Annual Performance Plan
2022/23

science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

technology innovation
AGENCY
Innovating Tomorrow Together

Contents

1. List of Abbreviations

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
APP	Annual Performance Plan
b	Billion
B-BBEE	Broad-based Black Economic Empowerment
BERD	Business expenditure on R&D
COVID-19	Coronavirus disease 2019
CSIR	Council for Scientific and Industrial Research
DDM	District Development Model
DSI	Department of Science and Innovation
GDP	Gross Domestic Product
GERD	Gross expenditure on R&D
HEI	Higher education institution
HIV/AIDS	Human immunodeficiency virus infection and acquired immune deficiency syndrome
ICT	Information and communication technologies
IDC	Industrial Development Corporation
IK	Indigenous knowledge
IKS	Indigenous knowledge systems
IP	Intellectual property
m	Million
MTEF	Medium-Term Expenditure Framework
MTSF	Medium-Term Strategic Framework
NACI	National Advisory Council on Innovation
NDP	National Development Plan
Necsa	South African Nuclear Energy Corporation
NRDS/TYIP Review	Review of the National Research and Development Strategy and Ten Year Innovation Plan
NSI	National System of Innovation
PFMA	Public Finance Management Act
R&D	Research and development
RDI	Research, development and innovation
SAMRC	South African Medical Research Council
SET	Science, engineering and technology
Stats SA	Statistics South Africa
STI	Science, technology and innovation
SMME	Small, medium and micro enterprise
TIA	Technology Innovation Agency
TRL	Technology readiness level
TSP	Technology Stations Programme
TVET	Technical and Vocational Education and Training
UNIDO	United Nations Industrial Development Organization

2. Executive Authority Statement

The Annual Performance Plan (APP) 2022/23 of the Technology Innovation Agency (TIA) identifies the outputs, output indicators and targets that the agency aims to achieve in the 2022/23 financial year. TIA's APP 2022/23 is informed by the National Development Plan (NDP) 2030, the Medium-Term Strategic Framework (MTSF) 2019-2024, the Economic Reconstruction and Recovery Plan and the District Development Model (DDM). It also considers relevant National System of Innovation (NSI) policies, specifically the White Paper on Science, Technology and Innovation, the Science, Technology and Innovation Decadal Plan 2020 and the Bio-economy Strategy. Furthermore, the APP 2022/23 considers the Sustainable Development Goals of the United Nations' Agenda 2030 and the African Union's Agenda 2063.

The APP 2022/23 is aligned with TIA's Strategic Plan for 2020-2025 in addition to the agency's mandate as per the Technology Innovation Agency Act (No 26 of 2008). It will be implemented with the oversight of TIA's Accounting Authority, the Board. Implementation of the APP 2022/23 will be monitored through quarterly and annual performance reporting to TIA's Shareholder, the Department of Science and Innovation (DSI).

Dr Bonginkosi E. Nzimande, MP

Minister of Higher Education, Science and Innovation

Executive Authority of the Technology Innovation Agency

3. Chairperson's Foreword

It is my profound honour to commence my tenure as the Chairperson of the TIA Board during a season of great hope and accelerated economic recovery. After enduring a bitter pandemic and the subsequent degradation of the economy, we urgently need to expedite our committed action to secure a more resilient, inclusive economy.

Necessity has truly given birth to much inventiveness with the widespread digitalisation of the workplace and associated lifestyle changes – technology has been a key ally in mitigating our restricted movements during the various lockdown responses. It is my hope that government's mass vaccination programme will continue apace, with prudent health protocols being maintained.

Our healthcare infrastructure remains an important endowment in advancing our economic recovery. I am consequently most pleased with the announcement in January 2022 of an investment in a vaccine manufacturing facility by NantWorks LLC (founded by Dr Patrick Soon-Shiong, born and raised in South Africa). This investment will stimulate value chains in the precision medicine sector, including demand for bio-reactors, reagents, viral vectors and other bio-economy inputs. I am delighted that TIA will play its full role in anchoring this investment through its investee network. We are keen advocates for precise, regenerative medicine and the broader biopharma/life science industry. Having a healthy nation is a legacy investment, particularly in our youth – custodians of our future.

There is much reason to be optimistic about the road to economic recovery, notwithstanding more frequent and variable extreme weather events born from the climate change emergency. As a country, we are committed to an equitable, just transition from coal-sourced energy to renewable energy in pursuit of a net-zero emissions energy system. Very notably, Hive Hydrogen South Africa (a venture between Hive Energy in the United Kingdom and BuiltAfrica Holdings in South Africa) and Afrox, a Linde subsidiary, are executing one of the largest green ammonia projects in the world, with expenditure estimated to be at least R70 billion. This export earning project should produce bulk product at scale and will be neutral of grid power sources at the Coega Special Economic Zone. The economics of green ammonia anchor the broader economics of green hydrogen and green methanol – a strategic bulwark in establishing credibility for our just transition efforts.

We are most sensitive to the adverse effects of vulnerable biodiversity and believe that TIA has a unique role to play in increasing ecosystem resilience and stimulating local adoption of appropriate clean technology for greater adaptive capacity. As a global society, we need a bold collective response to resolve the risks to our ecosystems. As we mobilise

in support of economic recovery, we must continually implement and close the finance gaps pertaining to the sustainable development goals.

The transition to net-zero emissions also carries inherent material risk to important sectors of our economy with the real prospect of stranding whole industries that have now been declared un-investable. The critical task of repurposing these industries will rely on the strategic inputs from TIA and other innovative actors, with important support from the government and social partners. In this, we should remain alive to the challenges posed by policies such as the European Union's Carbon Border Adjustment Mechanism, which has the potential to affect the significant markets for our mining, automotive, agriculture and steel industries. An appropriate response must prioritise strengthening of local value chains and consolidating technology gains to buoy the competitiveness of our economy.

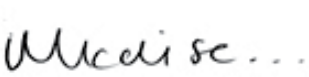
Within the NSI, TIA is one of the key vehicles that delivers the full expression of the circular economy, productive convergence around digitalisation and the Fourth Industrial Revolution (4IR). It is gratifying that in our performance plan for 2022/23, we will be integrating and consolidating our work with that of broader government. This promises to reduce duplications and inefficiencies with value-accretive benefits for the economy. A case in point is technology purchases in large infrastructure projects where TIA may support local innovation on a competitive basis.

To achieve higher levels of impact, we have enjoyed meaningful partnerships with strategic co-investments such as our flagship fund with the SA SME Fund in biotechnology and life sciences. The traction obtained by our fund manager, One Bio, has demonstrated the depth of our country's knowledge endowment in this cutting-edge industry. I look forward keenly to the creation of a clinical research fund that would support key investigations for therapies and technology developed at home and licensed on a proprietary basis. Our success in this area will greatly benefit our agenda for youth employment, substitute much importation of essential medicines and become a potential source of export earnings.

On a personal note, I would like to convey my heartfelt condolences to the family of Mr Michael Fichardt, co-founder of One Bio, who sadly passed away after a short illness. We will miss his energy and wisdom in delivering immense traction in the Bio-economy platform.

I am humbled to make my modest contribution to the important mission of TIA and the broader system of innovation under the stewardship of the DSI. I have the utmost regard for TIA's Executive Authority, the Honourable Minister of Higher Education, Science and Innovation, Dr Bonginkosi Nzimande, and the painstaking policy work undertaken to enable the knowledge-based economy. Thank you to the Director-General of the DSI, Dr Phil Mjwara, and his senior leadership for their continued support of and trust in TIA. It is patently manifest that if we make wise investments in our innovation infrastructure, we provide the economy with a winning chance to create wealth, decent jobs and a higher quality of life for our people.

I wish to thank the previous members of the TIA Board for their sterling contributions during their tenure of office. I would lastly like to thank the TIA executive team led by the acting CEO for their insights and wisdom.



Ms Matsi Modise

Chairperson of the Board

4. Chief Executive Officer's Overview

TIA was established with the objective of supporting the state in stimulating and intensifying technological innovation to improve economic growth and quality of life for all South Africans. Over the years, the agency has successfully supported the development and commercialisation of a range of technologies that address South Africa's socio-economic challenges and, most recently, enabled government to respond to the challenges of the COVID-19 pandemic.

In the last financial year, TIA collaborated with a wide range of actors in the NSI, through its rich portfolio of funding and non-financial interventions, to put no fewer than 30 technologies on the market and demonstrate at least 37 bio-based innovations in support of various government priorities. Through its Technology Stations Programme (TSP), the agency responded to the needs of many small, medium and micro enterprises (SMMEs) battling for survival in the market and deployed, once again, genomic sequencing capabilities of TIA's Technology Platforms to track, analyse and identify the various SARS-CoV-2 variants in the COVID-19 pandemic.

As TIA enters the third year of implementing its 2020-2025 Strategic Plan, the long-term impacts of the COVID-19 pandemic on the economy, people's lives and livelihoods continue to be deep, wide and far-reaching. There are rising levels of poverty, unemployment – especially among the youth – and levels of inequality are deepening. Into the future, the White Paper on Science, Technology and Innovation, though predating the pandemic period, remains the most important framework for directing national science, technology and innovation (STI) efforts towards higher productivity, inclusion and transformation.

The DSI has already started implementing in earnest a number of strategic intents of the White Paper. Key among those that constitute an important context for TIA's planning are the Decadal Plan development process; the Higher Education, Science, Technology and Innovation Institutional Landscape Review; the Ministerial Review of TIA; and the implementation of the Innovation Fund as a mechanism to inject additional funding to fast-track and enhance South Africa's commercialisation efforts. The last of these is the National Treasury Spending Review of TIA. All these are important considerations as TIA enters the 2022/23 financial year.

TIA welcomes the release of the draft Decadal Plan on Science, Technology and Innovation as an implementation plan for the White Paper. In its current form, the plan already provides sound guidance on emerging STI priorities for TIA's planning. TIA has therefore already sought to align its actions with the priorities on revitalising and modernising agriculture, manufacturing and mining, and exploiting new sources of growth in areas such as the circular economy and

the digital economy. Other priority areas include innovation in support of health, the energy sector and inclusive development.

That said, TIA's 2020-2025 Strategic Plan continues to remain relevant in contributing to these priorities. Through this, the agency has committed itself to directing a greater proportion of its resources to pursuing three outcomes: the translation and commercialisation of publicly financed intellectual property (IP); effectively delivering on the Bio-economy Strategy; and providing effective science, engineering and technology (SET) support to SMMEs. Our efforts in pursuing these outcomes are based on an acknowledgement that the fiscus is constrained and that there will be a need for more partnerships to promote pooling of resources and fostering improved funding efficiencies in the NSI.

Our key actions in the 2022/23 financial year will seek to build on past achievements and mainly focus on the following:

- Increasing the number of technologies that are successfully commercialised, deployed and diffused into the market, with a particular focus on how they make a positive impact on South Africa's socio-economic challenges and lead to the creation of new industries.
- Strengthening TIA's role as an important creator of a rich pipeline of de-risked technologies from publicly funded IP for the NSI through increased investments in the Seed Fund and Technology Development Fund.
- Continuing investments in strategic systemic infrastructure capabilities such as Technology Platforms and Technology Stations.
- Growing the pool of strategic local and international partnerships to bolster the execution of the agency's mandate through increased funding and sharing of complementary capabilities.
- Implementing the Innovation Fund with an emphasis on its intended commercialisation outcomes.
- Transformation and inclusivity, particularly in support of the objectives of the DDM and the policy intents of the White Paper on Science, Technology and Innovation.
- Building TIA into a strong organisation with good governance.

I wish to thank the Director-General and his senior officials at the DSI for their support during the previous year. The inputs of the DSI officials in the months leading up to finalising this APP have helped TIA to enhance its vision and implementation efforts for the year ahead. Lastly, I would like to thank and express my deep appreciation to the outgoing TIA Board for their stewardship, oversight and unwavering commitment to the mandate of TIA during their tenure. I wish to welcome the incoming Board members and look forward to working closely with them to continue building TIA into a world-class organisation, with appropriate leadership stature in the NSI.

I am pleased to present TIA's APP for 2022/23.

Patrick Krappie

Acting Chief Executive Officer

5. Chief Financial Officer's Overview

Responding to the COVID-19 pandemic demonstrated TIA's agility and ability to pivot as circumstances dictated, vindicating the efficacy of our mandate. The call by the Department of Planning, Monitoring and Evaluation for public-funded entities to revise their 2020-2025 Strategic Plans and 2020/21 APPs provided the opportunity for TIA to renew its vision to respond to the pandemic, its aftermaths, and the impact on the fiscus and the economy. This was necessary due to the budget cuts imposed and the need to reprioritise key elements of strategy to ensure that the limited available resources are directed to critical areas of need.

TIA operates with an annual budget of approximately R458 million. This is made up of a baseline of R197 million, with R260 million assigned as ring-fenced funding. As a result of depressed economic conditions arising from the COVID-19 pandemic, lockdown and the need for budget reprioritisation, TIA had seen its annual budget cut by 10% (R45 million) in the prior year. This resulted in TIA's capacity to fund investments being significantly reduced, although the agency was able to redirect savings from operational expenditure into investment expenditure to mitigate these cuts.

The budget estimates for the 2022/23 financial year, the third year of the current strategic cycle, are set based on the performance of the previous two years. The agency's planning has prioritised effective cost management solutions and continues to ensure that funds are appropriated in areas where they are most needed.

Medium-Term Expenditure Framework (MTEF) baseline allocations for 2022/23 and 2023/24 reflect an increase that is significantly lower than inflation. Because of this, constraints exist on the amount of funding available for projects. There remains a large unfunded pipeline of investments, putting great emphasis on the organisation leveraging additional funding through various partnership models. In this environment, the agency is challenged to intensify efforts to build partnerships that will bolster the execution of its mandate through co-funding initiatives, exploitation of resources and other forms of expertise and capabilities across the NSI. This will enable TIA to continue playing an important role in promoting collaboration and coordination with other players in the NSI, in both government and the private sector.

In line with zero-based budgeting methodology, the entity's budget is aligned with its strategic goals. All components of the annual budget are relevant and cost-effective based on reviews of prior years. TIA has a continuous drive towards improved savings. In addition, the agency will explore additional income sources to ensure sustainability and reduce reliance on funding from the fiscus.

The agency continues to ensure, through robust financial management, planning and control, that 80% of funding received is directed towards investment-related spending. This stringent target ensures that costs are maintained at the lowest possible level and all efficiencies are maximised.

Mr Ismail Abdoola

Chief Financial Officer

6. Official Sign-off

It is hereby certified that this APP:

- Was developed by the management of TIA under the guidance of the TIA Board and the DSI;
- Takes into account all the relevant policies, legislation and other mandates for which TIA is responsible; and
- Accurately reflects the impact, outcome and outputs that TIA will endeavour to achieve in 2022/23.

Brian Mphahlele

Executive: Commercialisation

Dr Vuyisile Phehane

Executive: Bio-economy

Vusi Skosana

Acting Executive: Innovation Enabling

Garth Williams

Head: Strategic Planning and Reporting

Petro Dekker

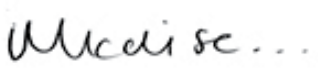
Executive: Corporate Services

Ismail Abdoola

Chief Financial Officer

Patrick Krappie

Acting Chief Executive Officer



Ms Matsi Modise

Chairperson of the Board

Minister Bonginkosi Nzimande

Executive Authority

Part A

Mandate

7. Legislative and Other Mandates

TIA is established as a schedule 3A public entity under the provisions of the Public Finance Management Act (PFMA) (Act 1 of 1999, as amended by Act 29 of 1999). Its mandate is derived from the provisions of the Technology Innovation Agency Act (No 26 of 2008),[1] which establishes TIA as an agency to promote the development and exploitation, in the public interest, of discoveries, inventions, innovations and improvements. TIA's objective is to support the state in stimulating and intensifying technological innovation to improve economic growth and the quality of life of all South Africans by developing and exploiting technological innovations. TIA's strategic programmes are aligned to the following national, continental and global imperatives.

7.1 National Development Plan 2030

The NDP seeks to eliminate poverty and reduce inequality in South Africa by 2030 by "drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society".

The NDP recognises that developments in STI fundamentally alter the way people live, connect, communicate and transact. It identifies science, technology and innovation as the main drivers of equitable economic growth and development, job creation and socio-economic reform, and emphasises that the role of STI is key to improving health systems, education and infrastructure. The NDP states that "South Africa's competitiveness will rely on national systems of innovation permeating the culture of business and society. Innovation and learning must become part of our culture."

Science, technology and innovation are key enablers that cut across the NDP's 14 focus areas of education, health, safety and security, economic growth and employment, skills development, infrastructure, rural development, human settlements, local government, environment, international relations, public sector, social protection, and nation-building and social cohesion. The NDP is split into three implementation phases: 2012-2017, 2018-2023 and 2024-2030. The contribution of the NSI to these three phases entails intensifying research and development (R&D) spending and exploiting opportunities linked to existing industries; laying the foundations for a more intensive improvement in productivity, with innovation across business, state and social sectors becoming pervasive; and consolidating the gains made through a greater focus on innovation, productivity increases and a more intensive pursuit of a knowledge economy, and improved utilisation of comparative and competitive advantages in a more integrated continent.

TIA plays a critical role in supporting the realisation of the NDP's vision by investing in and de-risking technological innovation and encouraging the commercialisation of market-ready technologies. Another critical role for TIA is to support knowledge and technology utilisation, particularly by providing SET and enterprise development support to SMMEs (especially to women, youth and people with disabilities).

7.2 2019-2024 Medium-Term Strategic Framework

Government's 2019-2024 MTSF serves as the implementation plan for the second phase of the NDP. Seven priorities guide planning by all stakeholders:

- Priority 1: A 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 quality basic services

[1] As amended by the Science and Technology Laws Amendment Act (No. 7 of 2014) and the Science and Technology Laws Amendment Act (No. 9 of 2020), with effect from 1 April 2021.

- Priority 5: Spatial integration, human settlements and local government
- Priority 6: Social cohesion and safe communities
- Priority 7: A better Africa and world

The DSI has committed itself to Priorities 2 and 3. Through its mandate, TIA will contribute to these through the commercialisation of IP from publicly funded research and support the creation of technology enterprises that will contribute to job creation with a specific emphasis on previously disadvantaged individuals and communities.

7.3 White Paper on Science, Technology and Innovation

The White Paper on Science, Technology and Innovation was adopted by Cabinet in March 2019. This policy development signalled material policy shifts for STI to address transformation and inclusivity and the need for stronger partnerships, linkages and coordination within the NSI. These include strengthening the culture of innovation within government and society; developing human capabilities; improving policy coherence and budget and programme coordination within the NSI; implementing monitoring and evaluation systems; creating a more enabling environment that improves innovation performance; developing local innovation ecosystems; and increasing investment in technology-based SMMEs and support to grassroots and social innovation projects. There is a particular focus on food security, energy, poverty alleviation and healthcare.

The DSI's mandate encompasses the generation and exploitation of knowledge for socio-economic development in South Africa. Within this knowledge-based economy, TIA's role is to support inclusive economic growth through technological innovation, improving the competitiveness of businesses (particularly SMMEs), and focusing on the empowerment of youth, women and people with disabilities.

7.4 White Paper on Post-School Education and Training

The 2013 White Paper on Post-School Education and Training provides a set of priorities to improve the capacity of the post-school education and training system to meet South Africa's needs. The stated objectives of the White Paper are as follows:

- A post-school system that can assist in building a fair, equitable, non-racial, non-sexist and democratic South Africa;
- A single, coordinated post-school education and training system;
- Expanded access, improved quality and increased diversity of provision;
- A stronger and more co-operative relationship between education and training institutions and the workplace;
- A post-school system that is responsive to the needs of individual citizens and employers in the public and private sectors, as well as to broader societal and developmental objectives.

The post-school education and training system includes universities, the National Student Financial Aid Scheme, technical and vocational education training colleges, community colleges and sector education and training authorities with the purpose of developing skilled graduates. The aim of the system is to provide a workforce that has the right training and skills meet the needs of the public sector, business and the broader economy.

7.5 Science, Technology and Innovation Decadal Plan 2020

DSI's Science, Technology and Innovation Decadal Plan 2020 will serve as the implementation plan for the White Paper on Science, Technology and Innovation. The draft Decadal Plan identifies the following STI priorities:

- Revitalising and modernising sectors of the economy:
  - Agriculture
  - Manufacturing, through high-tech applications
  - Mining
- New sources of growth:
  - The circular economy
  - The digital economy
- Innovation in support of health
- Innovation in support of the energy sector
- Innovation in support of a capable state
- Innovation for inclusive development
- STI missions:
  - Ecosystem-based climate change adaptation and mitigation
  - Education for the future and the future of society

The Decadal Plan brings together the grand challenges of the 2008 Ten Year Innovation Plan, the technology missions of the 2002 National Research and Development Strategy, the policy intents of the 2019 White Paper on Science, Technology and Innovation, and the thematic focus areas of the 2019 Foresight Exercise for Science, Technology and Innovation. It is also cognisant of the recommendations of the 2020 Review of the National Research and Development Strategy and Ten Year Innovation Plan (NRDS/TYIP Review), and the draft 2021 Ministerial Review of the Higher Education, Science, Technology and Innovation Institutional Landscape. Accordingly, it is incumbent on TIA to align itself more closely with priority areas, with a mission-oriented, transformation-focused and inclusive approach to innovation as envisaged by the DSI. TIA has a key role to play given the proposed implementation dimensions of the Decadal Plan.

7.6 Bio-economy Strategy

The Bio-economy Strategy provides a high-level framework to guide biosciences research and innovation investments and actions by all relevant stakeholders in the South African NSI. It seeks to turn South Africa's bio-based resources into a significant contributor to the country's economy by 2030 through the creation and growth of biotechnology-based industries. In turn, these new industries will generate and develop bio-based services, products, and innovations in which new and existing companies will provide and use such solutions. Additionally, bio-innovation will support social development and environmental protection.

TIA is one of the primary implementation actors of the Bio-economy Strategy, through its Bio-economy Division, which includes Indigenous Knowledge Systems (IKS).

7.7 District Development Model

The Cabinet-approved DDM of 2019 aims to synchronise planning by all spheres of government at the national, provincial and local levels, within the 44 district municipalities and eight metropolitan municipalities. The spatially referenced, integrated and strategically focused 'One Plan' will enable partnerships with civil society, including communities, private industry and labour at district level countrywide to foster the development of South Africa's municipal districts and metros. The role of government under the DDM is to ensure greater alignment between urban and rural development, emphasising local economic development.

The objectives of the DDM include the coordination of government's response to challenges of poverty, unemployment and inequality (particularly among women, youth and people living with disabilities); ensuring inclusivity (particularly gender-based inclusivity); strengthening monitoring and evaluation, coordination and capacities at district and city levels; and balancing the development of both urban and rural areas. TIA is an active member of the DSI Entities DDM Coordinating Committee.

7.8 United Nations Sustainable Development Goals

The United Nations Sustainable Development Goals entail ending poverty and hunger globally; combating inequality within and among countries; building peaceful, just, and inclusive societies; protecting human rights; promoting gender equality and the empowerment of women and girls; and ensuring the lasting protection of the planet and its natural resources. Countries committed to the goals aim to create conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all.

TIA's activities support virtually all of the 17 interlinked Sustainable Development Goals. For example, TIA provides SET support to SMMEs, particularly those that are black-owned, black-women-owned and youth-owned. TIA also supports grassroots innovators and indigenous knowledge-holders in vulnerable and marginalised communities. The agency makes a concerted effort to alleviate food insecurity and preserve South Africa's unique biodiversity. This is particularly important against the backdrop of scientific consensus on irreversible climate change and the need to redouble efforts to prevent further changes to earth systems.

7.9 African Union Agenda 2063

The African Union's long-term, people-centred Agenda 2063 is a strategic framework for the socio-economic transformation of Africa. Efforts are underpinned by STI as multifunctional tools and enablers for achieving development goals on the continent. Agenda 2063 calls for diversifying sources of economic growth for Africa and, in the long term, lifting large sections of the continent's population out of poverty. The strategic framework also fosters social transformation, industrialisation and entrepreneurship.

TIA plays a key facilitation role by collaborating with research and innovation institutions across the continent to implement joint technology development programmes and provide technical competence and entrepreneurial development to increase the application of research outputs in stimulating socio-economic transformation.

Part B

Strategic Focus

TIA was established to promote the development and utilisation – in the public interest – of discoveries, inventions, innovations and improvements. The objective of the agency is to support the state in stimulating and intensifying technological innovation in order to improve economic growth and quality of life for all South Africans.

VISION

Be a leading technology innovation agency that stimulates and supports technological innovation to improve the quality of life for all South Africans.

MISSION

Facilitate the translation of South Africa's knowledge resources into sustainable socio-economic opportunities.

VALUES

Teamwork	Professionalism	Excellence	Integrity	Transparency	Innovation
Together we can do more. Fostering teamwork creates a TIA work culture that values collaboration and cooperation.	We apply the most appropriate skills, competencies, experience and knowledge of best practices.	TIA will be accountable to all stakeholders to deliver exceptionally high standards of work and performance.	Everyone strives to do what they said they would. "We keep our word."	We engage in inclusive open communication and hold each other accountable for our performance and conduct.	We foster a culture in which we continually nurture and implement new ideas from our staff and stakeholders that enhance how we do things and deliver services.

8. Updated Situational Analysis

TIA's 2020-2025 Strategic Plan seeks to reposition the agency within the NSI and rests on three pillars. Firstly, it seeks to direct a greater proportion of its resources towards the translation and commercialisation of publicly financed IP emanating from higher education institutions and science councils. Secondly, there is a specific focus on implementing the Bio-economy Strategy, thereby deriving greater socio-economic value from South Africa's unique biological resources, historical biotechnology investments and bio-based capabilities. Thirdly, TIA aims to foster an enabling environment for innovation, with a specific focus on driving transformation and ensuring inclusion through the provision of SET and enterprise development services. These three pillars are the basis of TIA's three outcomes over the five-year period:

- Outcome 1: Commercialised innovations
- Outcome 2: Delivering on the Bio-economy Strategy
- Outcome 3: SMMEs supported through strategically informed and regionally distributed Technology Stations.

In developing this APP, the TIA Board and management undertook a review of the external and internal environment to assess the factors that are likely to influence the organisation's ability to deliver on its strategy during 2022/23. The resulting analysis of strengths, opportunities, aspirations and results is presented in Table 1.

Table 1: TIA strengths, opportunities, aspirations and results analysis for 2022/23

Strengths

- The uniqueness of TIA's offerings and the extent of TIA's mandate.
- Solid foundation of key programmes, e.g. Technology Stations, Technology Platforms and Seed Fund.
- Strong pipeline of near-market technologies for greater impact in the future (TRL7[2] and above).
- Good baseline of strategic partnerships and strengthened relationships with key stakeholders.
- A good collaborative relationship with the shareholder (DSI).
- A track record of a sound governance and control environment.
- Capable staff and robust information technology capabilities with a demonstrable ability to function optimally.
- TIA's attractive brand equity across selected stakeholder networks.
- TIA's strong bio-economy focus.

Opportunities

- Host/implementer of the Innovation Fund.
- New policy thrusts in the MTSF and the White Paper on Science, Technology and Innovation emphasising transformation and inclusivity, as well as a focus on economic revival.
- Following the COVID-19 pandemic, a greater market and government need is expected for new products, innovations and technologies (particularly locally).
- Increased transformation within TIA's portfolio with regard to historically disadvantaged higher education institutions and individuals, women, youth and people with disabilities due to the introduction of TIA's Broad-Based Black Economic Empowerment (B-BBEE) Policy, Transformation Framework and thematically focused funding calls.

[2] TRL = Technology Readiness Level.

Opportunities *(continued)*

- Several of TIA's core sectors are aligned to national priority areas (e.g. ICT and Health) in relation to the 4IR, artificial intelligence (AI)-driven trends in digital health and telemedicine, etc.
- Increased focus on the Bio-economy Strategy will improve South Africa's strategic positioning.
- Increase in demand for innovation/technology-based investments by industry, government and the funding community, leading to the potential for new funds (e.g. Clinical Trials Fund), programmes (e.g. IKS Platform) and partnerships.
- Contributing to the implementation of the DDM.
- DSI and Department of Higher Education and Training now report to the same Ministry, offering opportunities to leverage partnerships with Sector Education Training Authorities and other Department of Higher Education and Training initiatives.
- Leveraging funds to complement TIA's investment budget.
- Exploring external income generation from core activities to reduce reliance on the fiscus.
- Opportunity to support provinces other than Gauteng, KwaZulu-Natal and the Western Cape, which have previously been underfunded.

Aspirations

- To maximise and demonstrate the impact of TIA's investments through strategic decision-making that will benefit society, the economy and the environment.
- To create an inclusive and transformed innovation ecosystem.
- To influence the national innovation agenda and decision-making in the NSI.
- To be a transformed, coherent learning organisation that strives for excellence and efficiency.
- To maintain and continuously improve sound governance structures.
- Increased conversion of public-funded R&D outputs into commercialised innovations.

Results

- A diverse, inclusive and transformed innovation ecosystem.
- TIA's efforts contributing to national socio-economic development.
- A TIA that is the nexus of information on the innovation ecosystem, providing research and analysis for informed decision-making.
- An indispensable, agile, responsive and relevant TIA.
- TIA playing a strong leadership role in the NSI.

Within a fiscally constrained environment, TIA is being asked to intensify efforts to ensure that innovations derived from scientific research and technology development make more of an impact on society, the economy and the environment. This is in addition to the deployment, adaptation and diffusion of existing knowledge and technologies for socio-economic development. TIA also has a key role to play in the NSI by broadening the benefits of innovation to historically disadvantaged individuals and groups through directed transformation and inclusion efforts.

TIA seeks to address the following priorities within the NSI through STI-focused interventions:

- Alleviation of poverty, inequality and unemployment
- Transformation and inclusion, focusing on the historically disadvantaged and marginalised
- Sustainable growth and development
- Improved service delivery to citizens
- An enabling innovation environment

TIA measures its investment approval turnaround time from the date of receipt of a full application to when a final decision is made by the relevant decision-making body based on TIA's Delegation of Authority. TIA's funding application assessment process is thorough, ensuring that decisions taken on its limited discretionary funding are based on sound due diligence. Benchmarking against similar innovation agencies globally has revealed that similar processes are followed, and that the turnaround time is approximately six months.

TIA's 2021/22 APP identifies stakeholder dissatisfaction and associated reputational risk as consequential issues for TIA to manage when turnaround targets are not met. In mitigation, TIA's senior management and Executive Management Committee monitors and manages the agency's turnaround times closely. Furthermore, in 2021/22 TIA undertook a full process review to identify and address the causes of delays in achieving its turnaround time target. The following improvements were made:

- The Delegation of Authority was amended to enable quicker decision-making on lower-value applications.
- TIA reviewed its Investment Framework Policy.
- TIA established a Panel of Experts to support TIA's due diligence on technical and intellectual property, complementing its internal capacity.
- Turnaround time targets are now included in the individual performance agreements of all relevant staff members.

These corrective actions have, as of the time of writing, yet to have the desired effect, as TIA's performance against its investment approval turnaround targets is still unacceptable and of concern. TIA endeavours to continually monitor and improve on its performance.

9. External Environment Analysis

9.1 Emerging Global and Local Issues

The draft Science, Technology and Innovation Decadal Plan notes that fundamental global changes are taking place, straddling the political, economic, social and environmental domains. It notes that there is a breakdown in societal norms, with social cohesion and trust being eroded within civil society. Social tension and political unrest are on the rise, as is mass migration from conflict areas, caused by widening inequality within and between countries. Contributing to this inequality is the failure of growth and distribution of income and wealth within conventional capitalist economic models.

Environmental degradation and species extinction are on the rise. Globally, climate change is "widespread, rapid, and intensifying", according to the Intergovernmental Panel on Climate Change. Many observed changes to the climate are unprecedented, and some of the changes, such as continued sea-level rise, are considered irreversible. This underscores the need for drastic reductions in carbon emissions and other greenhouse gases.

In South Africa, the triple challenges of poverty, inequality and unemployment remain. The country has experienced structurally high (and rising) unemployment for a prolonged period. The COVID-19 pandemic has exacerbated these challenges. Job opportunities are scarce, particularly for women and the youth and especially in marginalised and rural communities. Given that SMMEs account for the bulk of job creation, the low enterprise creation rates and high business failure rates, particularly in the context of COVID-19, are of concern.

Job losses and limited employment opportunities are particularly evident in the primary and secondary sectors such as mining and manufacturing. Indeed, these economic sub-sectors have experienced a declining contribution to GDP, growth and employment for several decades.

While a new world of work has emerged due to a shift to remote (online) or hybrid working, such shifts together with restricted movement during hard lockdowns have severely affected the livelihoods and health of the poor and marginalised due to limited access to work opportunities and government services. The pandemic and associated government lockdowns to curb the spread of the disease have severely affected South Africa's economy, with high business failure and unemployment rates. The impact has been sharp for the youth and women in particular. The pandemic years of 2020 and 2021 have detrimentally affected the quality of learning and social development for hundreds of thousands of learners and students.

Energy supply remains constrained, notwithstanding significant investments in fossil-fuel electricity generating capacity in the last decade. The energy sector still relies heavily on coal, and the use of South Africa's low-grade coal reserves to produce electricity generates significant carbon emissions and other pollutants, harming human, animal and plant health. The transition to renewable energy sources such as solar and wind, while desirable, poses dire threats to mining employment and the rural communities in and around coal-mining areas. This underscores the need for a just energy transition focusing on upskilling marginalised communities to take up opportunities in new and emerging energy areas such as the hydrogen economy, fuel cells, batteries and renewables.

The COVID-19 pandemic has laid bare the stark inequalities in society, particularly in relation to internet access and participation in the digital economy. South Africa's lockdowns have constrained the movement of citizens, further harming the livelihoods and health of the poor and unemployed. These marginalised groups generally do not have the means to access the internet for economic or social purposes. Teaching and learning at many schools and higher education institutions stalled during the pandemic, reducing the potential for upward mobility of South Africa's poor, particularly youth and women. The so-called digital divide has widened.

The COVID-19 pandemic forced a transition to remote or hybrid modes of working. However, a significant proportion of SMMEs were not able to digitally transform or pivot to adjust to changing market consumption patterns. A high

business failure rate was recorded due to the hard lockdown measures implemented by the government to curb the pandemic. Those businesses that survived and were able to digitally transform now face increased cybersecurity and other challenges.

Increased burden of disease and lack of access to healthcare are the main challenges from a health perspective. The former concerns maternal, newborn and child health, HIV/AIDS and TB, non-communicable disease such as diabetes and cancer, violence and trauma, and the COVID-19 pandemic. The latter relates to long distances to health facilities, the cost of accessing treatment and medicines, the limited number of health facilities and the uneven distribution of such facilities.

Bio-security and zoonotic diseases are also of concern. Other challenges from an agricultural and agri-processing perspective are poor food safety standards (e.g. listeriosis) and food security, specifically equitable access to nutritious food. Farmers are switching from important but lower-value crops such as maize and wheat to higher-value crops such as berries, threatening food security. Loss of employment is gaining pace, which is of great concern given the high multiplier effects and number of dependants for each agricultural job lost. From an indigenous knowledge perspective, the challenge of under-exploitation of South Africa's unique and vast biodiversity persists, with loss of value creation and value capture by and for the indigenous knowledge holders.

There is an over-reliance on bio-based imports (e.g. drugs, medical devices, and basic and intermediate chemicals) due to a lack of manufacturing capacity. This was brought into sharp focus during the COVID-19 pandemic when key imported inputs such as active pharmaceutical ingredients and ventilators were in short supply.

Overall, there is increased pressure on finite environmental resources in terms of the energy-land-water nexus due to increased market demand, leading to ever-greater environmental degradation. The high cost and poor availability of skills and infrastructure persist, with levels of transformation remaining low.

There are few 'green' bio-based products on the market. Furthermore, there are low levels of inclusive job creation, specifically in marginalised communities and concerning women, youth and people with disabilities. Additionally, the transition to a circular economy has been slow, with low rates of recycling, reuse and repair. Efforts are mostly voluntary and constrained to the informal economy.

9.2 South African Research, Innovation and Entrepreneurship Landscape

A productive research, development and innovation (RDI) system is a critical requirement for South Africa to exploit its knowledge resources, producing research outputs in fields that are directly relevant to South Africa's socio-economic development objectives. This is a critical input and feeder to TIA's pipeline of investable projects. This section outlines the status of South Africa's RDI and entrepreneurship systems.

The rate of scientific articles being published in peer-reviewed journals has increased over the last decade, with the number of publications per million population increasing from 248 in 2011 to 476 in 2019[3] – almost doubling over this period. Indeed, South Africa has a balanced and highly productive scientific enterprise, and punches above its weight in the global arena in terms of scientific outputs on a normalised basis. In 4IR areas, the country's share of publications is highest in AI, the Internet of Things and nanotechnology, as shown in Table 2. South Africa is particularly strong in social science articles in weighted terms, with other areas of strength being agricultural sciences, biological and biomedical sciences, and natural resources and conservation.

[3] NACI STI Indicators Report 2021.

Table 2: South African share of 4IR-related articles (2019)

Technologies	South African Publications	World Publications	South Africa's Share of World Publications
Internet of Things	81	12,303	0.65%
Additive manufacturing	31	7,551	0.41%
Quantum computing	9	1,777	0.50%
Nanotechnology	1,424	220,207	0.64%
Robotics	85	25,863	0.32%
Artificial Intelligence	8	11,509	0.72%
Autonomous vehicles	54	9,269	0.58%

Source: NACI STI Indicators Report 2021

However, it is broadly acknowledged that the rate of utilisation of scientific outputs for socio-economic benefit is not at the desired level. This is particularly true in terms of commercialising the outputs of public-funded R&D, but also extends to incremental innovation and the utilisation of existing knowledge and technologies for inclusive growth and development. Access to new and existing knowledge and technologies remains imbalanced in terms of spatial distribution for innovators.

As diagnosed in the draft Decadal Plan, the benefits of innovation tend not to be evenly distributed. This is particularly true in relation to high-tech start-ups. Indeed, the participation rate remains low for start-ups owned by black people, women, youth and people with disabilities in leveraging de-risked, market-ready TIA-funded technologies.

The decline in the gross expenditure on R&D (GERD) (in nominal terms) from R38.7 billion in 2017/18 to R36.8 billion in 2018/19[4] is of concern (Figure 1). Business expenditure on R&D (BERD) also declined approximately 12% over this period. Business sector funding for R&D is largely concentrated on funding R&D in the business sector itself, with about 5% going to higher education, science councils and non-profit organisations in 2018/19. The share of business sector R&D expenditure dedicated to financial intermediation, real estate and business services has increased over the years, accounting for 44.3% of R&D expenditure in 2018/19. There has been a steady decline in business sector funding of R&D in manufacturing, from 38.8% in 2009/10 to 21.9% in 2018/19.

GERD as a percentage of GDP declined from 0.83% in 2017/18 to 0.75% in 2018/19[5]. The share of business expenditure on R&D within GERD has declined consistently, decreasing from 53.2% in 2009/10 to 39.3% in 2018/19. However, R&D expenditure in medical and health sciences has more than doubled from 9.8% in 2001/02 to 21.2% in 2018/19.

[4] NACI STI Indicators Report 2021.
[5] There was a low R&D survey response rate during the COVID-19 pandemic.

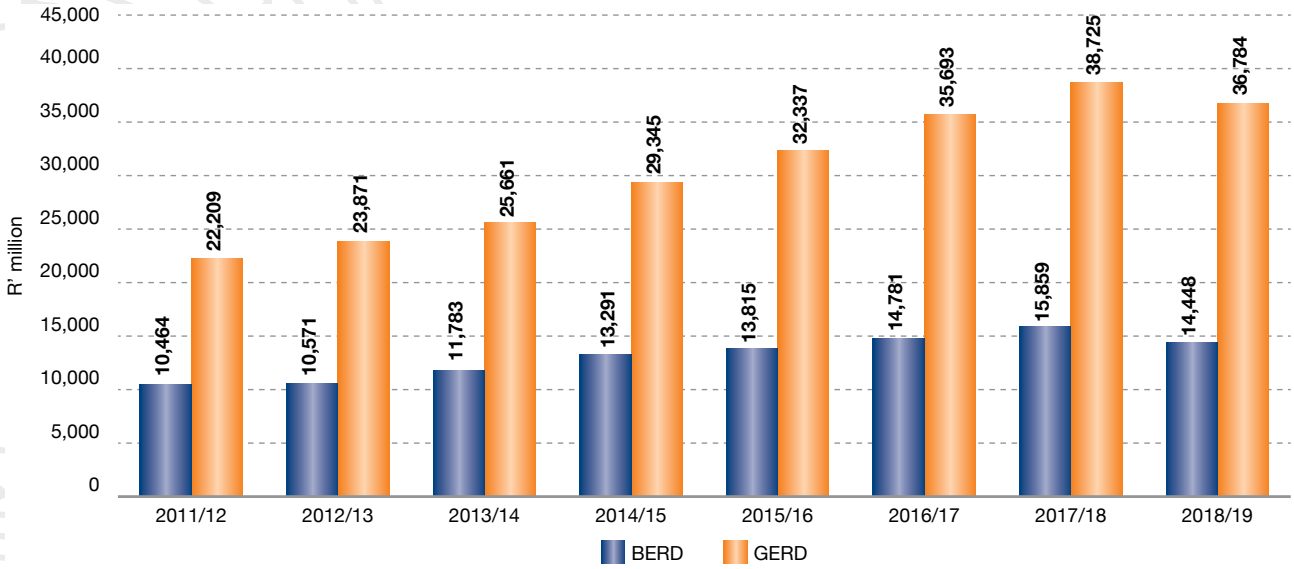


Figure 1: South Africa's R&D expenditure

Source: NACI STI Indicators Report 2021

While a decline in overall R&D expenditure is of concern to the NSI, the continued decline in experimental development as a proportion of total research expenditure is of concern to TIA specifically. Table 3 shows that expenditure on experimental development declined precipitously from 36.3% in 2010/11 to 19.3% in 2018/19. This was from a high of about 64% in 2006/7. Experimental development entails the systematic process of utilising existing and new knowledge to produce new or improved products or processes, and accounts for the bulk of GERD in leading countries. Given that experimental development enables product and process innovation that is crucial to economic growth, enterprise creation and employment, TIA maintains that South Africa needs to invest more in it.

Table 3: Expenditure by type of research

	Basic Research (%)	Applied Research (%)	Experimental Development (%)
2010/11	23.9	39.8	36.3
2011/12	24,5	42.3	33.2
2012/13	25.3	46.3	28.4
2013/14	23.8	47.3	28.9
2014/15	24.3	48.8	26.9
2015/16	25.4	47.5	27.1
2016/17	26.7	47.8	25.5
2017/18	26.4	53.3	20.3
2018/19	28.2	52.5	19.3

Source: NACI STI Indicators Report 2021

Figure 2 shows the proportional R&D expenditure trends at a provincial level. As can be expected, R&D expenditure tends to be concentrated in Gauteng, the Western Cape and KwaZulu-Natal, in line with the size and sophistication of their local economies. Gauteng has the highest proportional expenditure, but this has been in decline since 2016/17. Aside from the Western Cape, none of the other provinces have increased their R&D expenditure appreciably. Business R&D expenditure per province follows a similar trend.

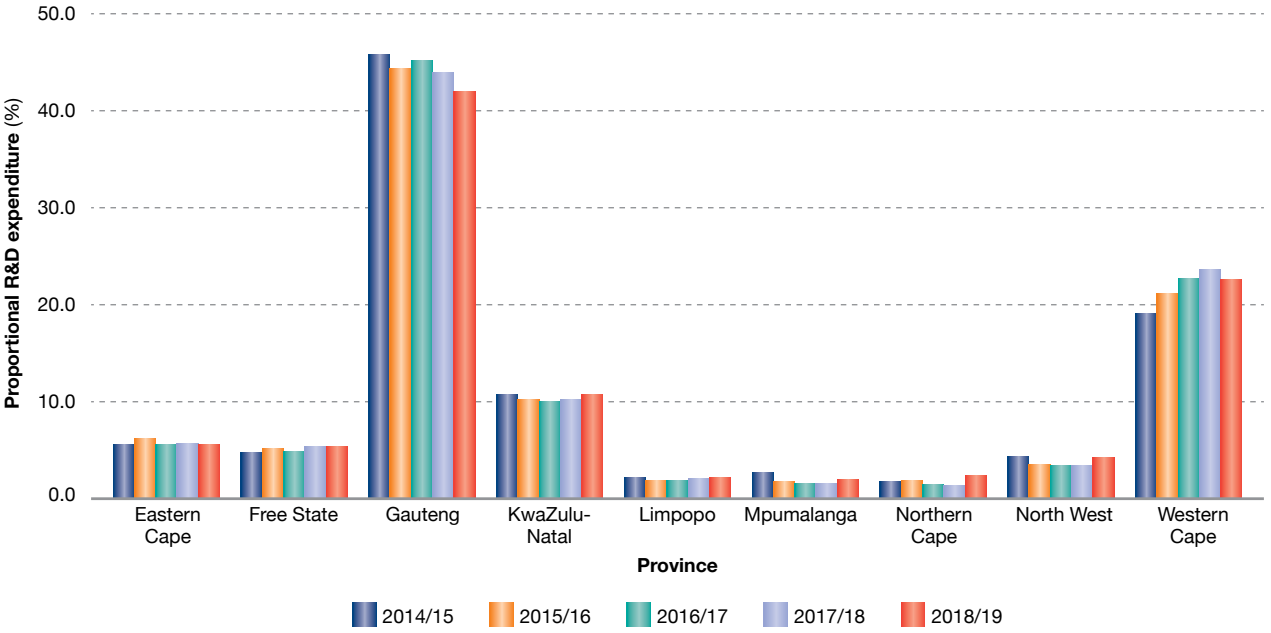


Figure 2: Provincial proportional R&D expenditure

Source: NACI STI Indicators Report 2021

In contrast to the increase in scientific publications, patent applications – a proxy indicator for inventiveness – have trended downwards in recent years. The number of patent applications per million population has declined from 34 in 2011 to 26 in 2019.[6] Furthermore, the proportion of patents granted to local inventors by the Companies and Intellectual Property Commission ranges between 9% and 12.1% of total patents awarded for the period 2008-2018. This is in stark contrast to most patents being awarded to local inventors internationally (with some exceptions). In percentage terms, South Africa's share of patents at the United States Patent and Trademark Office is low and has declined from 0.060% in 2016 to 0.051% in 2019. Furthermore, receipts from the sale of IP have grown at a slower rate compared with countries similar to South Africa, declining by 10% in 2019.

The European Innovation Scoreboard notes that South Africa's foreign direct investment and R&D spending by companies are low. In contrast, South Africa's total early-stage entrepreneurial activity is high. This tends to suggest strong entrepreneurship in the face of unfavourable conditions such as slow economic growth.

Promisingly, the value of venture capital investments increased by 15% in nominal terms in 2019 compared with 2018.[7] Venture capital is defined as financing that investors provide in the start-up and early growth phases to enterprises that are believed to have high potential for growth in the long term. The value of such investments has risen in nominal and real terms over the last decade. The rate of growth rose most rapidly after 2015. In 2019, manufacturing, food and

[6] NACI STI Indicators Report 2021.
[7] Southern African Venture Capital Association 2020 venture capital industry survey.

beverage, and business products and services were the three leading sub-sectors, accounting for 37.4% by value of all venture capital investments and 30.7% by number of deals. By value, venture capital deals take place predominantly in the Western Cape (48.2%) and Gauteng (42.5%).

In terms of innovativeness, South Africa ranked 60th (out of 313 countries) in the 2020 Global Innovation Index, up from 63rd in 2019. Notably the Innovation Inputs pillar remains a strong area for South Africa (49th), whereas the Innovation Outputs pillar remains low (68th), the lowest among the BRICS[8] countries. Within Innovation Outputs, South Africa lags behind in terms of the Human Capital and Research sub-index (70th) and Infrastructure (77th), but with the Market Sophistication sub-index (15th) the highest of the BRICS countries.

Table 4 shows the provincial spread of public-funded organisations that have been established to provide innovation support to SMMEs and previously marginalised communities. TIA's Technology Stations and the Small Enterprise Development Agency's Technology Programme (an incubator programme) are the main support instruments.

Table 4: Number and type of innovation support organisations in provinces

	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	Northern Cape	North West	Western Cape	Total
Technology Stations	3	1	6	2	1	0	1	0	4	**18**
Incubators	7	6	23	7	7	6	3	3	10	**72**
Science parks	1	1	1	0	0	0	0	0	1	**4**
Fab labs	2	1	2	0	1	0	1	1	1	**9**
Living labs	1	1	0	2	0	0	0	0	1	**5**
Ekasi labs	-	-	10	-	0	0	0	0	0	**10**
Innovation lab	0	0	0	1	0	0	0	0	0	**1**

Source: NACI STI Indicators Report 2021; TIA data

9.3 South Africa's STI Policy Environment

The White Paper on Science, Technology and Innovation (Section 7.3) provides the overarching framework within which TIA operates. The draft Science, Technology and Innovation Decadal Plan 2020 (Section 7.5) has, as system goals, an inclusive and coherent NSI, increased and transformed human capabilities, an expanded and transformed research system, an enabling innovation environment, expanded and targeted STI internationalisation, and significantly increased funding for STI.

The draft Decadal Plan is underpinned by two principles: transformation and economic inclusivity. The plan has a broad stance on transformation, encompassing not only transformation of South Africa's researcher demographics and STI institutions but also the achievement of a broader spatial footprint for innovation and greater awareness among citizens of the benefits of STI. In terms of economic inclusivity, which is closely tied to the imperative of transformation, the focus is on improving transformation in relation to technology-based firm ownership, a greater distribution of the benefits of

[8] BRICS – Brazil, Russia, India, China and South Africa.

innovation, commercialising IP to benefit women, youth and black entrepreneurs, and stimulating the development of both urban and rural local-level innovation systems.

The COVID-19 pandemic underscored the importance of a well-resourced and capacitated NSI. TIA's support of an enabling environment for innovation through historical investments in building the institutional capacities of the NSI through the TSP and the Technology Platforms Programme has borne fruit. Scientists, engineers and technicians supported under these programmes made significant contributions in responding to the pandemic with scientific breakthroughs and competitiveness improvements in a collaborative fashion.

Indeed, even before the pandemic there was an increased recognition of the need for a coherent and well-funded NSI, and for investments in STI to make greater contributions to national competitiveness and socio-economic transformation. The draft Decadal Plan maintains that from 2019 onwards there should be "an increased focus on the contribution of the NSI to socio-economic development, environmental sustainability and a capable state in an increasingly uncertain world characterised by rapid technological change, social disruption and climate change". This is in keeping with supporting the achievement of the NDP objectives in Phase II (2020-2024) and Phase III (2025-2030) of its implementation by harnessing innovation to improve the competitiveness and productivity of key economic sectors and contributing to higher GDP growth.

In a post-COVID-19 world and in support of government's economic recovery strategy, "the potential of STI, *and specifically innovation*, to support South Africa's turnaround is clear" (emphasis added). This is in keeping with the expanded and explicit innovation mandate of the Department of Science and Innovation, renamed in June 2019 from the Department of Science and Technology. The draft Decadal Plan provides a framework for the DSI to take up this new innovation mandate in partnership with relevant government departments under the DSI's 2004 Strategic Management Model.

The Science and Technology Laws Amendment Act (No 9 of 2020) came into effect on 1 April 2021. Several amendments were made to the TIA Act (No 26 of 2008). A key change is that the agency may perform any function in any territory outside South Africa. This change empowers TIA to more intentionally pursue international partnership opportunities to achieve its objectives in fulfilment of its mandate.

9.4 Regionalisation Opportunities

In its 2020-2025 Strategic Plan, the DSI states that it seeks to support the implementation of the DDM by providing decision-support tools and information, and support for institutional development in municipalities. The objectives are to strengthen municipalities so that they can deliver on their mandates through evidence-informed spatial planning with timely access to technical skills and research in response to migration, climate change and other challenges. The DSI (and its entities) plan to support various high-impact STI projects and programmes involving the delivery of basic services such as the provision of water, sanitation and energy, and those that seek to address developmental challenges such as job creation (especially for the youth), skills development and inclusive local economic development.

The DSI states that implementing the DDM will support the achievement of the Department's transformation and inclusion goals by introducing or scaling up STI activities in non-traditional spaces and away from metropolitan hubs. Furthermore, the DSI aspires to implement the DDM through activities directed at historically disadvantaged institutions. The Ministry of Higher Education, Science and Innovation has selected the Ugu District Municipality and the Zululand District Municipality in KwaZulu-Natal and Ekurhuleni Metropolitan Municipality in Gauteng as priority districts for intervention for the DSI and its entities.

TIA has, over the years, identified several other opportunities by engaging and building relations with local and provincial public sector stakeholders. The purpose and objectives of such engagements have varied depending on the strategic

priorities of the public sector actors TIA has engaged with, the identified needs of local communities and the unique features of local industries and businesses. From TIA's perspective the objective of such engagements also differs considerably from partnering with innovation-focused local or provincial government using TIA's 'Hub and Spoke' model, providing access to scientific or technological know-how by implementing the DSI's Grassroots Innovation Programme, or facilitating the transfer process of TIA-funded technologies to entrepreneurs or enterprises, to name a few.

One example of such an engagement has been between TIA, the Department of Economic Development and Tourism and Sol Plaatje University in the Northern Cape. The unique social and economic features of the province put an emphasis on ICT and data science, and finding solutions to the threat of global warming to the arid, water-scarce province, with future programmes in agricultural sciences featuring strongly. TIA's Natural Resources portfolio is of great interest to stakeholders in the province, particularly its projects on water, mining and minerals processing. As a water-stressed region, the province needs to manage and optimise the use and distribution of its water resources. TIA-funded initiatives such as the Water and Sanitation Fault Management System, water desalination, atmospheric water generation and algae projects are of great interest to the province.

An analysis[9] of TIA-supported initiatives has shown that the agency funds projects, activities and interventions in all nine provinces, with support provided in 16 of the 44 district municipalities and six of the eight metropolitan municipalities (Figure 3). In keeping with the agency's developmental mandate and in support of the DSI's transformation objectives, TIA will focus its energies on the Northern Cape, Limpopo, Free State and Mpumalanga.

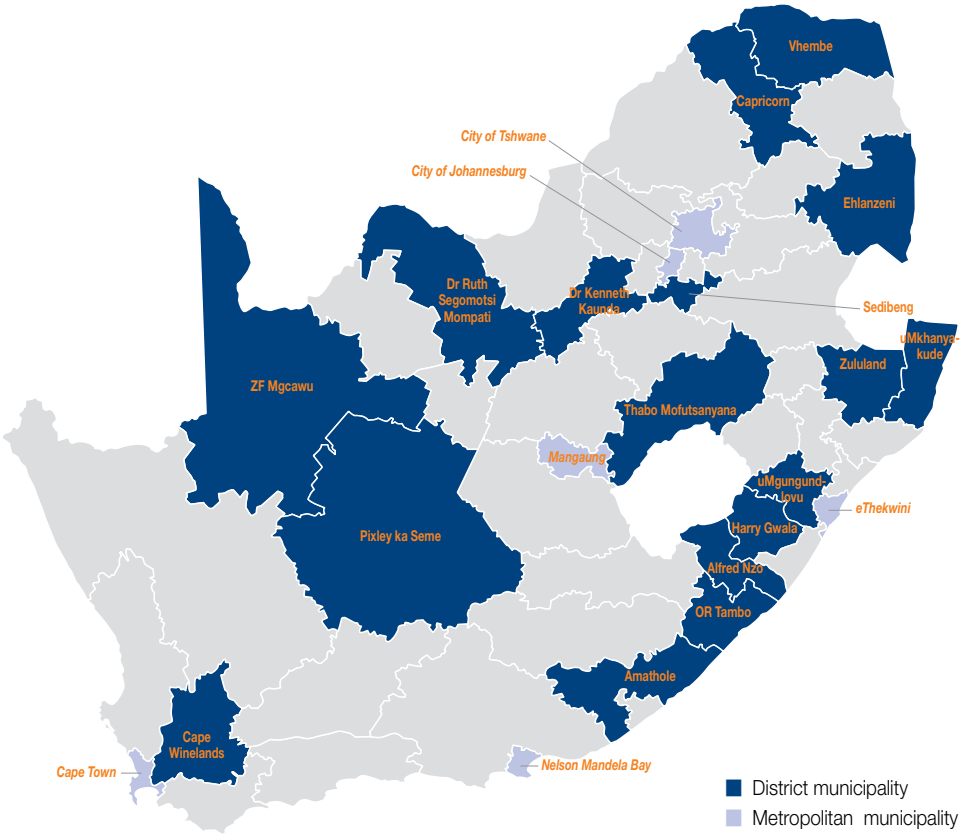


Figure 3: Geographic spread of TIA-supported initiatives at district and metropolitan municipality level

[9] The analysis covers the period 2017/18-2022/23 for both closed and ongoing TIA-supported initiatives. There are multiple initiatives in the listed municipalities, and some initiatives are spread across several municipalities. It should be noted that the information presented may not represent the full extent of TIA's activities.

9.5 PESTEL Analysis

A summation of TIA's external environment is presented in Table 5.

Table 5: PESTEL analysis

Dimension	Opportunity/risk
Political	Poor appreciation of the potential for innovation to address social, economic and environmental issues across government. Potential for closer cooperation with the departments in the Economic Sectors, Investment, Employment and Infrastructure Development Cluster, especially the Department of Higher Education and Training. Potential to address the coordination/fragmentation challenges of the NSI through greater cooperation with other government departments and the private sector and by implementing collaborative initiatives.
Economic	Low GDP growth rate. Jobless growth. High failure rates of start-ups and SMMEs. The weak Rand hampers imports but benefits exports, having mixed effects on the economy. A constrained public fiscus (lower tax collections from reduced economic activity) may result in below inflation budget allocations or possibly further budget cuts. Potential for economic recovery in the post-COVID-19, post-local-elections period.
Social	High unemployment among black people, the youth and women particularly. Likelihood of civil unrest, particularly at universities during the annual #FeesMustFall campaign. Poor service delivery, particularly at the local municipal level. Widening inequality and increasing poverty. Imperative to harness innovation to address transformation and inclusion.
Technological	Increased digitalisation of the economy. Declining expenditure on experimental development. Declining GERD and business expenditure on R&D in real (inflation-adjusted) and nominal terms. Declining inventiveness as reflected by patents. Low proportion of local inventors compared with other nations. Rapid technological change and associated disruption to the economy and society. South Africa's research enterprise is well-balanced, with pockets of world-class science and technology capabilities (e.g. health). The NSI's response to the COVID-19 pandemic demonstrated the importance of a strong, coordinated and well-resourced STI system.
Environmental	Accelerating and irreversible climate change. Increasing environmental degradation. Potential to leverage South Africa's rich diversity.
Legal	Compliance with relevant legislative prescripts, including enabling legislation. Potential for the state to adopt stronger capital controls and increased taxation, potentially rendering the economy less competitive and hindering growth.

10. Internal Environment Analysis

10.1 Organisational Performance

TIA started the new five-year strategic period in the context of the COVID-19 pandemic, characterised by a lockdown that limited the mobility and operations of its staff, stakeholders and customers. Despite these constraints, TIA managed to ride out the storm and has delivered tangible results on key elements of its core mandate of technology development and commercialisation. TIA closed the financial year 2020/21 with a performance achievement of 90%, delivering on nine of 10 output indicators. TIA over-achieved significantly against several of its performance targets. Allocating an equal weight to each target, the average percentage achievement for 2020/21 was 99%. TIA's performance proves that the agency is appropriately geared to deliver on its strategic plan. TIA's high-performance culture is evident from its achievements over the last six years as depicted in Figure 4.

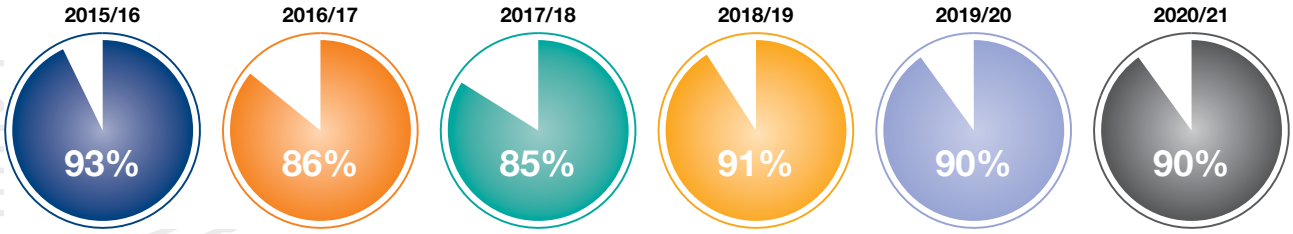


Figure 4: TIA's performance against its strategic objectives over the past six years

These performance results were achieved against the backdrop of a challenging external environment in which South Africa was emerging from yet another nationwide lockdown imposed by government in response to a rise in COVID-19 infections. There was also great uncertainty about the start of academic activities in higher education, in addition to the #FeesMustFall campaign.

10.2 Financial Overview

TIA operates with an annual budget of about R458 million. This is made up of a baseline of R197 million, with a further R258 million assigned as ring-fenced funding. Going into the 2022/23 financial year, TIA has an allocation of R458.4 million with a commitment book of R173.1 million and just over R285 million available for investments and operational expenditure. This presents a funding gap against funding needs as evidenced within the project pipeline. During the 2021/22 financial year, TIA responded well to fiscal pressure by putting operational expenditure savings into investment spending, which contributed to an improvement in its efficiency.

As a measure to appropriately reflect the agency's allocation of resources towards investment-related activities, TIA has revised the efficiency ratio calculation to include all investment-related expenditure. The calculation shows that approximately 85% of resources are directed towards investments.

The agency continues to support requests from its investees for relief from the impact of COVID-19 in the form of payment holidays and small bridging finance interventions.

Given that no inflationary increases have been built into the agency's MTEF allocation, its funding remains insufficient to fulfil its mandate effectively. The Innovation Fund is expected to assist in bridging this funding gap. In light of its past performance, including ability to leverage funding through partnerships, the agency is well placed to deploy funds effectively within the NSI.

10.3 Operational Structure

TIA reviewed its organisational structure during 2020/21 to ensure that it is appropriately geared to deliver on its objectives. The revised Board-approved structure (Figure 5) enables the agency to progress towards a leaner, more agile organisation that is properly capacitated to deliver effectively on three priority areas of need in the NSI. From a governance perspective, the Board approved the establishment of the Board Technical Committee to serve in an advisory capacity, in addition to the three existing Board subcommittees. This committee could, however, not be activated due to a limited number of Board members and restrictions on the number of committees each Board member may serve on.

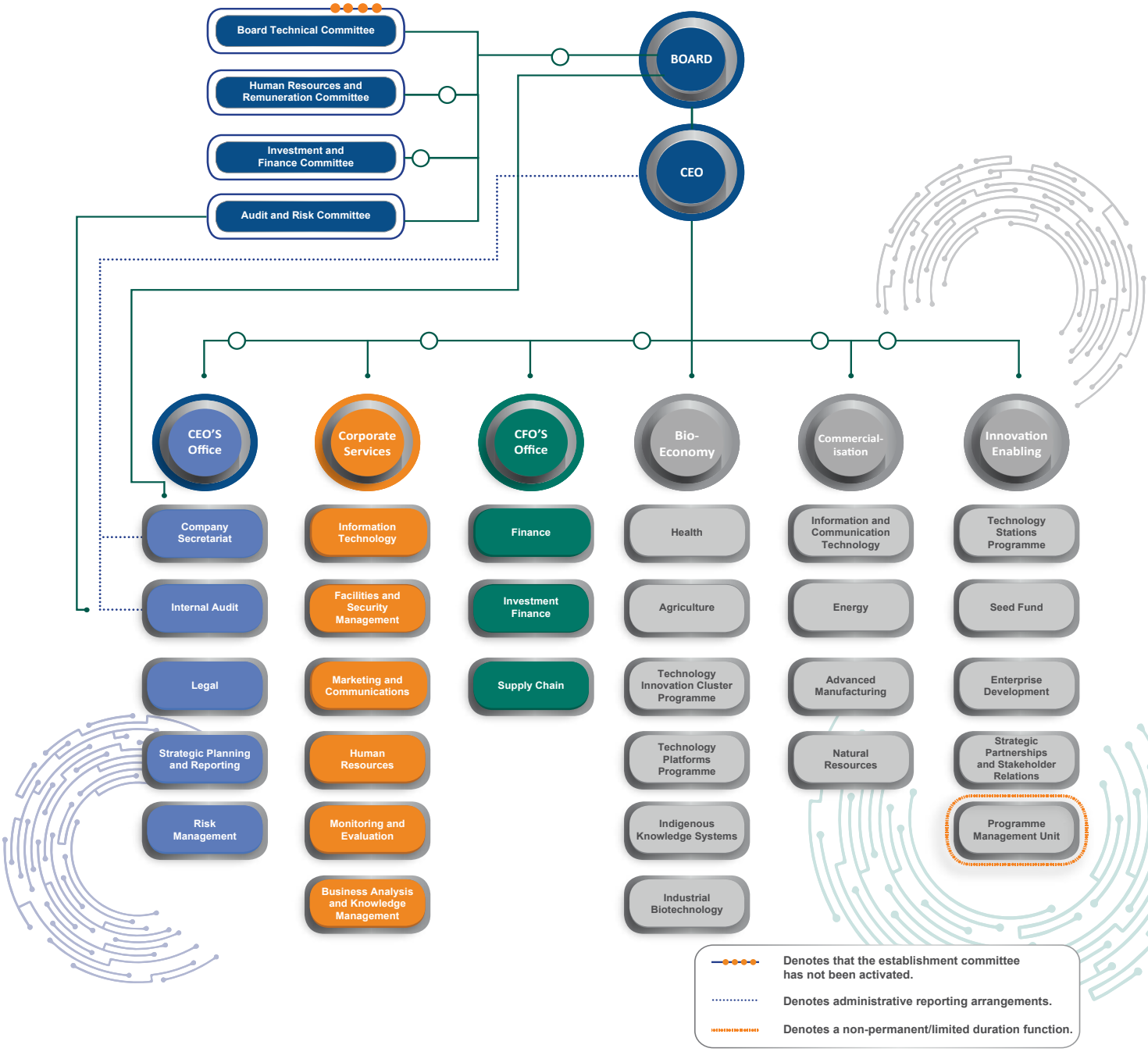


Figure 5: TIA's organisational structure

10.4 Operating Environment

The TIA structure is peopled by well-educated staff, with qualifications and experience covering a broad range, including science, innovation, engineering, finance, investment, legal and business management. However, current economic conditions and national fiscal constraints resulted in financial resources too limited to fully capacitate the structure. In response, TIA appointed staff in acting capacities and seconded staff to ensure key areas are sufficiently capacitated.

Staff retention is still a challenge, accentuated by tough economic conditions that limit monetary rewards such as increases and performance incentives to motivate high-performing staff. To mitigate the risk of staff turnover, TIA management has developed a full Employee Value Proposition, comprising both monetary and non-monetary elements, to enhance the employee experience and improve productivity.

TIA established a Panel of Experts to complement internal capacity. These experts will provide advice on technical and commercial due diligence, as well as on matters related to intellectual property. To improve operational efficiency and reduce turnaround times, TIA recognised the need for all its business systems to be assessed and to provide integrated process optimisation capabilities for seamless information flow across various systems. The goal is to integrate TIA's information technology systems to speed up information flows and reduce operational costs. This integration will bring together functional, transactional and management system components into one system. The Enterprise Resource System will not only enhance operational efficiency but will also enable TIA to track and report performance against its output indicators in real time.

11. Strategic Thrusts

TIA has retained the following strategic thrusts for 2022/23:

a) **Responding to the pandemic** – This will involve increasing investments in and commercialisation of health-related technology, including strengthening the capabilities of the Technology Platforms and Technology Stations infrastructure.

b) **Economic recovery** – TIA will accelerate the rate of commercialisation of investments in the high-technology sectors that will help to rebuild South Africa's economic competitiveness, increasing exports of knowledge-based products to international markets. The SMME sector will receive particular attention as this brings employment opportunities and poverty reduction, especially in underprivileged segments of society.

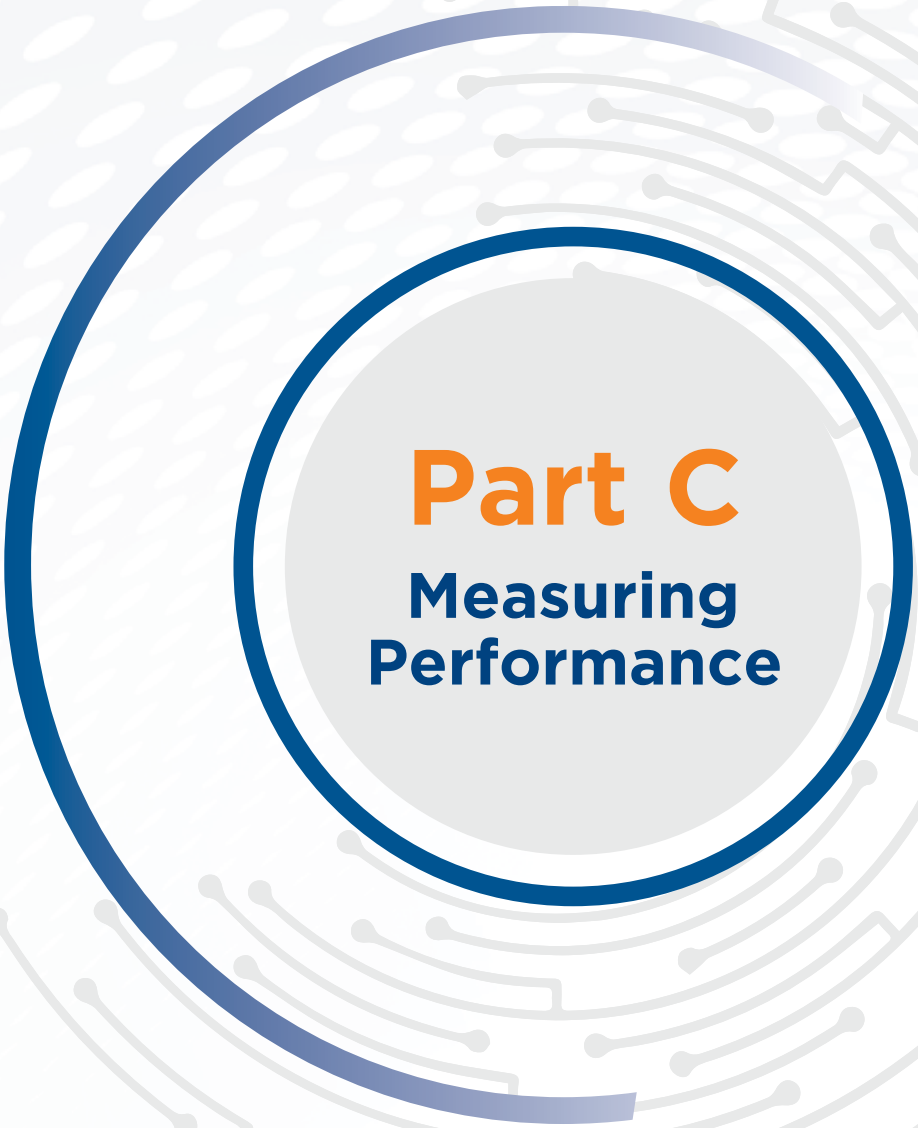
c) **Responding to communities in distress** – The Innovation for Inclusive Development Programme will be intensified, especially in support of grassroots innovators and provision of access to SET support and other forms of business development and market opportunities. This will also include investments in technology that promotes effective service delivery such as ICT-based solutions for education, health and other social services.

d) **Expanding the spatial footprint** – COVID-19 has exposed deep inequalities in South African society and in particular geographical disparities in levels of development. It has emphasised the need to spread the benefits of innovation more widely and to direct developmental efforts to underserved parts of the country. The DDM will serve as a key framework to guide TIA's efforts in this regard.

e) **Transformation framework** – The inclusion of women, youth and persons with disabilities remains an important priority for TIA. In commercialising the organisation's portfolio of IP from publicly funded research, efforts will be made to increase access and to spread the benefits of commercialisation to these previously disadvantaged beneficiaries.

   The organisation will continue to promote business with previously disadvantaged individuals. Our objectives are to prioritise working with SMMEs and with previously disadvantaged individuals in support of developing and transforming the South African economy. All procurement will address equity as a key element, in line with the agency's B-BBEE and Transformation policies.

f) **Building a resilient and well capacitated organisation** – Ensure business support through human capital development, automated business systems and processes that will enable and support TIA operations to enhance performance and efficiency.



Part C

Measuring Performance

TIA has the following functions:

- Administration
- Commercialised Innovations Division
- Bio-economy Division
- Innovation Enabling Division

Over the 2020-2025 strategic cycle, TIA will continue to fund, support and facilitate an innovation ecosystem. In support of this, TIA has three institutional outcomes and four outcome indicators.

Outcome 1

Commercialised innovations

In support of Outcome 1, TIA has adopted the following outcome indicator to measure over the strategic plan period:

1.1 Number of technologies commercialised

With this strategic thrust, TIA will intensify efforts to increase the rate of translation of locally developed technologies; exploit intellectual property from publicly funded institutions; ensure that these are commercialised in a manner that promotes economic growth and the competitiveness of industry; and respond to the imperatives of transformation and inclusive development. TIA will focus on leveraging local and global partnerships to support the translation of knowledge and innovation outputs from higher education institutions, science councils and the private sector into commercialised innovations that will have a positive impact on the lives of all South Africans. TIA will also take advantage of the 4IR to stimulate the economy and address some of the social challenges faced by many South Africans. This is all in keeping with the policy intentions of the White Paper on Science, Technology and Innovation for STI to benefit society and the economy directly.

TIA also wishes to support access to IP resulting from public-funded R&D to black, women and youth-owned high-tech start-ups. In recent years TIA has partnered with the private sector and civil society on technological innovation, the diffusion of market-ready technologies and related efforts with great success. TIA will intensify its efforts to partner with investors within the private sector, including exploring opportunities to exit out of currently funded investments. Doing so will broaden the distribution of the benefits of public-funded innovations, leading to the commercialisation and industrialisation of publicly funded IP and locally developed technologies.

In support of two of the STI priorities of the draft Decadal Plan, TIA will support efforts to rejuvenate South Africa's manufacturing and mining sectors through competitiveness and efficiency improvements and the application of new technologies. Furthermore, TIA will support efforts to improve energy supply security and to decarbonise the economy with greener energy technologies.

In support of another STI priority for new growth, TIA will support efforts to sustainably utilise natural resources, particularly in the waste and water sectors, and transition to a circular economy. TIA also aims to enable the digital transformation of key industries and sectors, including efforts to enhance cybersecurity.

In addition to its inclusive approach to supporting high-tech start-ups, TIA will support efforts to bridge the digital divide to ensure access by and inclusion of previously disadvantaged and marginalised groups.

Outcome 2

Delivering on the Bio-economy Strategy

In support of Outcome 2, TIA has adopted the following outcome indicators to measure over the strategic plan period:

2.1 Number of successfully demonstrated bio-based technologies
2.2 Number of bio-based entrepreneurs and organisations accessing high-end science, engineering and technical services

In this focus area, TIA's efforts will be directed towards creating new bio-based products and processes and will promote the creation of new enterprises and new markets that lead to job creation. This will be achieved by implementing the DSI's Bio-economy Strategy, which focuses on agriculture, health, industrial biotechnology and indigenous knowledge systems. In doing so, TIA will increase its efforts to grow and enhance the role of indigenous knowledge systems as an important sector with great potential for inclusive development and transformation.

The bio-economy has attracted significant interest as a means of addressing some of the major challenges characterising the 21st century. The cross-cutting nature of the bio-economy offers a unique opportunity to comprehensively address interconnected societal challenges, such as healthcare and the burden of disease, food security, the scarcity of natural resources, dependence on fossil fuels and climate change.

Advancements in biotechnological research and the resultant uptake of innovation will allow South Africa to improve the management of its renewable biological resources and open new and diversified markets in food and bio-based products. South Africa has a significant capacity for knowledge generation in the bio-economy domain. TIA aims to support the translation of these knowledge resources into sustainable bio-based solutions that have the potential for inclusive and sustainable economic growth, increase the number of jobs and businesses, foster a healthier population and improve the economic and environmental sustainability of primary production and processing industries.

Outcome 3

SMMEs supported through strategically informed and regionally distributed Technology Stations

In support of Outcome 3, TIA has adopted the following outcome indicator to measure over the strategic plan period:

3.1 Number of SMMEs accessing SET services

The changing innovation landscape requires that TIA constantly develops and implements effective responses to the myriad of challenges facing the SMME sector. This has become particularly urgent and important in the aftermath of the COVID-19 pandemic and the devastating impact it has had on the sector. The Technology Station capabilities form part of a package of support intermediaries in the NSI to promote the growth of SMMEs and co-operatives, contribute to innovation-led industrialisation and foster inclusive development with an expanded spatial footprint and enhanced access for entrepreneurs throughout the country.

In response to the problems of structurally high unemployment, particularly affecting women and youth, and a fragmented and poorly coordinated NSI, TIA aims to see decent jobs, technology start-up enterprises and the support of SMMEs increase significantly over the medium term. The ultimate measure of success of these initiatives should be the impact on SMMEs and start-ups in sales, revenue, licences, and distribution and manufacturing of products, processes and services. The impact will be measured in terms of job creation.

The National Spatial Development Framework and the DDM both seek to promote the coordination of efforts across government at local and district level. Accordingly, TIA aims to increase its spatial footprint and double the number of innovators who have access to key innovation infrastructure facilities and support. TIA aims to provide enhanced inclusive access to SET and enterprise development support to SMMEs, grassroots innovators and co-operatives through Outcome 3.

Alignment with Decadal Plan

The draft Decadal Plan identifies a number of STI priorities:

- Revitalising and modernising sectors of the economy, with focus on agriculture, high-tech manufacturing and mining.
- Exploiting new sources of growth offered by the circular economy and the digital economy.
- Innovation in support of health, the energy sector and a capable state.
- Innovation for inclusive development.
- Ecosystem-based climate change adaptation and mitigation, and education for the future and the future of society STI missions.

TIA has a portfolio of investments and initiatives in many of these STI priority areas. An important strategic emphasis for the year ahead will be to align with the proposed implementation dimensions of the Decadal Plan. These include the following:

- Revitalising and modernising key sectors of the economy by improving economic competitiveness and productivity in agriculture, manufacturing and mining.
- Leveraging the circular economy and the digital economy as new sources of growth.
- Innovation in support of health, specifically by optimising health systems, improving the quality of healthcare and digitalisation of healthcare systems.
- Energy sector innovation in support of improved energy access and decarbonising the economy.
- Fostering inclusive development with support to grassroots innovators and entrepreneurs.
- Ecosystem-based climate change adaptation and mitigation by developing and disseminating technology in key sectors (e.g. agriculture, energy and manufacturing) and domains (e.g. clean technologies).

The six goals and selected outcomes of the draft Decadal Plan relevant to TIA are presented in Table 6.

Table 6: Selected goals and outcomes of the draft Decadal Plan

1. An inclusive and coherent NSI	2. Increased and transformed human capabilities	3. Expanded and transformed knowledge enterprise	4. An enabling innovation environment in South Africa	5. Expanded and targeted STI internationalisation	6. Significantly increased funding for STI
Broader inclusion Increased linkages Enhanced policy coherence and improved programme & funding coordination Strengthened governance of STI public institutions Expand the institutional landscape Upgrade the monitoring, evaluation and policy learning capacity	Strengthen the skills base of the economy Expand internationalisation and science diplomacy	Increased research outputs An open, responsive and diverse knowledge system Upgraded and expanded research (and innovation) infrastructure	A broader concept of innovation A whole-of-government approach to innovation Increased support for and collaboration with the business sector Improved commercialisation of publicly funded IP Increased spatial footprint of innovation Focus on innovation for inclusive development Government as an enabler for innovation Modernise existing industries Exploit new sources of growth	Enhanced strategic focusing Efficiencies in international cooperation Coordination of international cooperation	Increased levels of funding across the system Improved funding efficiencies Agreed funding priorities across the system Improved guidance on public investment

12. Administration

12.1 Planned Outputs and Output Targets

Administration seeks to provide an effective and efficient enabling environment for TIA to achieve its strategy through the provision of systems, processes and people, and the prioritisation of appropriate resources (human and financial), in accordance with good corporate governance, legislative requirements and risk management practices.

TIA aims to deliver the outputs presented in Table 7 and Table 8. The retention of TIA's external audit outcome as a strategic indicator reflects the agency's commitment to good governance in the pursuit of responsible management of public funds within an appropriate control environment. In addition, TIA has measured the time taken to reach a decision on funding applications for some time. The measurement serves to demonstrate the efficiency of TIA's systems and capabilities to assess applications for funding, within the requirements of a rigorous due diligence process. This is the first year the agency has had separate indicators based on the amount of funding applied for. These three indicators remain aspirational stretch targets for TIA.

Given the increased focus on transformation in all forms and on inclusive development within innovation, economic and social development policy, TIA has taken the decision to allocate a portion of its uncommitted funds to recipients in underserved provinces and to transformed recipients. While the quantum of TIA's commitments may be modest to start off with, this step serves to demonstrate TIA's commitment to addressing the scourges of poverty, inequality and unemployment through a specific developmental focus. Efforts in this regard supplement TIA's existing transformation efforts, specifically its internal B-BBEE Policy and Transformation Framework.

Table 7: Administration outputs, performance indicators and targets

Outputs	Output Indicators	Annual Targets						
		Audited Actual Performance			Estimated Performance	MTEF Period		
		2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
A1.1 Good financial governance	Achieve an unqualified external audit opinion with no financial matters in the audit report	Unqualified external audit opinion	Unqualified external audit opinion	Unqualified external audit opinion	Unqualified external audit opinion	Unqualified external audit opinion with no financial matters in the audit report	Clean external audit opinion	Clean external audit opinion
A1.2 Improved investment decision turnaround time for funding applications[10]	a) Investment decision turnaround time for funding applications <R1m	New indicator[11]	New indicator[12]	New indicator[13]	New indicator[14]	Achieve a 4-week turnaround time	Achieve a 4-week turnaround time	Achieve a 4-week turnaround time
	b) Investment decision turnaround time for funding applications >R1m & <R15m	New indicator[11]	New indicator[12]	New indicator[13]	New indicator[14]	Achieve a 15-week turnaround time	Achieve a 15-week turnaround time	Achieve a 15-week turnaround time
	c) Investment decision turnaround time for funding applications >R15m	New indicator[11]	New indicator[12]	New indicator[13]	New indicator[14]	Achieve a 26-week turnaround time	Achieve a 26-week turnaround time	Achieve a 26-week turnaround time

[10] The time-frame in each target reflects the time taken at TIA in line with its assessment and approval processes and does not include time that potential applicants may spend in developing and refining their applications.

[11] Average turnaround time was 46 weeks.

[12] Average turnaround time was 54 weeks.

[13] Average turnaround time was 32 weeks.

[14] From 2021/22 this indicator was split into three, hence no baseline data.

Outputs	Output Indicators	Annual Targets						
		Audited Actual Performance			Estimated Performance	MTEF Period		
		2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
A1.3 Support transformation initiatives in underserved provinces	Allocation of funds to underserved provinces	New indicator	New indicator	New indicator	New indicator	At least 30% of available investment funds allocated	At least 30% of available investment funds allocated	At least 30% of available investment funds allocated
A1.4 Support the transformation of TIA's investment portfolio	Allocation of funds to transformed recipients	New indicator	New indicator	New indicator	New indicator	At least 30% of available investment funds allocated	At least 40% of available investment funds allocated	At least 50% of available investment funds allocated

Table 8: Administration output indicators and annual and quarterly targets

Output indicators	2022/23 annual target	Q1	Q2	Q3	Q4
A1.1 Achieve an unqualified external audit opinion with no financial matters in the audit report	Unqualified external audit opinion with no financial matters in the audit report	No target	Unqualified external audit opinion with no financial matters in the audit report	No target	No target
A1.2(a) Investment decision turnaround time for funding applications <R1m	Achieve a 4-week turnaround time	No target	No target	No target	Achieve a 4-week turnaround time
A1.2(b) Investment decision turnaround time for funding applications >R1m & <R15m	Achieve a 15-week turnaround time	No target	No target	No target	Achieve a 15-week turnaround time
A1.2(c) Investment decision turnaround time for funding applications >R15m	Achieve a 26-week turnaround time	No target	No target	No target	Achieve a 26-week turnaround time
A1.3 Allocation of funds to underserved provinces	At least 30% of available investment funds allocated	No target	No target	No target	At least 30% of available investment funds allocated
A1.4 Allocation of funds to transformed recipients	At least 30% of available investment funds allocated	No target	No target	No target	At least 30% of available investment funds allocated

12.2 Explanation of Planned Performance: Strategic Aims, Goals and Initiatives

Administration aims to provide an effective and efficient enabling environment for the agency to achieve its mandate and deliver on its strategy. Flowing from the aforementioned outputs, Administration has the following strategic goals and associated strategic initiatives (Table 9).

Table 9: Administration strategic goals and initiatives

Strategic Goal	Strategic Initiatives
Attracting and retaining skilled and experienced staff to effectively deliver on the TIA mandate	Maintenance of the TIA Employee Value Proposition Providing the required training and development to strengthen the skills pool Implementing succession planning
Providing the required systems and processes to achieve operational efficiency.	Implementing an Enterprise Resource System Optimising systems used within TIA Automating manual processes and business intelligence reporting
Prioritising resources to strengthen the agency's funding base	Exploring additional external income generation through core activities to reduce reliance on the fiscus Exploring operational cost-saving opportunities for reallocation towards investments while ensuring that the agency has the necessary resources to deliver on its mandate
Enhancing TIA's impact through programmatic monitoring, evaluation and learning to refine instruments and develop new strategic interventions	Designing and implementing a TIA monitoring, evaluation and learning strategy
Increasing TIA's strategic positioning and brand awareness in the NSI	Hosting strategic high-impact events and networking platforms

These interventions will be delivered by Administration, which has the following functional sub-programmes:

- The Finance and Supply Chain Management Division, guided by (but not limited to) the sound principles of the PFMA, National Treasury regulations, the TIA Act and TIA policies and procedures, continues to support the fulfilment of the organisational mandate.
- The Risk Management function is primarily responsible for coordinating and facilitating the risk management process, proactively promoting risk awareness, and monitoring and overseeing the management of key risks facing the organisation.
- The Internal Audit function provides TIA's Board and management with an independent and objective level of assurance by providing risk-based assurance, advice and insight, applying professional practices to cope with emerging challenges. It serves as the key assurance function to provide value and demonstrate impact by partnering and collaborating with management, and to improve TIA's operations, its internal control environment, risk management and governance processes. The Internal Audit function also serves as the primary assurance tool that supports stewardship and accountability in the spending of TIA's funds.
- The Office of the Board Secretary supports the Board and management of TIA. It oversees the various governance functions of TIA; carries out administrative functions together with the Chairperson of the Board; organises, attends Board meetings and compiles minutes; and ensures that the registers required to be kept under the Companies Act, 2008, are in place and properly maintained.
- The Strategic Planning and Reporting function is responsible for driving the agency's planning and institutional reporting obligations in line with shareholder and government frameworks, in alignment with best practices.
- The Legal Services function provides legal support to TIA, in both transaction support and TIA's internal business processes.

- Human Resources is responsible for implementing and maintaining the full human resources value offering, adding value to TIA by ensuring that each sub-programme is adequately resourced and capacitated to deliver on the strategy.
- Facilities Management supports the organisation by providing a conducive working environment through the acquisition and management of office infrastructure, security services and office support services.
- The Information Technology and Business Analysis & Knowledge Management functions ensure that appropriate, effective and optimised business systems, processes and workflows are in place to enable and support TIA operations for enhanced performance.
- The Monitoring and Evaluation function works closely with the various business units to evaluate and report on performance against key strategic objectives.
- The Marketing and Communications function aims to enhance the TIA brand by providing strategic communication support to raise awareness of the TIA objectives and achievements within the NSI and the communities it serves.

12.3 Resource Considerations

Other Income

Funding is an important enabler for TIA to carry out its de-risking role as the primary funder of early-stage technology innovations in the NSI. To increase its funding capacity, TIA pursues strategies to strengthen its funding base, especially under the current constrained fiscal conditions. The agency will continue to focus on obtaining other sources of income to support its programmes and project funding initiatives.

Through effective working capital management, the entity aims to maximise interest earned on cash reserves deposited with the Corporation for Public Deposits at the South African Reserve Bank. Returns generated will be used to fund innovation initiatives.

Operational Costs

As a result of the lower than inflationary increases in the baseline allocation that is used to fund operational costs, significant pressure exists to ensure that operational costs are not increased despite an inflationary environment. Various initiatives to reduce operational cost are pursued to ensure operational efficiency. From a human resources perspective, only critical vacancies will be filled.

Table 10: Support Division expenditure estimates

	2022/23 (R'000)	2023/24 (R'000)	2024/25 (R'000)
Income	**96,477**	**94,717**	**95,292**
MTEF ring-fenced	-	-	-
MTEF baseline	81,477	79,717	77,292
Other income (specific contracts, interest and royalties)	15,000	15,000	18,000
Operational Expenditure	**96,477**	**94,717**	**95,292**
Support and infrastructure costs	46,038	45,970	46,545
Human resources	50,439	48,747	48,747

13. Commercialised Innovations

13.1 Planned Outputs and Output Targets

To achieve the desired outcome of an increased rate of commercialisation of knowledge and innovation outputs for socio-economic stimulation, growth and development, TIA aims to deliver the outputs presented in Table 11 and Table 12. The indicators relating to technologies licensed or assigned, and products launched, are important measures of the success of TIA's interventions in the NSI in the development, maturation and commercialisation of technologies derived from public-funded research.

Furthermore, actors in the NSI are increasingly appreciating the value of the use of existing knowledge and technologies for socio-economic development. It is for this reason that the diffusion of technologies for inclusive development is important, as are products launched by grassroots innovators. Lastly, TIA aims to stimulate the NSI by fostering joint collaborations between academia and industry and leveraging TIA's funds for the purpose of technological innovation.

Table 11: Outcome 1 outputs, performance indicators and targets

Outputs	Output Indicators	Annual Targets						
		Audited Actual Performance			Estimated Performance	MTEF Period		
		2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
1.1 Technologies licensed or assigned	Number of licensed or assigned technologies	New indicator	New indicator	6	9	15	20	25
1.2 Joint collaborations between academia and industry	Number of projects involving industry being executed	New indicator	New indicator	29	15	36	40	44
1.3 Technologies diffused for inclusive development	Number of successfully diffused technologies	New indicator	New indicator	5	9	15	20	24
1.4 Products launched	Number of products launched	New indicator	New indicator	21	22	28	29	36
1.5 Leveraged funds	Total Rand value leveraged	New indicator	New indicator	R1.37b	R239m	R250m	R275m	R305m

Table 12: Outcome 1 output indicators, annual and quarterly targets

Output indicators	Annual target	Q1	Q2	Q3	Q4
1.1 Number of licensed or assigned technologies	15	1	4	4	6
1.2 Number of projects involving industry being executed	36	4	6	8	18
1.3 Number of successfully diffused technologies	15	1	6	4	4
1.4 Number of products launched	28	2	5	8	13
1.5 Total Rand value leveraged	R250m	R15m	R35m	R120m	R80m

13.2 Explanation of Performance: Strategic Aims, Goals and Initiatives

TIA aims to support technological development and innovation to increase the rate of commercialisation of knowledge and innovation outputs for socio-economic growth and development. Support is provided across key economic sectors by providing funding and other support, thereby creating commercialisation opportunities for entrepreneurs. The Commercialised Innovations Division has the following strategic goals and associated strategic initiatives (Table 13):

Table 13: Outcome 1 strategic goals and initiatives

Strategic goals	Strategic initiatives
Increased conversion of public-funded R&D outputs into commercialised innovations	Implement the Innovation Fund Formulate a TIA-wide Enterprise Development Strategy Embark on a roadshow to science councils and universities to articulate the rationale for TIA adopting a commercialisation-centric approach to funding Institutionalise a full investment lifecycle approach to investments made
Integration of commercialisation efforts across TIA (Commercialised Innovations, Bio-economy and Innovation Enabling and Support)	Develop and implement a commercialisation strategy
Improve and optimise TIA's investment practices	Review and revise TIA's Investment Framework Policy, include governance mechanisms for exit and disposals
TIA 4IR Strategy (AI, etc.)	Align TIA efforts with the prioritised strategic sectors of the RSA AI institute
Science council engagements	Initiate and develop high-impact projects in collaboration with science councils
B-BBEE exits and commercial harvests	Execute value creation opportunities through levy collection or conversion Execute redemptions Identify and execute investment exits to B-BBEE players

The division is organised according to four sector-focused sub-programmes.

Advanced Manufacturing

The purpose of the Advanced Manufacturing sub-programme is to support the transformation of South Africa's manufacturing industry into a competitive, high-tech and high value-creation industry. The programme focuses on commercialising its invested portfolio in the areas of chemicals, production technologies, lightweight materials and electronics. It supports innovations that are aligned with the roadmaps in additive manufacturing, automation, advanced electronics, photonics and aerostructures. The sub-programme supports and prioritises the commercialisation of innovative technologies, especially in agriculture, forestry, chemicals, health, manufacturing and energy. It supports the national STI efforts in the circular and green economy through projects such as Rubber Nano Products (rubber tyre recycling).

Although most of the sub-programme's projects are in Gauteng, a concerted focus will be on the underserved districts in the Eastern Cape. For example, the FibreLux technologies will be diffused in partnership with the province's Department of Rural Development and Agrarian Reform. International partnerships will also be sought where appropriate, as has been achieved through the Novelquip project with two international partners from Finland, Ponsse and Epec. TIA's Advanced Manufacturing portfolio has a natural fit with the TSP, given the common interest in engineering products, processes and projects.

Energy

The purpose of the Energy sub-programme is to support the development of innovative energy technologies that contribute to energy security and transition South Africa to a low-carbon economy. It does this by investing in and commercialising technologies in areas of renewable energy, hydrogen and fuel cells, energy storage and distributed generation. The sub-programme plans to support the development of an innovative wind energy technology to be demonstrated in the Western Cape. Development of energy storage technologies will be supported in Limpopo, one of the underserved provinces, while supporting hydrogen and fuel cells in various provinces, in support of the Decadal Plan.

The sub-programme will continue its collaboration with Technology Stations such as the Process, Energy and Environmental Technology Station at the University of Johannesburg. It will support the DSI's efforts in implementing the Energy Secretariat, which will be managed by the South African National Energy Development Institute. TIA will also collaborate with the institute on the development of energy solutions relating to distributed generation.

Information and Communication Technologies

The purpose of the Information and Communication Technologies (ICT) sub-programme is to increase South Africa's competitiveness by enabling innovators to exploit 4IR technologies and by contributing to the national goal of universal broadband access. In so doing, the sub-programme seeks to achieve the objectives that are aligned with the ICT RDI Roadmap, with specific emphasis on AI, big data, wireless connectivity, Internet of Things and scalable, inclusive ICT solutions.

TIA will continue to partner with the TIA-supported Technology Station in Electronics, specifically to pursue the establishment of an AI Technology Station at North-West University. In addition, given the cross-cutting nature of ICT and AI, the sub-programme will continue to explore supporting various initiatives in the bio-economy, particularly those focused on molecular biology research.

To broaden reach into underserved provinces, TIA-funded broadband connectivity programmes will expand pre-commercialisation trials in the Northern Cape and Eastern Cape. Furthermore, TIA aims to enter into agreements with the South African Radio Astronomy Observatory on cloud computing service localisation projects and the Council for Scientific and Industrial Research (CSIR) on next-generation cloud streaming innovations.

Natural Resources

The Natural Resources sub-programme supports national STI efforts in water security, the circular economy and the mining industry. It supports mineral resource extraction and the exploitation value chain in the mining industry, with a focus on digitisation and mining safety. The sub-programme focuses on future-orientated water and sanitation solutions, embedding the water sector in 4IR and ensuring water security by using advanced technologies to sustainably improve efficiencies. It supports the circular economy by focusing on a low-carbon and climate-resilient economy. The sub-programme has established partnerships with the Water Research Commission, Mintek and the Mandela Mining Precinct. There will be a drive to focus on supporting technologies from Mpumalanga, Northern Cape and North West.

13.3 Resource Considerations

Income

Funding is an important enabler for the division to enhance its de-risking role as the primary funder of early-stage technology innovations. Funding for the programme is facilitated through an apportionment of the baseline allocation. Given the current strategic focus, the funds available for this division are considered inadequate, and are supplemented through leveraging of funds as well as funding sourced through the Innovation Fund.

To increase its funding capacity, the division focuses on obtaining other sources of income to support its programmes and project funding initiatives. Maturing technology development projects are expected to yield financial returns in the form of royalties, loan repayments and other forms of commercialisation.

Operational Costs

As a result of below inflation increases in the baseline allocation used to fund the division's operational costs, significant pressure exists to ensure that operational costs are kept constant despite an inflationary environment. Only critical vacancies will be filled.

Investment Funding

Investment funding remains a challenge as applications for funding exceed the funding available. The division will have to increase its efforts to leverage funding from alternative sources and consider co-funding as intrinsic to its funding activities.

Table 14: Commercialised Innovations Division expenditure estimates

	2022/23 (R'000)	2023/24 (R'000)	2024/25 (R'000)
Income	**120,786**	**93,212**	**98,246**
MTEF ring-fenced	-	-	-
MTEF baseline	90,786	93,212	98,246
Additional income	30,000	-	-
Operational Expenditure	**17,588**	**17,592**	**17,644**
Support and infrastructure costs	1,148	1,152	1,204
Human resources	16,440	16,440	16,440
Investment expenditure	**103,198**	**75,620**	**80,602**
MTEF allocation	73,198	75,620	80,602
Specific contracts	30,000	-	-

14. Bio-economy

14.1 Planned Outputs and Output Targets

TIA aims to deliver the following outputs, presented in Table 15 and Table 16. The number of bio-based technologies developed is the primary measure of TIA's aim to improve food security, lower the burden of disease and derive optimal value by exploiting South Africa's natural resources and delivering on the Bio-economy Strategy. Managing the relationship with existing Technology Platforms ensures that bio-preneurs receive the necessary support through access to high-end equipment and expertise. Finally, TIA's support and management of Technology Innovation Clusters ensures that there exists an enabling environment for the advancement of biotechnology-focused innovation and commercialisation.

Table 15: Outcome 2 outputs, performance indicators and targets

Outputs	Output indicators	Annual targets						
		Audited/actual performance			Estimated performance	MTEF period		
		2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
2.1 Bio-based technologies[15] developed	Number of successfully demonstrated bio-based technologies	New indicator	New indicator	9	15	23	26	30
2.2 Technology Platforms managed and supported	Number of Technology Platforms that are operational and functional	New indicator	New indicator	7	8	8	8	8
2.3 Technology Innovation Clusters managed and supported	Number of Technology Innovation Clusters that are operational and functional	New indicator	New indicator	5	7	7	7	7

Table 16: Outcome 2 output indicators and annual and quarterly targets

Output indicators	Annual target	Q1	Q2	Q3	Q4
2.1 Number of successfully demonstrated bio-based technologies	23	4	5	5	9
2.2 Number of Technology Platforms that are operational and functional	8	-	8	-	8
2.3 Number of Technology Innovation Clusters that are operational and functional	7	-	7	-	7

It should be noted that TIA intends maintaining the number of Technology Innovation Clusters and Technology Platforms over the MTEF period. The intention is to consolidate and 'invest deeper' into the existing platforms and clusters, and not establish any new clusters or platforms over this period, to achieve greater impact. This will involve an impact measurement and management model, and developing a theory of change model.

[15] Bio-innovation technologies, processes and scientific services that will ensure food and nutrition security; bio-based technologies; agricultural products, processes and services that will be disseminated to farmer development programmes; e-health technologies, medical devices and diagnostics, pharmaceuticals and biosimilars; African traditional medicines, cosmeceuticals, nutraceuticals and health infusions; industrial bio-technologies for conversion of bulk products to fine, high-value products, and renewable biomass to generate high-value niche products such as proteins, fine chemicals, carbohydrates and oils; technologies for the production of bulk and specialty biochemicals such as nutraceuticals, flavourants and cosmeceuticals; and technologies for the creation of biofuels, bioenergy, algal biorefineries and bio ethylene as feedstock for the plastics industry.

14.2 Explanation of Performance: Strategic Aims, Goals and Initiatives

TIA aims to operate as an industry-builder in the bio-economy by supporting bio-preneurs, creating new products and new markets. The Bio-economy Division exists to support the translation of South Africa's knowledge resources into sustainable bio-based solutions that address societal challenges while contributing to sustainable economic growth.

The Bio-economy Division will pursue the modernisation of manufacturing by focusing on technologies that address high-tech industrialisation. Robotics, AI and the Internet of Things will be focus areas, as will industrial biotechnology and bioprocessing and the pursuit of additive manufacturing technologies to revitalise South African bio-industries. Convergence of technologies, underpinned by the 4IR and AI, will disrupt technological advancements. Opportunities for the convergence of nano-bio-info-cogno technologies will be incorporated into TIA's long-term planning as the organisation develops intelligence about the convergence of synthetic biology, medicinal chemistry, material sciences and allied technologies.

The division has the following strategic goals and associated strategic initiatives (Table 17).

Table 17: Outcome 2 strategic goals and initiatives

Strategic Goal	Strategic Initiatives
Create sustainable growth and value in the bio-economy through partnerships	Deliver an Algal Biorefineries initiative. Deliver high-value cultivars through existing programmes of the Agriculture Bio-Innovation Partnership Programme.
Create new bio-based industries based on publicly funded R&D	Spin out technologies from existing Innovation Clusters. Implement the Innovation Fund.
Create an enabling environment for bio-innovation	Map the IKS value chain and conduct an assessment of the remaining gaps.
Support bio-based enterprises with appropriate value creation strategies	Increase access to Technology Platforms and Clusters by bio-based enterprises.

These interventions will be delivered by the Bio-economy Division, which has the following functional sub-programmes.

Agriculture

The Agriculture sub-programme seeks to contribute to the development of a competitive, broad-based, inclusive and sustainably growing agricultural sector. This will be done by investing in strategic national sector priorities and value chain-focused initiatives that will contribute to the development of high-impact technologies, products and services to enable SMMEs, smallholder farmers and rural and township communities to enter the sector.

The sub-programme will continue to contribute towards agriculture priorities in line with the thematic challenges of food and nutrition insecurity highlighted in the Decadal Plan. The Agricultural Bio-innovation Partnership Programme will be a key intervention in this regard, together with the Soybean Food and Nutrition Development Programme, the Strategic Innovation Partnership for Grains and Oilseeds, and the Bio-innovation Aquaculture Programme.

The Agriculture sub-programme will partner with local government, industry and innovators to deploy an array of market-ready technologies and innovation in line with the Agriculture RDI roadmap goals. The sub-programme will pursue opportunities to deliver smart technologies that will lower production costs and increase farmer competitiveness. National initiatives to modernise agriculture will be supported through partnerships at provincial level. The Eastern Cape Agro-processing Programme serves as an example, having attracted the participation of Tiger Brands through its corporate venture capital fund.

Challenges in the agriculture sector will be addressed with interventions in crop and animal improvement, molecular breeding and genome engineering, bio-innovation support, agro-processing value chain development, small-scale farmer technology diffusion, digital agriculture and mobile food safety labs. These interventions will support the competitiveness of commercial agriculture, improving nutritional status and production. This will be achieved through the sub-programme's support of efforts to enhance crop protection, develop new vaccines and diagnostics (and support the revival of the animal vaccine manufacturing sector), and support genomics programmes for the beef and dairy industries that aim to enable emerging beef farmers to progress into commercial and stud breeders using superior genetics.

A new cross-cutting focus will be the deployment of smart digital and precision agriculture technologies that will be identified, developed and deployed through TIA in partnership with the South African National Space Agency, using satellite data for decision support. An opportunity has been created for the development of joint projects and integration with large infrastructure projects to determine how the country's productivity in agriculture can be enhanced. By prioritising animal and plant programmes, TIA will be contributing to the revitalisation of the economy.

In support of collaboration, linkages and alignment within the organisation, the Agriculture sub-programme recognises the important role of the AgriFood Technology Station at the Cape Peninsula University of Technology and the Limpopo Agro-Food Technology Station at the University of Limpopo.

Health

The Health sub-programme seeks to support the translation of South Africa's RDI outputs in the diagnosis, treatment and management of diseases relevant to South Africa into products and services that will improve quality of life and healthcare for all South Africans. It is underpinned by collaboration with key stakeholders in targeted initiatives that grow local manufacturing capacity, ensure security of supply in the health sector and create jobs to help revive the economy. The sub-programme aims to enhance South Africa's global competitiveness in the health arena and to deliver socio-economic value through technological innovation in healthcare products and services, addressing the diagnosis, prevention and treatment of priority disease areas.

The Health sub-programme will increase investment in the advancement of health-related technologies, particularly those directed towards the diagnosis and treatment of diseases relevant to South Africa and Africa. Initiatives focused on medical devices and diagnostics will be implemented, prioritised and enhanced. The sub-programme will also support the development of technologies and new synthesis methods for key antiretroviral molecules that are needed in South Africa and Africa.

South Africa has a long history in nuclear medicine, with world-class expertise and manufacturing and global distribution. Future investments in nuclear medicine have the potential to enable the early diagnosis of disease, the development of locally produced diagnostics and theranostics/therapeutics, and clinical applications focused on cancers prevalent in South Africa. TIA aims to pursue initiatives in nuclear medicine that have technological and commercial merit by harnessing and coordinating with national actors in the nuclear industry such as the South African Nuclear Energy Corporation (Necsa), its subsidiary NTP Radioisotopes, and academia. Efforts will focus on Mpumalanga, where certain initiatives have already started.

The Product Development Technology Station at the Central University of Technology is the development arm of the Medical Device and Diagnostic Innovation Cluster and is being considered as a key partner for initiatives in localisation and rapid product development.

Industrial Biotechnology

The Industrial Biotechnology sub-programme contributes to the promotion of the green economy by focusing its efforts on addressing national priorities and gaps in the biomanufacturing value chain, contributing to the development and commercialisation of cleaner technologies that promote environmental sustainability. The sub-programme will focus on developing and strengthening biomanufacturing capacity and capabilities by investing in market-ready technologies to support the production of locally developed bioproducts, with emphasis on the improvement of the production of bulk and specialty chemicals. The sub-programme will pursue biorefinery approaches involving bio-based products that have fewer negative impacts on the environment. An example of a significant opportunity is the production of polylactic acid from sugarcane waste, an initiative to be evaluated jointly with the Industrial Development Corporation (IDC) and private sector funders such as Grant Capital.

The sub-programme will continue to strengthen relationships with the CSIR on existing initiatives such as the Biomanufacturing Industry Development Centre, the Biorefinery Industry Development Facility, the Supercritical Carbon Dioxide Encapsulation Facility and the Industrial Biocatalysis Hub, as well as its own facility, the Bioprocessing Platform. The existing geographical spread of these facilities (Gauteng, KwaZulu-Natal and nationally through the Industrial Biocatalysis Hub), makes them suitable candidates for exploring the roll-out of technologies and services to SMMEs, particularly in industries such as sugarcane, forestry and chemicals, which require new technologies to revitalise them and improve their competitiveness.

The sub-programme will deploy biocatalytic technologies to develop bioproducts for the fine chemicals, polymers, textiles, cosmetics, flavours and fragrances industries, supporting biorefineries to convert biomass into value-added products such as biofuels, biochemicals, bioenergy and biomaterials. This relates directly to the implementation of the Bio-economy Strategy and the envisaged sustainable use of South Africa's microbial, floral and oceanic biodiversity.

Indigenous Knowledge Systems

It is important to acknowledge the potential for African medicines to improve health, given their reach locally and globally, and the export potential of natural medicines and nutritional supplements. The IKS sub-programme will help existing and new projects nationally to scale up and commercialise, and will harness indigenous ideas using an Ubuntu-based bio-innovation model. While working towards mainstreaming R&D based on holistic indigenous knowledge (IK), R&D, the central guiding principle of the sub-programme will be inclusive innovation that supports community-based technology demonstration.

The sub-programme's focus on African traditional medicines, IK-based cosmeceuticals, nutraceuticals and health infusions will serve as the base for technology transfer and commercialisation of IK-based innovations. The IKS sub-programme will harness indigenous ideas by supporting the development of technologies to conduct process development, product formulation and, where necessary, the clinical validation of indigenous-based natural products.

Increasingly, the value of indigenous knowledge systems is being recognised by other government departments that have an investment mandate. For example, the sub-programme has formed a relationship with the IDC in which the Natural Indigenous Products Programme is jointly funded to support indigenous innovations with technical and commercialisation interventions.

TIA established the African Traditional Medicines technology platform in 2021/22 at the University of the Free State in Bloemfontein, Mangaung. This technology platform aims to enable the development of IK-based proprietary pharmaceutical products that will comply with regulatory requirements for efficacy, safety and quality. A possible future collaboration partner for TIA on its IKS portfolio is InnoVenton at Nelson Mandela University in Gqeberha, Nelson Mandela Bay. InnoVenton incorporates the Institute for Chemical Technology and the Downstream Chemicals Technology Station. Its mission is to develop chemical, biochemical and related technologies for socio-economic impact in support of the DSI's Bio-economy Strategy.

Technology Innovation Cluster Programme

By adopting a value chain approach and catalysing collaborations among stakeholders, the Technology Innovation Cluster Programme facilitates an enabling environment for the advancement of technology innovation and commercialisation. Technology Innovation Clusters provide a collaborative multi-stakeholder vehicle following a broadly inclusive and coherent ecosystem approach geared to identify and achieve common objectives to create a knowledge-based economy in areas of national priority. Such clusters are collaborative initiatives, managed through the relevant sub-programme, involving stakeholders in a particular industry that play along the value chain, such as entrepreneurs, companies, suppliers, associations, manufacturers and research institutions. Through this programme, TIA catalyses the relationships and streamlines initiatives and related intellectual property developed by these partners to increase a sector's capacity to develop effective technology solutions and contribute to its overall global competitiveness.

Existing clusters will be grown to incorporate private sector funders from South Africa and abroad. An example is the Active Pharmaceutical Ingredients Cluster, which is attracting interest from international funders such as the Bill and Melinda Gates Foundation, and has gained attention from the Medicines Patent Pool to produce new drugs to combat COVID-19. The Medical Device and Diagnostics Innovation Cluster was established as part of the Global Health Innovation Accelerator under the Strategic Health Innovation Partnerships programme of the South African Medical Research Council (SAMRC). The cluster is an example of a mutually beneficial working partnership between the sub-programme and the SAMRC to co-fund opportunities in health.

The Clusters programme will accelerate the commercialisation of products from the Animal Health Cluster and services from the Beef Genomics Programme. The intention is to pursue national roll-out programmes together with partners such as the Agricultural Research Council and Onderstepoort Biological Products.

Technology Platforms Programme

The Technology Platforms Programme provides funding to facilitate access to key technical infrastructure and expertise that enables technological innovation in strategic technology areas. TIA funding ensures that technology platforms acquire cutting-edge research equipment, facilities and associated world-class expertise to lower barriers to technology innovation for public and private players. TIA's investment approach is to identify and co-develop opportunities with other role players to fund and support the rollout of Technology Platforms as a mechanism to build long-term technological capabilities in the South African bio-economy.

Expansion of the Technology Platforms Programme will support the DSI's DIPLOMICS[16] initiative. Furthermore, TIA will identify and invest in new or improved therapeutics and drug delivery systems, including the Malaria Drug Discovery programme. This responds to the priorities of the Decadal Plan by supporting the clinical development of new chemical entities, thereby facilitating the local manufacturing of active pharmaceutical ingredients targeting malaria.

TIA will support the deployment of genomics infrastructure to advance the expansion of precision medicine activities in South Africa. TIA will work with partners to provide infrastructure and technology development to stimulate innovation and new technologies in areas such as synthetic foods, pharmaceuticals and natural product formulation (including IK-based innovation). TIA will also facilitate training opportunities for interns and students, with emphasis on transforming the NSI to include black people and women. The agency will also foster cooperation with other funders to rationalise investments in critical infrastructure.

The Technology Platforms Programme will pursue opportunities to support precision fermentation, in recognition of its potential to deliver alternative food or food components such as producing proteins more efficiently compared with

[16] DIPLOMICS is a South African network of academic, commercial and industrial labs in 'omics', fields of study in the biological sciences that end with -omics, e.g. genomics, proteomics and metabolomics.

animal and plant sources. Synthetic foods are likely to become increasingly important within the 10-year horizon of the Decadal Plan.

Partnerships with funding and technology partners will become increasingly important as the platforms evolve to deliver measurable impact. Partnerships will include both public entities (higher education institutions and science councils) and private ones (large hospital groups) that recognise, for example, the value of the large genomic data sets generated to develop diagnostics for commercialisation. The sub-programme will also seek collaborations with the SAMRC in the priority areas of the Decadal Plan, namely digital health and precision medicine.

14.3 Resource Considerations

Income

Allocations to the division consist of specific ring-fenced funding to further the Bio-economy Strategy.

Operational Costs

Operational expenditure has been maintained at lower than inflationary increases over the MTEF period. This ensures that expenditure is directed to investment-related activities as per the targeted cost efficiency ratio. Critical vacancies are expected to be filled to meet the objectives of the Bio-economy Strategy.

Investment Funding

Funding is made available through ring-fenced allocations within the MTEF. There is a 4.8% increase over the MTEF period. In line with the Bio-economy Strategy, the focus will be on priority sectors, including Indigenous Knowledge Systems. Ring-fenced funding will be supported by funding of projects from alternative sources. The Technology Innovation Clusters will endeavour to leverage additional funding for their activities. There has been a focused allocation to the Health business unit.

Table 18: Bio-economy Division expenditure estimates

	2022/23 (R'000)	2023/24 (R'000)	2024/25 (R'000)
Income	**278,921**	**249,734**	**259,378**
MTEF ring-fenced	213,921	214,734	224,378
MTEF baseline	–	–	–
Additional income	65,000	35,000	35,000
Operational Expenditure	**36,768**	**38,921**	**38,921**
Support and infrastructure costs	2,382	2,392	2,392
Human resources	34,386	36,529	36,529
Investment expenditure	**242,153**	**210,813**	**220,457**
MTEF allocation	177,153	175,813	185,457
Specific contracts	65,000	35,000	35,000

15. Innovation Enabling

15.1 Planned Outputs and Output Targets

To provide enhanced inclusive access to scientific, engineering, technical and enterprise development support for SMMEs, grassroots innovators and co-operatives, TIA aims to deliver outputs presented in Table 19 and Table 20. These outputs will be pursued through effective management of the network of 18 Technology Stations, ensuring that these are provided with the requisite funding accompanied by planning and oversight to ensure delivery against targets.

Due to increasing demand for SET services throughout the country, the current network of Technology Stations lacks the capacity to enable effective coverage of marginalised communities. TIA aims to augment them with different types of innovation support centres that offer bespoke services based on specific needs. To achieve this, TIA will work with partners in industry and government at all levels to identify suitable facilities for capitalisation. With this approach, TIA seeks to widen its reach to many SMMEs that do not have access to SET infrastructure.

Human capital development remains an imperative in South Africa's transition to a knowledge-based economy. For this reason, TIA will monitor the number of postgraduate students and post-doctoral fellows who are active within TIA-supported initiatives such as the TSP. Finally, as a measure of TIA's impact and contribution to growing the economy, the number of innovation products produced in the form of various IP outputs and knowledge-based products will be measured.

Table 19: Outcome 3 outputs, performance indicators and targets

Outputs	Output indicators	Annual targets						
		Audited/actual performance			Estimated performance	MTEF period		
		2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
3.1 New centres established and supported	Number of new technology and innovation support centres providing SET support in targeted regions	New indicator	New indicator	1	3	7	5	6
3.2 SET and enterprise support provided to SMMEs[17] and co-operatives	Number of SMMEs[17] and co-operatives receiving SET and enterprise development support	3,272	3,269	1,990	2,800	2,800	2,940	3,115
3.3 High-level human capital development for competitiveness and new industry development	Number of high-level students and post-doctoral fellows admitted	New indicator	New indicator	New indicator	95	121	130	150
3.4 Innovation products produced	Number of IP- and knowledge-based innovation products produced	New indicator	New indicator	49	130	149	165	180

[17] SMMEs incorporate grassroots innovators.

Table 20: Outcome 3 output indicators and annual and quarterly targets

Output indicators	Annual target	Q1	Q2	Q3	Q4
3.1 Number of new technology and innovation support centres providing SET support in targeted regions	7	-	4	-	3
3.2 Number of SMMEs and co-operatives receiving SET and enterprise development support	2,800	300	600	850	1,050
3.3 Number of high-level students and post-doctoral fellows admitted	121	0	25	0	96
3.4 Number of IP- and knowledge-based innovation products produced	149	7	65	38	39

15.2 Explanation of Planned Performance: Strategic Aims, Goals and Initiatives

TIA aims to catalyse, coordinate and enable the innovation ecosystem through systemic interventions, particularly where there are system failures and gaps. TIA will transition from a project-level approach to a programmatic approach, and will prioritise programmes and applications with co-investment between the science base and the private sector.

Through Outcome 3, TIA aims to address the myriad of challenges facing SMMEs and start-ups by providing SET support and business development, including enterprise start-up. Support is provided through innovation infrastructure and expertise, direct funding and skills development. A key characteristic of the division is the development of innovators in parallel with technology development. The Innovation Enabling Division targets broader society, from higher education institutions[18] (HEIs) and science councils to co-operatives and communities.

The impact of COVID-19 on SMMEs has been particularly acute. In conditions of depressed demand, SMMEs have been reduced to basic issues of survival and access to markets. TIA drives a strong transformation agenda focusing on women, youth and persons with disabilities through technological innovation.

The division has several interlinked activities and initiatives planned for 2022/23 in support of TIA's strategic thrust, which positions innovation as central to improving the productivity and competitiveness of specific sectors and demonstrates the agency's support of the Decadal Plan. These are implemented through three sub-programmes: TSP, Seed Fund and Enterprise Development. TIA also implements the Innovation for Inclusive Development as a programme of the DSI through a project management unit.

[18] HEIs incorporate universities (academic universities, universities of technology and comprehensive universities), Community Education and Training colleges, private colleges and TVET colleges.

Flowing from the planned outputs, the division has the following strategic goals and associated strategic initiatives (Table 21):

Table 21: Outcome 3 strategic goals and initiatives

Strategic Goal	Strategic Initiatives
Increased productivity of the venture capital fund management and technology transfer system	Implement a revived Chuma IP commercialisation programme Implement the TIA/SA SME Fund/Southern African Venture Capital and Private Equity Association Fund Manager Development Programme
Contribute to a viable technology entrepreneurship ecosystem	Establish an accelerator programme (including technology-focused mentorship)
Support regional innovation ecosystems in underserved provinces	Develop a regional innovation strategy and plan, with an emphasis on underserved provinces
Increased private sector involvement and investment in R&D	Recruit additional private sector partners into the Industry Matching Fund and the Innovation Fund
Utilise government's public procurement spend as a lever for innovation	Establish a South African equivalent of the United States Small Business Innovation Research programme
Position TIA as an industry-builder in the NSI	Establish strategic innovation programmes through thematic innovation networks

These interventions will be delivered by the Innovation Enabling and Support Division through the following sub-programmes and initiatives:

Seed Fund

TIA's Seed Fund provides support to researchers and entrepreneurs to translate their research outputs into fundable ideas for further development. The recipients of funds under TIA's Seed Fund make extensive use of the equipment and expertise of Technology Stations to develop prototypes. Furthermore, staff at some Technology Stations provide their expertise, support and advice to Seed Fund projects. The Seed Fund is also an important bridging instrument that creates a rich and varied source of projects potentially eligible for TIA's Technology Development Fund.

The Seed Fund assists researchers from HEIs, science councils, technology entrepreneurs and SMMEs to advance their research outputs and ideas to the stages of proof of concept, development of prototypes and business cases. The Seed Fund has evolved to be a project preparation instrument for the NSI, serving as a preliminary innovation support mechanism that assists innovative companies and researchers in commercialisation.

Technology Stations Programme

The TSP is one of the flagship platforms of the DSI and an instrument for increasing competitiveness and support for new product development, especially to SMMEs. In addition, enhanced linkages between industry and universities (hosts of the Technology Stations) are expected to improve the content and relevance of curricula and also prepare students better for the needs of industry.

The TSP remains a critical initiative of the DSI in support of the policy intents of the 2019 White Paper and in support of South Africa's Economic Recovery and Reconstruction Programme. The TSP makes a valuable contribution to the competitiveness and industrial development of firms, both large and small, by providing technology solutions, services and training to SMMEs and co-operatives. The programme makes a valuable contribution to micro-enterprises development, localisation of imports, youth skills development and transformation in terms of demographics and reaching SMMEs and co-operatives in underserved provinces.

Enterprise Development

The purpose of the Enterprise Development sub-programme is to facilitate technology enterprise development with skills and acceleration platforms. The sub-programme also aims to stimulate a culture of innovation thinking within the NSI, increasing the rate of translation of innovative ideas into novel technologies, products and services. The sub-programme provides focused and targeted training interventions to strengthen the entrepreneurial capacity of researchers and innovators and enable them to commercialise their research outputs. Funding recipients under the Leaders in Innovation Fellowship Programme, Internship Programme and Gauteng Accelerator Programme are frequently referred to relevant Technology Stations for further support and assistance.

Innovation for Inclusive Development

The Innovation for Inclusive Development programme is a special programme of the DSI, hosted by TIA under a project management unit with responsibility for implementing initiatives in three focus areas: grassroots innovation, innovation for local economic development and innovation for sustainable human settlements. Recipients under the Grassroots Innovation Programme are frequently given assistance by Technology Stations to undertake feasibility studies and technology development.

Strategic Partnerships

Strategic Partnerships is a cross-cutting business development function within TIA whose primary purpose is to promote increased collaboration and funding opportunities to advance the organisation's strategic priorities. Its role is to coordinate the activities of the organisation to implement the Hub and Spoke model and the Glass Pipeline concept, as well as to develop relationships to enable TIA's backward and forward integration plan.

TIA's partnerships approach is premised on five objectives:

- Increasing TIA's funding base to reduce dependence on the fiscus.
- Promoting funding efficiencies with partner institutional funders in the NSI.
- Building a healthy pipeline of fundable projects.
- Leveraging complementary resources from partner institutions.
- Promoting market access and commercialisation.

Partnerships for Funding

Over the past few years, TIA has established partnerships with a range of players within the NSI, locally and internationally, to raise funding to enhance execution of its mandate. These have mainly been in the form of project co-funding and follow-on funding. Key partners were from the development finance community such as the IDC. In recent times, the increasing demand for innovation funding from TIA, constraints on the fiscus brought about by the COVID-19 pandemic and the need for TIA to reduce its dependence on transfers has meant that TIA needs to intensify efforts to strengthen its funding capacity through structured and smart funding partnerships.

Leveraging Private Sector Funding

The private sector in South Africa represents an important source of revenue for TIA in funding new projects and for commercialisation. In 2018 TIA established the Industry Matching Fund as a partnership model to leverage private sector funding. Although the fund has attracted much funding, it remains skewed in terms of sources, dominated by development finance institutions such as the IDC and the Small Enterprise Finance Agency. The primary private sector actor is the SA SME Fund, in addition to several venture capital and angel fund investors.

Future efforts will therefore focus on growing the fund with an emphasis on recruiting more venture capital companies, angel investors and corporates. Many corporates implement enterprise supplier development programmes while others have established corporate venture capital funds. TIA will pursue these with greater intensity to leverage funding and, where appropriate, launch innovation challenges. In the medium term, TIA will work to establish a special-purpose vehicle with an appropriate PFMA public institution schedule classification that will enable TIA to attract funding from the private sector and other sources, something that is not possible under the current scheduling of TIA.

Leveraging Public Sector Funding

South Africa has a dire need for efficient and cost-effective locally developed technologies to be utilised by national, provincial and local government departments for service delivery and execution of their mandates. TIA has a strong portfolio of innovations relevant to these objectives. Although government spends significant amounts on procuring solutions in the market, its record of procuring locally developed technology solutions has been poor.

The White Paper on Science, Technology and Innovation has a specific strategic intent that calls for using public procurement to further innovation. This is consistent with the practice in many countries such the United States, the United Kingdom, Australia, India and some parts of Europe, which have successfully used public procurement to stimulate the development of technologies developed locally by researchers and SMMEs.

Public procurement in South Africa represents a substantial market. Although government has, as a first step, introduced a rule to set aside 30% of government procurement spending for SMMEs, this does not make special provision for new and untested technologies developed in South Africa, largely on account of the challenging provisions of the PFMA and other regulatory requirements. TIA had started the process of establishing a Small Business Innovation Research instrument in 2018, building on the previous work of the Centre for Public Service Innovation. The DSI has also launched the Technology Acquisition and Deployment Fund through TIA, as a pilot model to build a policy case for revisions to the PFMA and as a precursor to a fully fledged Small Business Innovation Research instrument.

At a partnerships level, TIA is piloting this model with the Department of Tourism through a customised multi-year innovation programme that seeks to support the development of technologies relevant to the tourism sector. At provincial level, TIA has launched an Agro-Industry Innovation Programme with the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism and has established a Textiles Technology Hub together with the Gauteng Department of Economic Development. In 2022/23, TIA will implement the Technology Acquisition and Deployment Fund and more strongly pursue additional partnerships with government departments at national and provincial levels. TIA will seek to establish at least four partnerships with departments at national and provincial levels with the aim of raising at least R40 million over the next three years.

International Partnerships

International partnerships constitute an important focus area for TIA for the purposes of leveraging funds; promoting joint technology development initiatives; providing access to knowledge networks, creating opportunities for capacity-building and knowledge exchange; and fostering greater connection for TIA investees with international networks and markets. In this regard, TIA pursues its partnerships programme at bilateral, regional and multilateral levels, placing emphasis on South Africa's developmental challenges and the African agenda as outlined in the White Paper on Science, Technology and Innovation.

In the last few years, TIA has implemented partnerships with countries in Europe and Africa to promote joint RDI projects on a co-funding basis through platforms such as Eureka and the Africa Research Upscale programmes. In addition, bilateral initiatives to promote market access and internationalisation of TIA investees were undertaken with partner countries such as the United Kingdom, Switzerland, France and Finland. From a South-South perspective, TIA

continued to lead South Africa's participation in the BRICS Young Scientist Forum and has launched a soft-landing programme with Brazil to support market access for innovators in the agri-tech sector from both countries.

The focus in 2022/23 will be fund-raising. This will entail concerted efforts to raise international funds for technology innovation and commercialisation, targeting international venture capital, development cooperation funds, programmes under Horizon Europe, philanthropic/grant-making organisations and other development finance institutions. This will enable TIA to establish, host and manage challenge-led innovation programmes that address societal challenges on food security, climate change, communicable diseases, inclusive development, and so on.

In this regard, TIA has successfully implemented Phase I of the Global CleanTech Innovation Programme of the United Nations Industrial Development Organization (UNIDO). It concluded in 2018. This programme supported 50 'clean' technology innovations with funding from UNIDO totalling R30 million over a three-year period. In 2022/23 TIA will implement Phase II of the programme, with partners in the NSI, under a new contract with UNIDO for $3.4 million, targeting at least 200 clean technology start-ups.

As one of the recipients and implementing partners of the DSI's Innovation Fund, TIA will use the fund to invest in projects and initiatives that have the greatest potential to leverage external funding, especially from the private sector. Local and international venture capital firms, private equity firms and corporate venture capital will be key partners. These efforts will be augmented by onboarding black venture capital firms to drive transformation in the sector. In this regard there is a need to establish a special-purpose vehicle with appropriate scheduling to enable TIA to attract private sector funding. This is difficult to achieve under TIA's current scheduling.

With regard to the private sector, a large number of companies have established enterprise development programmes as part of their B-BBEE scorecards. A new development is the advent of corporate venture capital funds established with the aim of maturing enterprise development programmes to promote innovation in the companies themselves or to support innovation in general. TIA will identify these systematically and forge relevant structured partnerships with companies through appropriate vehicles within TIA.

Promoting a Coordinated Innovation Funding Value Chain

In addition to partnerships for fund-raising, TIA collaborates with a range of other partners in the NSI to pursue a range of other objectives critical to the effective execution of its mandate. Firstly, it collaborates with other government innovation funding instruments that are complementary to TIA's technology innovation and commercialisation mandate, promoting synergies. These include the instruments of the Department of Trade, Industry and Competition such as the Support Programme for Industrial Innovation, the Technology and Human Resources for Industry Programme and the Technology Venture Capital Fund. Through these efforts, TIA will seek to promote a pooling of funds and streamlining of processes to ensure seamless progression of innovations through the value chain to contribute to an NSI that is productive, efficient and effective. This important yet challenging task is expressed as a specific intent in the White Paper on Science Technology and Innovation.

In the same vein, TIA partners with other development finance institutions such as the IDC, the Public Investment Corporation and the Small Enterprise Finance Agency through structured joint sector funds. These partnerships include project handover modalities such as establishing joint investment and commercialisation support committees to allow seamless transition of investment across the innovation funding value chain. As an example, TIA and the IDC have established a National Indigenous Products Programme, which has a joint investment committee. Other important players with which work has started include the Development Bank of Southern Africa and the National Empowerment Fund.

Collaboration with State-Owned Enterprises

State-owned enterprises have the potential to play a catalytic role in promoting specialisation in the sectors that underpin South Africa's socio-economic wellbeing. With an agenda that drives technological deepening and upgrading, they can influence the development of downstream sector value chains with impact on the development of local technologies and the creation of innovative start-ups, using their procurement spending as a lever. Although the R&D spending of state-owned enterprises has, for many reasons, been in decline since the post-apartheid era, current efforts by government seek to position them as key contributors to the functioning of the NSI by increasing their RDI investments, including in skills formation.

TIA has established strategic relationships with a few of these, including Eskom, Telkom, Airports Company South Africa and the Air Traffic and Navigation Services. In his Medium-Term Budget Policy Statement, the Minister of Finance highlighted the need to improve efficiencies in the country's logistics infrastructure to support export growth. TIA will continue to intensify its efforts to develop structured innovation initiatives and programmes, using its membership of the State-Owned Entity Procurement Forum to position itself as a champion of technology innovation and collaborate with relevant partner entities to pursue joint initiatives. A case in point is TIA's role in working with the forum to develop a procurement framework for local new technologies that were not catered for in the current Procurement Bill.

Collaborating with the Research Community

TIA partners and collaborates with the research community in its efforts to grow and strengthen its pipeline of investable projects emanating from research outputs from publicly funded intellectual property and enhance its drive to promote commercialisation. Partners include universities, science councils and forums such as the Southern African Research and Innovation Management Association and the Technological Higher Education Network South Africa (formerly the South African Technology Network). Since 2013, the agency has, with a good measure of success, implemented the Seed Fund as a structured partnership to collaborate with universities, and, more recently, a few science councils through their Offices of Technology Transfer to source and fund bankable projects from the research communities.

The survey report of Offices of Technology Transfer shows that the Seed Fund model has been instrumental in driving commercialisation efforts. It notes, however, that there remains a gap in funding for both technology development and commercialisation. TIA has started a drive to work with universities and science councils to identify projects that require Series A[19] and Series B[20] funding, to quantify the need and to enable better planning for deployment of its limited resources to the most deserving projects – those that are closely aligned to government priorities, especially emerging priorities in the Decadal Plan.

Science councils also play an important role in the fulfilment of TIA's commercialisation mandate. South Africa has 10 science councils, including the National Research Foundation. These are critical partners for TIA, providing an important pipeline of investable projects. TIA has made substantial investments in science councils and is working to establish a more coherent commercialisation funding framework for this constituency. In addition, science councils are an important source of technology validation and demonstration before market launch.

Examples of collaboration include partnerships with Mintek that allow piloting of mining and mineral beneficiation technologies, and the validation of health technologies at the world-class facilities of the National Health Laboratory Service. Other science councils such as the CSIR and the Agricultural Research Council are equipped with facilities for

[19] Series A financing is "investment in a privately-held, start-up company after it has shown progress in building its business model and demonstrates the potential to grow and generate revenue". (Source: www.investopedia.com)

[20] Series B financing is "the second round of funding for a business through investment, including private equity investors and venture capitalists". (Source: www.investopedia.com)

piloting and validation before market and serve as industry test beds. TIA has established partnerships with many of the science councils, including the South African National Space Agency, the South African National Energy Development Institute and Necsa and has launched seed-stage co-funding programmes with the SAMRC and the Water Research Commission to produce investor-ready projects in relevant thematic areas.

In this quest to grow the pipeline of early-stage publicly funded IP, the National Intellectual Property Management Office is a critical partner that plays an important complementary role in developing technology transfer capacity at universities, managing IP disclosures and providing assistance to TIA investees on IP management matters. An important challenge for the future lies in strengthening the technology transfer capacity of previously disadvantaged universities that have not yet had the level of research output required to promote a balanced distribution of resources and contribute to the effective functioning of the NSI.

15.3 Resource Considerations

Income

Funding for the division is sourced from TIA's baseline funding, ring-fenced programmes and specific funded projects. The organisation has shown that it has the ability to implement specific programmes adequately. As a result, the agency has seen an increase in the number and value of specific contracts with the DSI.

Operational Costs

Operational expenditure is maintained over the MTEF period in support of the organisation's efficiency ratio target. This ensures that expenditure is directed to investment-related activities. Critical vacancies are expected to be filled in accordance with specific contract requirements.

Investment Funding

Investment-related activities are directed in line with the requirements of ring-fenced funding (Technology Stations) as well as specific contracts. In addition, in support of systemic intervention, the agency supports investment in the Seed Fund and Enterprise Development programmes as critical early-stage funding areas aimed at ensuring that the necessary pipeline is generated for the NSI.

Table 22: Innovation Enabling and Support Division expenditure estimates

	2022/23 (R'000)	2023/24 (R'000)	2024/25 (R'000)
Income	**153,619**	**163,468**	**161,879**
MTEF ring-fenced	46,685	46,862	48,966
MTEF baseline	25,501	25,606	31,913
Other income	81,433	91,000	81,000
Operational Expenditure	**19,869**	**19,873**	**19,913**
Support and infrastructure costs	892	896	936
Human resources	18,977	18,977	18,977
Investment expenditure	**133,750**	**143,595**	**141,966**
MTEF allocation	52,317	52,595	60,966
Specific contracts	81,433	91,000	81,000

16. Institutional Resource Considerations

Operational Costs

Support and infrastructure cost allocations have been prepared using a zero-based budgeting process focusing on improving the efficiency ratio within the agency through cost-saving initiatives. Human resource costs have been budgeted in line with the prior year, again focusing on improving the efficiency ratio. This has been achieved by filling only critical vacancies.

Investment Funding

Given current economic conditions, investment funding remains a challenge as applications for funding far exceed the funding available. This is mitigated by leveraging funds for projects from other parties, including co-funding of projects.

Other Income

Funding is an important enabler for TIA to enhance its de-risking role as the primary funder of early-stage technology innovations in the NSI. TIA pursues strategies to strengthen its funding base, especially under the current constrained fiscal conditions. The organisation has shown that it has the ability to implement specific programmes adequately. As a result, the agency has seen an increase in the number and value of specific contracts with the DSI.

The agency will continue to focus on obtaining other sources of income to support its programmes and project funding initiatives. This will be done through contract-specific funds from the DSI including the Innovation Fund, as well as other government institutions, and through partnerships with the public and private sectors (using the Hub and Spoke model). Estimated funding through these partnerships amounts to R364 million over the MTEF period.

Maturing technology development projects are expected to yield financial returns in the form of royalties, loan repayments and other forms of commercialisation. With effective working capital management, the entity aims to maximise interest earned on cash reserves deposited with the Corporation for Public Deposits at the South African Reserve Bank. Returns generated will be used to fund innovation initiatives.

Technology Innovation Agency: Summary 3 Year Budget 2022/23 to 2024/25

Table 23: TIA budget allocation for the MTEF period 2022/23 to 2024/25

	2022/23 (R'000)	2023/24 (R'000)	2024/25 (R'000)
Administration	**170,702**	**171,103**	**171,769**
Support and infrastructure cost	50,460	50,410	51,076
Human resources	120,242	120,693	120,693
Investments	**479,101**	**440,612**	**453,609**
Bio-economy	**242,153**	**210,814**	**220,457**
Ring-fenced	177,153	175,814	185,457
Specific contracts	65,000	35,000	35,000
Technology Stations	**72,685**	**92,013**	**92,013**
Ring-fenced	46,685	46,862	46,862
Specific contracts	26,000	45,151	45,151
Commercialisation	**103,198**	**75,620**	**80,602**
Baseline	73,198	75,620	80,602
Specific contracts	30,000	-	-
Innovation Enabling	**61,064**	**62,165**	**60,536**
Baseline	5,632	5,733	14,104
Specific contracts	55,432	56,432	46,432
Total Expenditure	**649,803**	**611,715**	**625,378**
Total funding received	**649,803**	**611,715**	**625,378**
Allocation from DSI	458,370	460,131	480,795
Baseline (other than Bio-economy and Technology Stations)	197,764	198,535	207,451
Bio-economy	213,921	214,734	224,378
Technology Stations	46,685	46,862	48,966
Additional income target	176,433	135,583	124,583
Other income	4,500	5,500	6,500
Interest	10,500	10,500	13,500
Surplus/(deficit)	**-**	**-**	**-**
Capex allocation:	12,000	8,000	5,000
Efficiency ratio	**15%**	**15%**	**15%**

17. Updated Key Risks and Mitigation Measures

Stemming from the Strategic Plan, TIA employs a robust, systematic process at both operational and strategic level that is integrated and central to its strategic planning process. The methodology applied is derived from the prescripts of the Committee of Sponsoring Organizations of the Treadway Commission: Enterprise Risk Management Integrated Framework, ISO31000 on Enterprise Risk Management Framework, National Treasury's Public Sector Risk Management Framework, the Institute of Risk Management South Africa's risk principles and TIA's Enterprise Risk Management Policy. TIA manages its risks at strategic, operational and project levels.

Table 24 outlines the key risks relating to TIA's outcomes together with identified risk mitigation measures.

Table 24: Strategic risks and mitigation plans (2020-2025)

Outcome	Key risk	Risk mitigation
Outcome 1: Commercialised innovations	Failure to translate technologies funded and developed into commercial ventures	Establish appropriate partnerships and instruments to ensure uptake of TIA investments Build relationships and with accelerators for innovation and business development support services Establish and implement a TIA venture build programme
	Low market uptake of and access to funded innovations	Build and develop investment portfolio and technologies in partnerships with industry (market-led investment strategy)
Outcome 2: Delivering on the Bio-economy Strategy	Sub-optimal implementation of the Bio-economy Strategy due to insufficient coordination	Implement strategic bio-innovation multi-stakeholder programmes Implement measures to address the factors that enable a bio-economy as articulated in the Bio-economy Strategy
Outcome 3: SMMEs supported through strategically informed and regionally distributed Technology Stations	Inability to meet the growing demand for SET and enterprise development services by SMMEs	Broaden access to SMMEs through the establishment of additional centres, particularly in underserved provinces Secure additional resources to upgrade the capabilities of Technology Stations, including inculcating a 4IR approach
	Inability of Technology Stations and other implementing partners to meet the needs of SMMEs for competitiveness improvements and growth	

Part D

Technical Indicator Descriptions

Administration

Effective and efficient internal environment to effect the strategy

Indicator title	A1.1 Achieve an unqualified external audit opinion with no financial matters in the audit report
Definition	An unqualified audit opinion on the audited annual financial statements of the previous financial year as presented by the appointed external auditors. It is an independent statement on the compliance of the entity with the regulatory frameworks, with no financial matters identified in the audit report.
Source of data	External audit report
Method of assessment	External auditors' report. The auditors' opinion is the only means of assessment. Qualified opinion means that management did not comply with prescripts and therefore did not meet the minimum expected standards of financial performance. Unqualified means that the entity performed at an acceptable level. Clean audit means that the organisation exceeded the expected standard and that its policies are effective.
Means of verification	Audit report from the appointed external auditors Financial statements, trial balance and detailed reports
Assumptions	Compliance with regulatory frameworks, policies and National Treasury instruction notes. Assessment of materiality after consideration of materiality framework. Prior-year recurring matters (carried over) to not affect the achievement of the target.
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	N/A
Calculation type	Non-cumulative
Reporting cycle	Annually in Q2 (2021/22 financial year audit opinion)
Desired performance	To meet or exceed the target set Acceptable performance: Unqualified audit opinion with matters of emphasis High performance: Clean audit opinion
Indicator responsibility	Board and Audit and Risk sub-committee Executive Management Committee

Indicator title	A1.2 Improved investment decision turnaround time for funding applications
Definition	Investment decision turnaround time is measured as the time taken by TIA to process and conclude funding applications, from receipt of a full funding application until when an investment decision is taken. The desired investment decision turnaround time is determined by the quantum of funding.
Source of data	Investment system
Method of calculation	(Number of full funding application assessment decisions concluded within the targeted turnaround time) / (Total number of full funding applications received) x 100%
Means of verification	Verification of supporting documentation
Assumptions	All transaction information is accurately recorded on the investment system. Open funding applications (where an investment decision has not yet been made) shall be excluded from calculations. The time taken by the applicant to respond to questions and to provide more information will be deducted from the total time taken for each individual application from receipt of a full application until when an investment decision is taken.
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	N/A
Calculation type	Non-cumulative
Reporting cycle	Annually in Q4
Desired performance	To meet or exceed the target set Acceptable performance: Meeting the targeted turnaround times in 70% of instances
Indicator responsibility	Executive: Bio-economy Executive: Commercialisation Executive: Innovation Enabling

Indicator title	A1.3 Allocation of funds to underserved provinces
Definition	Available investment funds directed towards supporting innovation projects and initiatives in underserved provinces.
Source of data	Programme or project databases Agreements or contracts
Method of calculation	Simple count of the value of signed agreements entered into with third parties as a percentage of total available investment funds (TIA's co-investment with third parties, financial and/or follow-on funding)
Means of verification	Verification of supporting documentation
Assumptions	Availability of sufficient unspent and uncommitted funds as of 1 April 2022 Willing partners/funding recipients
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	Recipients in the Northern Cape, Limpopo, Free State and Mpumalanga; supports the DSI's selected district and metropolitan municipalities (Ugu, Zululand and Ekurhuleni)
Calculation type	Cumulative
Reporting cycle	Annually in Q4
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 80% of the target
Indicator responsibility	Executive: Bio-economy Executive: Commercialisation Executive: Innovation Enabling

Indicator title	A1.4 Allocation of funds to transformed recipients
Definition	Available investment funds directed towards black recipients.
Source of data	Programme or project databases Agreements or contracts
Method of calculation	Simple count of the value of signed agreements entered into with third parties as a percentage of total available investment funds (TIA's co-investment with third parties, financial and/or follow-on funding)
Means of verification	Verification of supporting documentation
Assumptions	Availability of sufficient unspent funds as of 1 April 2022 Willing partners/funding recipients
Disaggregation of beneficiaries	Black recipients with a minimum black ownership of 30%, or recipients who are at B-BBEE Level 4 or better
Spatial transformation (DDM)	N/A
Calculation type	Cumulative
Reporting cycle	Annually in Q4
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 80% of the target
Indicator responsibility	Executive: Bio-economy Executive: Commercialisation Executive: Innovation Enabling

Outcome 1

Commercialised innovations

Indicator title	**1.1 Number of licensed or assigned technologies**
Definition	Intellectual property that has been licensed, assigned or sold to a third party for the purpose of commercialisation, including both registrable and non-registrable IP.
Source of data	Programme and project databases Reports Contracts or agreements
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	IPhas been created
Disaggregation of beneficiaries	Women-owned businesses or women entrepreneurs: ≥30% Youth-owned businesses or youth entrepreneurs: ≥20% Entrepreneurs who are persons with disabilities or businesses owned by persons with disabilities: ≥10%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the target
Indicator responsibility	Executive: Commercialisation Executive: Innovation Enabling

Indicator title	**1.2 Number of projects involving industry being executed**
Definition	Number of collaborative projects/businesses or initiatives/programmes with the private sector in developing and/or commercialising the technology. The collaboration can be financial or non-financial. The joint collaborations must be between academia and industry.
Source of data	Programme or project databases Reports Contracts or agreements
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Projects/businesses or initiatives/programmes have existing or new partnerships with the private sector
Disaggregation of beneficiaries	Women-owned businesses or women entrepreneurs: ≥30% Youth-owned businesses or youth entrepreneurs: ≥50% Entrepreneurs who are persons with disabilities or businesses owned by persons with disabilities: ≥10%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the target
Indicator responsibility	Executive: Commercialisation Executive: Innovation Enabling

Indicator title	**1.3 Number of successfully diffused technologies**
Definition	Number of technologies that have been introduced into the market (community structures, SMMEs, co-operatives and other business formations) for social gain, directly or indirectly (products, processes or services).
Source of data	Programme or project databases Reports Contracts or agreements Invoices Testimonies Publications
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Availability and approval of funding Innovation outputs developed successfully to demonstration stage (or higher) where there is a market for social diffusion A diffused technology can be counted more than once only if a derivative/modified/customised version of the original technology is diffused
Disaggregation of beneficiaries	Women-owned businesses or women entrepreneurs: ≥30% Youth-owned businesses or youth entrepreneurs: ≥50% Entrepreneurs who are persons with disabilities or businesses owned by persons with disabilities: ≥10%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the target
Indicator responsibility	Executive: Commercialisation Executive: Innovation Enabling

Indicator title	**1.4 Number of products launched**
Definition	The number of products that have been successfully launched in the market by start-ups or SMMEs.
Source of data	Programme or project databases Reports Contracts or agreements
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	The product is fully developed and ready for market entry A product launched can be counted more than once only if a derivative/modified/customised version of the original product is launched
Disaggregation of beneficiaries	Women-owned businesses or women entrepreneurs: ≥30% Youth-owned businesses or youth entrepreneurs: ≥50% Entrepreneurs who are persons with disabilities or businesses owned by persons with disabilities: ≥10%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the target
Indicator responsibility	Executive: Commercialisation Executive: Innovation Enabling

Indicator title	**1.5 Total Rand value leveraged**
Definition	The amount of funds contributed by third parties to investment initiatives for the purposes of funding technology development, technology commercialisation and related support activities.
Source of data	Programme or project databases Reports Contracts or agreements
Method of calculation	Simple count of the value of signed agreements entered into with third parties (TIA's co-investment with third parties, financial and/or follow-on funding)
Means of verification	Verification of supporting documentation
Assumptions	Third parties will continue to have available funds to spend on innovation
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the target
Indicator responsibility	Executive: Commercialisation Executive: Bio-economy Executive: Innovation Enabling

Outcome 2

Delivering on the Bio-economy Strategy

Indicator title	**2.1 Number of successfully demonstrated bio-based technologies**
Definition	Bio-based technologies, products or services that have reached demonstration stage in agriculture, health, industrial biotechnology, IKS and other bio-based domains. Bio-based refers to a technological application that uses biological systems, living organisms or derivatives of them to make or modify products or processes. This includes diagnostic kits, bioprocesses, technology packages and allied.
Source of data	Programme or project databases Reports Contracts or agreements
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Availability and approval of funding
Disaggregation of beneficiaries	Women-owned businesses or women entrepreneurs: ≥30% Youth-owned businesses or youth entrepreneurs: ≥20% Entrepreneurs who are persons with disabilities or businesses owned by persons with disabilities: ≥10%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the target
Indicator responsibility	Executive: Bio-economy

Indicator title	**2.2 Number of Technology Platforms that are operational and functional**
Definition	The number of Technology Platforms that are operational and/or functional that are supported by TIA to meet the needs of beneficiaries and stakeholders and develop into high-performing and capable facilities.
Source of data	Programme or project databases Reports Contracts or agreements Approved budgets or proof that funds are available Operational plans
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Adequate funding and resources are made available (disbursement) or obtained from third parties to assist with the funding of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Non-cumulative
Reporting cycle	Bi-annually (Q2 and Q4)
Desired performance	Platforms are functional and operational Acceptable performance: Achievement of 90% of the agreed targets towards being functional or operational
Indicator responsibility	Executive: Bio-economy

Indicator title	**2.3 Number of Technology Innovation Clusters that are operational and functional**
Definition	The number of Technology Innovation Clusters that are operational and/or functional that are supported by TIA to undertake innovation projects and activities in support of targeted industries and regions.
Source of data	Programme or project databases Reports Contracts or agreements Approved budgets or proof that funds are available Operational plans
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Adequate funding and resources are made available (disbursement) or obtained from third parties to assist with the funding and establishment of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Non-cumulative
Reporting cycle	Bi-annually (Q2 and in Q4)
Desired performance	Clusters are functional and operational Acceptable performance: Achievement of 90% of the agreed targets towards being functional or operational
Indicator responsibility	Executive: Bio-economy

Outcome 3

SMMEs supported through strategically informed and regionally distributed Technology Stations

Indicator title	**3.1 Number of new technology and innovation support centres providing SET support in targeted regions**
Definition	The establishment of new centres (technology and innovation support centres or other centres providing a similar service) in targeted regions based on government's spatial development priorities. Technology and innovation support centres are centres that provide SET services and support to SMMEs which are not necessarily hosted by universities.
Source of data	Programme or project databases Reports Contracts or agreements
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Adequate funding and resources are made available (disbursement) or obtained from third parties to assist with the funding and establishment of such facilities Willing hosts, champions and shareholders (including the DSI) commit and agree to the establishment of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Centres that are operational and functional
Indicator responsibility	Executive: Innovation Enabling

Indicator title	**3.2 Number of SMMEs and co-operatives receiving SET and enterprise development support**
Definition	SMMEs and co-operatives that access SET support for the purposes of developing innovative products or services through the financial or non-financial support of the Technology Stations network.
Source of data	Programme or project databases Reports Contracts or agreements Quotations or invoices Attendance registers and training manuals Proof of consultation Proof of identity Proof of company registration
Method of calculation	Simple count of number of SMMEs supported in the financial year. An individual or SMME supported more than once in the financial year can only be counted once for reporting purposes.
Means of verification	Verification of supporting documentation
Assumptions	An adequate number of SMMEs and co-operatives will be interested in the services offered by Technology Stations, possess adequate expertise and have access to adequate funding to provide and maintain infrastructure required for SET support
Disaggregation of beneficiaries	Entrepreneurs who are historically disadvantaged individuals or businesses owned by historically disadvantaged individuals: ≥80% Women-owned businesses or women entrepreneurs: ≥45% Youth-owned businesses or youth entrepreneurs: ≥40% Entrepreneurs who are persons with disabilities or businesses owned by persons with disabilities: ≥3%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI. The focus will be on targeting historically disadvantaged individuals.
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the agreed target
Indicator responsibility	Executive: Innovation Enabling

Indicator title	**3.3 Number of high-level students and post-doctoral fellows admitted**
Definition	Students enrolled at universities or universities of technology for an honours, master's or doctoral qualification (equivalent and above) participating in TIA-fully funded or co-funded initiatives.
Source of data	• Annual registration letter (proof of enrolment) from the HEI where the student is registered (proof of registration on an official letterhead of the HEI, stamped and signed); and • A letter from the Technology Station confirming the student is being funded or co-funded through the Technology Station. This letter should be signed by both the Technology Station and a research graduate. The Excel database will include additional profile information that is required for management and analytical purposes. The proof of registration will be accepted as valid for a specific calendar year, which implies that it covers two financial years.
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Number of high-level research graduates participating in TIA-funded activities to acquire adequate expertise and training in SET fields
Disaggregation of beneficiaries	Historically disadvantaged individuals: ≥80% Women: ≥45% Youth: ≥40% Persons with disabilities: ≥3%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Bi-annually (Q2 and in Q4)
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the agreed target
Indicator responsibility	Executive: Innovation Enabling

Indicator title	**3.4 Number of IP and knowledge-based innovation products produced**
Definition	Knowledge or innovation product: the output (discrete intermediate steps or finalisation) of knowledge or innovation (process, market, product or improved service delivery) that is quantifiable (e.g. invention disclosure, patent, prototype, technology transfer package, technology demonstrator). It should be noted that different technologies and processes have slightly different phases, conventions and names.
Source of data	Programme or project databases Register of knowledge and innovation products Quotations or invoices (scope of work) Reports
Method of calculation	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Researchers lodge their IP outputs through formal channels in the Office of Technology Transfer of the university or science council as per the IPR Act. Public-funded research organisations have existing frameworks to categorise the different types of knowledge-based products.
Disaggregation of beneficiaries	Historically disadvantaged individuals: ≥80% Women: ≥45% Youth: ≥40% Persons with disabilities: ≥3%
Spatial transformation (DDM)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, in support of the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	To meet or exceed the target set Acceptable performance: Achievement of 90% of the agreed target
Indicator responsibility	Executive: Innovation Enabling

Annexure: Changes to Output Indicators

In compiling this APP certain revisions to TIA's outputs and output indicators were made. This was necessitated by a changing operational environment and the removal of several management-level (internal) indicators, which are more appropriate for inclusion in TIA's 2022/23 Annual Operational Plan. This annexure summarises the changes made, and provides the reasoning for removing (Table 25), refining (Table 26) and adding (Table 27) certain output indicators.

Table 25: Outputs and output indicators removed

Outcome	Outputs	Output Indicators	Comments
N/A	A1.1 Reduced vacancy rate	Percentage of approved funded positions filled annually	This indicator will henceforth be tracked at an operational level.
	A1.3 Media and marketing initiatives to profile TIA and achievements from its investments	Number of media platforms used to promote TIA initiatives	At the time of compiling the 2021/22 APP it was felt that TIA's media and marketing efforts needed a boost. This has now been attended to, with efforts at the required levels. This indicator will henceforth be tracked at an operational level.
	A1.5 Support transformation initiatives through TIA operations	Recruitment: Recruitment initiatives which will move TIA demographics closer to the Economic Active Population (EAP) Procurement: Support women and youth owned businesses through procurement initiatives	This indicator will henceforth be tracked at an operational level.
	A1.6 Capacitate the organisation with the required commercialisation and IP management skills	Appropriately qualified staff: Implement initiatives to upskill resources in terms of commercialisation and IP management skills Availability of required resources: Create a panel of service providers for insourcing/ outsourcing approaches	This indicator has been achieved and will henceforth be managed at an operational level.
	A1.7 Provide learning opportunities to interns and graduates	Number of interns/graduates upskilled through exposure to TIA operations	This indicator will henceforth be tracked at an operational level.
2 Delivering on the Bio-economy Strategy	2.3 New Technology Platforms established and supported	Number of new Technology Platforms in targeted regions	The balance of the five-year cycle will see TIA maintaining the number of Technology Platforms, with the intention to consolidate and 'invest deeper' into the existing platforms, without establishing any new clusters or platforms over this period, to achieve greater impact.
3 SMMEs supported through strategically informed and regionally distributed Technology Stations	3.1 Existing Technology Stations managed and supported	Number of existing Technology Stations providing science, engineering and technology support that are operational and functional	TIA's management and oversight of existing Technology Stations remains an important activity, and will henceforth be reported on within the TIA-DSI TSP Steering Committee and associated formal reports.

Table 26: Outputs and output indicators refined

Outcome	**Outputs** Amendment *Original*	**Output Indicators** Amendment *Original*	**Comments**
N/A	(Not amended) *A1.1 Good financial governance*	Achieve an unqualified external audit opinion with no financial matters in the audit report *Achieve an unqualified external audit*	The standard was amended in consideration of the control environment and to align TIA with the DSI's financial governance standard through the inclusion of the phrase 'with no financial matters in the audit report'. The text was also improved by adding the term 'opinion'.
	A1.2 Improved turnaround time on investment decisions *A1.4 Improved turnaround times on investment decisions*	Improved investment decision turnaround time for funding applications *Improve on investment decision turnaround times*	The wording of the output and output indicator was improved.
1 Commercialised innovations	1.2 Joint collaborations between academia and industry *1.2 Joint collaborations between academia and industry, TIA and industry, or between academia and industry*[21]	Number of projects involving industry being executed *Number of projects involving industry in execution*	The output that TIA desires is to stimulate is industry-academia collaboration in pursuit of commercialising the outputs of public-funded R&D. It is for this reason that TIA has shifted the focus to such collaborations. The wording of the output indicator has also been improved.
	1.5 Leveraged funds *1.5 Leveraged funds (co-investment with other parties, financial and/or follow-on funding)*	Total Rand value leveraged *Total Rand value leveraged through signed agreements entered into with other parties*	The output and output indicator details are now reflected in the technical indicator description.
2 Delivering on the Bio-economy Strategy	2.2 Technology Platforms managed and supported *2.2 Existing Technology Platforms managed and supported*	Number of Technology Platforms that are operational and functional *Number of existing Technology Platforms that are operational and functional*	No substantive changes were made to the output and output indicator, except for removing the word 'existing'.
	(Not amended) *2.3 Technology Innovation Clusters managed and supported*	Number of Technology Innovation Clusters that are operational and functional *Number of existing Technology Innovation Clusters that are operational and functional*	No substantive change was made to the output indicator, except for removing the word 'existing'.

[21] This is how the output indicator is erroneously captured in the TIA 2021/22 APP. It should read "between TIA and academia, TIA and industry, or between academia and industry".

Outcome	Outputs Amendment *Original*	Output Indicators Amendment *Original*	Comments
3 SMMEs supported through strategically informed and regionally distributed Technology Stations	3.1 New centres established and supported *3.2 New centres established and supported*	Number of new technology and innovation support centres providing SET support in targeted regions *Number of new technology transfer centres providing science, engineering and technology support in targeted regions*	The term 'technology transfer centres' was replaced with 'technology and innovation support centres' to avoid confusion.
	3.2 SET and enterprise support provided to SMMEs and co-operatives *3.3 SET support provided to SMMEs*	Number of SMMEs and co-operatives receiving SET and enterprise development support *Number of SMMEs and cooperatives receiving SET support*	The output and output indicator have been expanded to reflect the additional enterprise support provided, and the specific inclusion of co-operatives in the output.
	(Not amended) *3.3 High-level human capital development for competitiveness and new industry development*	Number of high-level students and post-doctoral fellows admitted *Number of honours, masters, post-doctoral students admitted within the TSs activities*	The output indicator details are now reflected in the technical indicator description.
	3.4 Innovation products produced *3.5 Knowledge and innovation products produced*	Number of IP and knowledge-based innovation products produced *Number of patents, publication outputs and knowledge based products (i.e. prototypes, technology demonstrators and technology assistance packages) produced through TTO disclosures as per Intellectual Property Rights from Publicly Financed Research and Development (IPR-PFRD) Regulations*	The output indicator details are now reflected in the technical indicator description.

Table 27: Outputs and output indicators added

Outcome	Outputs	Output Indicators	Comments
N/A	A1.3 Support transformation initiatives in underserved provinces	Allocation of funds to underserved provinces	This new output indicator reflects TIA's developmental intent to stimulate innovation and transformation in underserved provinces.
	A1.4 Support the transformation of TIA's investment portfolio	Allocation of funds to transformed recipients	This new output indicator reflects TIA's developmental intent to improve transformation in relation to technology-based firm ownership and achieve a greater distribution of the benefits of innovation.

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