

ANNUAL PERFORMANCE PLAN 2021/22

Innovation for a better future

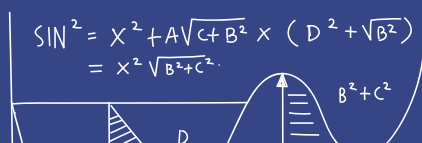
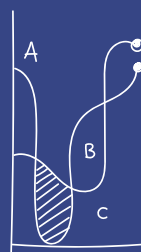
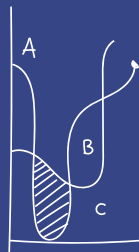
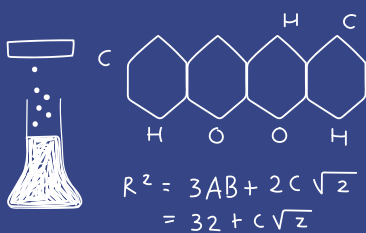
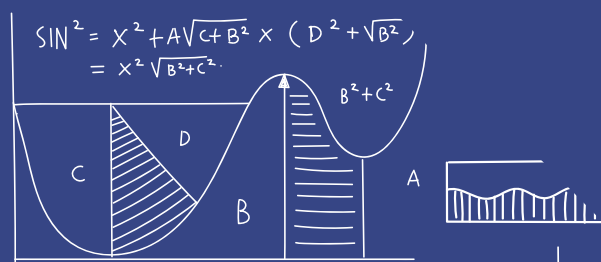


**science
& technology**

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

NACi
NATIONAL ADVISORY COUNCIL ON INNOVATION

NATIONAL ADVISORY COUNCIL ON INNOVATION
INNOVATION FOR A BETTER FUTURE
ANNUAL PERFORMANCE REPORT 2021/22



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OFFICIAL SIGN-OFF

It is hereby certified that this Annual Performance Plan –

- Was developed by the management of the National Advisory Council on Innovation (NACI) under the guidance of the Acting Chief Executive Officer (CEO) of NACI;
- Considers all relevant policies, legislation and other mandates for which NACI is responsible; and
- Accurately reflects the impact and outcomes that NACI will endeavour to achieve, given the resources made available in the budget for 2021/22.

Dr Shadrack Moephuli: Acting Chairperson: NACI

Signature



Mr Robert Shaku: Acting Chief Financial Officer: DSI

Signature



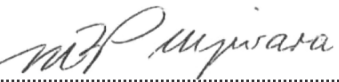
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Approved by:

Dr Blade Nzimande: Executive Authority

Signature



ABBREVIATIONS AND ACRONYMS

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
AM	Additive Manufacturing
APP	Annual Performance Plan
ASSAf	Academy of Science of South Africa
CEO	Chief Executive Officer
CREST	Centre for Research on Evaluation, Science and Technology
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
DPME	Department of Planning, Monitoring and Evaluation
DSI	Department of Science and Innovation
DST	Department of Science and Technology
EU	European Union
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
GCI	Global Competitiveness Index
GII	Global Innovation Index
HEMIS	Higher Education Management Information System
HSRC	Human Sciences Research Council
ICT	Information and Communication Technology
IMC	Inter-Ministerial Committee
IoT	Internet of Things
M&E	Monitoring and Evaluation
MTSF	Medium-Term Strategic Framework
NACI	National Advisory Council on Innovation
NDP	National Development Plan
NRDS	National Research and Development Strategy
NRF	National Research Foundation
NSI	National System of Innovation
NSTF	National Science and Technology Forum

OECD	Organisation for Economic Cooperation and Development
NSTIIP	National STI Information Portal
R&D	Research and Development
RoA	Rest of Africa
S&T	Science and Technology
SADC	Southern African Development Community
SciSTIP	Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy
SDGs	Sustainable Development Goals
SME	Small and Medium Enterprise
SMME	Small, Medium and Micro Enterprise
STI	Science, Technology and Innovation
THRIP	Technology and Human Resources for Industry Programme
TYIP	Ten-Year Innovation Plan
USA	United States of America

ACCOUNTING AUTHORITY STATEMENT

On behalf of the National Advisory Council on Innovation (NACI) and in the context of policy reflection and renewal in South Africa, I am honoured to present NACI's 2021/22 Annual Performance Plan.

NACI's 5-year (2020/21 – 2024/25) Strategic Plan identifies strategic outcomes to contribute to the realisation of the National Development Plan (NDP) and the 2019 White Paper on Science, Technology and Innovation (STI). To align NACI's performance to the vision and objectives the Council produced several enabling policy advice documents such as:

- framework for the development of the Decadal Plan for STI;
- the South Africa Foresight Exercise for Science, Technology and Innovation 2030;
- the National STI Information Portal; and,
- the Monitoring and Evaluation Framework for the National System of Innovation (NSI).

NACI will continue to improve the quality, relevance and efficacy of its advice to the Minister of Higher Education, Science and Innovation and, through the Minister, to the Cabinet. NACI generates advice proactively, or at the behest of the Minister of Higher Education, Science and Innovation.

As Council, we recognise the importance of focusing on both the foundations of STI (disciplines or knowledge domains, infrastructure and human resources) and the role of STI in addressing the challenges of education, health, food security and global change in a sluggish economy. To achieve its objectives Council recognised the need for access to good quality data, analytical capability, strong partnerships and healthy relationships with recipients of advice as critical. Some of NACI's strengths include the ability to mobilise NSI stakeholders and to access local and international experts to complement its limited resources. Accordingly, partnerships are critical towards enabling NACI to achieve its objectives of evidence-based science advice.

NACI will continue to build on its previous efforts to strengthen the planning, monitoring and evaluation capability in the NSI. Working with partners, the Council will continue to improve Phase 1 and develop Phase 2 of the National STI Information Portal.

The Council values the importance of good corporate governance, communication and international engagement, and we are confident that NSI role players and South African citizens will benefit from the work that NACI has planned for the 2021/22 financial year.



Dr Shadrack Moephuli
Acting Chairperson: NACI

PART A: OUR MANDATE

1. Constitutional Mandate

There are no specific constitutional provisions for NACI.

2. Legislative Mandate

The National Council on Innovation Act, No. 55 of 1997 provides the mandate for NACI (2015). The Act mandates NACI to advise the Minister for Higher Education, Science and Innovation and, through the Minister, the Cabinet, on the role and contribution of science, mathematics, innovation and technology, including indigenous technologies, in promoting and achieving national objectives – i.e., 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.

3. Policy Mandates

3.1 The Relationship between the NDP and the NSI

The 2011 National Development Plan (NDP) highlights the centrality of science, technology and innovation (STI) in creating sustainable socio-economic development and addressing societal challenges, such as those in education, health, food security, water scarcity and climate change. The difference between countries tackling poverty effectively by growing and developing their economies, and those that cannot, is the extent of their ability to grasp and apply insights from STI and use them creatively (NDP, 2011).

The NDP acknowledges that economic development is a long-term project and that innovation should grow in importance over time. In the first phase (2012–2017), the focus was on "intensifying research and development spending, emphasising opportunities linked to existing industries". In the second phase (2018–2023), the "country should lay the foundations for more intensive improvements in productivity", and "innovation across the state, business and social sectors should start to become pervasive". As the country approaches 2030, "the emphasis should be on consolidating the gains of the second phase, with greater emphasis on innovation, improved productivity, the more intensive pursuit of a knowledge economy and better utilisation of comparative and competitive advantages in an integrated continent".

The NDP is clear that achieving a competitive and sustainable economy will require a strong and effective national system of innovation (NSI), which must contribute to transformation. It views the NSI as the principal tool for creating new knowledge; applying knowledge in production processes; and disseminating knowledge through teaching and research collaboration. The NDP further acknowledges that advances in technological innovation and the production of new knowledge are critical to growth and development.

Having identified the potential contribution of the NSI to socio-economic development, the NDP proposes two actions for the NSI. Firstly, a common, overarching framework should be created to address pressing challenges in the NSI (involving the higher and further education systems, state-owned enterprises and private industries). The NSI should function in a coordinated manner with objectives being aligned to national priorities. Secondly, the size and effectiveness of the NSI should be increased.

3.2 Medium-Term Strategic Framework, 2020–2025

One of the aims of South Africa is to make progress in addressing poverty, inequality and unemployment, to avoid a single person in South Africa going hungry; ensure economic growth at a faster rate than the population growth; employ two million more young people; improve the educational outcomes at schools, and reduce violent crime significantly.

In pursuit of these goals, the following seven priorities have been identified to guide the government over the Medium-Term Strategic Framework (MTSF) period:

- Priority 1: Capable, Ethical and Developmental State;
- Priority 2: Economic Transformation and Job Creation;
- Priority 3: Education, Skills and Health;
- Priority 4: Consolidating the Social Wage through Reliable and Basic Services;
- Priority 5: Spatial Development, Human Settlements and Local Government;
- Priority 6: Social Cohesion and Safe Communities; and
- Priority 7: A Better Africa and World.

The achievement of these priorities requires improved coordination – both vertical and horizontal – alignment between various policies (including STI policies), leadership, human and financial resources, infrastructure, etc. The key challenge will be to align the implementation of the MTSF with other policies, including the NDP, the Re-imagined Industrial Strategy, the 2019 White Paper on STI and the post-school education and training policy.

Given the nature of its mandate, NACI indirectly contributes to the implementation of MTSF, through its NSI related initiatives. These include ongoing monitoring and evaluation of systemic initiatives (including DSI) and production of advice proactively and at the behest of the Minister of Higher Education, Science Technology and Innovation. Annually, NACI will publish results of its monitoring of the state of innovation focusing broadly on NSI as well as the TVET sector. Among indicators to be tracked are those related to human resources, intellectual assets, knowledge production, etc.

3.3 Science, Technology and Innovation Policy Mix

The period between 2014 and 2019 was characterised by a critical reflection on STI policy and policy implementation towards an improved understanding of the NSI and its role in shaping the future of South Africa. Government, with other NSI actors, including NACI, conducted or commissioned initiatives, such as reviews of the 1996 White Paper on Science and Technology, the 2002 National Research and Development Strategy (NRDS) and the Ten-Year Innovation Plan (TYIP), 2008–2018, an analysis of the performance of the NSI, the first phase in the STI institutional landscape review and a national STI foresight exercise looking towards 2030. A new White Paper on STI was developed and approved by Cabinet in March 2019. The White Paper, which is to be implemented through decadal plans, provides a framework for the development of the first Decadal Plan.

3.3.1 2019 White Paper on STI

The 2019 White Paper on STI was informed and shaped by the NDP, which identifies STI as critical for the creation of a competitive and sustainable economy and for addressing societal challenges, such as education and health. It advocates a strong, coordinated, coherent and effective STI system that promotes networks and partnerships between different actors in the public and private sectors; that contributes to transformation, and that recognises a multiplicity of knowledge production sites beyond higher education. It promotes the idea that knowledge should be shared as widely as possible across society and calls for the expansion of STI outputs by increasing government expenditure on research and development (R&D) and encouraging increased expenditure by the private sector.

Building on previous successes and adopting new approaches where required, the White Paper sets out a long-term policy approach for the government to ensure a growing role for STI in a more prosperous and inclusive society. Apart from identifying inclusivity, transformation and partnerships as core themes, the White Paper proposes a range of actions to address policy coherence, the development of human capacity, knowledge expansion, innovation performance and increased investment. The implementation of the White Paper should ensure that the twin concepts of inclusivity and transformation are given concrete expression by ensuring dignity and integrity to the marginalised and enabling good governance and service delivery. It also has to identify clear actions to support SMMEs and stimulate innovation in all regions of the country.

The commitment in the 2019 White Paper to a broader set of participants in STI priority-setting should be reinforced and policymakers should use the bodies of knowledge residing in different social constituencies – including government, academia, civil society and business – to address South Africa's most pressing socio-economic challenges.

3.3.2 Decadal Plan

NACI contributed two inputs into the process of developing the Decadal Plan for STI, namely, the Foresight Exercise and the review of the NRDS and TYIP. The Foresight Exercise generated the following STI domains and thrusts:

- (a) **Circular economy.** This is concerned with the generation of products with a restorative and regenerative design that circulates through the economy repeatedly, thereby minimising waste. This includes the conversion of biological and non-biological waste into new resources and materials, as well as the restoration and protection of biodiversity.
- (b) **High-tech industry domain** [Fourth Industrial Revolution (4IR)]. Products, processes and services will be transformed through the application of smart and connected systems. Therefore, the high-tech industry domain focuses on the implementation of advanced manufacturing in South Africa by using technologies like robotics, artificial intelligence (AI), the Internet of things (IoT) and additive manufacturing (AM). This will transform old industries and give rise to new industries. Industry actors, including SMEs, will need to equip themselves with the necessary skills, infrastructure and capacity for a successful transition.
- (c) **Education for the future.** Education is the foundation of a just and equitable society and a successful economy. By the 2030s, South Africa should be providing all its citizens with the quality of education that will enable them to find employment. One of the problems with the current public education system is the ineffectiveness of mathematics and science teaching and learning. All citizens, even those in rural areas, must have access to quality education. Technology provides an ever-growing range of opportunities to provide this access. New and alternative learning technologies will not only provide people with a basic education but will also equip them with the necessary skills for the future while reducing divides in society. Curricula should be developed to enable people to be more creative, with skills for idea generation and problem-solving.

- (d) **Nutrition for a healthy population.** Nutrition is essential for a healthy population. There are currently serious issues around malnutrition and stunting in South Africa, with women and children particularly being disadvantaged. Health and nutrition-related problems are generally caused by economic (low income, unemployment, etc.) and environmental (climate change) factors. Technologies should be used to create opportunities for advancing farming in South Africa and for making efficient use of arable land by reducing pressures resulting from climate change, waste and pollution. The nutrition security domain focuses on zero-impact agriculture and the application of biotechnologies, precision agriculture and big data.
- (e) **Opportunities, threats and social impact of information and communication technologies (ICTs).** ICTs are one of the key enablers of development in all domains – from agriculture to health and from industry to service delivery and governance. There are different technologies under the umbrella of ICTs. As recognised in the 2016 OECD Science, Technology and Innovation Outlook, the Internet of things promises a hyper-connected and ultra-digitally responsive society that supports human, societal and environmental developments. Artificial intelligence offers unique opportunities to improve human lives and address major societal challenges. Blockchain technology is expected to disrupt several markets by ensuring trustworthy transactions without the necessity of a third party. All of these technologies bring opportunities and threats to socio-economic systems. Therefore, their development needs to be regulated by addressing concerns regarding security, privacy, equity and integrity.
- (f) **Health technologies to prevent and treat ill-health and advance well-being for those who are marginalised.** Overall, the healthcare system needs to be optimised, to deliver better diagnostic and treatment services. Drug development is part of this. Prevention is cheaper than cure and, therefore, it is important to educate society so that, where possible, people take control of their health. It is also necessary to improve current health infrastructure and administration, which is inadequate, particularly in rural areas. As in other domains, mobile technologies, artificial intelligence and big data will bring enormous opportunities for the development of healthcare service delivery for all.
- (g) **Sustainable technologies for the marginalised.** In the modern world, energy is an integral part of all aspects of life. Although large cities in South Africa have a relatively stable energy supply, most rural and peri-urban communities have inadequate access to energy. These communities should be given opportunities to adopt new technologies to access clean and affordable energy from renewable sources (solar, wind and bioenergy). Sustainable energy technologies can leapfrog old technologies and their numerous limitations. Local sustainable energy production will reduce dependence on the national grid and create economic opportunities for the marginalised across South Africa. The energy domain focuses on clean, affordable and renewable energy solutions, energy efficiency and distributed generation.
- (h) **Integrated solutions for water security.** As a basis for a thriving society and economy, water security depends on water and sanitation solutions that are responsive to new challenges and emerging needs and opportunities. Three aspects are key to water security. Firstly, water supply needs to be driven by an integrated mix of context-appropriate sources of water at the bulk, regional and local level. Secondly, the next generation of sanitation and wastewater (urban and industrial) solutions needs to be introduced, understood and mainstreamed (low or no-water toilets, energy and water-efficient technology and smart waste solutions). Thirdly, water-sensitive designs for urban, peri-urban and rural spaces should be core to all water and sanitation planning and implementation (including greywater management, climate-resilient infrastructure, circular planning around water and sanitation and wastewater flows). The Fourth Industrial Revolution (4IR) is characterised by the intersection of the physical, digital and biological spheres through technology. Cyber-physical systems have the potential to bring positive change in the management of water and sanitation resources and services. A water sector innovating around off-grid and decentralised solutions could potentially provide an opportunity in South Africa to (i) reduce service delivery costs; (ii) allow for agility in responding to changing circumstances; (iii) promote the proliferation of innovation-focused water-sector businesses; and (iv) help to drive the industrial development of the water sector.

(i) **Future of society.** For inclusive development, STI needs to receive far more emphasis on the NSI and any future STI interventions. Listening to, understanding and responding to the collective and individual needs of people will be vital in harnessing STI to address societal challenges. Holistic and cross-cutting initiatives are required for the following reasons, among others:

- To rebuild trust within the NSI – between government, researchers, the private sector and the public;
- To address the causes of unequal access to and participation in the STI value chain, thereby ensuring sustainable benefits;
- To create an engaged scholarship and recognition of the value of STI for social good;
- To build a culture of research excellence that produces culturally acceptable technological solutions;
- To establish a developmental and capable state that provides an enabling environment for STI development by all players within the NSI;
- To ensure the self-sufficiency of communities through the adoption and adaptation of technologies; and
- To drive self-initiated, lifelong learning as a cultural value.

3.3.3 Review of the NRDS and TYIP

The results of the review of the 2002 National Research and Development Strategy (NRDS) and the Ten-Year Innovation Plan (TYIP), 2008–2018 are summarised as follows:

- In seeking to give effect to the tenets of the 1996 White Paper on Science and Technology through the NRDS and the TYIP, the Department of Science and Innovation (DSI) – first as part of the Department of Arts, Culture, Science and Technology, then as the Department of Science and Technology – put into place some interventions to establish, strengthen and transform the NSI. These included new legislation (relating to protecting biodiversity, intellectual property and astronomic advantage); new agencies and the South African National Space Agency) and offices (the National Intellectual Property Management Office); new funding instruments (most notably the R&D Tax Incentive and the Sector Innovation Fund) or rechannelled funding instruments (THRIP, Innovation Fund); new initiatives to improve knowledge production, knowledge exploitation and human resource capacity through the funding of 16 Centres of Excellence and more than 200 research chairs; and the development, funding and implementation of technology missions and five Grand Challenges (bioeconomy, energy security, global change, space technology and human and social dynamics) to address societal problems.
- The final review report makes it clear that, in many instances, an outcomes and impact evaluation of the sub-strategies of the NRDS and the TYIP was not possible because of poor strategy design (including lack or inexplicit theory of change); inappropriate indicators; erratic implementation; inadequate financing of projects; an uncoordinated approach where several agencies were involved in interventions; and a lack of systems for monitoring and evaluation. These systemic failures are not unique to the NSI/DSI but occur across the national policy landscape. Sometimes, inadequate planning or the absence of robust planning (including availability and use of data and evidence and tools) tends to impact the implementation of progressive policies.

- The final review report also reiterates some findings and recommendations that have been flagged in previous reviews of the system, such as the lack of high-level (ministerial level) governance oversight and coordination of STI policy; the continued underfunding of the NSI despite the long-standing intention to increase gross expenditure on R&D to 1,5% of GDP; decreasing levels of business expenditure on R&D; and the inadequate uptake of the recommendations of several successive reviews (with the resultant failure of policy learning about STI).

The overall impression from the analyses of the NRDS and TYIP in the final report is that STI policy (and its relative successes) over the past two decades has largely focused on strengthening and transforming the post-apartheid science and research enterprise under the rubric of the NSI, but without connecting this development pathway systematically with the main societal challenges confronting South Africa. In the face of overwhelming and long-standing problems relating to poverty, inequality and unemployment in the country, there has been a weaker orientation of STI policy towards broader societal questions. This is even though the two policy instruments – particularly the TYIP – were intended to address socio-economic challenges. The five Grand Challenges in the TYIP were intended as strategies to advance the STI-society nexus. However, the final report itself points to confusion in the conceptualisation of the Grand Challenges and weaknesses (including inadequate funding) in their implementation.

The extent to which the outputs of the Foresight Exercise and NRDS and TYIP review are considered in the Decadal Plan for STI will depend on the process itself and stakeholder engagement.

4. Policies and Strategies Governing the Five-Year Planning Period

The 2019 White Paper on STI has several implications for the NSI and its actors. About NACI, the White Paper proposes the following actions:

- 4.1 NACI will be reconfigured to act as the national STI monitoring and evaluation (M&E) institution, charged with analysing STI information and undertaking work to inform government planning on STI. NACI will convene a high-level forum to develop a framework of indicators to monitor South Africa's NSI performance.
- 4.2 Government recognises that to support the proposed Ministerial STI Structure in carrying out its mandate, ongoing stakeholder engagement is required, in addition to an STI Plenary. NACI will be strengthened to facilitate such engagements, e.g., by following up on matters discussed at the STI Plenary. Policy reports from relevant NSI institutions and think-tanks, e.g., the Academy of Science of South Africa (ASSAf), the Human Sciences Research Council (HSRC) and the DSI-NRF Centres of Excellence, will also be used.
- 4.3 The Ministerial STI Structure will require expert studies and up-to-date performance and environmental information to support its decisions. To advise the Ministerial STI Structure, a strengthened NACI will undertake such studies.
- 4.4 Implement knowledge management systems to enhance the analysis of NSI performance and support evaluation work that informs strategies. In this, NACI will draw on the work of existing specialist centres that collect STI-related information. Existing institutional arrangements for data collection (e.g., innovation and R&D surveys) will be maintained and strengthened and, where necessary, expanded.
- 4.5 The DSI, working with NACI, has developed a public STI investment framework to support the commitment of public resources for STI by the Ministerial STI Structure. NACI's role will be to undertake foresight studies and provide an independent STI M&E function (including regular analysis of public STI spending). The framework is based on an analysis of STI funding requirements in line with strategic and sovereign priorities, as well as consultation across government through an interdepartmental STI Budget Committee at the level of Director-General, including national and provincial governments with significant STI mandates. NACI will work with the DSI, the Department of Planning, Monitoring and Evaluation (DPME) and the National Treasury to ensure that the framework information is actionable and comparable in informing the management and funding of NSI initiatives.

Appropriate links will also be established between NACI and the DPME to help integrate STI into transversal government planning by the DPME and to support funding prioritisation by the DPME and National Treasury (e.g. via the annual Budget Mandate Paper). For instance, based on its new M&E function and regular environmental scanning, NACI will prepare reports on the implications of geopolitical and demographic shifts, technological changes, environmental sustainability imperatives and other megatrends for government STI planning.

To give effect to these proposals, a process will be initiated to amend the NACI legislation.

As part of implementing the above, NACI in partnership with SciSTIP produced the monitoring and evaluation framework for the NSI in 2019. As a sequel to this, NACI will develop an M&E framework specifically for the new decadal plan for STI.

5. Organisational Mandate

NACI derives its mandate from an Act of Parliament promulgated in 1997 and amended in 2011. The legislation requires NACI to offer advice to the government on the role and contribution of STI in meeting national imperatives, such as the creation of sustainable quality of life, sustainable development and economic growth and developing human capital for STI. The Act sets out several specific areas in which NACI is expected to provide advice, including:

- (a) Coordination and stimulation of the NSI;
- (b) Strategies for the promotion of technology innovation, development, acquisition, transfer and implementation in all sectors;
- (c) Coordination of science and technology policy and strategies with policies and strategies in other environments;
- (d) Identification of R&D priorities and their incorporation in the process of government funding of R&D;
- (e) Promotion of mathematics, the natural sciences and technology in the education sector;
- (f) Establishment and maintenance of information systems that support the monitoring and evaluation of the management and functioning of the NSI;
- (g) International liaison and cooperation in STI; and
- (h) Developments in STI that may require new legislation.

5.1 Strategic Outcomes

The 2020-25 Strategic Plan identifies the following strategic outcomes, which were designed to support the NACI mandate, vision and mission:

- To learn from previous experience to improve efficacy and ensure evidence-based, informed, confidential and timely policy advice to the Minister of Higher Education, Science and Innovation and, through the Minister, to the Cabinet.
- To contribute to the building of NSI monitoring, evaluation and learning capability, to assess the health of the NSI and its contribution to sustainable and inclusive development.
- To contribute to the building of a well-coordinated, responsive and effective NSI by exploring and proposing solutions to the long-standing STI policy questions of coordination, prioritisation, financing, size and shape, human resources, knowledge production and diffusion.
- To transform NACI into a smart, efficient and learning organisation. This goal is intended to address current internal operational inefficiencies; enhance quality, turnaround times and knowledge management and communication; and exploit the benefits of digitisation. Skills, knowledge and competency development will be critical.

6. Relevant Court Rulings

None.

PART B: OUR STRATEGIC FOCUS

1. Vision

A leading advisory body for government on science, technology and innovation within a well-coordinated, responsive and functioning National System of Innovation.

2. Mission

To provide evidence-based advice to the Minister of Higher Education, Science and Innovation and, through the Minister, to the Cabinet, on science, technology and innovation matters, through research expertise and engagement with stakeholders.

3. Values

- Professionalism;
- Integrity;
- Innovation and knowledge sharing; and
- Transparency and accountability.

4. Updated Situational Analysis

This Annual Performance Plan (APP) and its implementation is evolving within a context predominantly characterised by COVID-19, the contours and imperatives of which are likely to be shaped by even more acute social, environmental and economic crises than the ones we have endured to date. Given its role in the course of implementing the APP, NACI will, among others, seek to contribute towards shaping a post-COVID-19 STI system in South Africa.

4.1 External Environment Analysis

COVID-19 pandemic has changed the world dramatically. Beyond its disastrous impact on public health systems across the globe, accompanied by the deaths of tens of thousands of people, there are strong signs that the global economy will slip into depression, with rising unemployment levels and increasing numbers of school-going children dropping out of the education system.

Indeed, the COVID-19 pandemic is putting the gains related to the Sustainable Development Goals (SDGs) at risk, exposing vulnerabilities and inequalities both within and among nations. The UN Secretary-General has urged governments to re-examine how they cooperate to solve global challenges in the light of the impact of COVID-19 in the fight against poverty, inequality and climate change.

In South Africa, this has involved the structural challenges of inequality, unemployment, poverty and ecological degradation requiring even more urgent attention. There is a global consensus that progress towards the achievement of the SDGs of the United Nations has already been impeded. As shown in Figure 1, these recognise and frame the societal challenges as 17 actionable SDGs. The SDGs ought to be addressed and achieved in an integrated fashion. To this extent, the emphasis should, therefore, be on interlinkages, collective actions, coordination and collaboration between different nations, institutions and policies.



Figure 1: Sustainable development goals

Developing countries and emerging economies are expected to become even more exposed to greater risks in agriculture, food security, premature de-industrialisation, health and social care systems. In all these challenges, the need for robust and resilient scientific and technological capacities and capabilities has become critical. The world system is uneven and yet interlinked, thereby requiring the domestic systems of innovation crucial in transforming science and technology into socially useful products and practices.

In the wake of the pandemic, several countries have premised their economic recovery on STI. The European Union (EU), for example, deems research and innovation vital to support Europe's sustainable and inclusive recovery. This recognition has been matched by a firm commitment of resources to strengthen STI capability and outputs. The EU has indicated that the re-launching of the economy does not mean going back to the *status quo* before the crisis, but bouncing forward. The idea is to repair the short-term damage from the crisis in a way that also invests in the long-term future. Examples of similar initiatives by other countries include the following:

- The New Zealand government has announced that it will be investing approximately NZ\$400 million (close to R4.5 billion) to support entrepreneurs and R&D as part of economic recovery.
- Singapore's government has committed to major new research and innovation investments to enhance the country's competitiveness. As part of a new five-year plan, Singapore will invest over 20 billion dollars (close to R250 billion) to support basic and applied research, as well as innovation in high-impact areas, such as health and biomedical sciences, climate change and artificial intelligence.

- A bipartisan Bill enjoying support from both the Republican and Democratic parties has been introduced in the United States Congress that would expand the budget of the National Science Foundation by US\$100 billion (approximately R1.7 trillion) over the next five years, boosting research in areas such as artificial intelligence, machine learning, robotics and advanced manufacturing.
- Malaysia's national economic recovery plan, worth close to R70 billion, focuses on STI, digitisation and entrepreneurship.
- Egypt has increased its national investment in R&D significantly, doubling the investment from 2018–19 to approximately R25 billion.

COVID-19 has also reaffirmed the role of the state in development. It has demonstrated that, if we work together for the common good, we can overcome long-standing problems associated with lack of coordination, policy incoherence and misalignment and, in the process, deliver basic services to the poor, the working class and rural and black women.

The DSI has coordinated a package of responses across the NSI to address South Africa's readiness for the impact of COVID-19. The response has been centred on the following six pillars: analytics and modelling, research and innovation, manufacturing, satellite mapping of settlements and spaza shops, deployment of alternative energy solutions, and international cooperation initiatives in support of the global response to the pandemic.

How various players in the STI environment, have responded to the government's call for innovative ideas to assist in fighting the pandemic, is an example of how collaborative efforts between government, industry, academia and society should be encouraged to build a united front in repositioning our country post-COVID-19. The nature and level of policy change in post-COVID-19 South Africa are still to emerge. However, the existing inequalities, high unemployment rate and grim life prospects of large numbers of the population will be exacerbated by the pandemic and its social and economic consequences. In such a situation, the STI policy will need to become demonstrably responsive to a growing and intensifying range of socio-economic challenges. In other words, the promotion of fundamental social change should be at the focus area of future STI frameworks, strategies and plans. This also fully aligns with the 2019 White Paper vision of using STI "to improve the quality of lives of South Africans, particularly in poor communities".

The Economic Reconstruction and Recovery Plan,¹ points out that, while the COVID-19 global pandemic is a crisis of unprecedented scale, it is also a "rupture with the past, and an opportunity to drive fundamental and lasting change. Just as the past war era enabled the restructuring of economies, societies and the global order, COVID-19 will herald a transformation of social and economic relations in South Africa" (2020). Further, the Reconstruction and Recovery Plan states South Africa's growth story will "rely on a massive investment in infrastructure, including in energy, telecommunications, posts and rail. It will be propelled by swift reforms to unleash latent potential, and supported by an efficient state that is committed to clean governance. It will be inclusive, digital, green and sustainable, and it will invest in our human capital to lay the foundations for the future" (2020).

¹ South African Economic Reconstruction and Recovery Plan, October 2020

The core elements of the Economic Reconstruction and Recovery Plan are as follows:

- I. Priority interventions for economic recovery: the plan sets out eight priority interventions that will ignite South Africa's recovery and reconstruction effort. These are the flagship initiatives that all of society will rally around to build a new economy.
- II. Enabling conditions for growth: these are the growth-enhancing reforms and other preconditions for an inclusive, competitive and growing economy.
- III. Macroeconomic framework: economic reconstruction and recovery requires careful mobilisation of resources to ensure sustainability.
- IV. Institutional arrangements: the plan focuses on execution and is supported by enhanced institutional arrangements to ensure implementation and accountability.

Priority interventions for economic recovery are: (i) infrastructure investment; (ii) energy security; (iii) presidential employment stimulus; (iv) strategic localisation; (v) tourism recovery and growth; (vi) the green economy; (vii) food security; and (h) gender equality and economic inclusion.

All NSI actors (including NACI) are expected to contribute towards the realisation of the Economic Reconstruction and Recovery Plan objectives. On its part, NACI will among others, analyse how innovation can support the industrialisation process, especially in the manufacturing sector. It will analyse, monitor and evaluate various interventions of different NSI actors, to generate a systemic view. NACI will also review the role and contribution of the NSI and its actors in the combat against COVID-19. Part of this will be drawn lessons necessary to inform future actions against new pandemics.

4.1.1 Selected STI Trends

(a) Global Trends in STI

Both the two global indices monitored in NACI's South African STI Indicators Report – namely, the Global Innovation Index (GII) and the Global Competitiveness Index (GCI) – show positive and negative trends in the performance of South Africa's NSI about other countries.

The GI provides an important indicator of the efficiency of the NSI by measuring innovation inputs and outputs for 126 countries. South Africa's GI ranking dropped from 58th in 2018 to 63rd in 2019. South Africa ranked 83rd on the efficiency ratio in 2019, with a score of 0.55. South Africa performed far better in terms of inputs than outputs, which strongly suggests that, compared to other countries, the NSI is not converting inputs into outputs as effectively.

The GCI ranks countries according to their international competitiveness. Although South Africa's overall ranking on the GCI improved from 67th in 2018 to 60th in 2019, the country's innovation ranking declined from 46th in 2018 to 50th in 2019. The improvement in the overall GCI ranking was driven by improvement in human capital, a category in which South Africa's score is very low (108 in 2019). The improvement in human capital was driven by the improved ranking on health.

(b) STI Enablers

The public sector has a dual role to play: that of innovation performer and provider of conditions conducive to innovation in the private sector. This involves creating and implementing enabling STI policy and appropriate strategies; establishing and maintaining strategic STI institutions to generate knowledge and de-risk technology development; funding research, development and innovation; building STI human resources and establishing strategic partnerships, among other things.

(c) STI Investments

Financing the NSI continues to be a challenge. South Africa's gross expenditure on research and development (GERD) as a percentage of gross domestic product (GDP) decreased from 0,77% in 2014 to 0,75% in 2018/19 but remains well below the 1,5% government target. In constant rand values, GERD amounted to R25,96 billion in 2017, which was a small increase from R25,19 billion in 2016. Business expenditure on R&D as a percentage of GERD also declined from 58,6% in 2008 to 41,0% in 2017, and as a percentage of GDP from 0,52% in 2008 to 0,34% in 2017.

It is worth noting that between 1996 and 2016, public resources for both public and private sector STI have increased significantly (the DSI's expenditure alone has increased nine-fold). Furthermore, over the past decade, some provincial growth and development strategies have recognised innovation as an important driver of social and economic well-being, and provinces have invested resources in innovation hubs, ICT infrastructure and science park-type developments. However, there is potential to do more.

The government has also established some incentives to stimulate R&D investment. These include the R&D Tax Incentive Scheme, which was introduced to counter systemic problems in the South African innovation system, namely the low level of private-sector R&D and the non-competitive position of the country versus its peer countries in terms of the attractiveness and affordability of R&D. The incentive allows for a 150% deduction of the qualifying R&D expenses from taxable income, thereby reducing the cost of R&D by 14% (assuming a tax rate of 28%). The introduction of the R&D Tax Incentive Scheme in 2005 was a clear indication to the business sector that the government was placing a strong emphasis on R&D. However, the response was not at the level that had been hoped. There is some evidence at the micro-level of a positive response, but it is clear that, at the system level, business expenditure on R&D has remained static and, in some sectors, has declined.

Although exogenous issues such as business confidence and cost of capital also affect R&D expenditure, the effective adoption of the scheme is an important goal if the higher-level strategic objectives are to be realised. However, STI-related elements such as increasing levels of businesses expenditure on scientific and technological R&D, advancing scientific and technological R&D aimed at creating new or significantly improved materials, devices, products or processes and increasing the positive spill-over to the rest of society through knowledge transfer and skills development have remained essentially unchanged since the introduction of the scheme. Therefore, further sustained effort through the scheme and other forms of encouragement for business R&D remain important.

(d) Fourth Industrial Revolution (4IR)

Human beings have always identified and developed tools to augment their constraints or limitations and, in the modern era, the Fourth Industrial Revolution (4IR) represents such tools. South Africa has embraced the 4IR by establishing the Presidential Commission on 4IR, ensuring that it features prominently in the White Paper on STI and establishing the CSIR-based Centre of Artificial Intelligence. 4IR is seen as a radical and disruptive technological change that will impact production and quality of life across the world. 4IR will have both positives and negatives: it will create new jobs and, at the same time, destroy existing jobs. Technological change demands better management of the transition to ensure that old institutions are not ruined while new institutions are established.

Depending on their present situations and objectives and their STI interests, countries have diverse views on the future challenges and opportunities presented by 4IR. Some developed countries (such as Germany, Italy, Japan and the USA) have articulated and determined how they seek to exploit 4IR to meet local needs. The decadal plan offers the opportunity for South Africa to set out how it intends to exploit and leverage 4IR to meet national imperatives. In this regard, the 4IR² and draft AI and Big Data Analytics strategies will serve as necessary, although not adequate, sources of information.

The ten key issues that emerged from SA's 4IR review are as follows:

- I. The 4IR involves a new epoch in social and economic life. It is driven by technological advancements that will deepen the connections between the biological, physical and digital worlds, resulting in the blurring or merging capabilities among these domains.
- II. Success in the 4IR will depend on our ability to unleash the full scientific, industrial and creative capabilities of South African society. The fundamentals of this revolution are consistent with the aims of South Africa's developmental state: economic competitiveness and societal wellbeing.
- III. Failure to respond to the nature of these technological changes and their related infrastructural requirements will pose a threat to South African industries, the relative wellbeing of South African people and their ability to participate in the world as equals.
- IV. Although South Africa is the most industrialised country on the African continent, it has not reaped the full benefits of the previous industrial revolutions owing to an interrupted history, which has had adverse consequences for our people, banishing most to poverty and socio-economic exclusion.
- V. South Africa's capability is evidenced by its history, which includes the ancient Kingdom of Mapungubwe, which was home to advanced scientific, artistic and industrial capabilities.
- VI. The major challenge of our time is not one of developing human capabilities, but the recognition of the competitive landscape and our comparative place among nations.
- VII. In a bid to secure their unique place in the global economy, 4IR strategies for various countries are pursuing different investments in technological, industrial and human capabilities.
- VIII. Focusing on leveraging technology to address service delivery challenges; placing research, data management and science at the cross-cutting base of the state and public-private partnerships focused on scientific experimentation is central to country strategies.
- IX. The South African state is currently fiscally constrained: it has a unique opportunity to use its buying power to ignite the creation of industries of the future. This would simultaneously respond to the delivery of public goods while creating a clear, initial market for new industrialists, representative of the broader transformation vision.
- X. All government departments have a crucial role to play in aligning scientific and training efforts to clear industrial development priorities. This will require focus and a possible reduction in programmes.

² Presidential Commission on the 4th Industrial Revolution Report, published in Government Gazette, No. 42388 on 9 April 2019.

The recommendations of the review commission bare significance for the NSI community, considerations to apply are³:

- *Investing in human capital* – The 4IR gives us a rallying point of urgency and an opportunity to redesign, streamline and align the education system through a coordinated, robust, multi-stakeholder process.
- *Establishing an AI institute* – Artificial intelligence (involving the theory and development of computer systems to perform tasks usually requiring human intelligence) is a bedrock technology in the 4IR, underpinning the growing connections in cyber, physical and biological systems. Therefore, research and development, as well as implementation capabilities in AI are critical and must be embedded within the state.
- *Establishing a platform for advanced manufacturing and new materials* – The revival of South Africa's manufacturing sector is a core concern of the Industrial Policy Action Plan, given the centrality of the sector to job creation and global competitiveness. To be successful in the context of the 4IR, it is imperative to support the manufacturing sector by a state-led research initiative focused on advanced manufacturing and new materials.
- *Secure and avail data to enable innovation* – The principal opportunity in the 4IR is the storage of large amounts of data. Reliable, accurate, standardised, integrated and easily accessible citizen data is critical for building e-government services across sectors such as health, transport and justice. This must be safeguarded.
- *Incentivise future industries, platforms and applications of 4IR Technologies* – For the industries of the future to emerge, new forms of incentives are required, incorporating subsidies and tax breaks, to support the acquisition and application of advanced technologies in the manufacturing of goods and delivery of services.
- *Build 4IR infrastructure* – Biotechnology, 3D printing and the digital economy all require an infrastructure base. However, 4IR infrastructure does not stand alone: it should integrate with existing economic and social infrastructure.
- *Review and amend policy legislation* – The regulatory environment must be adapted to enable the desired progress. The generation of intellectual property rights stands out in this context, as the principle of a creative economy implies the rapid production of new technologies, artefacts and processes for commercialisation and scale. This exercise requires the legislature and the state executives to be trained to become 4IR and science literate, in order to implement changes that are holistic, integrating the specific logics of technologies, the industries they impact, the people who will both consume and produce them and the policy and legislative agility required to compete on a global stage.
- *Establish 4IR strategy implementation coordination council in the presidency* – There is a requirement to ensure that existing institutions of state are revived and reenergised, where needed, to deliver on the 4IR strategy. This will require a combination of training efforts to ensure 4IR understanding and skills, and the possible consolidation of teams and budgets to reduce duplication and optimise delivery.

³ Presidential Commission on the 4th Industrial Revolution Report, published in Government Gazette No. 42388 on 9 April 2019.

(e) Human Resource Capabilities

The number of masters graduates (research) increased from 6 460 in 2013 to 8 610 in 2018. The number of doctoral graduates increased from 2 051 in 2013 to 3 307 in 2018. This means that there is progress towards the NDP target of 5 000 PhDs by 2030. In 2018, 1 051 doctoral degrees were awarded in the field of natural and agricultural sciences: the majority of total doctoral degrees were awarded in this area.

The engineering field remained male-dominated, with a greater imbalance at the doctoral level, where only 21,8% of graduates were female in 2018. However, there was an improvement in the share of African doctoral graduates in engineering, from 37% in 2015 to 53% in 2018, and African researchers increased from 6 595 in 2008 to 10 815 in 2017. Women made up 45,3% of the total number of researchers in 2017.

Unemployment is lower among people with higher levels of education. Among those with masters and doctoral degrees, unemployment increased from 2,4% in 2018 to 2,8% in 2019.

(l) Human Resources for S&T: Retaining Local Talent

In a 2015 report of the Centre for Research on Evaluation, Science and Technology (CREST), we provided detailed evidence on the retention and progression rates of postgraduate students in South Africa. The report highlighted the following challenges:

- Financial challenges, which constitute the single biggest obstacle to producing more postgraduate students in South Africa.
- Financial challenges are more prevalent for black students at all levels in the system.
- Low progression and retention rates are mainly due to the part-time nature of studies, which, in turn relates to the lack of funding for full-time studies).
- Students in the natural sciences (where larger proportions study full-time) have significantly higher progression and completion rates.
- Various factors influence student choices about continuation and discontinuation of studies, but the main reason is availability of funding. Choice of university and degree programme at all levels is mostly informed by academic reputation and quality considerations, as well as employability factors.

Recent initiatives by the Department of Higher Education and Training (DHET) and the National Research Foundation (NRF) to address the challenges in the academic pipeline need to be supported and strengthened if we want to be more successful in retaining our best talent for the science system and the labour market.

(ii) Human Resources for S&T: Attracting Foreign Talent

There is only one reference in the NRDS to attracting foreign talent (with specific mention of increased numbers of postdoctoral fellows), and it is found in the context of a discussion on internationalisation. There is also no reference to an international strategy or programme in either the NRDS or TYIP. However, considerable resources have been expended on a wide range of bilateral and multilateral S&T agreements in support of increased international (particularly African) cooperation and collaboration.

To ensure a coherent and sustainable solution to some of these challenges, the South African government has established an Inter-Ministerial Committee (IMC) on the Employment of Foreign Nationals. The Committee is tasked to ensure that our approach to the employment of foreign nationals provides the scarce and critical skills that we need to grow the South African economy.

As indicated in the CREST report on the state of the South African research enterprise, South Africa has indeed managed to attract foreign talent in recent years and specifically at doctoral and masters levels. The statistics attest to the fact that South Africa has once again become a destination for migrant students from Africa, on a far larger scale than before apartheid. This increase is partly driven by the Southern African Development Community (SADC) Protocol on Education and Training, which removes barriers to the free movement of researchers and students of higher education across the region. The protocol requires member states to allocate up to 5% of their university places for SADC students and to charge them domestic fees. The trend has also been stimulated by the increasing number of students from Africa not being able to afford the high student fees in Europe and North America.

Between 2000 and 2017, a total of 28 686 doctoral students graduated from South African universities. Approximately two-thirds of these graduates were South African nationals and slightly more than one quarter (26%) were from the Rest of Africa (RoA). However, the real growth in doctoral graduation output is driven by students from the rest of Africa. The rate of increase of RoA students (17%) has been nearly three times higher than the rate of increase of South African students. Hence, by 2017 doctoral graduates from the rest of Africa already constituted 37% of all graduates, compared to SA nationals, who constituted 57% of all graduates. It is mainly because of the inbound mobility of doctoral students from the rest of Africa that we have witnessed the steep increase in the number of graduations over the past ten years, which is also the reason why it now seems realistic to expect that we will reach the national target of producing 5 000 PhDs by 2030. According to this forecast, if current rates of growth continue, the number of doctoral students from the rest of Africa will surpass the number of graduates born in South Africa in 2020/21. A far more alarming result is that the number of South African doctoral graduates has already started to plateau and is growing at slower rates.

The challenge is to exploit the complementarity in a way that contributes to meeting national objectives and the country's international commitments, particularly to the rest of Africa.

NACI will contribute towards the development of an international programme to enhance human resource capability especially in areas that are said to be critical in the transition to the future, whether in respect of the so-called fourth industrial revolution, digitisation and other gaps exposed by COVID-19. This envisaged intervention has played a vital role in the development of countries such as China, South Korea and India. Its conception and implementation will require resources and partnerships and cooperation between various NSI actors.

4.2 Internal Environment Analysis

Challenges, opportunities and partnerships

The 1996 White Paper on Science and Technology and the 2002 NRDS note that the post-apartheid government had inherited an "ailing" science and technology system that was fragmented, uncoordinated and not geared to help the government realise the imperatives of economic growth and enhanced quality of life for all citizens.

The need for greater coherence and coordination in the NSI has, therefore, been understood for a long time. A variety of statutory and voluntary mechanisms have been established⁴ in an attempt to transform the system. The idea of an NSI, introduced in the 1996 White Paper, was premised on the notion of stakeholders working together for a common purpose. The NSI concept assumes the need for the different actors across the system (in both the public and the private sector) to achieve coherence and complementarity in their functions so that the resources invested in the various entities can have the greatest impact.

In 2014, the Minister at the time requested that the CEOs of the DST public entities become *ex officio* members of the NACI Council. He also asked NACI to develop and host the National STI Information Portal, which was launched in 2017. The NACI Chairperson has been granted direct access to the Minister to improve coordination and the collaboration of diverse stakeholders (e.g., the DSI-NRF Centre of Excellence in Scientometrics and STI Policy (SciSTIP), the DHET, the Higher Education Management Information System (HEMIS), the Research Information Management System, and the Centre for Science, Technology and Innovation Indicators).

Following the recent NACI Institutional and Higher Education Science Technology and Innovation Institutional Landscape Reviews and the adoption of the 2019 White Paper on STI, NACI has initiated a drafted discussion document focusing on its renewal and repositioning. The draft document seeks among others, to address persistent challenges such as structural location, secretariat capacity, and efficacy. It will also conduct an international benchmarking with NACI type bodies, the outcome of which feed into the reconfiguration of the system's institutional landscape and amendments to the NACI legislation.

NACI has established partnerships with different organisations domestically and internationally. These include,

- The Organisation for Economic Cooperation and Development – STI policy analysis, evaluation, country reviews, impact assessment, bibliometrics and data and repository management.
- The Global Forum on National Advisory Councils on Innovation – experience and knowledge sharing and learning, improving the role and contribution of advisory councils, developing relevant advice, the interaction between advisors and policymakers, capacity building and joint projects.

⁴ These include NACI, the Council on Higher Education and the National Science and Technology Forum. Government attempted to achieve coherence across departments or across priority outcomes by first introducing a cluster system and then delivery forums. There are also numerous sectoral bodies such as Universities South Africa for higher education institutions and the Committee of Heads of Organisations of Research and Technology, which is mainly for science councils. The contribution of these mechanisms to strengthening the NSI varies, but there is little doubt that much more could be achieved than is currently the case.

- The NRF, HSRC, ASSAf, South African Council for Natural Scientific Professions, Technology Innovation Agency, Accenture, the New Partnership for Africa's Development, the National Science and Technology Forum (NSTF), the Science Policy Research Unit (University of Sussex), and SciSTIP at Stellenbosch University – strengthening the system's monitoring, evaluation and learning capability, developing and operating the National STI Information Portal, and developing the next generation of STI policy analysts.
- The Institute for Statistical Studies and Economics of Knowledge (Moscow) – planning, such as foresight exercises.
- African Union-European Union High-Level Policy Dialogue on Science, Technology and Innovation (HLPD).
- Brazil India Russia China South Africa (BRICS) institutions-.
- Going forward, NACI in partnership with DSI International Cooperation and Resources Programme will seek to identify and build relations with Cuba. Such relations will offer an opportunity to learn and share about the challenges and opportunities facing both Country STI systems.

NACI in partnership with DSI International Cooperation and Resources Programme intends to host the BRICS conference on STI Policy and Foresight Exercise in August 2021. It also intends to host an international webinar on the role of advisory councils in the fight against COVID-19.

PART C: MEASURING OUR PERFORMANCE

I. Outcomes, Indicators and Targets for the 2021/22 Financial Year

Table 1: NACI's performance outcomes, indicators and targets for the 2021/22 financial year

Outcome	Outputs	Outcome Indicators	AUDITED/ACTUAL PERFORMANCE			Estimated performance	MEDIUM-TERM TARGETS		
			2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
To learn from previous experience to improve efficacy and ensure evidence-based, informed, confidential and timely policy advice to the Minister of Higher Education, Science and Innovation and, through the Minister, to Cabinet	STI advice	Number of STI policy advice documents submitted to the Minister of Higher Education, Science and Innovation	Three STI policy advice documents submitted to the Minister and Director-General of Science and Innovation focusing on the following areas: 1. Draft White Paper on STI 2. Analysis of government support programmes for business research and innovation; 3. South African STI Indicators Report. Also, a piece of draft advice on a biomass assignment model within a bio-based economy was finalised.	Three STI advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2019	Three STI ⁴ advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2020	Three STI advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2021	Three STI ⁵ advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2022	Three STI advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2023	Three STI advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2024

⁵ NACI generates advice proactively or at the behest of the Minister. The need for advice can be identified at any time during the course of the financial year. It is therefore not advisable to commit to the types of advice to be generated in advance.

Outcome	Outputs	Outcome Indicators	AUDITED/ACTUAL PERFORMANCE			Estimated performance	MEDIUM-TERM TARGETS		
			2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
To contribute to the building of NSI monitoring, evaluation and learning capability to assess the health of the NSI and its contribution to sustainable and inclusive development	State of STI reports ⁶	Number of "State of STI" reports produced	The State of STI Report produced before 31 March 2018	STI indicators Report finalised by 31 March 2019	STI Indicators Report finalised by 31 March 2020	STI Indicators Report produced by 31 March 2021	STI Indicators Report produced by 31 March 2022	STI Indicators Report produced by 31 March 2023	STI Indicators Report produced by 31 March 2024
	NSI M&E reports	Number of "NSI M&E" reports produced	A draft progress report on the evaluation of the Sector Innovation Fund Programme was produced. A preliminary draft of an M&E framework for the South African STI system was produced. An inception report on the costs, benefits and impact (as well as absorption and diffusion) of imported technologies was produced.	Two NSI M&E Reports finalised by 31 March 2019	Two NSI M&E Reports finalised by 31 March 2020	Two NSI M&E Reports produced by 31 March 2021 ⁷	Two NSI M&E Reports produced by 31 March 2022	Two NSI M&E Reports finalised by 31 March 2023	Two NSI M&E Reports produced by 31 March 2024
	National STI Information Portal (NSTIIP)	Successful implementation of NSTIIP	The user experience of the NSTIIP was documented. A technical forum was established and is functioning well. Potential areas for upscaling the NSTIIP (e.g. communities of practice and a database of researchers) have been identified.	Phase 1 (upscaling of NSTIIP) by 31 March	Phase 2 (full-scale roll-out of the NSTIIP)	Ongoing maintenance and implementation of the NSTIIP by 31 March 2021	Directory of Experts and Communities of Practice platforms/modules developed by March 2022	Ongoing maintenance and implementation of the NSTIIP by 31 March 2023	Ongoing maintenance and implementation of the NSTIIP by 31 March 2024

⁶ The STI Indicators Report will serve as the "State of STI Report". Discussions are underway with different actors to enhance the framing, content and quality of the STI Indicators Report so that it becomes an authoritative State of STI Report for South Africa. In future, the production of the State of STI Report will be produced biennially.

⁷ M&E reports will emerge from studies including state of innovation in the TVET sector; impact of imported technologies, technology diffusion, transformation and absorption of STI human resources, evaluation of maths and physics education performance.

Outcome	Outputs	Outcome Indicators	AUDITED/ACTUAL PERFORMANCE			Estimated performance	MEDIUM-TERM TARGETS		
			2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
To contribute towards building a well-coordinated, effective and responsive NSI	Institutional Foresight exercise capability	Foresight exercise capability institutionalised	No target	Finalisation of foresight exercise by 30 September 2018	High-level framework for STI decadal plan was submitted to the Minister of Higher Education, Science and Innovation – 31 July 2019	Institutional foresight exercise capability model conceptualised, partnerships established and skills development occurred by 31 March 2021	One sectoral/provincial/regional foresight exercise conducted in partnership with relevant stakeholders by 31 December 2022	Evaluation of the South Africa Foresight Exercise for STI 2030 by 15 March 2023	Review of the South Africa Foresight Exercise for STI 2030 by 15 March 2024
To transform NACI into a smart, efficient and learning organisation.	Communication plan	Communication plan updated and implemented	Media coverage of the launch of the South African STI Indicators Report included live broadcast and television interviews. Articles were also published in newspapers on a range of issues related to the Council's work.	Communication plan implemented by 31 March 2019	Communication plan updated and implemented by 31 March 2020	Communication plan updated and implemented by 31 March 2021	Communication plan updated and implemented by 31 March 2022	Communication plan updated and implemented by 31 March 2023	Communication plan updated and implemented by 31 March 2024

Outcome	Outputs	Outcome Indicators	AUDITED/ACTUAL PERFORMANCE			Estimated performance	MEDIUM-TERM TARGETS		
			2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
	Internal corporate governance system	Internal corporate governance system implemented	The 2016/17 Annual Report and 2018/19 APP were approved by Parliament. The Terms of Reference for the Institutional Review (2009-2018) were finalised. The Institutional Review Panel was established	Corporate governance system implemented (such as Annual Report, Annual Performance Plans) by 31 March 2019 Institutional review report completed by 30 July 2018	Corporate governance system implemented (2019/20 APP, 2018/19 Annual Report) developed and approved by Minister and submitted to Parliament by 31 March 2020	Corporate governance system implemented (2020/21 APP, 2019/20 Annual Report) developed and approved by Minister and submitted to Parliament by 31 March 2021	Corporate governance system implemented (2021/22 APP, 2020/21 Annual Report) developed and approved by Minister and submitted to Parliament by 31 March 2022	Corporate governance system implemented (2022/23 APP, 2021/22 Annual Report) developed and approved by Minister and submitted to Parliament by 31 March 2023	Corporate governance system implemented (2023/24 APP, 2022/23 Annual Report) developed and approved by Minister and submitted to Parliament by 31 March 2024
	Knowledge management system	Knowledge management system implemented	Knowledge management system implemented through Alfresco system by 30 March 2018	Knowledge management system implemented by 31 March 2019	Knowledge management system implemented by 31 March 2020	Knowledge management system implemented by 31 March 2021	Knowledge management system implemented by 31 March 2022	Knowledge management system implemented by 31 March 2023	Knowledge management system implemented by 31 March 2024

2. Quarterly Targets for 2021/22

Table 2: NACI's quarterly targets for the 2021/22 financial year

Output indicator	Annual Target	QUARTERLY TARGETS			
		1st	2nd	3rd	4th
Number of STI policy advice documents submitted to the Minister of Higher Education, Science and Innovation	Three STI policy advice documents submitted to the Minister of Higher Education, Science and Innovation by 31 March 2022	Planning and data analysis by June 2021	Data analysis, consultation and reporting: 30 September 2021	One STI advice document by 20 December 2021	Two STI policy advice documents generated by 31 March 2022
Number of "State of STI" reports produced	STI Indicators Report finalised by 31 March 2022	Concept and work plan produced by June 2021	Data collection completed by September 2021	Data Analysis and Review by December 2021	Final STI Indicators Report finalised by 31 March 2022
Number of NSI M&E reports	Two NSI M&E reports finalised by 31 March 2022	Finalise concept and data collection by June 2021	Data analysis by September 2021	Drafting M&E reports 15 December 2021	Two NSI M&E reports finalised by 31 March 2022
Successful operation of National STI Information Portal (NSTIIP)	Directory of Experts and Communities of Practice platforms/modules developed by March 2022	Implementation concept completed by June 2021	Approved documentation for the NSTIIP upgrade and implementation by September 2021	Monitor the implementation for the NSTIIP portal upgrade by December 2021	Directory of Experts and Communities of Practice platforms/modules developed by March 2022
Communication plan	Communication plan implemented by 31 March 2022	Communication plan refined and implemented by 30 June 2021	Communication plan implemented by 30 September 2021	Communication plan implemented by 31 December 2021	Communication plan implemented by 31 March 2022
Corporate governance system	Corporate governance system implemented (2022/23 APP, 2020/21 Annual Report) developed and approved by Minister and submitted to Parliament by 31 March 2022	Annual Report highlights submitted to the DSI by 30 May 2021	1. 1st draft of the 2020/21 Annual Report submitted to the DSI by 30 July 2021 2. 2nd draft of the 2020/21 Annual Report submitted to the DSI by 30 August 2021 3. 2020/21 Annual Report ready for tabling in Parliament by 30 September 2021	1st draft of the 2022/23 Annual Performance Plan submitted to the DSI by 15 October 2021	Final draft of the 2022/23 Annual Performance Plan submitted to the DSI by 30 January 2022
Knowledge management system	Knowledge management system implemented by 31 March 2022	Knowledge café to be hosted as a platform to create NACI knowledge management strategy by 30 June 2021	Identification of key interviewees (with NACI knowledge) to be finalised by 30 September 2021	All NACI meetings recorded and transcripts stored safely in Alfresco by 30 November 2021 Interviews with selected knowledge holders recorded and stored by 30 November 2021	Knowledge management system implemented by 31 March 2022

3. Planned Performance over the Medium-term Period

3.1 *To learn from previous experience to improve efficacy and ensure evidence-based, confidential and timely policy advice to the Minister of Higher Education, Science and Innovation and, through the Minister, Cabinet*

Achieving this outcome will require better data and information analysis, more coordination and improved scientific advisory mechanisms. Building internal capability and exploiting new and established external networks will be critical.

3.2 *To contribute to the building of NSI monitoring, evaluation and learning capability, in order to assess the health of the NSI and its contribution to sustainable and inclusive development*

This outcome is intended to partly support government to learn from experience and bolster policy performance over time, and to help ensure that government action meets its objectives efficiently at the lowest possible cost. To achieve this outcome, NACI will need the capacity to ensure that STI quantitative and qualitative indicators needed for monitoring, evaluation, planning and management are available and analysed.

3.3 *To contribute to the building of a well-coordinated, responsive and effective NSI*

NACI will be seeking to explore and propose solutions to the long-standing STI policy questions of coordination, prioritisation, financing, size and shape, human resources, and knowledge production and diffusion, among others.

3.4 *Building a capable, smart and effective organisation*

For this outcome to be realised, current internal operational inefficiencies will have to be addressed; the quality and turnaround time for the production of advice enhanced, knowledge management and communication improved; and the benefits of digitisation optimally exploited. Skills, knowledge and competency development will be critical.

4. Resource Considerations

4.1 Human Resource Requirements

To implement its advisory work programme, the NACI Council is supported by the NACI Secretariat. The Secretariat comprises a small team of 11 members, including the Acting CEO. In the 2020/21 financial year, two people were employed on fixed-term contracts to assist the team with their workload.

4.2 Expenditure Estimates

Table 3 presents a summary of 2021/22 expenditure estimates for the total budget of R15 million, comprising compensation of employees (R7,2 million) and goods and services (R8 million).

Table 3: NACI expenditure estimates

Programme	Audited outcomes			Adjusted/ appropriation	Medium-term expenditure estimate		
R'000	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Compensation of employees	8,334	6,883	9,891	7,976	7,250	7,344	7,357
Goods and services	8,730	9,401	9,587	8,816	8,013	8,116	8,132
Transfers and subsidies	40	-	26	-	-	-	-
Payment for financial assets	34	-	-	-	-	-	-
TOTAL	17,138	16,284	19,504	16,792	15,263	15,460	15,489

5. Key Risks and Mitigations

Outcomes	Key Risks	Risk Mitigations
To learn from previous experience to improve efficacy and ensure evidence-based, informed, confidential and timely policy advice to the Minister of Higher Education, Science and Innovation and, through the Minister, to Cabinet	Low uptake of advice. Appointment of highly capable and competent staff 4	<ul style="list-style-type: none"> • Secretariat to undergo training to develop skills relating to drafting and delivering high quality advice timeously. • Council to secure Ministerial advice/direction/approval of identified areas prior to the production of advice. • Council to robustly engage with the draft advice prior to submission to the Minister
To contribute to the building of NSI monitoring, evaluation and learning capability in order to assess the health of the NSI and its contribution to sustainable and inclusive development	Copyright infringements relating to STI data and information stored on the STI data and information portal. Non-appointment of individuals with critical skills	Continue negotiations with the service provider to determine the terms of utilising STI data and information
Building a capable, smart and effective organisation	Inaccurate, unreliable and incomplete reporting of actual achievements against predetermined objectives as indicated in the APP (Qualified Audit Opinion on non-financial performance) Lack of funding to fill critical and scarce skills	<ul style="list-style-type: none"> • Conduct awareness sessions with all employees on Technical Indicator Descriptive Matrix (A step-by-step training to the user on how to capture the indicator as indicated in the APP using the Technical Indicator Descriptive standard template prescribed by National Treasury) • Implement and monitor quarterly the approved Roles and Responsibilities on Performance Information Reporting Guidelines • Finalise the draft Department of Science and Technology Performance Information Reporting Guidelines

PART D: TECHNICAL INDICATOR DESCRIPTIONS

Strategic outcomes are broad and focused on the long-term. Short to medium-term objectives that can be pursued, implemented and tracked are, therefore, needed. The NACI objectives are articulated in Table 4, which also provides indicators and a baseline.

Table 4: NACI technical indicator descriptions

Indicator title	PPI 1: Number of STI advice submitted to the Minister of Higher Education, Science and Innovation
Short definition	An evidence-based, confidential and timely advice (proactive and reactive) will be generated
Source/collection of data	Primary data, secondary data (survey and literature review) and existing data (literature review)
Method of calculation/ Assessment	Quantitative and qualitative
Data limitations/ Assumptions	Assumption & Limitation 1: NACI will have access to readily available data that is relevant, up-to-date and of high quality. Assumption & Limitation 2: The capacity is readily available within NACI and its committees to tackle all pertinent content issues.
Disaggregation of beneficiaries	Different advice areas may target different beneficiaries through various recommendations.
Spatial transformation	To be considered as and where applicable.
Calculation type	Non-cumulative
Reporting cycle	Annually
Desired performance	To learn from previous experience to improve efficacy and ensure evidence based, confidential and timely production of advice to the Minister of Higher Education, Science and Innovation and, through the Minister, to Cabinet.
Indicator responsibility	Chief Senior Specialist & Senior Specialists

Indicator title	PPI 2: Number of “State of STI” reports produced
Short definition	To be considered as and where applicable
Source/collection of data	Secondary data
Method of calculation/ Assessment	Qualitative and quantitative 4
Data limitations/ Assumptions	Assumption & Limitation 1: NACI partners will be able to provide accurate, relevant and quality data, since NACI conducts secondary data analysis. However, the required data may not always be available in a form or quality that NACI prefers or would like it to be.
Disaggregation of beneficiaries	Yes. All reports will be required to provide disaggregated data where possible.
Spatial transformation	To be considered as and where applicable.
Calculation type	Non-cumulative
Reporting cycle	Annually and quarterly
Desired performance	STI Indicators Report Different M&E reports
Indicator responsibility	Chief Senior Specialist, Senior Specialists & Acting Senior Specialist: S&T Indicators and Measures

Indicator title	PPI 3: Number of NSI M&E Reports produced
Short definition	Generate research findings to inform policy recommendations.
Source/collection of data	Primary data, secondary data (survey and literature review) and existing data (literature review)
Method of calculation/ Assessment	Qualitative and quantitative
Data limitations/ Assumptions	Assumption & Limitation 1: NACI partners will be able to provide accurate, relevant and quality data since NACI conducts secondary data analysis. However, the required data may not always be available in a form or quality that NACI prefer or would like it to be.
Disaggregation of beneficiaries	Generally, NACI's reports are intended to benefit all beneficiaries without necessarily specifying them. In certain instances, M&E reports will be specific to certain social groups.
Spatial transformation	To be considered as and where applicable.
Calculation type	Non-cumulative and cumulative (Long-term)
Reporting cycle	Quarterly and annually
Desired performance	Advice letters with policy recommendations based on research findings
Indicator responsibility	Chief Senior Specialist & Senior Specialists

Indicator title	PPI 4: Successful implementation of National STI Information Portal (NSTIIP)
Short definition	Central repository of all key STI data and information
Source/collection of data	Primary data (surveys, etc. from data collectors), secondary (linkages with other similar portals) and improvement of existing data (issues or challenges faced)
Method of calculation/ Assessment	Qualitative and quantitative 4
Data limitations/ Assumptions	Assumption & Limitation: NACI partners will always be willing to cooperate and avail primary data as and when required. The challenge is that NACI lacks the necessary authoritative power to force data sources to share their data.
Disaggregation of beneficiaries	Yes All reports will be required to provide disaggregated data where possible.
Spatial transformation	To be considered as and where applicable.
Calculation type	Non-cumulative
Reporting cycle	Annually
Desired performance	Optimal functioning of the National STI Information Portal
Indicator responsibility	Acting Senior Specialist: S&T Indicators and Measures

Indicator title	PPI 5: Communication plan implemented
Short definition	Through the use of the media engagement, electronic communications, branding, events management, internal, intergovernmental communications and outreaches ensure that stakeholders and citizens are aware of and can access the initiatives and programmes undertaken by the National Advisory Council on Innovation.
Source/collection of data	<ul style="list-style-type: none"> • On-site surveys at events • Attendance registers • Distribution of reports • Media analysis reports • Ministry and presidential speeches • Departmental advices
Method of calculation/ Assessment	<ul style="list-style-type: none"> • Attendance registers • Public reports produced • Number of media/press clippings/inserts/interviews
Data limitations/ Assumptions	Assumption & Limitation I: NACI will generate enough and useful material that can be communicated to the public and to key stakeholders locally and internationally. The challenge is to translate scientific data into easy to understand messages.
Disaggregation of beneficiaries	Yes All reports will be required to provide disaggregated data where possible.
Spatial transformation	To be considered as and where applicable.
Calculation type	Non-cumulative
Reporting cycle	Quarterly and annually
Desired performance	Awareness of and access to NACI programmes and initiatives by NSI stakeholders and South African public
Indicator responsibility	DD:Administration and Coordination/Chief Director: Communications

Indicator title	PPI 6: Internal corporate governance system approved and implemented
Short definition	To develop and implement monitoring and evaluation reports to inform planning and decision making
Source/collection of data	<ul style="list-style-type: none"> • Strategic and Annual Performance Plans • National Treasury Framework for strategic planning and annual performance plans • DPME National Evaluation Policy Framework
Method of calculation/ Assessment	Quantitative 4
Data limitations/ Assumptions	Assumption & Limitation I: Council projects are not completed timeously.
Disaggregation of beneficiaries	Yes All reports will be required to provide disaggregated data where possible
Spatial transformation	To be considered as and where applicable.
Calculation type	Cumulative
Reporting cycle	Quarterly and annually
Desired performance	Reports (Four quarterly reports and one annual report) leading to informed decision-making that will ensure the attainment of the MTSF objectives.
Indicator responsibility	DD:Administration and Coordination/ Chief Director: Governance

Indicator title	PPI 7: Knowledge management system implemented
Short definition	To extract and harness historical organisational data to inform continued operations
Source/collection of data	Primary data (surveys, interviews, etc. from data collectors), secondary (stored information in registry)
Method of calculation/ Assessment	Quantitative and Qualitative
Data limitations/ Assumptions	Assumption & Limitation: NACI partners will always be willing to cooperate and avail primary data as and when required. The limitation is that NACI lacks the necessary authoritative power to force data sources to share their data.
Disaggregation of beneficiaries	Yes All reports will be required to provide disaggregated data where possible
Spatial transformation	To be considered as and where applicable.
Calculation type	Non-cumulative
Reporting cycle	Annually
Desired performance	Knowledge system
Indicator responsibility	DD:Administration and Coordination/ Chief Director: Governance

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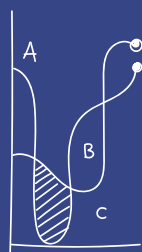
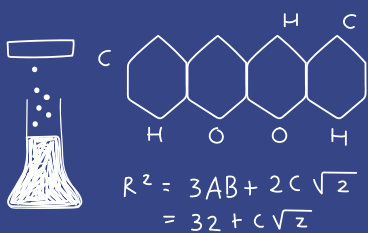
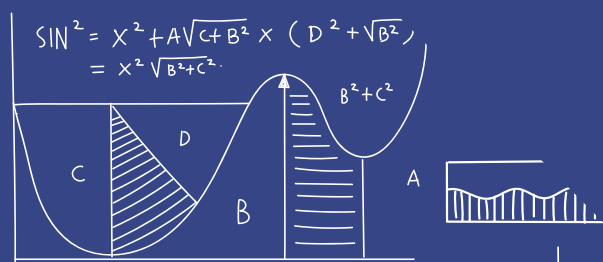
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