year target	
MTSF Apex Priority 2 Outcome Increased knowledge generation and innovation output Outcome statement: <i>Increase the relative contribution of South African researchers to global scientific and innovation output</i>	Outcome Indicator 1: Percentage of South Africa's share of global publication output	0,88% of global publication output	1% of global publication output	
	Outcome Indicator 2: Percentage of prototypes, technology demonstrators and pilot plants that advance industrialisation through innovation	115	10%	
Knowledge utilisation for economic development – (a) in revitalising existing industries (b) in stimulating R&D-led industrial development	Outcome Indicator 1: Rand value of RDI investment attracted to support RDI needs identified through the sector masterplans process	New indicator	R 100 million	
	Outcome Indicator 2: Percentage investment in SMMEs/co-operatives/start-ups to secured new opportunities through support provided by the DSI and its entities	2 800	3%	
	Outcome indicator 3: Number of new commercialised disclosures from publicly financed research and development	New indicator	75	
	Outcome Indicator 4: New R&D-led industrial development opportunities initiated by the DSI	5	1	

NDP Pillar 3	Building and strengthening the capabilities of South Africans			
MTSF Apex Priority 3	Education, Skills and Health			
Outcome	Outcome indicators	Baseline	5-year target	
Human capabilities and skills for the economy and for development Outcome statement: Improve the representivity of high-end skills and increase the development of technical and vocational skills for the economy.	Outcome Indicator 1: Number of artisans and technicians absorbed into the economy in sectors where the DSI has active programmes	New indicator	60	
	Outcome Indicator 2: Percentage of women and black researchers in South Africa's research workforce	Women at 45,1% Blacks at 62,9%	Women at 49% Blacks at 67%	
	Outcome Indicator 3: Number of DSI funded PhDs graduating annually as a contribution to the NDP target of 100 PhDs/million population by 2030	1 000	4 700	
	Outcome Indicator 4: Percentage of PhD-qualified staff in higher education research and academic workforce	45%	60%	
	Outcome Indicator 5: Improved knowledge about science among the general public	35% of the sample of the South African population surveyed	50% of the sample of the South African population surveyed	

2.1 Explanation of planned performance over the five-year period

The Department has identified the following six outcomes for the period 2020-2025:

- Outcome 1: A transformed, inclusive, responsive and coherent National System of Innovation.
- Outcome 2: Human capabilities and skills for the economy and for development.
- Outcome 3: Increased knowledge generation and innovation output.
- Outcome 4: Knowledge utilisation for economic development in (a) revitalising existing industries and (b) stimulating R&D led industrial development.
- Outcome 5: Knowledge utilisation for inclusive development.
- Outcome 6: Innovation in support of a capable and developmental state.

The challenges of poverty, inequality and unemployment continue to plague South Africa. Drawing from the lessons learnt from the Department's performance in the period from 2012 to 2019 about how the national system of innovation can contribute to the realisation of national priorities, the 2019 White Paper on STI is positioned to respond to the triple challenge – bearing in mind that in many cases time will elapse between investment in STI and the realisation of the return on this investment. It is possible to act proactively and influence the landscape to benefit and/or protect society.

The White Paper has the following objectives:

- Improved coherence and coordination.
- Increased NSI partnering between business, academia, government and civil society.
- Strengthened and transformed NSI institutions.
- Increased human capabilities.
- Expanded research enterprise.
- Enhanced enabling environment for innovation.
- Improved funding across the NSI.
- Education and skills for the future.
- Nutrition for a healthy population.
- Harnessing the potential of ICTs.
- Health technologies to treat and prevent ill health.
- Sustainable energy technologies.
- Integrated solutions to water security.
- The circular economy.
- Improving exports through the high-technology sector.

These objectives are to be realised through ensuring full alignment with the NDP objectives, expanding on what has worked and building off the successes of the 1996 White Paper on Science and Technology, while, where necessary, proposing new approaches that take full advantage of the opportunities presented by megatrends and advance transformation ambitions and imperatives.

This revised 2020-2025 Strategic Plan aims to deliver in part on these broad objectives of the 2019 White Paper on STI and its policy thrust including the 2021-2031 STI Decadal Plan interventions by targeting impactful and transformative initiatives over the medium term. The six outcomes identified by the Department aim to leverage the strengths and broad contributions of all STI role players. The six outcomes of the strategic plan also support the three pillars of the NDP, namely, driving a strong and inclusive economy, building and strengthening capabilities of South Africans, and achieving a more capable state.

The impact statement that has been adopted is **“South Africa’s sustainable and inclusive development enabled and enhanced through science, technology and innovation”**. To provide an evidence base for the STI socio-technical developments that could accelerate the inclusive and sustainable socio-economic development for South Africa, a foresight study conducted by the National Advisory Council on Innovation (NACI) identified the following possible focus areas for South African STI system over the next decade:

Informed by the findings of the NACI foresight study concluded in 2019, the selection of areas that will inform the missions and priorities for the next 10 years will be detailed in a Decadal Plan. The overarching goal of the Decadal Plan is to increase the contribution of the NSI to the achievement of South Africa's national objectives, which the Department will measure through the outcomes identified. This will be done by enhancing innovation and experimentation and by accelerating the use of tried and tested approaches to successfully introduce innovation for transformative social and economic change.

The impact of science, technology and innovation is not realisable in the short term. Research and development are a long-term endeavour. Many of the successes claimed today as part of the DSI's performance have been many years in the making. The Square Kilometre Array (SKA) project, for example, originated in 2006/07, building on the KAT-7 engineering expertise. The Hydrogen and Fuel Cell Technologies RDI Strategy, on which the Hydrogen South Africa (HySA) programme (now entering the third phase of its implementation) is based, was approved in 2009. A new era of flagship programmes needs to be conceptualised and implemented based on the priorities and missions that will emerge as part of the Decadal Plan.

STI are important drivers of sustainable economic growth, economic competitiveness, socio-economic development and environmental sustainability. STI agenda setting, planning and budgeting should be integrated at the highest levels of government planning. To ensure policy certainty, and hence higher investment in the economy, the White Paper prioritises an innovation compact across government to ensure coherence in policy clusters related to STI and the economy, STI and social development, STI and education and skills, and STI and the environment. The intended long-term outcomes of the implementation of this coordinated planning approach would be a productive NSI contributing to economic growth and inclusivity, social development and environmental sustainability, and a capable and developmental state.

Most national government departments, as well as provincial and local administrations, have embraced the enabling nature of STI and are now embarking on developing sectoral innovation policies and initiatives. These are sometimes not grounded in the latest thinking and best practice on innovation policy. Activities are seldom coordinated or funded at critical mass. Neither is there a critical assessment of the relevance of the policy choices and their interface with other national strategies. In responding to its refined mandate on innovation, the Department will strive to foster and enable the entrenchment of an innovation culture across the state.

The DSI will introduce measures over the next five years to enable the Department to play a value-adding role by endorsing, advising, providing expertise and/or facilitating STI issues and STI elements in all departmental strategies. This role must be clearly defined in view of the lack of a clear leader and owner of innovation policy development in South African government in the past.

The relationship between the adopted outcomes and the challenges of inequality, poverty and unemployment is depicted below.

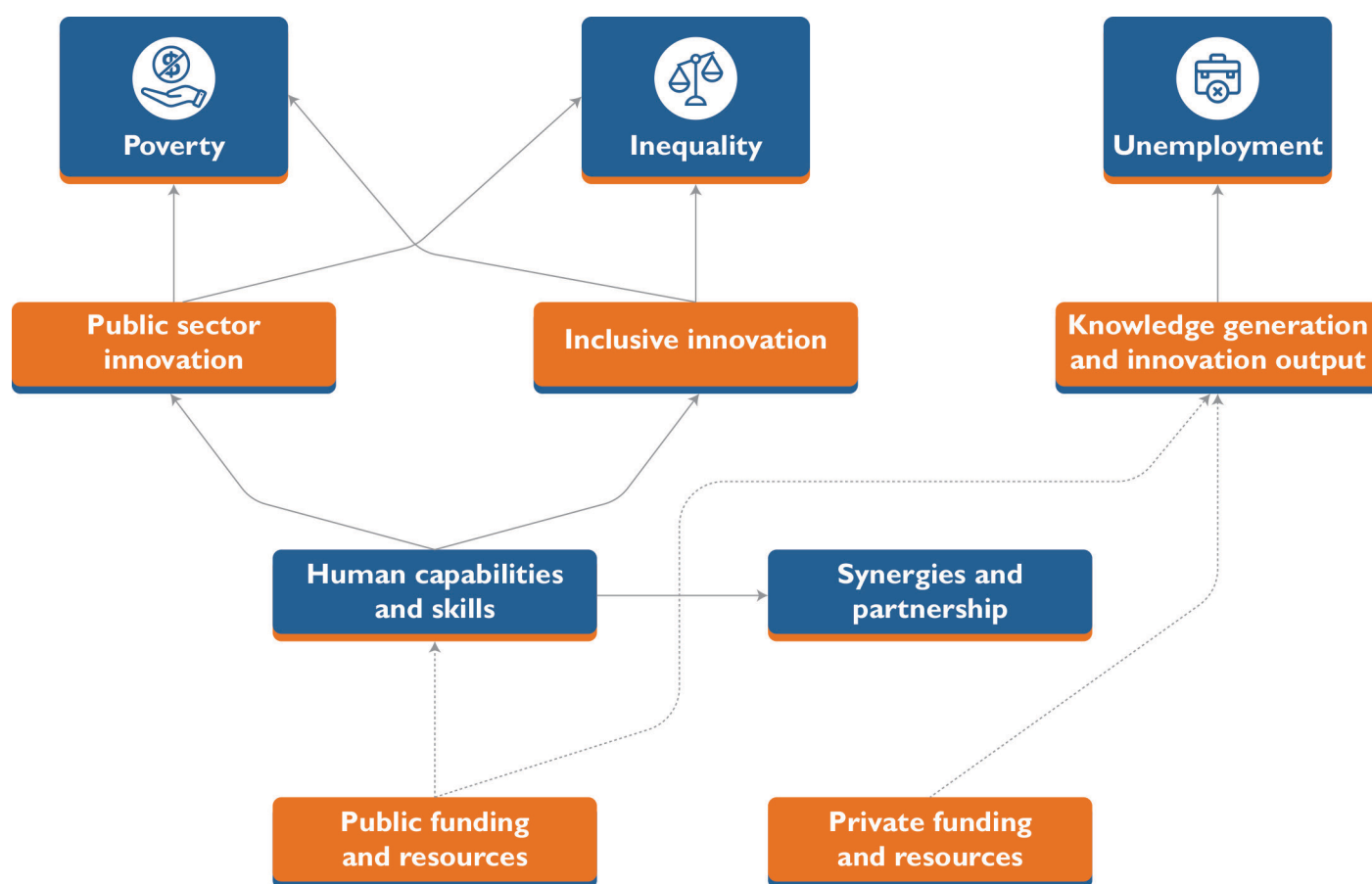


Figure 4: Connectedness between the Strategic

2.2 Key enablers

(a) Inclusivity and transformation

The 2019 White Paper on Science, Technology and Innovation has identified the lack of transformation in the national system of innovation as a challenge that needs to be addressed urgently. South Africa's discriminatory past did not spare the NSI and generated a range of inequalities and imbalances that need to be redressed. Current challenges and developments at global level have brought additional transformation imperatives to the fore.

Over the last 26 years, progress has been made in many aspects of transformation. However, this has been uneven and is a significant number of cases progress needs to be accelerated. Guided by the White Paper, the Department of Science and Innovation and its entities have defined a multi-dimensional transformation framework that will steer future planning and resource allocation.

The framework identifies the 10 key dimensions defined below:

- **Dimension 1:** Target investments to support current and future knowledge and technology producers to accelerate progress towards demographic representation in terms of race, gender and disability.
- **Dimension 2:** Ensure that prioritised groups are the major beneficiaries of the technology development, technology support, technology transfer, commercialisation and procurement efforts of the DSI and its entities.
- **Dimension 3:** Reverse spatial imbalances in the availability and quality of infrastructure and facilities that is used

to support knowledge production and exploitation.

- **Dimension 4:** Reverse the legacy of language inequalities in written, audio and visual material generated or supported by the DSI and its entities.
- **Dimension 5:** Strengthen research, development and innovation capabilities at historically disadvantaged universities and other institutions.
- **Dimension 6(a):** Enhance support for research and knowledge production efforts that were neglected as a result of South Africa's male-dominated racial and colonial past.
- **Dimension 6(b):** Enhance support for technology development efforts that reverse racial and gender biases in knowledge and technology, and focus on knowledge and technology that are likely to have a disproportionate benefit for priority groups such as women and people with disabilities.
- **Dimension 7:** Diversify the demographic profile of the leadership of the DSI and its entities as well as policy analysts, reviewers and experts that are used by the DSI and its entities to shape policy and practice in science, technology and innovation.
- **Dimension 8:** Ensure that international partnerships maximise the benefits of a multipolar world for South African science and technology.
- **Dimension 9:** Leverage cutting-edge digital technologies to strengthen planning, interaction and operations within the DSI and its entities.
- **Dimension 10:** Increasingly direct and coordinate partnerships and investments that support the transformation of the eight priority socio-technical systems under the Sustainable Development Goals.

While there have been pockets of racial and gender transformation in the NSI, the pace has been slow. According to the 2019/20 National Survey of Research and Experimental Development, the South African research workforce has remained stagnant over the past 10 years, at just over 34 000. White male researchers make up 41% of this number, while blacks share the remaining 46%, with Africans at 31%, coloured people at 6% and Indians at 9%). An emerging feature was the prominence of foreign researchers, contributing 12%.

Interventions such as the Thuthuka Programme have contributed to improving female representation, which has increased to 46%. Increased female representivity is expected to contribute beyond transforming the gender demographics, changing the type of new knowledge that is generated and the landscape.

Leveraging on the University Capacity Development Programme (UCDP), the DSI will implement the recommendations of the 2018 Study on Building a Cadre of Emerging Scholars for Higher Education in South Africa ("silent majority study"). The 2018 study sought to establish the proportion and demographics of academics at lecturer and senior lecturer levels/all levels of the permanent instruction staff at HEIs who are active researchers, as well as those who are not active researchers. In addition, the "silent majority" study had the following subsidiary objectives:

- To establish what the sector (HE) profile of lecturers and senior lecturers are in the system.
- To establish what proportion of lecturers and senior lecturers are actively publishing (one meaning of "research active").
- To establish what proportion of lecturers and senior lecturers are applying actively for funding (another meaning of "research active").
- To establish what proportion of lecturers and senior lecturers are actively publishing and applying for funding.

Support and expansion of the UCDP is aimed at increasing the percentage of senior lecturers and lecturers who have PhDs and are publishing. The emerging researcher segment of the human capital development pipeline continues to be under-funded compared to the next generation of researchers and established researchers' segments of the pipeline. Financial resources need to be reprioritised in this area and relevant recommendations from the "silent majority" study implemented. The Academy of Science of South Africa will need to assist in implementing some of the recommendations of the study.

The DSI will work with the DHET in the implementation of the Historically Disadvantaged Institutions Development Programme and intervention aimed at the holistic

development of historically disadvantaged institutions (HDIs) through the provisioning of student, staff and infrastructure development support. Through the DSI-DHET joint task team, the DSI and the NRF will align its instruments to those proposed in the HDI development grant. In addition to starting new tailor-made initiatives to support the HDIs, the DSI/NRF will ring-fence a certain quota of awards/grants for the HDIs. A key component of the HDI Development Programme is the USA-SA Higher Education Network, which operates in a triad including one HDI, one historically advantaged university and one USA university. The primary purpose of the initiative is to increase the percentage of PhD-qualified staff at HDIs. There are 101 university staff employed as the first cohort of beneficiaries in this programme, and the DSI and the NRF are currently aligning their PhD qualification attainment programmes to complement this initiative.

As part of the National Development Plan, it is important to broaden opportunities for all South Africans, but particularly for the historically marginalised groups of the population, namely, black people, women, youth, people with disabilities and people in rural areas. Support of the designated groups will be approached as part of the transformation framework to address the gaps across the DSI ecosystem and its entities. It is also key to broaden ownership and control of assets and means of capital accumulation. It is about broadening access to services of all forms, with reasonable pricing, and equity and inclusivity in life opportunities. This will mean attaining ownership, income distribution, and access to professions and skilled jobs.

The DSI will use the Department of Women, Children and People with Disabilities' 2019 Gender-Responsive Planning, Budgeting, Monitoring, Evaluation and Auditing Framework to guide its plans for the allocation of resources towards the marginalised and designated beneficiaries and to enhance the gender dividend in the NSI.

Broad-based economic and social development programmes of the Department include an explicit requirement to prioritise women beneficiaries. This

includes support provided by industry development centres at the CSIR, the Technology Stations Programme, the Technology Localisation Plan, the Grassroots Innovation Programme and various community-based rural economic development initiatives. The Department currently does not have comprehensive information on the profile of beneficiaries or the budgets supporting women beneficiaries. In line with new requirements in this regard, the DSI is in the process of collecting and consolidating the required information for inclusion in future annual performance plans.

In addition to the above, the DSI will continue to prioritise women in support programmes targeting researchers and innovators. Current empirical data show that women, youth and people with disabilities continue to be under-represented in the science and research system. Going forward, in collaboration with its entities, agencies and key stakeholders, the DSI will develop a comprehensive transformation framework for the system. The framework will, among other things, address inequities in gender, race, and spatial distribution. Currently, the Department mainstreams the issue of transformation through set quotas in its various instruments, such as bursary support and research grant holders.

The 2019/20 National Research and Experimental Development Survey shows that women constitute 46% of South Africa's research workforce, one of the highest among both developed and developing countries.

While the focus will be on improving this figure, there is also a pressing need to ensure that women occupy more strategic research and leadership positions in the science system. Current interventions have brought encouraging progress toward achieving equity upstream (i.e. postgraduate level), although there are still huge gaps downstream (established researchers and research leadership positions). To address the historic legacy of exclusion, the Department will strive to ensure that women's participation in its programmes is above the population demographic. The Department will ensure that women's participation data is also analysed by race to ensure that all race groups benefit equitably.

The Department's broad-based economic and social development programmes (including the Industry Development Centres at the CSIR, the Technology Stations Programme and the Grassroots Innovation Programme) have an explicit requirement to prioritise the youth. In addition, the DSI has put in place several initiatives where the primary beneficiary group is young people (including women). This includes the mLab initiative. Under the leadership of the Youth Employment Programme Management Office in the Presidency, the DSI is supporting the development of digital platforms to strengthen access by young people to technology services and support.

The science engagement-driven youth development initiative is meant to promote youth access to and participation in STEM and seeks to improve its reach to quintile 1 to 3 schools (non-fee-paying schools) so as to benefit more disadvantaged young people.

From the perspective of human capital development, and with particular reference to participation in science and engineering, people with disabilities remain largely under-represented. There are concerted efforts to prioritise full-cost-of-support (including assistive devices) in bursary funding targeted at people with disabilities. This will be carried through to support for researchers; and will form part of the long-term and comprehensive transformation strategy.

(b) Increased internationalisation

STI is a global enterprise. South Africa has a mature and diverse portfolio of international partnerships, which have significantly benefited South African science, technology and innovation in achieving the objectives of the National Research and Development Strategy as well as the Ten-Year Innovation Plan. Building on this foundation, the following relationships, among others, will be deepened and expanded over the strategic plan term:

- South Africa's political leadership role in various multilateral programmes, including those of the African Union and the Southern African Development Community, as well as the United Nations (related to the Sustainable Development Goals), to be leveraged as platform to leverage partnership opportunities for

the national system of innovation.

- South Africa's partnership with the European Union will continue through strengthened participation in its new research funding programme, Horizon Europe. Opportunities include areas aligned with key South African priorities, to support missions identified in the Decadal Plan.
- A select number of priority bilateral partnerships (including priority partners identified in Africa, Asia, the Americas and Europe) will see a smaller number of larger programmes supported in order to achieve greater impact and to minimise the transaction costs of cooperation.

Although South Africa's existing portfolio of international STI partnerships already includes a broad and diverse scope, new relationships will be promoted to better achieve the objectives of the White Paper and the Department. While these relationships will not be entirely new, they will be promoted in a more concerted and strategic manner, building on initial engagements undertaken over the years. They will include the following:

- Cooperation with international non-state actors, which play an increasingly important role in global STI – this will include partnerships with multinational companies and international philanthropy.
- A priority focus on South-South relationships, specifically within the context of the BRICS partnership, to complement the historic North-South orientation of South Africa's international relations, and to better align with South Africa's evolving portfolio of international political and economic relations.
- Comprehensive implementation of a departmental "Science Diplomacy Framework for Africa", which will see a significant increase in South African investment in bilateral and multilateral African partnership programmes, with co-investment by other African partners.

The Department's Science Diplomacy Framework for Africa will respond to the following strategic objectives: (i) Supporting the implementation of STI programmes of the African Union and SADC, as well as other relevant

multilateral initiatives; (ii) Contributing South African resources to bolster STI capacities in strategic African partner countries; (iii) Implementing joint research and innovation programmes with other African countries enabling a mutually beneficial sharing of experience expertise; and (iv) Accessing market opportunities for technology intensive products and services emanating from South Africa's national system of innovation.

The entry into force of the African Continental Free Trade Area in 2019 will significantly enhance the processes of economic and political integration in Africa, advanced through the African Union. This will have important implications for intra-African STI partnerships, and cooperation will not only play a crucial role in enhancing Africa's competitiveness in the global marketplace, but also act as instruments for integration in their own right, especially through people-to-people exchanges and infrastructure development. Despite these commitments to collaboration and solidarity, as embodied for example in the SADC's regional industrialisation programmes, South Africa will also have to respond to the opportunities and challenges associated with intra-African economic competition. These relate to access to markets for technology intensive products and services, for example, and to attract foreign investment. These dynamics will all unfold against the geopolitical backdrop of an increased interest in Africa from competing global powers and the welcome growth of vibrant innovation ecosystems across the continent.

The traditional focus of South Africa's international science, technology and innovation partnerships has been on research cooperation, chiefly involving public organisations, especially higher institutions. A stronger emphasis will be placed on innovation and commercialisation initiatives, inter alia by –

- including support for entrepreneurs and innovators in international mobility and training programmes;
- developing instruments, including some to be deployed by the Technology Innovation Agency, for innovation projects to be co-funded with international partners where there is a shared economic interest;
- assisting South African entrepreneurs and organisations to access international, especially

African markets, for technology products and services;

- enhancing dedicated interventions to increase the STI-orientated foreign investment secured by South African to align such investment better with national priorities as part of the overall effort by government to promote South Africa as preferred foreign investment destination.

(c) Partnerships

The need to increase both the range and number of strategic research, development, and innovation partnerships is a core feature of the 2019 White Paper on science, technology and innovation. The DSI will prioritise the following partnerships over the next five years:

- Building on successful innovation partnership instruments such as the Sector Innovation Funds, the Mandela Mining Precinct and the Wheat Breeding Platform, the DSI will continue to strengthen current and develop new innovation funding partnerships arrangements with different industrial sectors. This will be guided by the Sector Master Plan process led by the Department of Trade, Industry and Competition.
- In addition to working with different economic sectors, the DSI will continue to partner with individual companies, including state-owned enterprises.
- A flagship partnership that will mature over the 2020-2025 period is the World Economic Forum Affiliate Centre for the Fourth Industrial Revolution. The Affiliate Centre will be a multi-stakeholder partnership bringing together government, business and other key non-state actors to jointly assess technology governance challenges and to develop arrangements that can address the requirements of different stakeholders.
- A specific area of focus over the next five years is the development of partnerships with non-governmental organisations and other non-state actors. Over the last few years, the DSI has experimented with different partnership models and this will continue over the next five years.

- The DSI will continue to mature and strengthen partnerships with other national government departments, provincial departments and local governments.

Noting the need to advance innovation policy, the DSI will also continue to strengthen its participation in leading-edge innovation policy programmes including the Transformation Innovation Policy Consortium, the Mission-Oriented Innovation Network, and various policy programmes specifically looking at the interface between innovation policy and the Sustainable Development Goals.

Given the relatively low levels of PhD-qualified teaching and research staff in our universities (currently at 45%), and therefore limited research and supervisory capacity, the Department will reorient and position its international partnership networks towards enhancing doctoral and research training.

A strong partnership between the DSI, the Department of Basic Education (DBE) and provincial education departments is a catalyst for identifying and nurturing young talent that is required to build a STEM human capital pipeline, as well as advancing the goals of the DSI-led science engagement programme. The feasibility of an interdepartmental model for establishing and managing science centres will be tested over the next five-year period. The test case will be the Albertina Sisulu Science Centre in Cofimvaba, in the Eastern Cape, which is a partnership initiative involving the DSI, the Eastern Cape Department of Education, DBE and Intsika Yethu Local Municipality.

(d) An organisation that is enabled and efficient

(i) Human resources

The Department aims to optimise its organisational capacity by actively sourcing the best skills to support service delivery while investing in the development of its employees to maximise their productivity. Human Resources will focus on driving organisational change by ensuring the development of an agile workforce capable of adapting to new and automated workplace solutions. A strategic approach and redefined business partnering

will enhance effective human resource management that remains suitable and relevant to programmes while advancing organisational performance and efficiency, and ensuring effective change management interventions.

The Department will also embark on an organisational structure review to ensure alignment to the mandate from the National Development Plan, MTSF, and the White Paper on Science, Technology and Innovation. The organisational review process will require the DSI to change its current post establishment to ensure greater alignment with new requirements and priorities. Priority in the filling of vacant positions will be allocated to areas declared priorities in terms of the Decadal Plan. A new human resources development strategy will be adopted to ensure the alignment of development interventions to priority areas of the Department.

Employees are a critical resource for the Department, and various customised interventions will be implemented to ensure sound and capable human resources. These interventions will include providing employee and organisational wellness solutions as a strategy to manage health and wellness risks that may impact the Department's achievement of its strategic objectives. The DSI aims to ensure that employees experience a safe and conducive working environment and a culture that values the diversity of employees.

(ii) Knowledge management, data management and ICT systems

The Department has embarked on an enterprise architecture project based on the Government Wide Enterprise Architecture Framework. The process involves conducting a gap analysis, which in turn informs the development of a roadmap towards the desired future state of the enterprise.

Some of the principles of enterprise architecture are to improve reuse, remove duplication, and ensure the interoperability and integration of systems. The aim is for all systems in the Department to be under one umbrella and interoperable.

One of the benefits of this will be that all users in the Department will be able to share systems and resources. The roadmap will also address the requirements of the White Paper on STI, the Decadal Plan and the National Development Plan. A key output of the enterprise architecture process will be a recommendation on how to implement data warehousing and data management, especially in the current era of big data and data analytics. The project will unfold in phases from year to year.

The Department approved a knowledge management strategy in April 2019, which is in line with the Department of Public Service and Administration Knowledge Management Framework. One of the key objectives is to ensure that institutional knowledge in the Department is well managed and preserved. The project involves knowledge warehousing via a knowledge/content management system and knowledge expert locators within the Department.

(iii) Finance

With the constrained fiscus and the slow growth of South Africa's economy, the Department's financial resources will have to be optimally allocated and used if the plans outlined in this strategy are to be achieved. The current budget allocation to various Programmes is based on a historic and incremental budgeting method. However, with priorities having changed due to the policy shift (new political administration and the new White Paper), this allocation method will change.

During the 2020-2025 Strategic Plan period, the Department will undertake a budget restructuring exercise within the MTEF allocated funds (and extrapolate to the two outer years) to ensure realignment with new priorities during the planning cycle. Guided by the 2021-2031 STI Decadal Plan approach of sectoral planning, a sectoral-based budgeting approach will be adopted. The Department will be required to review and assess the efficiency, effectiveness and relevance of its investments.

The sectoral-based budgeting approach will require DSI to change its current budget structure to align with the funding requirements of the new priorities. After the current planning cycle, funds will be reallocated to

higher priority areas in the next MTEF – areas that will have high impact on socio-economic growth. Existing initiatives or programmes that have a minimal impact and/or are no longer relevant will have to be scaled down or discontinued.

(iv) Branding and communication

The Department's Brand Positioning Strategy will provide a roadmap for guiding future communication, ensuring consistency in messaging, and growing the reputation of the Department and its entities both locally and internationally. The approach and framework will support the development of communication around themes covering the full spectrum of the Department's work.

Under the broad implementation framework, the Department will construct messages about what it is and what it makes possible for the country. Communication will ensure that the DSI contributes to national priorities, the NDP and service delivery in general. The Department will communicate the intents and aspirations of the 2019 White Paper, its implementation through the Decadal Plan, and the benefits of STI for various sector of our society, including the private sector, civil society, all spheres of government, and players in the national system of innovation, as well as international partnerships, with a focus on the pan-Africanist agenda.

2.3 Responding to the District Development Model

The District Development Model (DDM) provides an approach through which national and provincial departments allocate budgets that are geo-referenced to a particular District Municipality. This is an approach the 6th administration has adopted in order to foster a whole of government response to the development needs in a particular geographical area. This DDM approach seeks to solve the insular approach and lack of information sharing in government's development programmes, and to maximise the impact, coordination and alignment of resources to improve service delivery.

It is the view of the Department of Science and Innovation that the DDM provides an ideal opportunity for national,

provincial and local government to play a role in creating conditions and an environment for entrepreneurial and innovative districts through inclusive innovation, where innovation is happening within an innovative policy framework, and where the DDM discourse and the district development programmes are inclusive. In this way, the DDM provides a space for the implementation of the DSI's Decadal Plan to support economic construction and recovery.

The Decadal Plan initiatives that can support economic recovery and district economic regeneration through innovation include supporting existing sectors of the economy such as mining, tourism and agriculture through innovation, as well as Decadal Plan initiatives to support new sources of growth such as the circular economy. These interventions will be collectively implemented through the DSI's packaging model for DDM interventions at district level. Furthermore, the DSI will consider setting up appropriate institutional arrangements and mechanisms for the implementation of the Decadal Plan interventions in the districts. This will include establishing committees for mayors and/or premiers, the DDM Innovation Compact, the DDM Innovation Strategic Management Model, the DDM Innovation Fund, DDM Inclusive Innovation Programmes and the DDM Inclusive Innovation Council.

District Development Model Projects

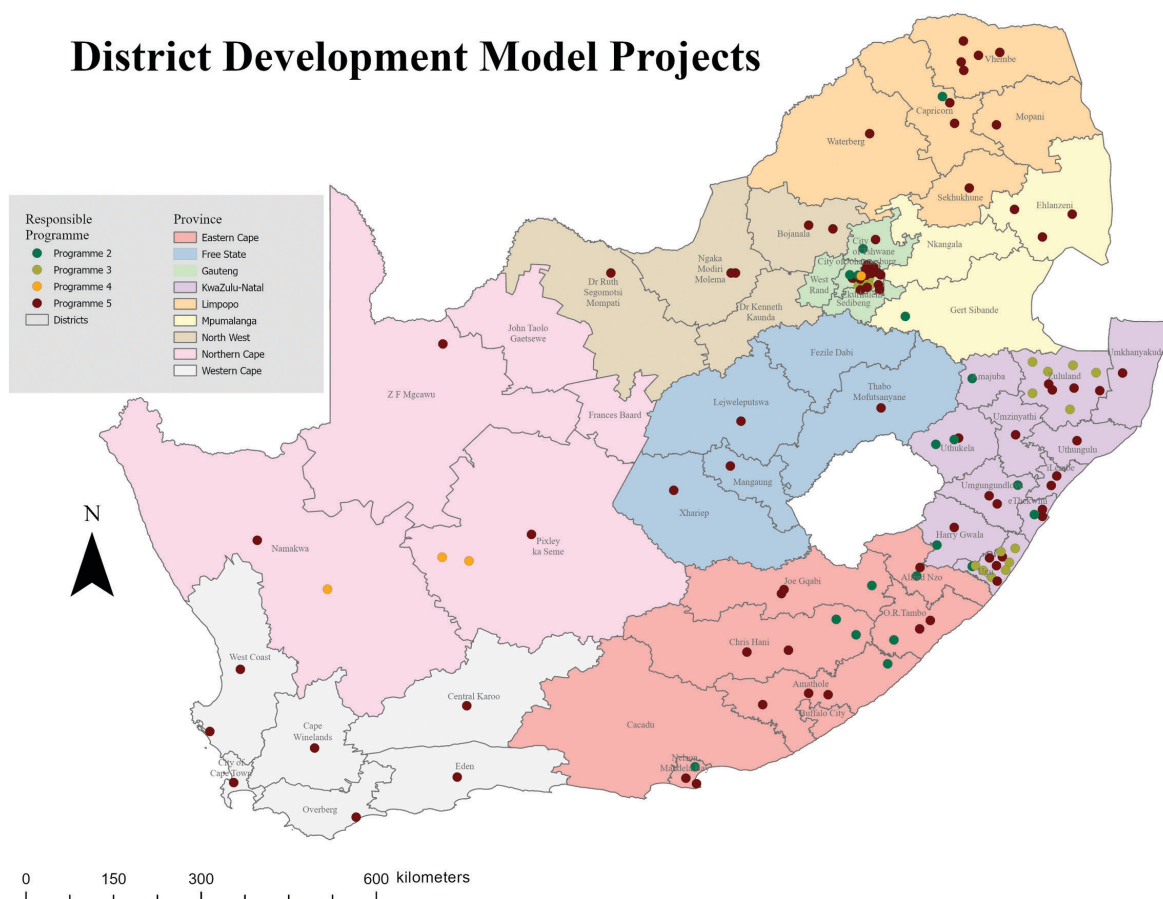


Figure 5: DDM Process I – Selection of initiatives that are high impact and most responsive to current district profiles

The Department will identify and prioritise interventions that are responsive to the municipal development profiles. These are projects with high socio-economic development impact responding to challenges facing the municipalities, e.g. unemployment, economic recovery and service delivery. The initiatives to be selected by the DSI to support districts will take into account the One Plan and five transformative outcomes as outlined in the DDM framework and guidelines, namely, (i) economic inclusion, (ii) spatial restructuring, (iii) infrastructure engineering, (iv) integrated service provisioning, and (v) governance and management. Departmental initiatives will be informed by the actual gaps, and

specific demographics and district information, including service delivery challenges in each municipality.

The DSI will identify 120 responsive DDM interventions which should align with key DSI strategic objectives, such as the STI White Paper policy intents, the DDM profiles and the DDM One Plan transformative outcomes. In this context, the DSI has set out an approach for the DDM not driven by a mere selection or listing of projects due to their geographic location, but guided by the philosophy that the DDM presents a platform for innovation to achieve inclusivity. This approach would be premised on the selection criteria, institutional arrangements, and coordinating structures within the Department and in entities reporting to the Minister of Higher Education, Science and Innovation to enable a holistic and an effective response by the Department and its entities to the District Development Model. Additional budget will be required to support the DSI's identified DDM implementation commitments and interventions, as some of these interventions are new and will be implemented for the first time at a district level.

The DSI DDM interventions will be chosen following the selection criteria outlined below:

- Initiatives that catalyse and advance the economic inclusion of youth through support to youth-owned enterprises and innovations, develop skills for employability, and enhance the engagement of youth as active citizens.
- Projects that are directly responsive to challenges such as crime, health, drought and climate change, including risk and vulnerability profiles.
- Projects that respond to challenges and/or promote the roll-out of innovative solutions to deliver services in municipalities.

The DSI will also pilot an enterprise project management office (EPMO) within the department to fast-track the implementation and coordination of DDM projects with municipalities. The EPMO pilot will ensure internal planning, coordination and reporting of DDM projects and programmes within the DSI. In the long run, EPMO will also entrench project coordination and management discipline, and build the Department's capacity to manage

using geographic information systems (GIS) and to track strategic benefits and the alignment of key DSI DDM initiatives with other sector department initiatives to avoid duplication and to maximise impact.

The DDM process will be implemented over the next five years by the DSI through a three-pronged strategy. This will involve the implementation of DDM initiatives in the following processes:

- **DDM Process 1:** This process involves the selection of initiatives that are high impact and most responsive to the current district profiles or development challenges of municipalities.
- **DDM Process 2:** This process will support the DDM by establishing a bottom-up process for the Viability and Validation of Innovations for Service Delivery Programme.
- **DDM Process 3:** This process is about positioning the DDM as a platform for inclusive innovation and for the implementation of the DSI's Decadal Plan initiatives.

(a) Selection of the district municipalities to be supported

There are 44 district municipalities and eight metropolitan municipalities in South Africa. It is acknowledged that the DSI DDM process will not prioritise programmes and projects across all the district and metropolitan municipalities due to financial constraints. However, the DDM interventions will be prioritised in district/metropolitan municipalities incrementally.

(b) Alignment of the identified DDM interventions with DSI strategic objectives and the Decadal Plan

The DSI's DDM approach addresses two of the six outcomes of its 2020-2025 Strategic Plan (Outcomes 5 and 6), as outlined below. The following strategic outcomes will be achieved through the interventions prioritised by the Department to support the district municipalities as outlined below.

Outcome 5: To achieve knowledge utilisation for inclusive development at a district level, it will be necessary

to create an environment in district municipalities that facilitates the use of innovation and knowledge to achieve inclusivity. This will require increased access to intellectual property arising from publicly funded research by youth entrepreneurs and SMMEs in support of economic development and competitiveness. Youth-owned technology businesses at a district level should be mentored in partnership with the private sector and appropriate innovation intermediary organisations. Youth entrepreneurs will be supported in scaling-up successfully demonstrated innovative technology solutions that can improve service delivery. Appropriate resources and innovation instruments will be made available in the DDM context.

In the context of the District Development Model, the DSI will prioritise the implementation of its youth innovation incentives programme designed to support youth enterprises and entrepreneurs, and innovation for local economic development. This will include the implementation of innovation for inclusivity programmes in partnership with industry stakeholders and other government departments in catalytic areas for inclusive development such as information communication technology, system-wide e-hailing applications, the 4th industrial revolution, special economic zones, circular and green economy technologies, and renewable energy technologies and mission-oriented initiatives such as the future of society, the future of work, and the future of education.

Innovations for Service Delivery Programme Projects

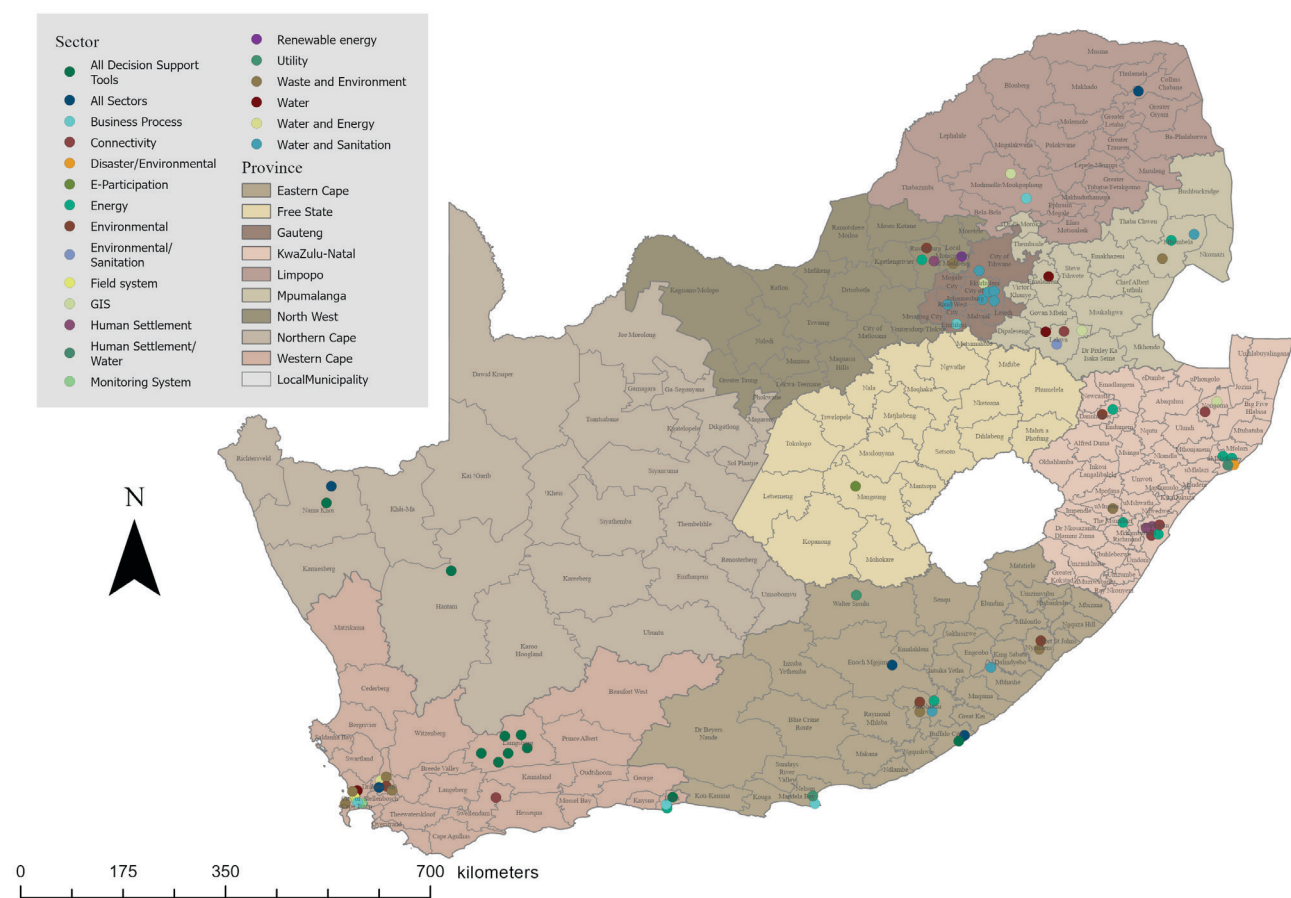


Figure 6: DDM Process 2 – Initiatives selected to support the DDM through a bottom-up process for the Viability and Validation of Innovations for Service Delivery Programme

Through the Regional Innovation Support Programme (RISP), the DSI will support the District Development Model through interventions to enable innovation ecosystems in support of innovation for inclusivity. The interventions to be selected to support the DDM will increase the spatial footprint of innovation in provinces to support district municipalities to enable innovation for socio-economic development. Therefore, the DSI will aim to understand provincial growth and development strategies, district development profiles, planned socio-economic infrastructure projects at a district level, and existing local economic development strategies and initiatives. The Department will then link innovation with these ongoing initiatives at a district level.

Outcome 6: According to the Decadal Plan, to use innovation to achieve a capable and developmental state, the public service has to be transformed into a digital enterprise. The initiatives to be supported and implemented in the next five years in district municipalities will require the adoption of decision-support tools, the digitalisation of municipal services in support of e-government and online services, the scaling up of online public services and the adoption of alternative technologies for basic service delivery. The Department has identified four outcome indicators to measure over the strategic plan horizon, namely, (i) increase in the number of use cases of decision-support systems; (ii) number of demonstrators that have successfully introduced a new way of delivering a service; (iii) number of districts/ metropolitan municipalities supported with technology-based applications as part of the District Development Model for service delivery improvement; and (iv) the evidence-informed integration of innovation in service delivery.

These outcome indicators will influence the identification and prioritisation of initiatives by the DSI to support the districts.

DSI's District Development Model Impact Areas

These are four areas of impact in which the departmental DDM interventions will create change and deliver meaningful transformation in people's lives, and encourage municipalities to adopt innovation to improve their performance. This will be achieved through the Innovation for Service Delivery Programme – a programme designed to support the demonstration of technologies addressing waste management, water and wastewater management, human settlement, sanitation, education, and energy provision. This programme will help municipalities to address and respond to climate change through innovation and use the same to realise SDG obligations. Other interventions to be supported will include circular economy interventions to enable the just transition to a low-carbon economy by districts. This will require the DSI to support municipalities through the District Development Model to create and implement circular economy and municipal waste management technology centres. The DSI will advance the implementation of DDM interventions that can make an impact in the following four DSI DDM impact areas:

Impact Area 1 **Life-changing opportunities**

- Skills development
- Training, innovation leadership skills
- Entrepreneurship support
- Digital skills
- Incentives and support for tech startups, innovation SMEs, cooperatives
- Support for unemployed youth, women
- Youth Innovation incentive scheme

Impact Area 2 **Economic Competitiveness and recovery**

- Local systems of innovation and production
- Circular economy
- Innovation for local economic development
- innovation support for existing economic sectors such as mining, agriculture, tourism and manufacturing
- Support for new sources of growth

Impact Area 3 **Access to basic services and infrastructure**

- Basic service delivery (water, energy, human settlements, education, waste management, health and sanitation)
- Innovation infrastructure
- Community innovation, science support centres
- Community broadband connectivity
- Research infrastructure
- Support for new sources of growth
- Smart cities, settlements, etc.

Impact Area 4 **Societal problems, challenges and decision support**

- Youth and drugs
- Environmental pollution and degradation
- Climate change and drought
- Safer cities and communities
- Social development
- Decision-support tools
- Policy research

3. Key Risks and Mitigations

Outcome	Risk description	Risk mitigation
A transformed, inclusive, responsive and coherent NSI	The DSI may be unable to effectively deliver on its responsibility to coordinate and steer the NSI.	- Establishment of a ministerial-level committee for Science, Technology and Innovation. - Establishment of the STI plenary. - Development of the Decadal Plan for STI. - Improve stakeholder engagements in support of the White Paper on STI.
	Loss of institutional memory.	- Implement the Knowledge Management Strategy. - Implement a record-keeping system that is in line with the relevant regulatory framework.
	Decline in the number as well as quality of engagements with international partners.	- Review and update focused engagement plans including leveraging additional resources (Europe, Africa, Asia, America and multilateral engagements). - Global awareness campaigns on the opportunities in the NSI that are available, including supporting attendance by South Africans at international STI events, using the Department's international networks to promote South Africa as a desirable destination for STI collaboration and technical and scoping visits to key partner countries and hosting of foreign delegations in SA.
	There may be a mismatch with respect to the funding, structure, systems and capacity for the Socio-economic Innovation Partnerships Programme.	- Identify and manage areas of uncertainty in relation to the responsibilities of the Programme in support of the outcome. - Use intelligence to develop options and scenarios to feed into departmental processes.
	Inadequate funding to meet the operational costs and strategic needs of the Department.	Implementation of the budget restructuring process.
Increased knowledge generation and innovation output	Possible decline in publicly funded research, development and innovation activities.	- Increase the number of partnerships with the private sector, non-governmental organisations, philanthropic foundations, and non-profit organisations and governments (local and international). - Solicit strategic infrastructure proposals and submit them to Programme 4 to evaluate and fund successful proposals. - Expand the NIPMO Incentive Scheme.
	There may be a mismatch with respect to the funding, structure, systems and capacity for the Socio-economic Innovation Partnerships Programme.	- Identify and manage areas of uncertainty in relation to the responsibilities of the Programme in support of the outcome. - Utilise intelligence to develop options and scenarios to feed into departmental processes.

Outcome	Risk description	Risk mitigation
Human capabilities and skills for the economy and for development	Inability to effectively contribute to human capital and research capacity development to support national imperatives and priorities.	- Develop and implement a framework to articulate the roles and responsibilities of the two departments (DHET and DSI) and relevant entities to effectively deliver on national imperatives. - Align strategic objectives and targets for the Programme in line with the STI Decadal plan.
Knowledge utilisation for economic development in revitalising existing industries and in stimulating R&D-led industrial development	The DSI may be unable to effectively deliver on its responsibility to coordinate and steer the NSI.	- Establishment of a ministerial-level committee for STI. - Establishment of the STI plenary. - Development of the Decadal Plan for STI. - Improve stakeholder engagements in support of the White Paper.
Knowledge utilisation for inclusive development	There may be a mismatch with respect to the funding, structure, systems and capacity for the Socio-economic Innovation Partnerships Programme.	- Identify and manage areas of uncertainty in relation to the responsibilities of the Programme in support of the outcome. - Utilise intelligence to develop options and scenarios to feed into departmental processes.
Innovation in support of a capable and developmental state	Spatial location and dispersion (no concurrent function but need to integrate innovation across three spheres of government).	District Development Model to improve the coherence and impact of government service delivery and development is seen as game changer in service delivery.
	Internal capacity within DSI to deliver on the new White Paper and Decadal Plan.	- Restructuring the organisation guided by White Paper objectives. - Re-skill staff where applicable.

4. Public Entities

Name of public entity	Mandate	Outcomes
National Research Foundation	To support, promote, and advance research and human capacity development through funding and the provision of the necessary research infrastructure, in order to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including humanities, social sciences and indigenous knowledge; develop, support and maintain national research facilities; support and promote public awareness of, and engagement with, science; and the development and maintenance of the national science system and support of government priorities	- A transformed, inclusive, responsive and coherent NSI. - Increased knowledge generation and innovation output. - Human capabilities and skills for the economy and for development. - An informed and fully engaged public on science and its benefits.

Name of public entity	Mandate	Outcomes
Council for Scientific and Industrial Research	To foster, in the national interest and in the fields which in its opinion should receive preference, industrial and scientific development, either by itself or in cooperation with principals from the public or private sector, and thereby to contribute to the improvement of the quality of life of the people of South Africa, and to perform any other functions that may be assigned to it by or under the Scientific Research Council Act.	• Knowledge utilisation for economic development (a) in revitalising existing industries and (b) in stimulating R&D-led industrial development. • Increased knowledge generation and innovation output. • Innovation in support of a capable and developmental state.
Technology Innovation Agency	To support the state in stimulating and intensifying technological innovation in order to improve economic growth and the quality of life of all South Africans by developing and exploring technological innovation.	• Knowledge utilisation for economic development (a) in revitalising existing industries and (b) in stimulating R&D-led industrial development. • Increased knowledge generation and innovation output. • Innovation in support of a capable and developmental state.
Human Sciences Research Council	To initiate, undertake, and foster strategic basic and applied research in the human sciences, and to gather, analyse and publish data relevant to developmental challenges in South Africa, elsewhere in Africa and in the rest of the world, especially by means of projects linked to public sector oriented collaborative programmes. To inform the effective formulation and monitoring of policy, and to evaluate the implementation of policy. To stimulate public debate through the effective dissemination of fact-based research results. To help build research capacity and infrastructure for the human sciences in South Africa and the rest of Africa. To foster and support research collaboration, networks and institutional linkages within the human sciences research community. To respond to the needs of vulnerable and marginalised groups in society by researching and analysing developmental problems, thereby contributing to the improvement of the quality of their lives. To develop and make publicly available new datasets to underpin research, policy development and public discussion of the key issues of development, and to develop new and improved methodologies for use in their development.	• Innovation in support of a capable and developmental state. • Increased knowledge generation and innovation output. • Knowledge utilisation for inclusive development.

Name of public entity	Mandate	Outcomes
Academy of Science of South Africa	To promote common ground in scientific thinking across all disciplines, including the physical, mathematical and life sciences, as well as the human, social and economic sciences. To encourage and promote innovative and independent scientific thinking. To promote the optimum development of the intellectual capacity of all people. To provide effective advice and facilitate appropriate action in relation to the collective needs, opportunities and challenges of all South Africans. To link South Africa with scientific communities of the highest levels, within the SADC, the rest of Africa and the rest of the world.	- Increased knowledge generation and innovation output. - Innovation in support of a capable and developmental state.
South African National Space Agency	To promote the peaceful use of space. To support the creation of an environment conducive to industrial development in space technology. To foster research in space science and technology, communications, navigation, and space physics. To advance scientific, engineering and technological competence and capabilities through human capital development outreach programmes and infrastructure development. To foster international cooperation in space-related activities.	- Increased knowledge generation and innovation output. - Innovation in support of a capable and developmental state. - Knowledge utilisation for economic development (a) <i>in revitalising existing industries</i> and (b) <i>in stimulating R&D-led industrial development</i>.
National Advisory Council	To advise the Minister for Science and Technology and, through the Minister, Cabinet, on the role and contribution of science, mathematics, innovation, and technology, including indigenous technologies, in promoting and achieving national objectives, namely, to improve and sustain the quality of life of all South Africans, develop human resources for science and technology, build the economy, and strengthen the country's competitiveness in the international arena.	- A transformed, inclusive, responsive and coherent NSI. - Innovation in support of a capable and developmental state.
South African Council for Natural and Scientific Professions	To administer the registration of professional, candidate, and certificated natural scientists, and related matters.	- A transformed, inclusive, responsive and coherent NSI. - Human capabilities and skills for the economy and for development.

TECHNICAL INDICATOR DESCRIPTIONS

PART

D

Title: Indicator I	Number of formalised partnerships between different category actors of the NSI that advance Decadal Plan priorities
Definition	The indicator seeks to measure the number of formal partnerships that advance the White Paper on STI and the STI Decadal Plan objectives and that involve different actors in the NSI. These actors could be higher education institutions, different government departments, private sector and business, civil society, and non-governmental organisations. A formalised partnership will be measured as one that is concluded by signature of an agreement by multiple parties.
Source of data	A submission and signed agreements.
Method of calculation/assessment	Count each concluded agreement approved by the Director-General or Minister.
Assumptions	The agreements will be concluded once off but may span multiple years.
Disaggregation of beneficiaries (where applicable)	Target for women: n/a
	Target for youth: n/a
	Target for people with disabilities: n/a
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	The agreements should strive to include as many different actors as possible.
Indicator responsibility	Institutional Planning and Support

Title: Indicator 2	Number of STI missions introduced and adopted by Cabinet over the next five years that crowd in resources and capabilities across the NSI
Definition	The indicator measures STI missions that are reliant on different NSI players for development and implementation. The directing of different actors' efforts and resources towards these missions will reflect the responsiveness and relevance of the NSI in responding to national priorities and challenges. The missions will be defined as per the Decadal Plan 2020.
Source of data	Cabinet memoranda and approved minutes.
Method of calculation/assessment	Count each mission approved.
Assumptions	The Decadal Plan will define the necessary missions. A separate process for developing implementation plans for the missions will be developed and submitted to Cabinet for approval. The Cabinet agenda will allow for timely approval.
Disaggregation of beneficiaries (where applicable)	Target for women: n/a
	Target for youth: n/a
	Target for people with disabilities: n/a
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	Approval of STI missions by Cabinet.
Indicator responsibility	Institutional Planning and Support

Title: Indicator 3	Percentage of STI investment support by government domestic business, non-governmental sector and foreign/international sources that advances GERD towards 1,1% of GDP
Definition	The indicator will measure the support by government, domestic business, non-governmental sector and foreign/international sources contribution towards GERD as a percentage of GDP.
Source of data	Annual National Survey on Research and Experimental Development
Method of calculation/assessment	Domestic business, non-governmental sector and foreign/international sources proportion of GERD as a percentage of GDP.
Assumptions	The National Survey on Research and Experimental Development will be conducted annually with a one-year lag of data series.
Disaggregation of beneficiaries (where applicable)	Target for women: n/a
	Target for youth: n/a
	Target for people with disabilities: n/a
Spatial transformation (where applicable)	Yes, provincial data will form part of analysis.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	High performance is desired.
Indicator responsibility	Socio-economic Innovation Partnerships

Title: Indicator 4	Number of approved strategies that give effect to the agreed dimensions of transformation to be effected in the NSI
Definition	The indicator will measure the extent to which a concerted effort is being driven by the DSI to accelerate transformation efforts directed by the agreed 10 key dimensions of transformation.
Source of data	Database of guidelines/frameworks approved by the Minister that advance transformation in the form of a basic spreadsheet (to be developed by the end of December 2022).
Method of calculation/assessment	Number of guidelines/frameworks approved by the Minister.
Assumptions	An NSI-wide transformation framework will be developed and adopted and will inform the various guidelines to be developed on the agreed dimensions.
Disaggregation of beneficiaries (where applicable)	Target for women: Some of the proposed dimensions will accommodate this group.
	Target for youth: Some of the proposed dimensions will accommodate this group.
	Target for people with disabilities: Some of the proposed dimensions will accommodate this group.
Spatial transformation (where applicable)	Transformation efforts will include spatial transformation.
Desired performance	Higher performance towards targeted groups.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Indicator responsibility	Institutional Planning and Support; Technology Innovation; Socio-economic Innovation Partnerships; Research Development and Support; International Cooperation and Resources.

Title: Indicator 5	Number of demonstrators that have successfully introduced a new way of delivering a service
Definition	Demonstrator – experimental deployment for purposes of assessing whether an innovation or technology can work in practice. Delivery of a service will be measured by the percentage increase in number of units delivered to enable access to basic services.
Source of data	Reports
Method of calculation/assessment	Number of demonstrator projects. Number of knowledge products/policy briefs. Change in service delivery practice.
Assumptions	Adequate technology solutions available for demonstration in line with district socio-economic profiles, governance and spatial transformation priorities.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	Yes, at provincial and district levels. Database will enable DSI to assess how demonstrators are being implemented in line with service delivery and development imperatives and in support of the DDM.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	High performance is desired.
Indicator responsibility	Socio-economic Innovation Partnerships

Title: Indicator 6	Number of district/metropolitan municipalities supported with technology-based applications as part of the District Development Model for Service Delivery Improvement
Definition	The district and metropolitan municipalities counted are the 44 district and 8 metropolitan municipalities managed by the Department of Cooperative Governance and Traditional Affairs as part of the DDM. The DDM was adopted in 2019 to enable the production of a spatially referenced integrated single government plan (as an intergovernmental compact) for the 52 municipal spaces, and will therefore guide and direct all strategic investment spending and project delivery across government, as well as forming the basis for accountability.
Source of data	• Number of municipalities connected to web portals and Earth Observation Data Centre. • Enterprise Programme Management Office administrative systems and processes (under development). • District Development Model progress reports. • Geo-referenced DSI DDM project database.
Method of calculation/assessment	• Number of municipalities using Earth observation decision-support tools. • Extract from the Enterprise Project Management Office administrative system. • DSI participation in District Development Model engagements.
Assumptions	Municipalities have infrastructure to access Earth observation applications and products.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	• Rural municipalities. • Extracts from the EPMO administrative system will enable an assessment of initiatives across the 44 district and 8 metropolitan municipalities.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	Municipalities have accessed and use decision-support tools.
Indicator responsibility	Socio-economic Innovation Partnerships

Title: Indicator 7	Number of grassroots innovators provided access to publicly financed IP (innovative solutions and/or patents, rights, and designs) by the DSI
Definition	Publicly financed intellectual property (IP) is IP that arises from publicly financed research and development (innovative solutions and/or patents, rights, and designs).
Source of data	Register of grassroots innovations receiving access of publicly funded IP (as part of the simple spreadsheet to be compiled and managed by the Chief Directorate: Innovation for Inclusive Development.
Method of calculation/assessment	Number of grassroots innovators provided access to publicly funded IP.
Assumptions	- Information on publicly financed IP is made available to grassroots innovators. - Mechanisms in place to enable conclusion of formal agreements between the grassroots innovators and relevant institutions
Disaggregation of beneficiaries (where applicable)	Target for women: 40%
	Target for youth: 80%
	Target for people with disabilities: 4%
Spatial transformation (where applicable)	Focus on district and metropolitan municipalities as part of the DDM (provincial and district).
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	Increased number of grassroots innovators accessing the multi-tiered support package to commercialise their offerings.
Indicator responsibility	Socio-economic Innovation Partnerships; Technology Innovation

Title: Indicator 8	Publicly financed intellectual property made available in support of grassroots innovators
Definition	Publicly financed intellectual property (IP) is IP that arises from publicly financed research and development.
Source of data	Register of grassroots innovations receiving access to publicly funded IP (as part of the simple spreadsheet to be compiled and managed by the Chief Directorate: Innovation for Inclusive Development).
Method of calculation/assessment	• Number of grassroots innovators benefiting from publicly funded IP. • Number of formal agreements between the grassroots innovator and the institution wherein the publicly financed IP resides.
Assumptions	• Information on publicly financed IP is made available to grassroots innovators. • Mechanisms in place to enable conclusion of formal agreements between the grassroots innovators and relevant institutions.
Disaggregation of beneficiaries (where applicable)	Target for women: 40%
	Target for youth: 80%
	Target for people with disabilities: 4%
Spatial transformation (where applicable)	Provincial and district or metropolitan municipality levels.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	Increasing number of grassroots innovators benefiting from publicly funded intellectual property to improve their innovation offerings.
Indicator responsibility	Socio-economic Innovation Partnerships; Technology Innovation

Title: Indicator 9	Increase South Africa's share (percentage) of global publication output
Definition	This indicator measures productivity of the country's research work force. Investments are made to promote and support research activities, leading to increased production of research outputs published in internationally recognised peer-reviewed and high-impact journals.
Source of data	Web of Science
Method of calculation/assessment	Simple count of outputs produced by South African researchers as a percentage of global outputs. Formula: $(\text{South African outputs} \div \text{global outputs}) \times 100$
Assumptions	Publications include articles, books, book chapters and conference proceedings. Annually, the outputs counted are those published within a calendar year.
Disaggregation of beneficiaries (where applicable)	Target for women: 40% of SA publications
	Target for youth: 10% of SA publications
	Target for people with disabilities: 2% of SA publications
Spatial transformation (where applicable)	Increased publication output from the historically disadvantaged institutions.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	An annual increase of at least 0,025 percentage points over the five-year period is desired.
Indicator responsibility	Research Development and Support; International Cooperation and Resources

Title: Indicator 10	Percentage of prototypes, technology demonstrators and pilot plants that advance industrialisation through innovation
Definition	Percentage increase as compared to a baseline in prototypes, pilot plants, technology demonstrators and pre-commercial products, processes or services developed over the period 2020-2025.
Source of data	• Baseline data. • Signed contracts. • Signed reports or signed summary reports from implementing agencies as appropriate, with the number and names of knowledge application products funded during the period. • Approved submission and payment stubs.
Method of calculation/assessment	Baseline to be established based on the total number of prototypes, technology demonstrators, and pilot plants funded through a DSI contract or through Parliamentary grants made available. From this, the percentage increase will be calculated. For 2020-25, the baseline is 115 prototypes, technology demonstrators and pilot plants by the end of March 2020.
Assumptions	In instances where a prototype, technology demonstrator or pilot plant is funded by both contract funding and a Parliamentary grant, this will only be counted once. Business process mapping for updating the register will make provision for this.
Disaggregation of beneficiaries (where applicable)	Target for women: n/a
	Target for youth: n/a
	Target for people with disabilities: n/a
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term Review in 2022/23 after Q2.
Desired performance	High performance is desired.
Indicator responsibility	Technology Innovation; Socio-economic Innovation Partnerships

Title: Indicator I I	Rand value of RDI investment attracted to support RDI needs to be identified through the sector masterplans process
Definition	Sector masterplans are the masterplans developed as part of the process led by the Department of Trade, Industry and Competition reimagining South Africa's industrialisation.
Source of data	Sector masterplan RDI interventions register in the form of a basic spreadsheet (to be developed by the end of March 2021) administered and managed by the Chief Directorate: Technology Localisation, Beneficiation and Advanced Manufacturing.
Method of calculation/assessment	Total rand value leveraged for RDI activities in support of masterplans that the DSI contributes to.
Assumptions	Each masterplan document will be clear on what constitutes an RDI intervention.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	Masterplans should include a strong spatial transformation footprint focusing on rural and township economies. The RDI activities should ideally occur in close proximity to the Master Plans hubs and as part of special economic zones.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	High performance in leveraging funds in support of RDI.
Indicator responsibility	Socio-economic Innovation Partnerships; Technology Innovation; International Cooperation and Resources

Title: Indicator 12	Percentage investment in SMMEs/co-operatives/ start-ups to secured new opportunities through support provided by the DSI and its entities
Definition	The indicator refers to SMMEs (including potential entrepreneurs and co-ops) that are supported through research, development and innovation initiatives to improve their product quality, scale-up and market access. The indicator also refers to research, development and innovation projects that support women and youth working for SMMEs/co-ops, with value-addition, product development, infrastructure, equipment and entrepreneurship skills. The assistance can also come in the form of non-technical assistance such as advice on policy, organising meetings with key stakeholders and advocacy work that will lead to funding opportunities from other sources outside the DSI. For instance, funding was leveraged by the DSI for SolarTurtle. DSI officials attended the meetings where the bid for funding were made, but SolarTurtle received funds direct from the European Union.
Source of data	• Baseline data. • Signed contracts. • Signed reports or signed summary report from implementing agency as appropriate with number and names of knowledge application products funded during the period. • Approved submission and payment stubs.
Method of calculation/ assessment	After the SMMEs were supported, were they able to get more improvement on products, processing facilities, entrepreneurship skills, business, or employ more people, or develop new products for the market. At the end of each year, calculate the number of beneficiaries registered and disaggregated by gender and age.
Assumptions	• That sustained funding to support new SMMEs creation, and existing ones will be available. • That when SMMEs are supported to secure a new business opportunity this may take time, as the development of the product may take time. The support could be in the form of organising meetings with key stakeholders across government, and meeting with the SMMEs to discuss key policy changes that they could take advantage of. The same SMME may be supported over multiple years.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	Some projects will involve land allocation to SMMEs for plant propagation, pilot facilities and agri-businesses. If possible, efforts should be made to focus on rural communities as well as the township economy.
Reporting cycle	Mid-term review in 2022/23 after Q2.
Desired performance	High performance in growth and increase in the number of technology-based SMMEs, sustainability of SMMEs/co-ops and increased share of beneficiaries from designated groups.
Indicator responsibility	Technology Innovation; Socio-economic Innovation Partnerships; International Cooperation and Resources

Title: Indicator 13	Number of new commercialised disclosures from publicly financed R&D
Definition	This indicator refers to the number of new commercialised disclosures emanating from publicly financed R&D received from recipients over the period 2020-2025.
Source of data	NIPMO knowledge information management database report as signed off by the Head: NIPMO
Method of calculation/assessment	Sum per year of all disclosures that indicate on the disclosure that they are either licensed (pre-revenue) or commercialised (with revenue). Disclosures will only be counted as once, at the time of being commercialised, irrespective of the number of individual licenses per disclosure.
Assumptions	Recipients reporting accurately and on-time
Disaggregation of beneficiaries (where applicable)	Target for women: n/a
	Target for youth: n/a
	Target for people with disabilities: n/a
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	Improved commercialisation rate of publicly financed intellectual property
Indicator responsibility	Technology Innovation; Socio-economic Innovation Partnerships

Title: Indicator 14	R&D-led industrial development opportunities initiated by the DSI
Definition	An R&D-led industrial development opportunity is defined as where new technology (or technological solutions) could be employed and could result in the establishment of new/improved markets; new industry subsectors or new firms, resulting in increased industrial activity. Initiated opportunities refers to new initiatives that shall be commenced between 2020 and 2025 which has the potential to impact on industrial growth
Source of data	A register (in the form of a spreadsheet) to be developed and managed by Strategy and Planning
Method of calculation/assessment	Number of records on the register that are initiated between 2020 and 2025 as informed by the Decadal Plan missions
Assumptions	Processes in place for entities to register new R&D-led industrial development opportunities
Disaggregation of beneficiaries (where applicable)	Target for women: n/a
	Target for youth: n/a
	Target for people with disabilities: n/a
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	Consistent pipeline of new industrial opportunities that the NSI will nurture and grow
Indicator responsibility	Socio-economic Innovation Partnerships; Technology Innovation; International Cooperation and Resources

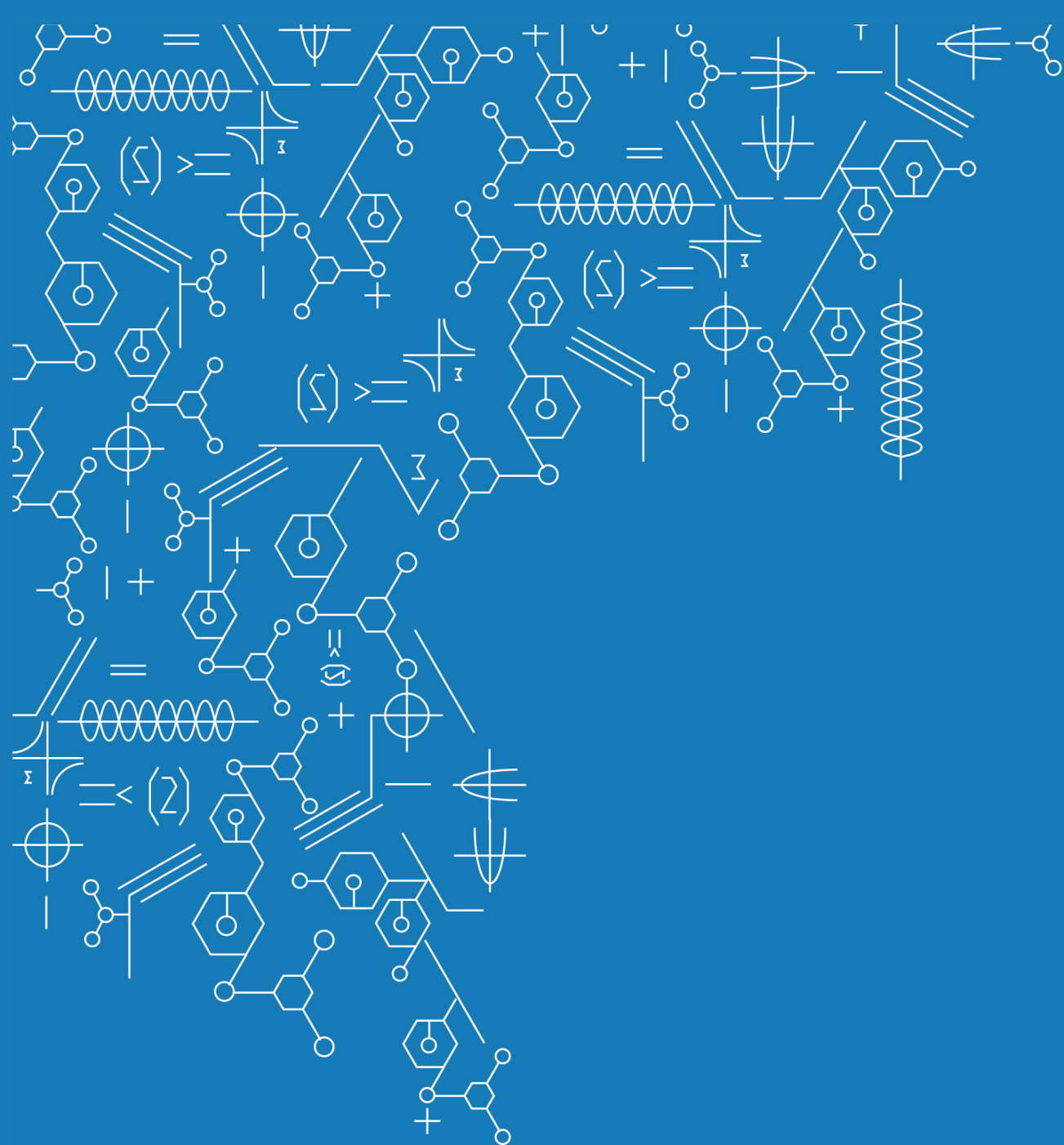
Title: Indicator 15	Number of artisans and technicians absorbed into the economy in sectors where DSI has active programmes
Definition	This indicator seeks to measure and track the number of artisans/technicians absorbed into the sectors of the economy where DSI has active RDI programmes. Absorbed means employed (temporarily or permanently) at a laboratory, company, university, etc. The proof will be included in a letter received from the institution confirming employment. A key aspect is that the indicator is not limited to research but includes support for technology services in the sector. or This indicator refers to the number of artisans/ technicians/intellectual property practitioners employed in sectors supported by DSI over the period 2020-2025. or This indicator refers to the number of artisans/ technicians absorbed into high-tech sectors, and means that a person is employed (permanently or on contract).
Source of data	Cumulative totals from each year (verified in the APP) or Annual reports from companies or Register (in the form of a spreadsheet) to be developed by March 2021
Method of calculation/ assessment	Total number receiving employment contracts by the end of the financial year.
Assumptions	In some cases, there may be a delay in obtaining the relevant data given dependencies on other internal or external stakeholders. This also affects the quality of data obtained. Caveat: Depending on the timing of training, the period for absorption may differ.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	Dependent on the location of the industrial development project
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	100% absorption of trained artisans and technicians
Indicator responsibility	Technology Innovation; Socio-economic Innovation Partnerships;

Title: Indicator 16	Number of DSI-funded PhDs graduating annually as a contribution to the NDP target of 100 PhDs per million population by 2030
Definition	Absolute number of supported PhD students who graduate in a given year
Source of data	Graduation data from the Higher Education Management Information System
Method of calculation/assessment	Simple count of supported PhD students who graduate in a given year
Assumptions	A student may have received financial support for the entire duration of his/her PhD studies or for a part of the duration of his/her PhD studies. This financial support must be in the form of a bursary. This graduation data excludes NRF students supported for full-time PhD study abroad as such data will come from multiple sources and will be too detailed to consolidate.
Disaggregation of beneficiaries (where applicable)	Data will be disaggregated by race, gender and nationality. Also, students who received National Student Financial Aid Scheme undergraduate bursaries will be designated as such.
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	The NRF supports about 15% of total enrolled PhDs. It is desired that approximately 30% of annual graduating cohorts should have received NRF bursaries.
Indicator responsibility	Technology Innovation; Socio-economic Innovation Partnerships; Research Development and Support

Title: Indicator 17	Percentage of women and black researchers in South Africa's research workforce
Definition	This indicator measures gender and racial transformation to promote equity in line with the country's demographics. The focus is on increasing the participation of previously marginalised groups such as women and black people (African, Indian and coloured) in the research workforce
Source of data	National Survey of Research and Experimental Development
Method of calculation/assessment	Simple count of women and black researchers as a percentage of the total South African research workforce. Formula: $(\text{Women researchers} \div \text{total research workforce}) \times 100$ $(\text{Black researchers} \div \text{total research workforce}) \times 100$
Assumptions	As per the (Frascati Manual) principles adopted in R&D surveys. Researchers counted are South African citizens and permanent residents.
Disaggregation of beneficiaries (where applicable)	Target for women: Black researchers can be further disaggregated into African, coloured, and Indian, and women researchers into black and white.
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	Increase in the proportion of researchers based at historically black institutions and universities of technology
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	One percentage point increase per year from the baseline (for both women and black researchers)
Indicator responsibility	Research Development and Support; International Cooperation and Resources

Title: Indicator 18	Percentage of PhD qualified staff in the higher education research and academic workforce
Definition	The proportion of research and academic staff who are PhD-qualified in South Africa's higher education sector.
Source of data	Higher Education Management Information System (HEMIS) staff data, which has a two-year time lag before audited data become available. Data for year x will reflect this measure in year x-2.
Method of calculation/assessment	Simple count of PhD-qualified staff as a percentage of total research and academic staff
Assumptions	It is assumed that staff attaining PhD qualifications are added into the method of calculation, and that staff who are leaving the systems are deducted from the calculation.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	Should be disaggregated by institution
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	A three percentage point increase per year is desired, i.e. a 15 percentage point increase over a five-year period (45% to 60%)
Indicator responsibility	Research Development and Support

Title: Indicator 19	Improved knowledge about science among the general public
Definition	Initiatives or projects encompassing a host of science awareness and engagement activities.
Source of data	Quarterly synoptic reports.
Method of calculation/assessment	Counting the number of initiatives conducted.
Assumptions	Planned number of initiatives comprising multiple activities will be conducted throughout the country.
Disaggregation of beneficiaries (where applicable)	Target for women: Indirect beneficiaries
	Target for youth: Indirect beneficiaries
	Target for people with disabilities: Indirect beneficiaries
Spatial transformation (where applicable)	n/a
Reporting cycle	Mid-term review in 2022/23 after Q2
Desired performance	Higher Performance – initiatives promoting public awareness of and engagement with science conducted over medium term, as reflected in the reports of the NRF and other implementing and collaborative partners.
Indicator responsibility	Research Development and Support (science awareness and engagement initiatives); Technology Innovation (SpaceWeek and NIPMO intellectual property rights awareness activities); Socio-economic Innovation Partnerships (learning interventions)



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