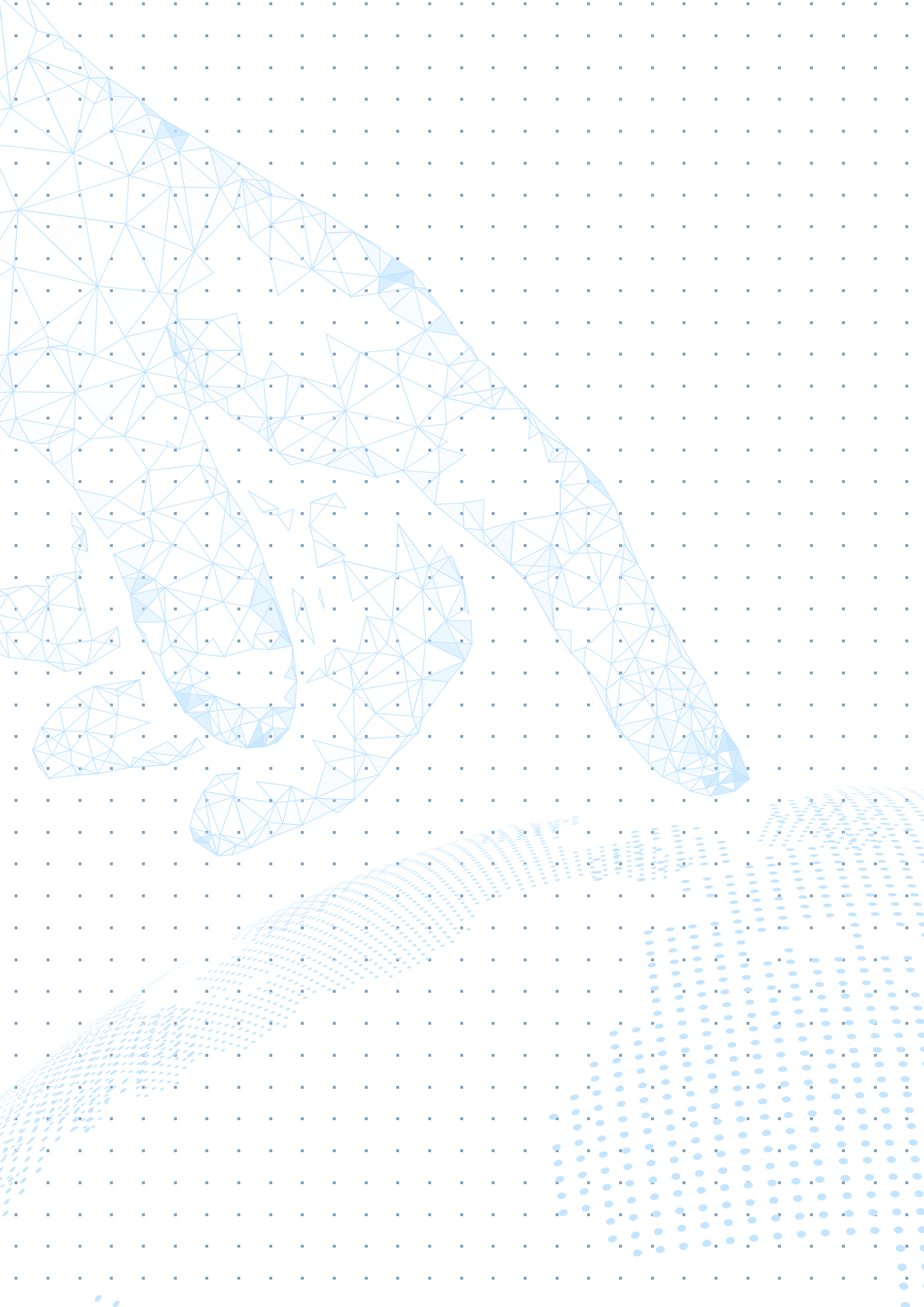
ANNUAL PERFORMANCE PLAN - 2023/24

science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

technology innovation
A G E N C Y
Innovating Tomorrow Together



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1. List of Abbreviations

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
API	Active Pharmaceutical Ingredients
APP	Annual Performance Plan
B-BBEE	Broad-based Black Economic Empowerment
BERD	Business expenditure on research and development
COP27	27th Conference of the Parties to the United Nations Framework Convention on Climate Change
COVID-19	Coronavirus disease 2019
DDM	District Development Model
DHET	Department of Higher Education and Training
DSI	Department of Science and Innovation
GDP	Gross Domestic Product
GERD	Gross expenditure on research and development
HEI	Higher education institution
HIV/AIDS	Human immunodeficiency virus and acquired immune deficiency syndrome
ICT	Information and communication technologies
IKS	Indigenous knowledge systems
IoT	Internet of things
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
NSI	National System of Innovation
PWD	Persons with Disabilities
R&D	Research and development
RDI	Research, development and innovation
SET	Science, engineering and technology
STAs	Scientific and technological activities
STET	Scientific and technical education and training
STI	Science, technology and innovation
STS	Scientific and technological services
SMME	Small, medium and micro enterprises
TIA	Technology Innovation Agency
TRL	Technology readiness level
TSP	Technology Stations Programme
TVET	Technical and vocational education and training
UNCTAD	United Nations Conference on Trade and Development

2. Executive Authority Statement

The Annual Performance Plan (APP) 2023/24 of the Technology Innovation Agency (TIA) identifies the outputs, output indicators and targets that the Agency aims to achieve in the 2023/24 financial year. TIA's APP 2023/24 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 2023/24 considers the Sustainable Development Goals of the United Nations' Agenda 2030 and the African Union's Agenda 2063.

The APP 2023/24 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 2023/24 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

I am pleased to present TIA's APP for the financial year 2023/24.

Over the past mid-term period, TIA has performed well against its set objectives, with a sharp focus on commercialising a wide range of technologies that address challenges across various sectors of the economy. In line with its core mandate, the organisation has seen more than 70 technologies introduced into the market and a number of enterprises established with no less 700 jobs created.

The Agency played an important role in supporting Government's response to the COVID-19 pandemic. The deployment of TIA's genomics platform and technology stations capabilities played a key role in identifying the various COVID-19 strains and developing appropriate diagnostics and other safety measures. Past efforts have seen TIA effectively supporting Government's response to health challenges arising from the pandemic, promote economic recovery and address the risks of further marginalisation of communities in distress.

> *The Agency played an important role in supporting Government's response to the COVID-19 pandemic.*

Many reports show that the country is not yet out of the woods in the aftermath of the pandemic. South Africa is faced with a myriad of challenges of low economic growth, a constrained fiscus and deteriorating infrastructure that constrain economic activity and investments. The current electricity and energy crisis now represents the greatest threat to any prospects of a fast recovery. Consequently, all indicators around the triple challenges of poverty, unemployment and inequality are deteriorating. As with many other economies around the world, South Africa is faced with global risks such as high inflationary pressures, supply chain disruptions, rising geoeconomic and geopolitical tensions and climate change.

There is no doubt that our innovation ecosystem is dynamic and remains resilient in the face of these challenges with many start-ups making their mark on both a local and global scale. The South African research and innovation ecosystem is expected to play an important role in enabling the country to overcome these challenges. Significant investments will be required to make the system more responsive to these.

The Just Energy Transition Investment Plan unveiled by the President at COP27 represents one such high-impact initiative aimed at achieving decarbonisation of the economy, thereby addressing the challenge of climate change through the reduction of greenhouse gas emissions.

As TIA enters the fourth year of its 2020-2025 Strategic Plan, there has been much reflection on how to increase society's dividend from Government's many years of investments in Science, Technology and Innovation (STI). As the main instrument of Government tasked with the mandate of supporting the commercialising research output from public research organisations and other segments of society, there is no question that this will represent TIA's primary focus for the year ahead. In pursuing this mission, four priority areas will receive attention:

- Intensifying efforts to continue building a strong pipeline of de-risked early-stage technologies from across the NSI, by working with key partners such as universities, science councils and others to identify and support high-potential innovations and large-scale RDI programmes with higher socio-economic impact.
- Packaging solutions and interventions to accelerate commercialisation of the rich portfolio of matured technologies within the TIA portfolio and in the NSI broadly. In this, the DSI's Innovation Fund will be deployed more purposefully, targeting those technologies that require last mile interventions toward market launch and scale-up for successful commercialisation.
- TIA will continue to build on its strong linkages with other key players in the NSI to bolster the execution of its mandate by increasing funding, leveraging expertise and creating forward linkages for successful commercialisation of innovations. These include many actors in the research space such as higher education, the private sector, institutional investors, venture capital community and the many small, medium and micro enterprises (SMMEs) that support intermediaries in the country.
- Finally, the conclusion of the Ministerial Review of TIA marks a significant development for the organisation and its future positioning in the NSI. The purpose of the Review was to evaluate the effectiveness of TIA's programmes and its positioning in the NSI, as well as to recommend measures to enhance the Agency's execution of its mandate. Following this, a key focus for the year ahead will be to redesign an organisation that is fit for purpose, appropriately geared and capacitated to deliver on its core commercialisation mandate, and able to play an effective curatorship role in the ecosystem.

In all this, the Agency will continue to be guided by the key strategic intents of the White Paper on Science, Technology and Innovation and the Decadal Plan recently approved by Cabinet, along with other key policies such as the Economic Reconstruction and Development Plan, which are all intended to realise the outcomes of the 2030 National Development Plan.

On behalf of the TIA board, I wish to thank our colleagues at the DSI, the Director-General and his senior leadership, the TIA management and staff for all their contributions in putting this plan together.

Ms Matsi Modise
Chairperson of the Board

4. Chief Executive Officer's Overview

The TIA APP 2023/24 represents the fourth year of implementation of the Strategic Plan 2020-2025 and thus the last of the two years in the strategic planning cycle.

An analysis of TIA's mid-term performance shows that TIA is on track to achieve its outcome targets with regard to technologies commercialised, bio-based technologies demonstrated and bio-based entrepreneurs and organisations accessing high-end science, engineering and technology (SET) services. Two key areas requiring closer attention relate to the number of SMMEs receiving support and transformation issues relating to women, youth and Persons with Disabilities (PWD). This analysis, therefore, serves as an important basis in planning for the year ahead. In addition, the planning process took account of a number of important developments in the NSI, together with the resources and capabilities required to respond meaningfully.

> *TIA fulfils an important role in South Africa's innovation ecosystem. It provides risk funding to early-stage technologies derived from research output from publicly funded intellectual property (IP), technology entrepreneurs and SMMEs.*

TIA fulfils an important role in South Africa's innovation ecosystem. It provides risk funding to early-stage technologies derived from research output from publicly funded intellectual property (IP), technology entrepreneurs and SMMEs. The ultimate goal is to translate them into commercialised technologies in the form of products and services. A recent South African technology transfer survey report revealed that TIA's Seed Fund has contributed significantly over the years, enabling university research output to be converted into prototypes, products and ultimately spinout companies. The report, however, points to additional funding requirements of no less than R500 million for technology development and commercialisation. The report has also raised a concern around the constant decline in funding in experimental development in the higher education sector. From a future funding perspective, these are two important considerations that remain of particular interest to TIA in driving the agenda regarding the commercialisation of publicly funded IP.

A viable technology entrepreneurship and start-up ecosystem is a key enabler for ensuring that early-stage technologies are successfully taken to market. The current situation has positive aspects, as the ecosystem is dynamic and vibrant with many actors such as the angel and venture capital communities, SMME support intermediaries, ecosystem builders and other international partners, each making efforts to contribute to the development of successful start-ups addressing different socio-economic challenges in South Africa. In this regard, further efforts are required to boost the performance of this system. A 2022 start-up ecosystem report by Disrupt Africa identifies some areas of intervention, i.e. quality acceleration of high potential start-ups, more capital for early-stage seed funding and regulatory frameworks.

TIA will thus collaborate with key partners to design appropriate interventions, some of which are already built into the organisation's existing instruments, including the Agency's Industry Matching Fund and the DSI's Innovation Fund. The latter has seen TIA commencing with implementing this through a Fund-of-Funds approach, enabling existing fund managers to deploy funds into the system more effectively. In this, the important role of TIA's Technology Stations and Technology Platforms cannot be understated. These are key infrastructure capabilities under the Agency's management that are designed to provide SET services to entrepreneurs and SMMEs in their quest to develop products for commercialisation. They are also pivotal in providing support to entrepreneurs and innovators in marginalised communities, enabling them to be included in the formal systems of innovation. In future, TIA will explore opportunities to expand these facilities with ae view to increasing the national footprint to increase access by entrepreneurs.

Cabinet's approval of the Decadal Plan in November 2022 represents an important milestone for the NSI, as this provides a final confirmation of the policy direction that the NSI will follow in the next 10 years. TIA will continue to work within the framework of the White Paper and the Decadal Plan in accordance with the priorities identified therein. These include modernising sectors of the economy in agriculture, manufacturing and mining; exploiting new sources of growth, i.e. digital and circular economies; and increasing investing in health and energy innovations. Investments in these priority areas will see TIA launching multi-stakeholder innovation programmes that are designed to promote the pooling of expertise, resources and other capabilities by various actors in the NSI, bringing together the research community and industry, and leveraging international partnerships to deliver high-impact projects with increased socio-economic outcomes.

TIA will implement a number of key initiatives. These include developing a comprehensive commercialisation strategy and augmenting the organisation's capacity with appropriately skilled experts in this area; establishing tailored innovation programmes for women, youth and PWD; expanding the Agency's infrastructure capabilities through investments at Technology Stations and Technology Platforms and launching three new high-impact multi-stakeholder innovation programmes.

Achievement of all of the priorities and targets set in this APP requires an organisation characterised by a culture of high performance with people who have high levels of motivation, a sense of purpose and relevant skill sets. In this respect TIA has much to offer, save for the need to reorganise and direct the energies of our employees towards a common purpose, which is the successful and speedy launch of products into the market by start-ups with significant socio-economic impact as the ultimate outcome. This, therefore, also speaks to the priority TIA attaches to continuous improvement in its assessment capabilities, decision-making and ultimate investment approval turnaround time as key operational efficiency challenges that continue to undermine the organisation's achievements.

I am pleased that the TIA Ministerial Review process has been concluded. The report of the expert panel contains many insights that are important for positioning TIA strategically within the NSI into the future. This APP therefore has been developed with due consideration of some of the important issues identified in the Review report. It is acknowledged, however, that many of the recommendations will form an important task for the organisation and the Board in the year ahead.

Patrick Krappie
Acting Chief Executive Officer

5. Chief Financial Officer's Overview

TIA's Strategic Plan and APP takes, as a point of departure, an acknowledgement that the pandemic and its aftermaths will remain and represent the biggest area of focus for all segments of society. With 2023/24 being the fourth year in implementing the Strategic Plan 2020-2025, TIA's APP 2023/24 has been designed to respond to the government's imperatives around the ripple effects of challenges that resulted from COVID-19. The annual plan emphasises efforts to enhance the commercialisation of technologies that address the health of our people, food security, enhancing the exploitation of our biological resources and increasing investments in technologies that contribute to economic revival and reindustrialisation of the South African economy.

The Agency's planning cycle has prioritised effective cost management solutions and continues to ensure that funds are appropriated in areas in which they are most needed.

The plans also focus on measures to support the SMME sector and to increase the participation of marginalised segments of society such as people in townships, rural communities, women, youth and PWD. Having adopted the Broad-based Black Economic Empowerment (B-BBEE) policy, more efforts will be directed towards the empowerment of previously disadvantaged individuals through deliberate investment decisions, stakeholder engagements and general mobilisation initiatives.

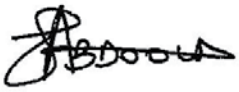
TIA operates with an annual budget of approximately R460 million. This is made up of a baseline of R198 million, with R262 million assigned as ring-fenced funding for 2023/24. The Budget estimates for 2023/24 are well placed, based on the performance for the first three years. The Agency's planning cycle has prioritised effective cost management solutions and continues to ensure that funds are appropriated in areas in which they are most needed.

Medium-Term Expenditure Framework (MTEF) baseline allocations for the MTEF period 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.

By implementing robust financial management, planning and control the Agency continues to ensure, that 85% 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 2023/24.

Brian Mphahlele
Executive: Commercialisation

Dr Vuyisile Phehane
Executive: Bio-economy

Vusi Skosana
Acting Executive: Innovation Enabling

Garth Williams
Head: Strategic Planning and Reporting

Matshidiso Matlolane
Acting 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 Mandate

TIA is established as a Schedule 3A public entity under the provisions of the Public Finance Management Act (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 established 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 through the development and exploitation of technological innovations.

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), with a key change enabling the Agency to perform any function in any territory outside South Africa (SA). This change empowers TIA more intentionally to pursue international partnership opportunities to achieve its objectives in fulfilment of its mandate.

[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).*

PART B

Strategic Focus

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
Together we can do more. Fostering teamwork creates a TIA work culture that values collaboration and cooperation.

PROFESSIONALISM
We apply the most appropriate skills, competencies, experience and knowledge of best practices.

EXCELLENCE
TIA will be accountable to all stakeholders to deliver exceptionally high standards of work and performance.

INTEGRITY
Everyone strives to do what they said they would. "We keep our word."

TRANSPARENCY
We engage in inclusive open communication and hold each other accountable for our performance and conduct.

INNOVATION
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.

TIA's Role in the Innovation Ecosystem

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.

TIA plays a critical role in supporting the realisation of government's vision through funding and de-risking technological innovation and through supporting the commercialisation of public-funded IP, especially (but not limited to) bio-based technologies. TIA also supports the process of knowledge utilisation, the diffusion of existing technologies and grassroots innovators in vulnerable and marginalised communities, thereby contributing to achieving the Sustainable Development Goals.

TIA also provides SET and enterprise development support to SMMEs and co-operatives, particularly to those that are black-owned, black women-owned, youth-owned or located in underserved provinces. From a regional and international perspective, TIA plays a key facilitation role through its collaboration with research and innovation institutions across the continent and beyond through joint technology development programmes and more.

TIA remains committed to contributing to the realisation of the following four NDP outcomes:

- **Outcome 2:** A long and healthy life for all South Africans.
- **Outcome 4:** Decent employment through inclusive economic growth.
- **Outcome 5:** A skilled and capable workforce to support an inclusive growth path.
- **Outcome 10:** Protect and enhance our environmental assets and natural resources.

It is incumbent on TIA to contribute to the realisation of the DSI's Decadal Plan in terms of:

- Revitalising and modernising key sectors of the economy through improving economic competitiveness and productivity in agriculture, manufacturing, and mining.
- Leveraging off the circular economy and the digital economy as new sources of growth.
- Innovation in support of health, specifically through the optimisation of health systems, improving the quality of healthcare, and the digitisation of healthcare systems.
- Energy-sector innovation in support of decarbonising the economy.

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

- Accelerating the rate of commercialisation of investments in the high-technology sectors that will help to rebuild SA's economic competitiveness, thereby supporting economic recovery.
- Alleviation of poverty, inequality and unemployment through the provision of SET and enterprise development support to SMMEs in particular.
- Transformation and inclusion, focusing on the historically disadvantaged and marginalised (women, youth and PWD), thereby responding to communities in distress.
- Improved service delivery to citizens through investments in technologies such as information and communication technology- (ICT-) based solutions for education, health and other social services.
- Fostering a broader enabling innovation environment, including expanding TIA's spatial footprint through technology and innovation support centres and Technology Stations.
- Stimulating bio-entrepreneurship through interventions which include the provision of access to expertise and high-end infrastructure.
- Supporting transformed recipients and investees in underserved provinces, thereby spreading the benefits of innovation more widely and directing developmental efforts to underserved parts of the country.
- Responding to the pandemic through increasing investments in and commercialisation of health-related technologies.

8. Updated Situational Analysis

In developing this APP 2023/24, 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 2023/24.

While SA and indeed the world are adjusting to a post-COVID-19 pandemic era, the effects and impacts of the disease will be felt for years to come. For example, the World Bank has observed that ending extreme poverty across the globe by 2030 will not be achieved, with the COVID-19 pandemic contributing to this. The pandemic not only contributed to economic decline in SA but also negatively affected the NSI. Significant budget cuts were made to the baseline of public-funded organisations, and STI activities were significantly curtailed due to the restrictions imposed on people's movement.

On the positive side, COVID-19 increased public recognition of the role of STI in healthcare, for making policy decisions and for inclusive and sustainable socio-economic development. It also led to galvanised, focused and collaborative efforts across government, with TIA playing a strong role alongside SA's public research organisations in the development of personal protective equipment, sanitisers, ventilators and diagnostic tools. Indeed the pandemic served to demonstrate the importance of having strong STI institutions not only from the perspective of public health and safety and pandemic preparedness, but also for facilitating and enabling innovation for entrepreneurs to survive and grow and for researchers to de-risk their IP through technology development and commercialisation.

TIA's overall performance in the immediate preceding period was commendable under the circumstances, particularly given its resource constraints. The Agency stands ready to meet the challenges and uncertainties of a post-COVID-19 world.

An analysis of TIA's strengths, opportunities, aspirations and results is presented in Table 1.

Table 1: TIA strengths, opportunities, aspirations and results analysis

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 (Technology Readiness Level 6 [TRL] and above).
- Good baseline of strategic partnerships and strengthened relationships with key stakeholders.
- A good collaborative relationship with the shareholder (DSI).
- A sound governance and control environment track record.
- 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.
- Good track record of piloting programmes such as the Innovation for Inclusive Development programme and the Innovation Fund.

OPPORTUNITIES

- 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 (HEIs) and individuals, women, youth and PWD due to the introduction of TIA's B-BBEE Policy, Transformation Framework and thematically focused funding calls.
- Several of TIA's core sectors are aligned with 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 SA'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. Indigenous knowledge systems [IKS] Platform) and partnerships.
- Contributing to the implementation of the DDM.
- DSI and Department of Higher Education and Training (DHET) now report to the same Ministry, offering opportunities to leverage partnerships with Sector Education Training Authorities and other DHET 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.
- Convening and participation in new and existing initiatives in response to climate change and just energy transitions.
- Opportunity to expand TIA's Technology Stations network, Technology Platforms and Technology Cluster initiatives.

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 research and development (R&D) outputs into commercialised innovations.
- To be entrusted with greater portions of public and private funding so as to make more of an impact on society and in the economy.

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.

An analysis of the external environment within which TIA operates is presented in Table 2.

Table 2: 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 DHET. • 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. • Uncertainty concerning the effects of possible coalition politics at a national level in the future.
Economic	• Recessionary environment post COVID 19 resulting in a low gross domestic product (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. • Deteriorating infrastructure constraining economic activity and greenfields investment. • Escalating energy costs together with uncertain electricity availability.
Social	• High and worsening unemployment among black people, the youth and women particularly. • Likelihood of civil unrest, particularly at universities during the annual #FeesMustFall campaign. • Poor and deteriorating service delivery, particularly at the local municipal level. • Widening inequality and increasing poverty. • Imperative to harness innovation to address transformation and inclusion. • High likelihood of pandemics into the future. • Adjusting to a post-COVID-19 world in terms of re-integration in the workplace and hybrid working arrangements.
Technological	• Increasing digitalisation of the economy. • Declining expenditure on experimental development. • Declining gross expenditure on R&D 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. • SA'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.

Dimension	Opportunity/risk
Environmental	• Accelerating climate change and associated extreme weather events. • Increasing environmental degradation and species extinction. • Potential to leverage SA's rich biodiversity.
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.

9. External Environment Analysis

9.1 Global Issues

An analysis of global issues[2] reveals the following.

1. Global Recession

The International Monetary Fund expects that a third of the world's economy will contract, with some countries going into recession. Prospects for constrained economic growth are on par with the 2008 global financial crisis and the start of the COVID-19 pandemic. Contributing factors are rising inflation, weakening currencies and a cost-of-living crisis. The war in Ukraine continues to exacerbate matters. Other factors are Europe's energy crisis and trade wars between the United States and China.

2. COVID-19 Pandemic

Despite the initial rapid development and distribution of COVID-19 vaccines, several geopolitical factors hindered the prevention of the spread of Delta and Omicron variants, resulting in an upsurge in infections and deaths globally. This underscores the importance of addressing vaccine inequality and achieving greater vaccination rates. There is also the need to improve the resilience of healthcare systems and improve capacities concerning the prevention, preparedness and response to future health threats and epidemics, particularly those posed by AIDS, tuberculosis, malaria and polio. The pandemic also highlighted the need for science to inform policy responses.

The COVID-19 pandemic also highlighted the inequalities that exist in healthcare access and the need for greater investments in public health infrastructure. The pandemic also worsened mental health, with increases in anxiety and depression observed worldwide, particularly amongst health workers and the youth.

3. Poverty Reduction and the SDGs

The global COVID-19 pandemic caused significant setbacks in global efforts to eradicate poverty, reduce inequalities and create a more prosperous and healthy planet. Across the world millions have lost their jobs and have slid back into poverty, childhood education has been interrupted, inequality has worsened and essential health services have been severely disrupted. The Sustainable Development Goals (SDGs) provide a framework for more focused collective action on a global and local scale to improve people's lives and preserve the planet's ecosystems.

[2] *Sources: United Nations, World Economic Forum, International Monetary Fund.*

4. Wildlife and the Environment

According to the World Wide Fund for Nature and the Zoological Society of London there has been a 69% decline in vertebrate animal populations worldwide since 1970. Causes for the decline include habitat loss and overexploitation through hunting, fishing and poaching. The highest losses have been found among freshwater fish and populations of sharks and rays in the oceans, with average declines of 83% and 71%, respectively.

Since 1900 approximately 600 trees, flowers and fruit-bearing plants have become extinct across the world. This took place at a rate of about three species a year, which is around 500 times higher than the background (natural) extinction rate. The United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services predicts that more than one million of all species are currently threatened with extinction. The bulk of threatened species are insects, e.g. dragonflies, bees, butterflies and beetles that are crucial for healthy ecosystems, and in particular ecosystem services such as pollination and nutrient recycling.

The natural world provides invaluable ecosystem services that keep us alive and sustain us: from the water we drink, the air we breathe, to the ground that nourishes our food and the forests and oceans that not only regulate the Earth's temperature but also absorb greenhouse gases and other pollutants. However, the biodiversity and ecosystem functions and services provided by nature as well as its essential contributions to people are under pressure from the irresponsible disposal of waste and our unsustainable use of natural resources.

5. Climate Change

The 2015 Paris Agreement seeks to limit global temperature rise to 1,5°C above pre-industrial levels. While some progress has been made it is generally acknowledged that global commitments to arrest climate change are not enough and that there is insufficient urgency to address the crisis. This as the world witnesses more frequent extreme weather events and accelerating biodiversity loss. In the future climate change will create other dangers to human health such as major health issues, premature deaths and risks to cities and settlements.

Indeed, breaching the 1,5°C level would cause "unavoidable increases in multiple climate hazards" as well as "multiple risks to ecosystems and humans" according to the 2022 report of the Intergovernmental Panel on Climate Change. Greater attention is needed on measures to mitigate and adapt to climate change. Countries most threatened by climate change need to be supported. The catastrophic destruction of the planet's forests, plants, animals and ecosystems must be prevented.

The 27th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27) took place in November 2022 in Sharm el-Sheikh, Egypt at which participants reaffirmed their commitment to limit global temperature rise to 1,5°C above pre-industrial levels. The main agreement reached at COP27 was a new global climate pact - the Sharm el-Sheikh Implementation Plan - including the establishment of a Loss and Damage Fund for vulnerable countries. This entails a commitment by wealthier nations to provide money to developing and poorer nations to help them recover from the damage and economic losses caused by climate change. This is significant as previously such countries only received funds for climate change adaptation measures and mitigation efforts to move away from fossil fuels. Unfortunately, no agreement was reached to reduce fossil fuel usage, although the Plan entailed renewed commitments by countries to cutting greenhouse gas emissions, implementing efforts to adapt to the impacts of climate change, and enhancing financial, technological and capacity building support to developing countries.

SA plans to move away from fossil fuel dependence and established a Just Energy Transition Partnership during climate talks at COP26 in Glasgow, Scotland together with the EU, France, Germany, the UK and the US. Collectively referred to as the International Partner Group, members of the grouping committed to support SA's energy transition plans, with funding of $8,5 billion pledged. SA is one of the top 20 emitters of greenhouse gases globally, accounting for almost a third of all of Africa's emissions, mostly due to the country's reliance on coal for electricity generation, underscoring the importance of an energy transition for SA.

SA subsequently presented its Just Energy Transition Investment Plan during COP27. This plan outlined the scale of the country's need and investments required to achieve decarbonisation commitments while promoting sustainable development and ensuring a just transition. The International Partner Group pledged an additional $10 billion during COP27 to support SA's plan.

Under the Just Energy Transition Investment Plan the goal to decarbonise SA's economy is supported by interventions in the following three sectors:

- Electricity sector: The priorities are decommissioning and repurposing coal-fired power plants, expanding and strengthening the national transmission and distribution infrastructure, and accelerating new renewable energy investments.
- New-energy vehicles: Priorities are decarbonising the industry and supporting a supply chain transition to sustainable manufacturing, including transitioning to manufacturing electric-vehicle parts and vehicles.
- Green hydrogen aimed at addressing emission challenges in the hard-to-abate energy-intensive sectors such as mining, steel and cement manufacturing and heavy transport equipment.

6. Food Security

Acute food insecurity is rising dramatically. The causes include economic shocks that underpin increases in global food prices, weather-related disasters and increased demand due to continued global population growth. Global shocks like the war in Ukraine have led to price increases and supply constraints in relation to agricultural commodities.

The issue in many sub-Saharan African countries is that food is often available but not easily accessible, with distribution and food costs being the issues underpinning food insecurity. SA is technically food secure at a national level, but many households do not have access to adequate food to meet their dietary needs, with 6,5-million South Africans (approximately 11% of the population) being hungry and food insecure. Food insecurity also drives avoidable health conditions such as stunting among children, affecting physical development in their crucial formative years.

7. Gender Equality and the Rights of Girls and Women

There are pervasive and systemic challenges preventing the world from closing the gender rights and opportunity gaps for girls and women. The COVID-19 pandemic has also had a disproportionate impact on girls and women, setting back hard-won progress made in the past. Initiatives are needed to advance economic justice and gender equality, and address gender-based violence.

SA's triple challenges of poverty, inequality and unemployment are experienced disproportionately by girls and women. Gender-based violence also persists within the country. It is for these reasons that August is celebrated as Women's Month, with SA also actively participating in the United Nations' annual 16 Days of Activism for No Violence against Women and Children Campaign from the International Day of No Violence against Women in November. The 16 Days of Activism Campaign focuses on raising awareness of the devastating impact that gender-based violence and femicide has on women and children. In this regard, TIA will make deliberate efforts to stimulate and support innovations to address the challenges of gender-based violence.

8. Growing Humanitarian Crises and Conflicts

The world has in recent times faced unprecedented levels of humanitarian need due to rises in forced displacement, famine, drought, vaccine inequity as well as overlaps between issues like climate, hunger and conflict. The crises and conflicts are most often cross-border in nature, requiring global cooperation. The war in Ukraine has precipitated what is considered to be the fastest-growing refugee crisis since the Second World War. Such crises endanger already marginalised groups, putting women and children at a higher risk of trafficking, violence and death.

9. Cybersecurity

Cybersecurity vulnerabilities are on the rise due to the rapid digitalisation of societies and industries. This was accelerated in part by the COVID-19 pandemic and the need to work from home together with entrepreneurs needing to pivot to take advantage of or create opportunities in the digital economy. The risk of cyber attacks is accordingly higher than before, with malware and ransomware attacks rising dramatically.

9.2 Emerging Technology and Innovation Issues for Developing Countries

It is broadly acknowledged that human development and economic growth are associated with rapid changes in technology. According to the United Nations Conference on Trade and Development (UNCTAD), the rate of change is likely to increase due to so-called frontier technologies. Rapid advances in these technologies have greatly benefited society but can also have significant negative consequences such as job losses through automation, the divisiveness of social media platforms, and widening already existing inequalities.

Frontier technologies are defined as those that combine digitalisation and connectivity, thereby potentially combining and multiplying their impacts to boost productivity and improve livelihoods. They are AI, the Internet of things (IoT), big data, blockchain, 5G, 3D printing (also known as additive manufacturing), robotics, drones, gene editing, nanotechnology and solar photovoltaic.

UNCTAD contends that whereas frontier technologies are created and developed by specific countries, all countries need to prepare for them. The organisation has created a readiness index for countries to assess their national capabilities to equitably use, adopt and adapt these technologies. SA's readiness index (and sub-index rankings), compared with selected countries is presented in Table 3.

Table 3: Selected countries' readiness to use, adopt and adapt frontier technologies equitably

Country name	Total ranking	ICT ranking	Skills ranking	R&D ranking	Industry ranking	Finance ranking
United States of America	1	14	17	2	20	2
Sweden	4	1	7	16	15	16
Germany	9	23	16	5	10	39
China	25	99	96	1	7	6
Russian Federation	27	39	28	11	66	45
Brazil	41	73	53	17	42	60
India	43	93	108	4	28	76
SA	54	69	84	39	71	13
Mexico	57	68	83	29	33	96
Mauritius	77	83	58	94	74	40
Egypt	87	117	67	42	100	116
Kenya	105	108	123	78	89	108
Nigeria	124	124	106	74	155	149

Number of countries: 158; Source: UNCTAD Technology and Innovation Report 2021.

SA ranks the lowest in terms of its ability to use, adopt and adapt frontier technologies in the BRICS grouping of countries, but is ranked the highest among sub-Saharan African countries. The country scores highly in its finance ranking and high in its R&D ranking relative to its overall ranking, but low in terms of ICT, skills and industry rankings.

The digital nature of these frontier technologies is mirrored by Gartner in its annual emerging technologies hype cycle analysis. Garner identifies technologies that are anticipated to impact business and society over the next two to 10 years, and in particular those that will support digital business transformation. These emerging technologies are presented in Figure 1.

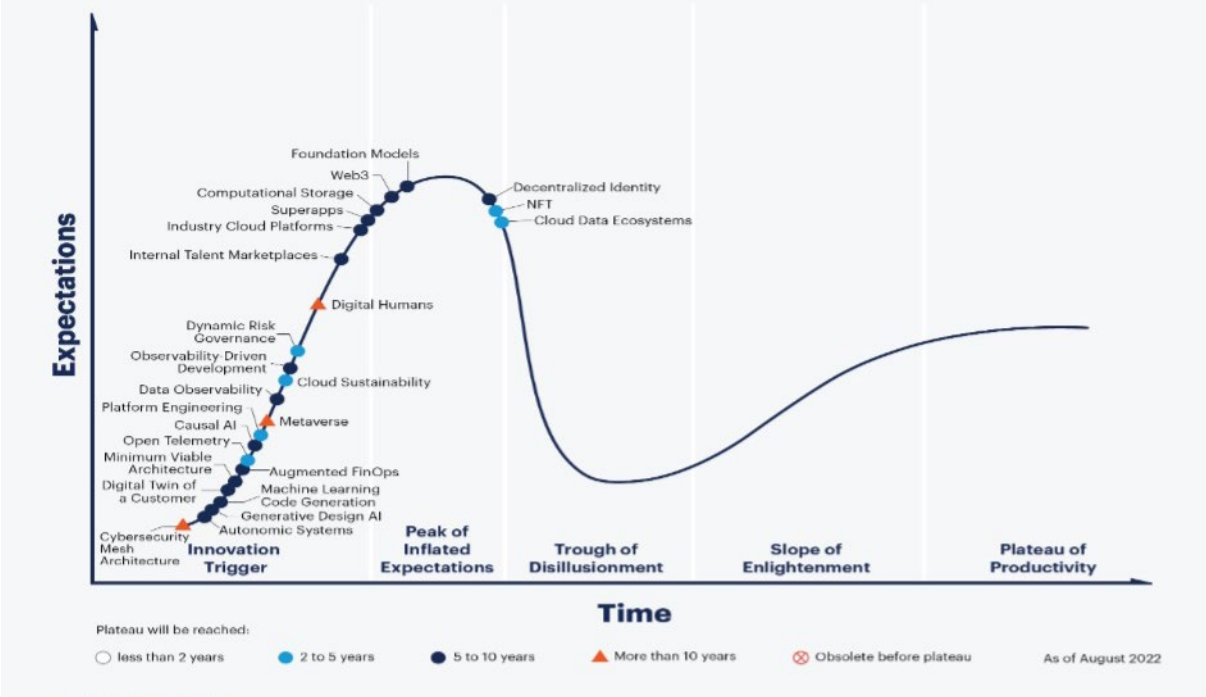


Figure 1: Gartner's hype cycle for emerging technologies in 2022

Source: Gartner (©2022)

Emerging technologies on the so-called 'peak of inflated expectations' include computational storage, Web3 (a new conception of the World Wide Web that incorporates decentralisation, blockchain technologies and token-based economics), foundational models (large AI models trained by using large quantities of unlabelled data), decentralised identity, non-fungible tokens and cloud data ecosystems. Interestingly and unlike the case in the past, Gartner does not identify any technologies in the 'trough of disillusionment', perhaps suggesting that there are not many emerging technologies that were once over-hyped but which have not yet come to fruition. Almost all of the emerging technologies that reside on the 'innovation trigger' side of the hype cycle are digital in nature.

9.3 South African Research, Innovation and Entrepreneurship Landscape

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

The rate of scientific articles being published in peer-reviewed journals continues to increase. The number of publications per million population has risen from 248 in 2011 to 505 in 2020[3]. However, it is broadly acknowledged that the rate of utilisation of scientific outputs for socio-economic benefit is not at the desired level in SA. 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.

The generation, advancement, dissemination and application of scientific and technical knowledge in all fields of S&T are termed scientific and technological activities (STAs). There are three categories of STAs according to international guidelines, namely R&D[4], scientific and technical education and training (STET[5]), and scientific and technological services (STS[6]).

Table 4 shows SA's historical STA budget and proportional share between the three STA categories. In 2020/21 the STA budget was R30,1 billion. While the STA budget has increased over the last few years in nominal terms, in inflation-adjusted terms there has been a decline. There was an increase of 6,95% from 2019/20 nominal terms, but a decline of 5,14% in 2010 constant prices. Additionally, the STS share is increasing, whereas R&D and STET are declining.

Table 4: Quantum and proportion of scientific and technological activities in SA (2016/17-2020/21)

Year	STA budget (R billion)	R&D (% share)	STET (% share)	STS (% share)
2016/17	23,4	57,5	17,8	24,7
2017/18	20,2	56,9	17,8	25.3
2018/19	26,0	53,5	16,9	29,6
2019/20	28,6	55,4	15,8	28,8
2020/21	30,1	55,3	15,6	29,1

Source: NACI STI Indicators Report 2022.

[3] *NACI STI Indicators Report 2022.*

[4] *R&D (also called research and experimental development) is defined as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications." (Source: South African National Survey of Research and Experimental Development Statistical Report 2019/20.)*

[5] *STET "includes all activities related to specialised non-university higher education and training; higher education and training leading to a university degree; post-graduate and further training and organised life-long training, for scientists and engineers." (Source: Eurostat.)*

[6] *STS are defined as "activities concerned with [R&D] and contributing to the generation, dissemination and application of … S&T." (Source: Eurostat.)*

Gross expenditure on R&D (GERD) was R34,485 billion in 2019/20[7]. This is down from R36,784 billion in 2018/19 and from its highest nominal value of R38,726 billion in 2017/18. In real (constant 2015 prices) GERD fell from R31,367 billion in 2018/19 to R28,140 billion in 2019/20. GERD as a percentage of GDP also continued to decline and a steady decrease to 0,62% in 2019/20 from 0,75% in 2018/19 and 0,83% in 2017/18 is cause for concern. This decline is precipitous given that GDP itself declined in nominal terms due to the pandemic.

Business expenditure on R&D (BERD) also declined consistently over this period in nominal terms. It was R10,705 billion in 2019/20, down from R14,448 billion in 2018/19 and also from its highest of R15,859 billion in 2017/18. The R&D expenditure composition of BERD has decreased from 41% in 2019/20, down from 39,3% in 2018/19 and 31% in 2017/18. BERD as a percentage of R&D was its highest at 53,2% in 2009/10. The 8,3 percentage point decrease from 39,3% in 2018/19 to 31% in 2017/18 is of particular concern.

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 particular interest to TIA. 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. Table 5 shows that expenditure on experimental development declined from 36,3% in 2010/11 to 21,4% in 2018/19. This was from a high of approximately 64% in 2006/7. Given that experimental development enables product and process innovation that is crucial to economic growth, enterprise creation and employment, TIA will work with other partners in the NSI to maximise the available resources to improve the spend on experimental development.

Table 5: Expenditure by type of research in SA (2010/11-2019/20)

Year	GERD R'000	Basic Research R'000 (%)	Applied Research R'000 (%)	Experimental Development R'000 (%)
2010/11	20 253 804	4 848 283 (23,9)	8 058 799 (39,8)	7 346 722 (36,3)
2011/12	22 209 192	5 439 561 (24,5)	9 388 273 (42,3)	7 381 358 (33,2)
2012/13	23 871 219	6 030 827 (25,3)	11 064 247 (46,3)	6 776 146 (28,4)
2013/14	25 660 573	6 102 085 (23,8)	12 132 211 (47,3)	7 426 277 (28,9)
2014/15	29 344 977	7 133 213 (24,3)	14 331 016 (48,8)	7 880 748 (26,9)
2015/16	32 336 679	8 209 662 (25,4)	15 349 070 (47,5)	8 777 948 (27,1)
2016/17	35 692 973	9 542 644 (26,7)	17 061 167 (47,8)	9 089 162 (25,5)
2017/18	38 724 590	10 223 956 (26,4)	20 623 856 (53,3)	7 876 778 (20,3)
2018/19	36 783 968	10 364 091 (28,2)	19 316 433 (52,5)	7 103 444 (19,3)
2019/20	34 484 862	11 043 171 (32,0)	16 074 948 (46,6)	7 366 744 (21,4)

Source: South African National Survey of Research and Experimental Development Statistical Report 2019/20.

At a provincial level, R&D expenditure remain concentrated in Gauteng (R14,386 billion and 41,7% of the national total R&D), the Western Cape (R8,453 billion and 24,5%) and KwaZulu-Natal (R3,629 billion and 10.5%) provinces. This is consistent with size and sophistication of their local economies as well as the presence of innovation support initiatives such as incubators and Technology Stations. Gauteng has the highest proportional expenditure, but this has been in decline since 2013/14.

In contrast to the increase in scientific publications, patent applications – a proxy indicator for inventiveness – have trended downwards in recent years. In nominal terms domestic patents granted to South Africans declined significantly from 694 in 2019 to 313 in 2020, whereas patents granted to non-residents also declined significantly from 5 468 in 2019 to 3 153 in 2020[8]. Overall the number of patent applications per million population has declined from 34 in 2011 to 25 in 2019. This figure is low compared with the average of 641 for upper middle-income countries in 2019.

[7] *South African National Survey of Research and Experimental Development Statistical Report 2019/20.*

[8] *NACI STI Indicators Report 2022.*

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, SA'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 SA, declining by 10% in 2019.

The Global Entrepreneurship Monitor measures the state and quality of country entrepreneurial ecosystems in a composite indicator dubbed the National Entrepreneurship Context Index. SA ranked 49th out of the 54 countries measured in 2018/19 and also had the lowest score of the BRICS countries. The conclusion drawn in the report is that SA does not support entrepreneurship sufficiently and that the country's entrepreneurial ecosystem does not show signs of improvement.

On the venture capital front, while investment activity by value of deals decreased to R1,31 billion in 2021 from R1,39 billion in 2020, the number of deals increased by 11,4%.[9] 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. In 2021, ICT, consumer products and services and business products and services were the three leading sectors, accounting for 69,2% by value of all venture capital investments. Ranked by number of deals, ICT, business products and services and consumer products and services were the three top sectors, largely mirroring deals by value, accounting for 71,3% all venture capital deals. By value, venture capital deals take place predominantly in the Western Cape (51,3%) and Gauteng (35,8%).

In terms of innovativeness, SA's ranking fell slightly to 61st (out of 132 countries) from 60th (out of 131 countries) in the 2021 Global Innovation Index. SA's ranking on the Innovation Inputs pillar fell from 49th in 2020 to 55th in 2021 whereas its ranking on the Innovation Outputs pillar remained static (68th). This appears to suggest that in SA innovation inputs are not translated into the expected level of outputs than in other countries.

[9] *Southern African Venture Capital Association 2022 Venture Capital Industry Survey.*

9.4 Local and International Policy Environment

The NDP 2030 is a long-term vision for the country and provides the programme through which SA can achieve economic transformation through development, thereby eliminating poverty and reducing inequality by 2030. The NDP states that the country's competitiveness will be determined by vibrant national systems of innovation being in place, with the need for innovation and learning to permeate business and society. The 2020/21–2024/25 MTSF outlines government's strategic intent to implement the ruling party's electoral mandate and NDP Vision 2030 to address the triple challenges of unemployment, inequality and poverty.

The Economic Reconstruction and Recovery Plan of October 2020 aims to restore SA's economy through stimulating equitable and inclusive growth following the impact of the COVID-19 pandemic. The objectives of the plan are to create jobs through infrastructure investment and mass employment programmes, reindustrialise the economy with a focus on small businesses, speed up economic reforms to unlock investment and growth, fight crime and corruption, and improve the state's capability.

The District Development Model aims to improve service delivery through better planning across the three spheres of government at the national, provincial and local government levels and through enabling partnerships a district level with communities, private industry and labour. The overall objective is to improve development and service delivery at the municipal district and metropolitan level.

The African Union's Agenda 2063 is a long-term, people-centred strategic framework for the socio-economic transformation of Africa. Agenda 2063 calls for diversifying sources of growth for Africa's economic performance and, in the long term, raising large sections of the continent's population out of poverty. The strategic framework also fosters social transformation, economic industrialisation, and entrepreneurship.

The United Nations' Sustainable Development Goals aims to end poverty and hunger globally, combat inequality, build peaceful, just and inclusive societies, protect human rights, promote gender equality and the empowerment of women and girls and ensure the protection of the planet and its natural resources. The objective is to create conditions for sustainable and inclusive economic growth, shared prosperity and decent work for all.

9.5 South African STI Policy Environment

STI plays a pivotal role with respect to equitable and inclusive economic growth and development, decent work, sustainable livelihoods, environmental protection and service delivery.

The Bio-economy Strategy provides a high-level framework to guide bioscience research and innovation investments and actions by stakeholders in the South African NSI. It seeks to use SA's bio-based resources to become a significant contributor to the country's economy by 2030 through the creation and growth of biotechnology-based industries.

The White Paper on Science, Technology and Innovation of 2019 lays out the policy direction for government to ensure a growing role for STI in a more prosperous and inclusive society. It envisages STI increasing inclusive economic growth, furthering social development with an emphasis on transformation and supporting environmental sustainability. It also emphasises the need to improve policy coherence and for more effective budget and programme co-ordination in response to persistent STI policy fragmentation across government and with the private sector, public-funded research organisations and civil society. The White Paper also emphasises the need to broaden monitoring and evaluation systems, create a more enabling environment for innovation; develop local innovation ecosystems, increase investment support to technology-based SMMEs and provide support to grassroots and social innovation, amongst others.

The DSI's Cabinet-approved Decadal Plan is the implementation plan of the White Paper on Science, Technology and Innovation and gives effect to the White Paper's vision for STI "enabling inclusive and sustainable South African development in a changing world". Innovation in particular holds great potential for economic growth, employment creation, improving livelihoods and enhancing government performance and service delivery. The interventions of the Decadal Plan seek to position STI, and innovation specifically, as central for sustainable socio-economic growth and development to address poverty, inequality and unemployment, and ensure environmental protection.

The Decadal Plan has the following STI priorities:

1. Modernising agriculture, manufacturing and mining through STI

In response to the contraction in South Africa's productive sectors, the development of innovative capabilities in support of productivity improvements is important to drive economic growth and competitiveness. The Decadal Plan therefore proposes an innovation-led response to modernise and reindustrialise these sectors. This entails transitioning to higher value-added activities and greener production methods.

Modernising these sectors is particularly important given their high economic and jobs multiplier effects. In the manufacturing sector the potential for knowledge spillovers from high-tech innovation into adjacent sectors is also high. The agricultural sector plays a key role in terms of the potential for the creation of direct jobs, ensuring food security and stimulating rural economic development. Lastly, the mining and minerals processing sector remains important to South Africa's economy, given that the country is regarded to have one of the largest mineral resource endowments in the world.

In the manufacturing sector, STI interventions encompass biomanufacturing, space science, additive manufacturing and ICT-based technologies. Upgrading the technological intensity of manufacturing firms and SMMEs in particular is also important.

In agriculture STI interventions are aimed at the development and deployment of bio-innovation products, processes and technological services by generating new knowledge products and fostering technology transfer and adoption for nutrition security and improved livelihoods.

In the mining sector STI interventions are focused on discovering, accessing and processing low-grade, complex and deeper ore bodies, particularly in more remote locations. This takes place within the context of energy and water constraints and the need to maximise possible socio-economic returns. The Decadal Plan envisages the sector being modernised through STI in mining and mining equipment manufacturing to enhance operations at the stope face, supporting the digitalisation of mines and extending the life of mines.

2. New source of growth: The digital economy

The Decadal Plan posits that the digital economy represents an attractive path to the prosperity of the country. Digitalisation and digital economy development is crucial to achieve national growth. ICTs such as the IoT, AI and blockchain technologies are key enablers for growth and development across industries and domains, as well as for improved service delivery and governance.

The Decadal Plan's ICT-based interventions have a dual focus. Firstly, ICT interventions are anticipated to contribute significantly in support of productivity improvements in manufacturing, agriculture and mining to modernise these sectors through data analytics and digital and precision technologies. Secondly, the Decadal plan seeks to build foundational ICT capabilities in several domain areas to bridge SA's widening digital divide. STI intervention areas include an Internet backbone, fixed broadband, mobile telecommunications and communications satellites, cloud platforms, automation systems, and integration and application programme interfaces and services.

3. New source of growth: The circular economy

The circular economy represents a paradigm shift from the mainstream consumption-driven economy of 'take, make and dispose' and is crucial to achieving environmental sustainability. Circular economy approaches also have the potential for socio-economic growth in terms of employment, profits and resource utilisation efficiency. According to the Decadal Plan, enhancing the circularity of the economy will result in more sustainable and resilient economic growth and job creation.

STI interventions in support of the circular economy will focus on manufacturing (e.g. reducing resource dependence and utilising design thinking), agriculture (e.g. reforming agricultural practices, improving resource utilisation, reducing or eliminating waste and reducing pollution) and mining (e.g. energy and water utilisation efficiency, sustainable automated mining methods and recycling). The principles of the circular economy, namely waste and pollution reduction, regenerative systems and sustainable materials management, will be taken into account.

4. Health innovation

The Decadal Plan observes four intersecting epidemics, namely maternal, newborn and child health; HIV/AIDS and tuberculosis; non-communicable diseases such as cardio-vascular disease; and violence and injury. SA has a bifurcated health system with a large public health sector serving the needs of the poor and rural, while the health needs of the more affluent are served by a smaller private health sector. Looking to the future, the NDP aspires to reduce or eliminate these epidemics. It expects a dramatically reduced burden of disease, a greater life expectancy for South Africans and an HIV-free under-20 generation. It also envisages a major change in healthcare provision in terms of equity, efficiency, effectiveness and quality.

The Decadal Plan states that innovative tools and services are required to address SA's rising burden of disease and disparities which exist between urban and rural areas. Pandemic preparedness and resilience is also crucial. The first set of STI interventions focuses on a contemporary precision medicine and digitally-enabled approach based on the convergence of several technological disciplines like nanotechnology, biotechnology, information technology and cognitive and social sciences. The purpose is to develop new treatments and diagnostics, strengthen precision medicine outputs and digitalise health and healthcare systems.

The second focus relates to indigenous knowledge-rooted health innovation responses based on SA's unique megadiversity and indigenous knowledge related to medicinal plants. The purpose is to mainstream African traditional medicines to treat including cancer, diabetes, tuberculosis, HIV/AIDS, infectious diseases and other health conditions.

5. Energy innovation

The Decadal Plan recognises the need for energy security in the long and short term, meeting the energy needs of growing industries, decarbonising and transitioning to a net zero carbon economy, and achieving a just energy transition. Currently the country's energy mix has an appreciable fossil fuel proportion, with approximately 50% of industrial sector energy demand being met by fossil fuels. Hence industrial production increases in support of infrastructure-led growth is more than likely to cause increases in greenhouse gas emissions without deliberate efforts to decarbonise the process.

Rising public pressure and global activism for climate action notwithstanding, there are barriers to achieving a net zero carbon economy in SA. The private sector, while cognisant of the effects and risks of climate change, remains largely focused on the bottom line. Furthermore, uncertainty and poor understanding of a just labour transition has induced government inertia with regard to moving towards a just energy transition, given the size of the existing labour pools in fossil fuel-based sectors such as mining.

The Decadal Plan recognises that future carbon dioxide emission reductions will originate from technologies which presently are in prototype form. The Plan references international studies that call for increased government expenditure in the areas of electrification, hydrogen, bioenergy and carbon capture, utilisation and storage. Locally, energy-related STI capabilities have been built in renewable energies, hydrogen and fuel cells, energy storage and carbon capture, storage and use. Efforts are also needed to leverage private investment in energy R&D to include the increased roll-out of demonstration projects, and to encourage the uptake of clean energy technologies in energy-intensive industries.

6. STI in support of a capable state

Existing policy and technology initiatives in government are designed to transform the public sector and build a capable state. These include decision-support tools for municipalities and government departments for improved functioning and performance.

The Decadal Plan aims further to deploy decision-support tools and data analytics capabilities in support of developing a capable state. The purpose of the Innovation for Service Delivery Programme is to demonstrate, pilot and evaluate the suitability/viability of technologies and innovations designed to improve the delivery of basic services. It also aims to improve the performance and functioning of government departments and municipalities. The Programme seeks to foster an enabling municipal policy environment which can facilitate the diffusion of technologies and the adoption and scaling-up of successful technology pilots and demonstrations.

7. Innovation for inclusive development

The Decadal Plan explains that government's innovation for inclusive development agenda is concerned with creating an enabling environment for innovation that allows all facets of society to have equality and equity of access to RDI infrastructure, to participate in innovation opportunities and to share in the benefits of STI. Interventions would seek to improve the livelihoods of youth entrepreneurs, women and PWD, create improved access to market and income opportunities for grassroots innovators, and to make more efficient use of scientific knowledge and tools to provide evidence-based decision support for improved service delivery.

8. Societal Grand Challenge: Climate change and environmental sustainability

Human-induced climate change poses an ever increasing threat to natural ecosystems and people who depend upon them. The Decadal Plan highlights that these effects will affect SA and the African continent disproportionately as a 2°C global temperature rise will translate to a 4°C rise in Africa. This will cause an increase in the incidence and severity of droughts, floods and other natural disasters locally, affecting food security and contributing to accelerating species extinction.

Climate change is threatening SA's natural capital and the ability of nature to provide ecological systems services. For example, the potential of SA's marine economy to contribute up to R177 billion to GDP by 2033 and create approximately 1 million jobs is under threat due to rising sea temperatures and ocean acidification.

The value of insects pollinating crops is estimated to be R5,6 billion a year. If these bees, flies, moths, butterflies and other insects dwindle in numbers or die out locally this would have a catastrophic effect on the surrounding ecosystem, including the human societies and economies that depend on the delivery of such free services.

STI focus areas associated with climate change and environmental sustainability include carbon-neutral transport, smart and carbon-neutral cities, clean energy solutions, sustainable water security, sustainable and modernised agriculture, zero-waste manufacturing and mining, and systematic earth observation and long-term monitoring.

9. Societal Grand Challenge: Future-proofing education and skills

One of SA's structural challenges is that of poor education outcomes, particularly its poor results in science, technology, engineering and mathematics. The development of skills for employment, decent jobs and entrepreneurship is crucial to address the NDP's challenges of poverty, unemployment and inequality. This occurs within the context of rapid technological change and associated consequences such as job losses due to automation. However, limited progress has been observed in re-engineering education services to be in alignment with AI, robotics, the IoT and other emerging/converging technologies.

The Decadal Plan envisages a human-centred technological future in which resilient and digitally skilled citizens are not only empowered to leverage ICTs, robotics, big data, AI, the IoT and other digital technologies to enhance the quality of their lives, but are also able to adapt rapidly to the future digital world. In this context, investments in STI must serve as an enabler for citizens to overcome the digital divide and should facilitate equitable access to decent employment opportunities, particularly among vulnerable groups, as well as stimulating economic growth. The Decadal Plan stresses the importance of collaboration with other government departments and stakeholders to achieve these objectives.

10. Societal Grand Challenge: The future of society

SA's social challenges are well-known, namely persistent and unacceptably high levels of poverty and unemployment, and it is widely accepted that the country is one of the most unequal societies in the world. Citizens experience ongoing inefficient service delivery and face high levels of crime on a daily basis, impacting on their security and safety. The country's triple challenges also disproportionately affect the youth and women, underscoring the need for inclusive STI interventions that creates economic benefits for the youth and women in particular.

10. Internal Environment Analysis

10.1 Operating Environment

Internal Environment

In a post-COVID-19 era TIA is poised to continue operating optimally with hybrid work arrangements, seeing some employees working from home and others coming to the office during agreed intervals. This is enabled by the Remote Working Policy, which is now in place, permitting employees to maintain a healthy work-life balance while ensuring that employee performance is appropriately managed by working from the office at times as required. The heightened reliance and use of technology will be fully exploited through the application of the TIA Digital Transformation process and the IT Digital Strategy for continued adoption of future technology trends and new solutions.

The Human Resources Unit is cognisant of staff well-being and workforce changes and demands during this era. TIA will strive in its quest to be "the best companies to work for" by building the TIA brand awareness and continuous communication and engagements with staff and stakeholders. The TIA culture will be reinforced and inculcated to resonate with employees in living and demonstrating the TIA values vital for improved customer satisfaction and operational efficiency.

Employee Retention and Skills Development

During this turbulent market and economic period, staff retention is one of the key challenges attested to by the increased vacancy rate and difficulties encountered in attracting requisite skills. The limited MTEF allocation for 2023/24 and the outer years without any provision made for salary increases and bonuses for employees will exacerbate the natural attrition rate. It is also our mission to manage and keep the operational budget acceptable for the coming years; however, we also anticipate overheads to increase in the outer years due to increased number of programmes handed over to TIA from the DSI.

In our attempt to decrease staff turnover, various modalities like employee secondments, promotions and lateral transfers will be fully utilised to offer interested officials opportunities internally first. It is our undertaking to fill vacant positions with internal staff before opting for external candidates in the coming year. The TIA Employment Equity Plan will be used earnestly to fill vacant positions in achieving the organisational targets for 2023/24.

The organisational Employee Value Proposition will continuously be improved to attract and retain requisite skills to deliver the mandate. The monetary and non-monetary employee benefits of TIA's Employee Value Proposition must be robustly enhanced by the Employee Benefits committee fitting to the nature of our business to retain staff. To enhance the Employee Value Proposition, the Succession Plan executed must yield the desired results with critical positions and skills possessed to deliver the mandate and employee loyalty.

The Annual Training and Development Plan for 2023/24 will be compiled and approved to attend to employee training and developmental needs. The ongoing utilisation of external experts will close the skills gap for project due diligence processes for improved turnaround time.

Investment Approval Turnaround Time

The current investment turnaround time measures implemented for the approval of investment according to the Delegation of Authority have yielded positive results during 2022/23. However, these measures

needed continuous improvements to mitigate process inefficiencies. A 'dip-stick' assessment conducted by management to ascertain root causes impacting turnaround time will be fully sanctioned and monitored for reporting. Several measures have been implemented by the organisation to enhance project turnaround time across the investment value chain. A desire for investment process flexibility and agility to adapt to changing customer needs is critical to achieve seamless project lifecycle management (from receipt of a Statement of Interest to commercialisation).

The organisational structure will be aligned to this process for clear Glass Pipeline and projects visibility. Based on learnings from the use of external experts for due diligence process, more experts will be invited to be included on the TIA database for other service areas to reduce lengthy decision making and turnaround time. The Customer Relationship Management system will be managed effectively to reduce stakeholder and customer complaints by continuous communication with clients.

The Enterprise Resource System will be fully implemented in 2023/24 to manage the investment process end-to-end and integrate with all TIA functional systems for enhanced efficiency. TIA Investment Management Process will be revised from time to time to cater for future flexibility and agility requirements and to inform the Enterprise Resource System capability holistically. The system's external portal used to manage all "TIA Investment Call for Proposals" will be fully compatible with all end user devices.

Stakeholder Satisfaction

An independent market research company was commissioned by TIA in 2022 to assess its stakeholders' satisfaction with the Agency's service delivery. The reason for undertaking the survey was to assist TIA in identifying areas for improvement as the Agency is committed to becoming a customer-centric and impactful organisation.

The survey was undertaken primarily via the Internet, supplemented by telephonic interviews, with TIA's funders, innovators, researchers, SMMEs and support institutions. Stakeholders were asked to rate their overall satisfaction with TIA's service using a rating scale of zero to ten where zero indicates complete dissatisfaction and ten indicates complete satisfaction. Responses were received from 88 innovators, researchers and SMMEs, three co-funders and 28 partners.

Innovators, researchers and SMMEs were the most satisfied with the service they received from TIA, with generally positive overall satisfaction as reflected in the average respondent score of seven. Seventy five percent of respondents gave TIA a score of six or higher, with 27% of respondents rating TIA's service at nine or ten.

Respondents who were very satisfied with TIA's service were generally happy with the service received, particularly with regard to the support they received on their business journey. Those that gave an average overall satisfaction rating were content with the service but cited several issues such as a slow response to their funding applications, a lack of communication and a lack of urgency on the part of the TIA team. Unhappy stakeholders felt communication was poor, there was a lack of urgency and the TIA team were slow to respond to their overall queries or funding requests.

Environmental, Social and Governance

The ESG or Environmental, Social and Governance framework is becoming increasingly important for innovation agencies like TIA as it helps to ensure that the products and services developed are sustainable and socially responsible. By considering ESG factors, the Agency seeks to identify potential risks and opportunities in their operations and product development, and make adjustments to promote long-term sustainability.

The Agency integrates ESG factors into the investment process to improve the analysis of all investments, promote improved standards of practice, and assist the investment process to mitigate any ESG risks to potential or existing investments.

In terms of the environment, TIA uses ESG principles to minimise the environmental impact of not only its operations but also the impact achieved by projects in which it seeks to invest. For example, the Agency is the selected national implementor and host for a global network initiative hosted by the United Nations Industrial Development Organization aimed at promoting clean technology innovation and supporting entrepreneurs to grow their SMMEs and start-ups into viable, investment-ready businesses. Choices for TIA's investment into energy technologies are taken based on whether or not they are 'green' and would contribute to the decarbonisation of South Africa's economy. At an operational level, the Agency facilities utilise various energy saving mechanisms and will seek to use more renewable energy sources.

On the social side, the Agency uses ESG principles to promote social responsibility in its operations. This includes ensuring fair labour practices and promoting diversity and inclusion. Furthermore, TIA has not only embedded transformation sub-targets within its output performance targets in relation to the youth, women and PWD, but also aims to launch dedicated innovation support programmes across these three areas in 2023/24.

Finally, in terms of governance, the Agency utilises ESG principles to promote transparency and accountability in its operations and products. This includes implementing strong corporate governance policies, disclosing environmental and social information and engaging with stakeholders to understand their concerns and needs.

Overall, by incorporating ESG principles into its operations, the Agency strives not only to mitigate risks but also create more sustainable and socially responsible products. This will help to reinforce TIA's good reputation and attract customers and investors who are seeking responsible organisations as partners.

10.2 Financial Overview

TIA had an allocation of R458,4 million for 2022/23 with a commitment book of R238,7 million, with more than R219,6 million available for investments and operational expenditure. While this funding is inadequate for the purposes of fulfilling the organisation's mandate effectively, the additional funding from round two and three of the Innovation Fund (R102,2 million and R100 million respectively) has served to bridge this funding gap, especially given that no inflationary increase has been built into the following financial years in the MTEF.

Going into the 2023/24 financial year, TIA has an allocation of R460,1 million which represents a 0,4% increase from the prior year. While this funding remains inadequate for the purposes of fulfilling the organisation's mandate effectively, the additional funding from the Innovation Fund will serve to bridge this funding gap. To respond to the ever-increasing demand for TIA funding, TIA must continue to identify and secure alternative sources of funding and revenue. Given the excellent track record of being able to deploy funds as supported by the current year's performance, TIA is well poised to deploy funds effectively in the NSI and to continue to bolster its funding capacity through leveraging its partnerships effectively.

11. Performance Analysis

11.1 Organisational Performance

In 2021/22 TIA recorded a year-end output performance achievement of 86%, representing a total of 19 targets achieved out of 22 output indicator targets for the year. These results were achieved against the backdrop of a challenging economic environment characterised by low growth and a constrained fiscal environment. TIA's performance achievements over the last six years are presented in Figure 2.

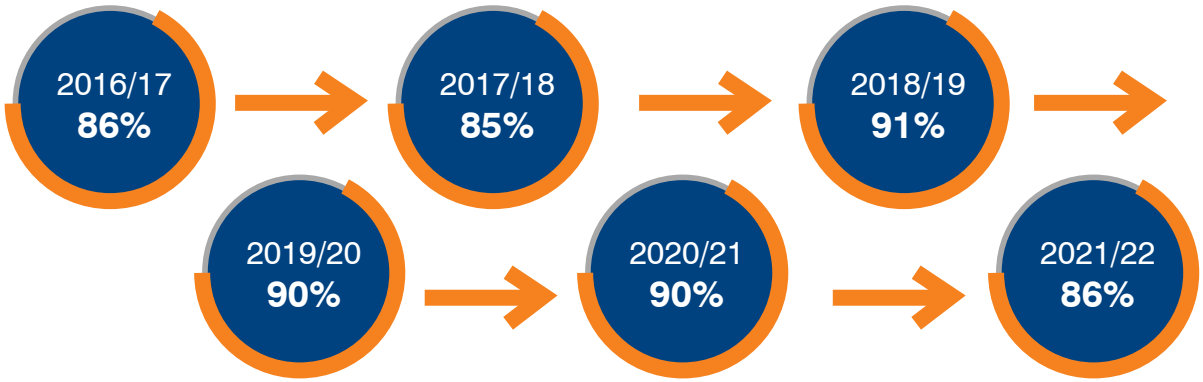


Figure 2: TIA's performance against its strategic objectives over the past six years

11.2 Transformation

TIA is committed to transformation and inclusive innovation, and seeks to invest in a developmental fashion to support innovators in underserved provinces and invest in women, the youth, and PWD. This section examines the characteristics of disbursements made in 2021/22 at the beneficiary level.

Disbursements to Public-Funded Organisations

TIA's disbursements to research organisations in the public sector (universities and science councils) was 74,5% (R280,9 million) of TIA's total payment to beneficiaries in 2021/22, compared with 25,5% (95,9 million) to non-public (private) beneficiaries. This is in line w ith the DSI's requirement for TIA to direct the bulk of its investment expenditure (approximately 70%) to public-funded recipients. This compares favourably with 57% disbursed to universities and science councils and 43% to private beneficiaries in the 2015-2020 period.

A 2021 survey[10] of public-funded institutions, comprising HEIs (universities) and science councils (also known internationally as public research organisations), revealed that 292 new licences and 40 new assignments were concluded over the survey period of 2014-2018. Of these, 238 transactions across 17 institutions produced total revenues of more than R185 million.

Such IP transactions with commercial partners are an important step towards achieving an impact through the further development and deployment of products, processes or services stemming from IP produced through public-funded research. However, it is telling that for four out of the five years of the survey period, the same five universities accounted for more than 80% of the licences concluded.

While the survey report does not reveal the identities of these institutions it can reasonably be surmised that these five are traditional academic universities and that none are historically disadvantaged institutions. Given that such transactions have a critical economic impact and that the NSI must remain relevant to the needs of the economy and society, it is imperative that more public-funded institutions conclude more IP transactions. Furthermore it behoves TIA to adopt more of a transformational role through supporting historically disadvantaged public-funded institutions in partnership with the National Intellectual Property Management Office.

The university sector has acknowledged the critical role that TIA plays in terms of funding the development of promising research outputs (and associated IP) beyond proof of concept through the Agency's Seed Fund. This fund enables innovators to evaluate, demonstrate and advance the value proposition and commercial potential of their research outputs and supports the development of a business case. Figure 3 shows how TIA has been the main source of funding of this type during the 2014-2018 period

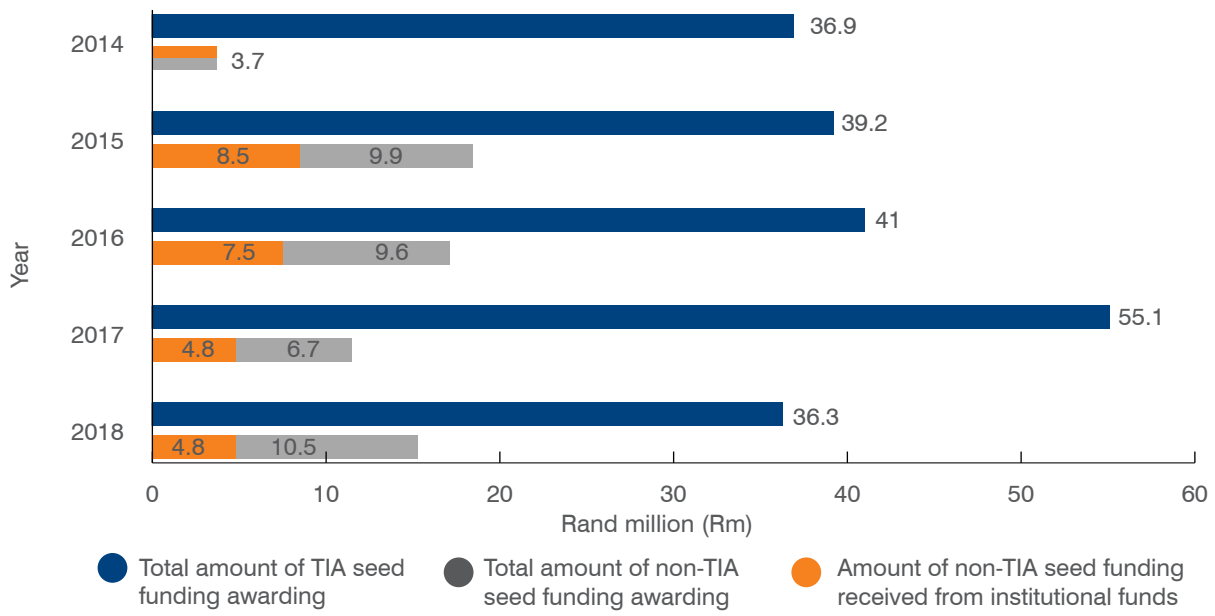


Figure 3: Seed funding received by 26 universities in SA over the period 2014-2018

Source: SA National Survey of Intellectual Property and Technology Transfer at Public Funded Research Institutions, Second National Survey: 2014-2018.

[10]*South African National Survey of Intellectual Property and Technology Transfer at Public Funded Research Institutions, Second National Survey: 2014-2018.*

Geographic Spread of Disbursements

In 2021/22 the Gauteng, Western Cape and KwaZulu-Natal provinces account for 38,5% (R138 million), 27,3% (R98,3 million), and 14,4% (R451,8 million) of TIA's disbursements, with the other six provinces collectively receiving the remaining 23,7% (R71,1 million). This disbursement spread is not surprising given that innovation tends to happen mostly in established economic centres where there are pre-existing vibrant knowledge and innovation ecosystems. The data also echoes national R&D statistics in which the proportional GERD is greatest in Gauteng, Western Cape, and KwaZulu-Natal provinces.

TIA is actively seeking to play an increased developmental role by directing more of its expenditure to the other six underserviced provinces. TIA plans to spend 30% and 40% of its unallocated funds in underserved provinces in 2022/23 and 2023/24 respectively.

Support to Women

In 2021/22 TIA's proportional disbursements to women was 37,1% (R127,3 million). This performance can be benchmarked according to SA's Quarterly Labour Force Survey for the fourth quarter of 2021/22. The survey reports that the proportion of working-age women is 50,4%, with the proportion of employed working-age women being 43,6%. Additionally, considering the latest available R&D statistics (according to the National R&D Survey for the 2019/20 year), women make up 42,0% of the total researcher headcount. In relation to this data TIA's disbursements to women could be higher.

At the output indicator level, TIA has sub-targets for women, women entrepreneurs and women-owned businesses. Table 6 shows TIA's performance against these output sub-targets in 2021/22. The Agency has performed well against its women-focused sub-targets, achieving six out of eight of these. TIA could do better in terms of support to honours, masters, post-doctoral students and also in relation to knowledge and innovation products produced.

Table 6: TIA's performance against its women-focused output sub-targets in 2021/22

Indicator	Target	Actual
Proportion of technologies licenced or assigned	≥30%	60%
Proportion of projects involving industry	≥30%	44%
Proportion of successfully diffused technologies	≥30%	42%
Proportion of products launched	≥30%	70%
Proportion of successfully demonstrated bio-based technologies	≥30%	75%
Proportion of SMMEs and co-operatives receiving SET support	≥45%	46%
Proportion of honours, masters, post-doctoral students supported	≥45%	38%
Proportion of knowledge and innovation products produced (patents, prototypes, technology demonstrators, etc.)	≥45%	22%

Support to Youths

TIA's proportional disbursements to the youth in 2021/22 was 37,8% (R133,3 million). In comparison, SA's Quarterly Labour Force Survey for the fourth quarter of 2021/22 reveals that the proportion of working-age youth is 51,6%, with the proportion of employed working-age youth being 34,3%.

TIA also has sub-targets for youths, youth entrepreneurs and youth-owned businesses, with the Agency's performance for 2021/22 provided in Table 7. TIA's performance against youth-focused sub-targets is mixed, with the Agency achieving only three of its eight sub-targets. The Agency should improve its performance across most metrics in this regard.

Table 7: TIA's performance against its youth-focused output sub-targets in 2021/22

Indicator	Target	Actual
Proportion of technologies licenced or assigned	≥20%	30%
Proportion of projects involving industry	≥50%	38%
Proportion of successfully diffused technologies	≥50%	33%
Proportion of products launched	≥50%	46%
Proportion of successfully demonstrated bio-based technologies	≥20%	64%
Proportion of SMMEs and co-operatives receiving SET support	≥40%	60%
Proportion of honours, masters, post-doctoral students supported	≥40%	29%
Proportion of knowledge and innovation products produced (patents, prototypes, technology demonstrators, etc.)	≥40%	12%

Support of Persons with Disabilities

Disbursements made to PWD amounted to 0,8% (R874 508) in 2021/22. In contrast, according to Statistics South Africa, the national disability prevalence rate is 7,5%. Table 8 shows TIA's performance against its sub-targets for PWD. Aside from technologies licensed or assigned, the Agency has not performed at all well against its PWD-focused sub-targets. This, together with the very modest total disbursements made, underscores the necessity for TIA to improve its performance in this regard.

Table 8: TIA's performance against its persons with disabilities-focused output sub-targets in 2021/22

Indicator	Target	Actual
Proportion of technologies licenced or assigned	≥10%	20%
Proportion of projects involving industry	≥10%	0%
Proportion of successfully diffused technologies	≥10%	0%
Proportion of products launched	≥10%	5%
Proportion of successfully demonstrated bio-based technologies	≥10%	0%
Proportion of SMMEs and co-operatives receiving SET support	≥3%	1%
Proportion of honours, masters, post-doctoral students supported	≥3%	0%
Proportion of knowledge and innovation products produced (patents, prototypes, technology demonstrators, etc.)	≥3%	1%

11.3 Commercialisation Pipeline and Outputs

Demand for Funding for Technology Development and Commercialisation

The aforementioned 2021 survey[11] of public-funded institutions revealed the extent and scope of the funding needs of this community in terms of technology development, upscaling and commercialisation. Such funding is needed to enable the development and commercial deployment of IP resulting from public-funded research. Of the 37 organisations surveyed, 29 reported that they did not have sufficient funds for these activities. The report estimated that a minimum increase of R575 million in funding is needed over a two-year period for technology development/early commercialisation, seed funding, early-stage venture capital/commercialisation funding, Series A[12] funding and Series B[13] funding.

Figure 3 above reveals that TIA is the main provider of seed funding through its Seed Fund Programme. The Agency provided an average of R34,5 million per year over the five-year period of the review out of a total of R42,6 million in seed funding. The additional funding of R575 million required by universities and science councils is over and above the funding provided by TIA and other funders, illustrating that the demand for technology development, upscaling and commercialisation far outstrips the funding available for the same.

[11] *South African National Survey of Intellectual Property and Technology Transfer at Public Funded Research Institutions, Second National Survey: 2014-2018.*

[12] *Funding for the formation/incorporation of a company/first-round funding.*

[13] *Company scale-up funding (business strategy and customer track record established).*

Technology Development Pipeline

TIA has in excess of 500 projects under management across its various sectoral focus areas and programmes (Figure 4). An analysis of the most promising of these in terms of prospects for successful commercialisation identified 80 active disbursing projects within the Commercialisation Division, the Bio-economy Division, the Seed Fund Programme and the Innovation for Inclusive Development programme. Figure 5 shows these projects according to Technology Readiness Level[14] (TRL) and division/programme. These projects have a total technology development and pre-commercialisation funding requirement of approximately R714,6 million over a two to four year period. Out of these 80 projects, 67 are at TRL6 or higher, meaning that the technology (system, subsystem model or prototype) has at the very least been demonstrated in a relevant environment. This analysis shows that TIA is fulfilling its core mandate of de-risking technologies moving towards commercialisation, and also the quantum of funding still needed to further develop these technologies towards commercialisation.

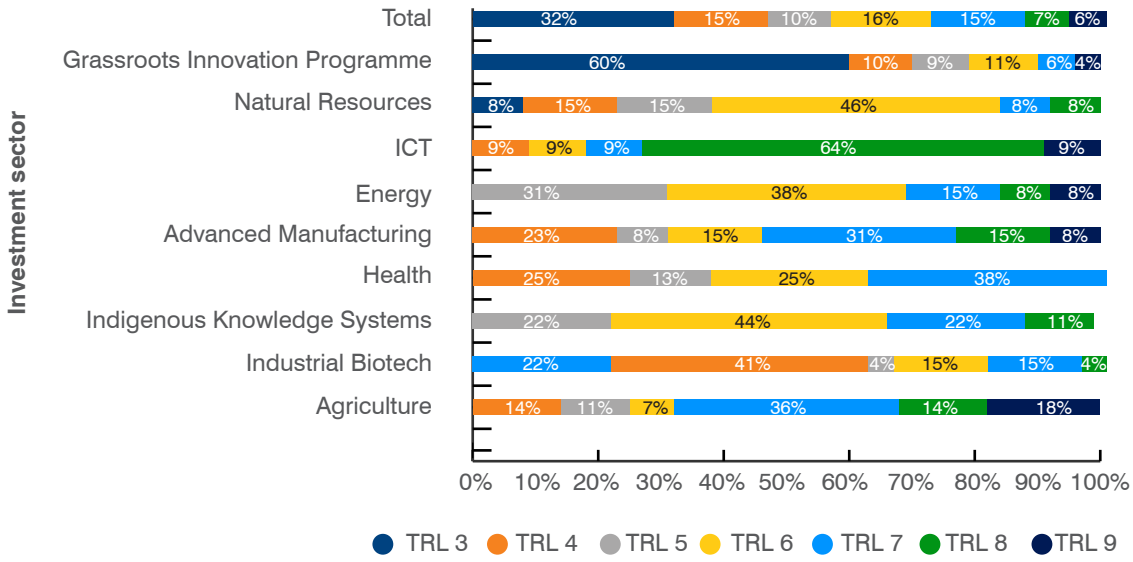


Figure 4: TIA's project portfolio across its various business units according to TRL

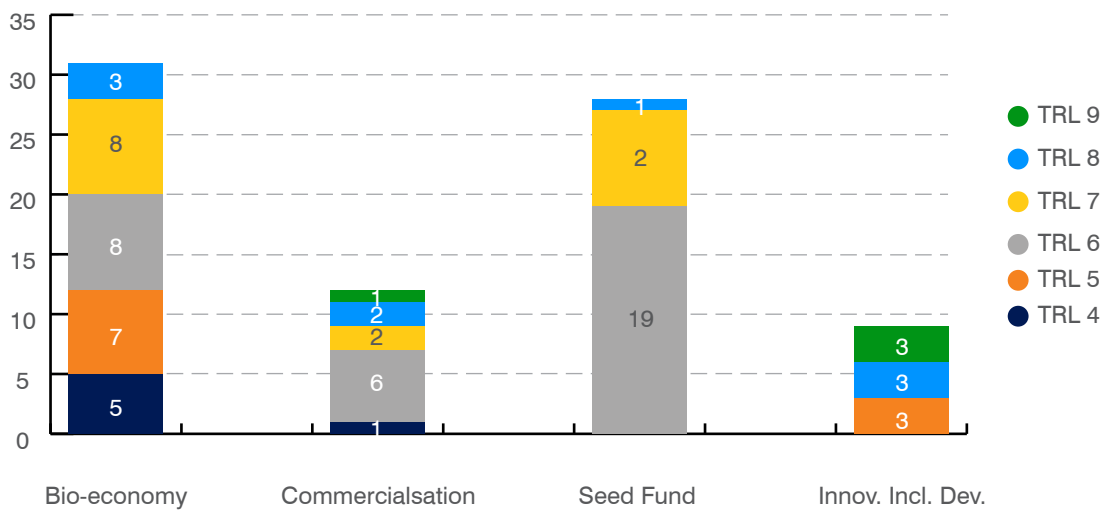


Figure 5: TIA-supported projects at TRL4 or above which have high prospects for commercialisation

[14] *Technology readiness levels describe the maturity of technologies.*

Near-Commercial Pipeline

TIA's core mandate relates to de-risking technologies developed from local IP stemming from public-funded R&D. The DSI's Innovation Fund was established to further de-risk investments through technology development and demonstration and to serve as a catalyst for co-investment and follow-on investment from industry and private sector sources (commercial funding). To date TIA has received an allocation of R182,2 million from the DSI under Phases I and II with a further R100 million approved for allocation by the DSI under Phase III of the fund late in 2022/23. The Agency has utilised Phase I and II funding and has invested in a portfolio of 30 projects selected primarily from TIA's historical technology development investment portfolio.

The results of TIA's investment in previously-funded projects have been encouraging. As of September 2022 the Agency recorded a total of R283,4 million in leveraged funds, with R192,4 million of this stemming from the private sector. This represents R1,42 in funds leveraged for every R1 from TIA through the Innovation Fund.

Figure 6 presents the features of companies or organisations housing Innovation Fund projects. As can be seen, most (28 out of 30 or 93% of projects) were previously public-funded or stem from a public-funded research organisation. The majority (21 out of 30 or 70% of projects) have utilised IP originating from public-funded research.

Of the 27 projects (a total of three are being exited, dormant or in distress), nine (33%) are fully de-risked and are ready to be introduced in the market or already are in the market and seven (26%) will be fully de-risked at the end of the current Innovation Fund investment. The remaining 11 (41%) projects would require further financing to be fully de-risked after receiving the contracted Innovation Fund investment.

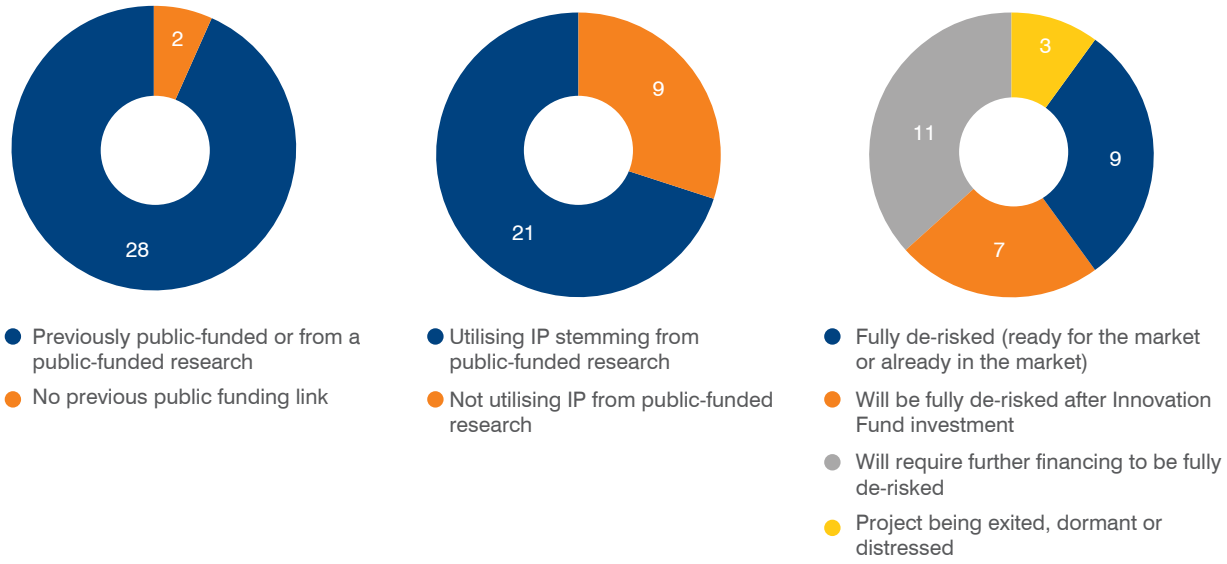


Figure 6: Characteristics of companies or organisations which have Innovation Fund projects

Commercialisation Outputs

TIA has several commercialisation-related output indicators, namely technologies licenced or assigned, technologies diffused for inclusive development, products launched and bio-based technologies developed. Since the start of the current strategic cycle (2020/21) to date, 19 technologies have been licenced or assigned, 22 technologies have been diffused for inclusive development, 43 products have been launched and 88 bio-based technologies have been developed.

Using the Standard Industrial Classification code system, TIA's outputs have been assigned according to high-level categories as shown in Figure 7. As can be expected given TIA's strong bio-economy-related focus, the bulk of TIA's outputs relate to human health and animal/plant health (the professional, scientific and technical activities category), manufacturing, water, and agriculture, forestry and fisheries.

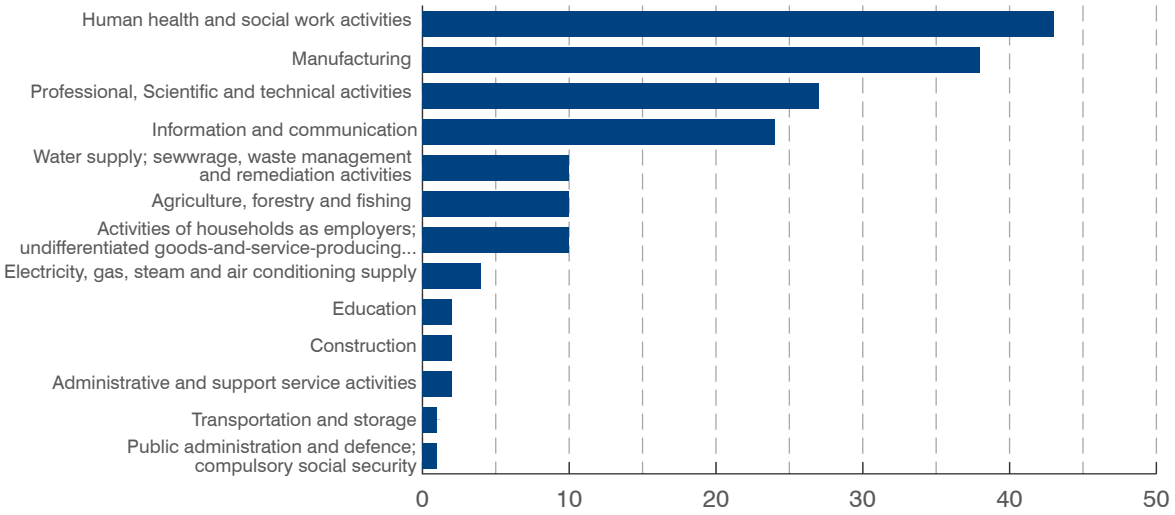


Figure 7: Categorisation of TIA's commercialisation-related output indicators for the period 2020/21 to date

Alignment with National STI Priorities

The post-democratic STI policy landscape has a rich history and trajectory in terms of the identification of priorities for the NSI by identifying challenges and opportunities for socio-economic growth and development. There has also been an evolution in terms of STI policy development, with the prevailing apex policy document (the 2019 White Paper on Science, Technology and Innovation) and implementation plan (the 2022 Science, Technology and Innovation Decadal Plan) being more holistic. The policy and implementation plan also seeks to achieve a broader transformative and inclusive impact not only in the economy and in society, but also in terms of sustainability and environmental protection.

As a key actor in the NSI, TIA has been privy to the development of the White Paper and Decadal Plan and has sought to align its efforts with the draft Decadal Plan during the development of earlier APPs and the Agency's Strategic Plan for 2020-2025. This section presents a selection of funded projects and demonstrates their alignment with the Science, Technology and Innovation Decadal Plan. Going forward, TIA will make investment approval decisions based on whether or not the project or programme funding application demonstrates substantial alignment with the priorities of the Decadal Plan.

The NovelQuip Pty (Ltd) **Forestry Mechanised Planting Technology** project entails the development of a fully automated seedling planter for application in commercial forestry. Existing methods of tree planting are inefficient, requiring a series of expensive capital equipment and exposing workers to harsh, strenuous and unsafe working conditions. These methods cannot plant trees at the scale required to cater for humankind's growing need for timber and wood by-products, or combat deforestation and climate change.

With TIA's assistance, Novelquip Pty (Ltd) has developed one of the world's first fully automated tree planting machines that prepares the soil, plants the seedling, and applies water, fertilizer and herbicide. The system digitally transforms planting operations with its GPS and management software which facilitates planning, execution, and reporting of operations. The product enables cost-effective, digitally transformed, precise and safe tree planting operations.

The Novelquip project promotes sustainable forestry, forest regeneration and regreening projects in support of the Decadal Plan's priority to modernise the agricultural sector. Novelquip's fully mechanised planter aims to have an economic impact through increasing the quality and consistency of tree plantings, reducing seedling mortality and increasing yield. Integration of operations will lead to increased efficiency, and digitisation enables precision operations and generates intelligence to optimise management.

Furthermore, state-of-the-art ergonomic and safety features ensure decent, safe jobs and working environments in forestry as well as higher skilled and higher paid jobs. The project also provides a cost-effective way to plant trees quickly at scale in support of efforts to combat climate change, as well as to make commercial forestry more sustainable.

The TIA-supported Brayfoil Technologies (Pty) **Self-adjusting Wing Turbine** project entails the development of a morphing wing which can change shape and thickness, allowing it to adjust the angle of attack relative to the wind. The innovative Brayfoil wing is composed of a single composite shell wing structure that is robust, simple to make and has no open or sliding joints. This characteristic of the wing allows a turbine to operate with a thin aerofoil section at low lift and low drag with a very high wind velocity, but also to operate with a very thick aerofoil section at low wind velocities when the drag and lift coefficients are high.

The Decadal Plan highlights the critical role to be played by energy innovation over the next decade in bringing new technologies to the market speedily. It focuses on accelerating the adoption of clean energy technologies by energy-intensive industrial users and preparing for the next phase of the transition (post-2030). Furthermore, the Decadal Plan emphasises the need to accelerate the roll-out of demonstration projects to leverage private investment in R&D and to boost overall deployment levels to help reduce costs.

Stone Three has been supported by TIA to develop a **Smart Sensor Process Advisory Dashboard**. This project has the aim of increasing the productivity of mineral process plants in crushing, grinding and flotation operations by increasing stability and throughput in crushing circuits, improving the energy efficiency and stability in grinding, and increasing grade, recovery and stability in flotation. Improvements in productivity within mineral processing operations would lead to better competitiveness in the minerals and mining sector in SA. The technology supports the Decadal Plan's aim to modernise the mining sector through digitalisation and contributes to extending the life of mining equipment.

Khepri Innovations (Pty) Ltd is a TIA-supported insect protein company that offers the food value chain a cost-effective landfill alternative. It also provides the animal feed and pet food industry with a consistent supply of high quality protein at a stable and more competitive price than traditional protein sources like soy and fish meal. Khepri's facility processes a wide range of organic waste streams from the agricultural, industrial, commercial and hospitality industries to produce protein for animal feeds. Of the approximately 9 300 tonnes of food waste expected to be produced per year in SA, about 7 200 tonnes are likely destined for landfill. This represents an opportunity for Khepri to contribute towards the Decadal Plan's circular economy priority and the national Waste RDI Roadmap through the diversion of waste streams to high-value agro-industrial inputs. Furthermore, the initiative contributes towards pollution reduction and the promotion of regenerative systems by a reduction in the use of fertilisers and antibiotics in farming, in addition to enabling import substitution of soy-based protein and wild fish-based proteins.

The potentially devastating effects of climate change and variability on the food and nutrition security of SA is a concern shared both by government and industry. There have been significant efforts devoted to studying this threat, leading to the establishment of the **Climate Resilience Consortium** of the Agricultural Bio-Economy Innovation Partnership Programme to build resilience to climate change and variability. The main aim of the consortium is to investigate the impact of climate change and variability on agricultural production and develop sustainable response plans to ensure food and nutrition security for the future, while developing capacity to respond to the climate change challenges. Specific focus areas are building a knowledge-base of the effect of climate change on agriculture and breeding maize hybrids with increased resilience to drought and heat stress. Long-term crop rotation trials with universities and industry, and several high-yield crop hybrids resistant to drought and heat stress have been developed.

The Climate Resilience Consortium objectives speak to the Decadal Plan's priority of revitalising and modernising agriculture through reformative agricultural practices as well as supporting the Agriculture and Agroprocessing Masterplan. It does this by developing cultivars that can be grown in resource-poor areas of the country, for the delivery of produce for agroprocessing. The consortium aims to achieve this through partnerships with industry, science councils, universities and farmer groups to drive transformation, spatial planning, strengthened value chains, and co-funding.

In 2019/20 TIA, DSI and the South African Medical Research Council formed the **Active Pharmaceutical Ingredients (API) Cluster Programme** to produce APIs and/or alternatives of strategic value to SA. This will allow the country to develop and manufacture its own APIs more economically, to reduce reliance on imported APIs, and to support and grow the surrounding value chain and related innovations.

Other benefits include job creation opportunities through the establishment of new manufacturing facilities, SMME development, support for the advancement of black entrepreneurship in the pharmaceutical manufacturing sector, training and capacity building in the pharmaceutical sector and the development and diversification of the chemicals sector.

TIA has funded the development of a pilot scale regulatory-compliant API chemical laboratory to support the analytical testing required during the synthetic process of API molecule development. The equipment required for this purpose is now fully installed and operational. The cluster continues to engage with other international players to canvass both technical and financial support with the goal of enabling the local manufacture of APIs to combat the priority diseases in SA and the continent. This includes the localisation of technologies and demonstration of capabilities for the manufacture of scare and/or costly drugs and APIs. Success will be measured by an increased number of locally-developed new treatment and prevention technologies, and improved availability of health innovation technologies appropriate for resource-poor settings. TIA's support of the API Cluster thereby comprehensively responds to the Decadal Plan's health innovation priority.

PART C

Measuring Performance

12. Commercialised Innovations

12.1 Outcome One: Commercialised innovations

Impact statement

TIA aims to commercialise innovations that are economically sustainable to achieve a positive impact on the lives of all South Africans.

Outcome statement

TIA seeks to direct a greater proportion of its resources towards the translation and commercialisation of IP emanating from publicly funded research organisations such as universities and science councils, for the purpose of improving the lives of South Africans and to contribute to economic growth and development. To track TIA's progress towards achieving Outcome 1 over the 2020-2025 Strategic Plan period, TIA will report on the number of technologies commercialised on an annual basis.

12.2 Planned Outputs and Output Targets

TIA has developed five outputs 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 increase the conversion rate of IP from publicly-funded research organisations by exploiting the resources of the private sector and promoting their competitiveness. Licencing, assigning or selling public-funded IP associated with technologies that have been de-risked by TIA, and fostering joint collaborations between public funded research organisations and industry are two pathways to foster the conversion rate of such publicly-funded IP.

The diffusion of existing technologies to community structures, SMMEs, co-operatives and other business formations for inclusive socio-economic development represents TIA's third output. The fourth output is start-ups or SMMEs launching products on the market, which is an important measure of the successful commercialisation of innovations.

Finally, TIA will track royalty payments, revenue generated through the sale of equity holdings in TIA-supported companies and the proceeds of equity exits. Income from the proceeds of TIA-supported initiatives serves to demonstrate TIA's direct impact on the economy in terms of the successful commercialisation of innovation.

TIA's output targets in support of commercialising innovations are presented in Table 9 and Table 10.

Table 9: Outcome 1 outputs, performance indicators and targets

Outputs	Output Indicators	Audited Actual Performance			Estimated Performance	MTEF Period Targets		
		2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
1.1 Technologies licensed or assigned	Number of licensed or assigned technologies	New indicator	6	10	17	20	25	30
1.2 Joint collaborations between public funded research organisations and industry	Number of projects involving industry being executed	New indicator	29	34	47	50	52	56
1.3 Technologies diffused for inclusive development	Number of successfully diffused technologies	New indicator	5	12	18	20	24	28

Outputs	Output Indicators	Audited Actual Performance			Estimated Performance	MTEF Period Targets		
		2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
1.4 Products launched	Number of products launched	New indicator	21	37	33	40	44	48
1.5 Revenue derived from commercialised innovations[15]	Total Rand value of royalties, sales and exits	New indicator	New indicator	New indicator	New indicator	R10m	R15m	R20m

Table 10: Outcome 1 output indicators, annual and quarterly targets

Output indicators	Annual target	Q1	Q2	Q3	Q4
1.1 Number of licensed or assigned technologies	20	3	4	5	8
1.2 Number of projects involving industry being executed	50	8	10	14	18
1.3 Number of successfully diffused technologies	20	3	4	5	8
1.4 Number of products launched	40	6	9	12	13
1.5 Total Rand value of royalties, sales and exits	R10m	R1m	R2m	R3m	R4m

12.3 Explanation of Planned Performance

TIA will continue to intensify efforts in modernising the agricultural sector by supporting and commercialising cutting-edge technological innovations that not only deliver automated precision-driven operations to the agricultural sector but also enhance productivity, seedling yield and survival rate at reduced costs. The application of advanced Industrial applications such as ICT digital and decision management systems and advanced manufacturing innovations; introduces modernised interventions that contribute toward increased commercial prospects in terms of increased market share and revenues from agricultural ventures. Modernisation of the agricultural sector requires integrated systems that address underlying interventions ranging from soil preparation and revitalisation all the way to cultivation and precision techniques that improve the quality and quantity of crop yield.

The diffusion of novel industrial technologies from the advanced manufacturing sector such as the NovelQuip technology, which transforms the agricultural sector through its fully automated silviculture seedling planters that prepare the soil, extract the seedling from the nursery tray, plant the seedling and apply water, fertilizer and herbicide. The system digitally transforms operations with its GPS and silviculture management system, which allows for planning, execution and reporting on planting operations. The entire process is electronically controlled to ensure consistent, precise operations. NovelQuip enhances efficiency, precision and consistency by combining several separate operations in one cost-effective, digitally transformed operation, thus reducing costs and facilitating improved decision-making. TIA will continue to harness its investment pipeline and strategically foster the application of cross-functional integrated technology innovations to enhance agriculture productivity and competitiveness.

[15] *This is a new output and output indicator as of 2023/24. The 'old' output 1.5 (Leveraged funds) has been moved in support of Outcome 3. The reader is referred to Section 14.2 in this regard.*

Novel technology innovations from the advanced manufacturing sector fit directly within the ambit of modernising the manufacturing sector and creating new commercial opportunities across several sectors of the economy. The application of high-end advanced manufacturing capability coupled with industrial expertise, SET skills and integration with advanced digital capabilities contributes toward increasing manufacturing outputs within the country and African region. Despite recent global pandemics and macroeconomic shifts such as the silicon chip shortage which had major impact across critical sectors such as auto and advanced electronics, the manufacturing sector remains a key sector that presents greater market opportunities for machinery, equipment and appliances, motor vehicles and transportation equipment including chemicals. The sector remains a critical source of new job creation and the export of manufactured products, which will continue to boost the country's GDP and generate indirect jobs in a multitude of industry sector verticals such as health, electronic vehicles and ICT amongst others within the broader economy.

Technology innovations emanating from the advanced manufacturing sector continue to solve societal challenges and generate new market opportunities within the health sector. The Cardio Flow technology innovation provides much needed intervention through a portable, user-friendly, hand-held, point-of-care screening device that will be able to detect and predict potential cardiovascular diseases by extracting, normalising and predicting features of the internal carotid or common carotid artery of the individual using the characteristic features of ultrasound signals. Current medical ultrasound devices are not effectively adapted for the arterial measurements at various points on the neck where critical blood flows to and from the brain. Cardio Flow provides a portabable, cost-effective and easy-to-use probe suitable for primary health care that enables health care providers to make a quick diagnosis of cardiovascular problems.

TIA will continue to play a pivotal role in supporting and diffusing technologies that harness emerging market opportunities within the green economy to address climate change, as well as technologies that modernise mining and minerals processing, mineral beneficiation and water resource management. We will continue to grow new industry players within the circular economy to build a stronger ecosystem and value chain for transformation and economic development. Furthermore, we will continue to support these investments with a particular focus on prioritising strategic interventions that address key national imperatives for mining and mineral beneficiation, addressing the country's water crisis as well as prioritising supplier development and community development from new industry opportunities within the circular economy. These efforts will contribute to economic transformation and the creation of more jobs.

The mining sector continues to contribute much needed growth and to sustaining the country's GDP growth. The sector remains a priority for modernisation and transformation. We will continue implementing strategic interventions and commercialising novel technologies that advance how we extract and process raw materials, as well as diversifying new sources of growth and international export through our dedicated investments and strategic partnerships. For instance, the Smart Sensor technology system from the Natural Resources portfolio is an integrated system that integrates hardware and software programmes for the monitoring of mineral processing (i.e. crushing, grinding, and flotation processes) to increase the productivity of processing plants in the mining industry. The system positively impacts the ability to measure difficult material properties, throughput, stability, quality, grade and recovery. The technology currently generates revenue and continues to present a potentially significant source for international export markets.

The country needs deliberate strategic interventions and collective buy-in to curb the current energy crisis. The uncertainty of energy security and its overall adverse impact all sectors of the economy remain a going concern for all. The energy sector has experienced macroeconomic shifts that impacted price of oil and gas; the impact of human-caused climate change are increasingly evident around the globe with increased carbon emissions globally and transitions toward a global energy mix of power and hydrogen are underway. Increased carbon emissions remain a source of concern, triggering multiple interventions to unlock greater market opportunities including policy reform and technology innovations in the energy sector.

We remain resolute in promoting the energy sector imperatives for economic growth and social equity through expanded access to energy services and environmental sustainability to mitigate the effects of global climate change. Our role and focus are to facilitate the integration of hydrogen-related technologies in various sectors of the South African economy and to stimulate economic growth prospects. In support of the national Hydrogen Society Roadmap, TIA has approved and disseminated the hydrogen economy proposal to invite suitable innovators that are currently developing innovative energy technologies within the hydrogen economy with a niched focus on fuel cells for mobile and stationary applications and the production of green hydrogen, as well as infrastructure for storage, distribution and dispensing hydrogen.

TIA's investments in advanced ICT technology innovations and IP outputs continue to bear much anticipated commercial prospects in the creation of new high-tech commercial ventures as new sources of economic growth. Most of the TIA-funded ICT sectoral

technologies supported finding application and market footprint across many industry verticals through the underlying IP as an ICT platform or system. The nature and complexity of ICT systems that we currently employ to solve a plethora of social and industrial challenges are driven by underlying cutting edge capabilities such as AI and machine learning, blockchain, fintech, IoT, 5G connectivity, space innovations, cybersecurity and digital social enterprise systems will directly contribute growth prospects for the economy.

Moreover, there is an emerging trend of synergies of the components of the existing ICT technology innovations complementing other sector innovations within the TIA investment portfolio projects for cross-functional application, market validations and joint ventures. We are experiencing how the digital economy brings vast global market opportunities and its potential to modernise key sectors of the economy and infrastructure and capability for convergence, increased efficiencies and automation, complex analytic insights and disaster management control amongst many priorities in a 4IR driven economy and technology ecosystems and value chains. For instance; one of the commercialised innovation within the ICT sector is Contactable, which has grown exponentially as the world transitions to the digital era and there is less dependency on in-person identity verification and authentication. The SMME has managed to provide a much needed solution to industry through its digital identity management service orchestration platform that has great potential to address service delivery challenges and inherent cybercrimes.

As part of a systematic intervention for innovation enablement and to translate IP into commercial products diffused in the marketplace, we will strengthen the opportunity management process for the high IP pipeline. This will be implemented by accessing specialised knowledge and competencies from the TIA Technology Stations Programme (TSP) centres for SET expertise with the aim of decluttering complexity and assessing the technical feasibility and competitiveness of high IP technology innovations. We will also endeavour to tap into our existing Seed Fund programme to harness a bouquet of high-potential industrial, social and digital pipeline opportunities that have been de-risked to fast-track technology development and market validations. These cross-functional interventions will foster increased collaboration and facilitate the critical interactions and partnership between industry and academia for the express purpose of translating and increasing the conversion of technology innovations into commercially viable opportunities.

The planned strategic initiatives in support of Outcome 1 are presented in Table 11.

Table 11: Strategic initiatives in support of Outcome 1

Topic	Challenge or Opportunity	Strategic Initiative
Commercialising public-funded R&D for socio-economic benefit	Ad-hoc and sub-optimal technology commercialisation practices across the organisation	Implement an organisation-wide Commercialisation Strategy and Structure, including the use of appropriate instruments, e.g. convertible instruments
	IP leakage leading to loss of the opportunity to harvest the gains of public investment in RDI, including the lost opportunities of contributing to the fiscus and to society broadly	Implement the findings and remedial actions stemming from an independent study commissioned to investigate publicly-funded IP leakage, both at a national and a TIA level
	Opportunity to leverage off pockets of IP strength and technological capabilities within public-funded research institutions	Strategic alignment partnerships with key public research organisations that collectively possess the bulk of SA's national technological capabilities in radar science and engineering, and nuclear medicine
	Internal capacity and capability constraints for successful commercialisation of research	Address capacity and capability constraints within TIA, particularly in IP due diligence and deal-making
Leadership within the 4IR	Suboptimal coordination and non-participation in RSA 4IR Institute	Formulate a TIA-wide 4IR Strategy in the context of the RSA 4IR strategy
Energy security	Ensuring a Just Energy Transition for SA	• Collaboration with Eskom in repurposing and re-powering its old coal fleet • Collaboration with the Presidential Climate Commission in addressing SA's climate issues
	Decarbonisation of South African industry	Support the implementation of the Cabinet-endorsed Hydrogen Society Roadmap (policy)

12.3 Resource Considerations

Table 12: Commercialised Innovations Division expenditure estimates

	2023/24 (R'000)	2024/25 (R'000)	2025/26 (R'000)
Income	**93 212**	**98 246**	**101 911**
MTEF ring-fenced	-	-	-
MTEF baseline	93 212	98 246	101 911
Other income (specific contracts, interest and royalties)	-	-	-
Operational Expenditure	**17 592**	**17 644**	**17 698**
Support and infrastructure costs	1 152	1 204	1 258
Human resources	16 440	16 440	16 440
Investment Expenditure	**75 620**	**80 602**	**84 213**
MTEF allocation	75 620	80 602	84 213
Specific contracts	-	-	-

13. Bio-economy

13.1 Outcome Two: Delivering on the Bio-economy Strategy

Impact statement

TIA aims to stimulate a productive bio-economy through technology innovation, thereby making a significant contribution to SA's economy.

Outcome statement

TIA is the leading implementer of the innovation-focused aspects of the Bio-economy Strategy, by which SA's unique biological resources, historical biotechnology investments and bio-based capabilities are used for greater socioeconomic value. To track TIA's progress towards achieving Outcome 2 over the 2020-2025 Strategic Plan period, TIA will report on the number of successfully demonstrated bio-based technologies and the number of bio-based entrepreneurs and organisations accessing high-end SET services.

13.2 Planned Outputs and Output Targets

In order to foster a productive bio-economy, TIA has developed three outputs with the purpose of stimulating entrepreneurial activity in the bioeconomy.

Firstly, TIA will support the demonstration of bio-based technologies, products or services in agriculture, health, industrial biotechnology, IKS and other bio-based domains. Secondly, TIA will increase the impact of existing Technology Platforms across the country that offer high-end bio-based SET support to the biotech community. In addition, TIA will exploit emerging opportunities in strategic industries to establish new Technology Platforms. Finally, TIA will support a number of Technology Innovation Clusters in implementing collaborative innovation projects and activities in support of targeted bio-based industries.

TIA's output targets in support of delivering on the Bio-economy Strategy are presented in Table 13 and Table 14.

Table 13: Outcome 2 outputs, performance indicators and targets

Outputs	Output indicators	Audited Actual Performance			Estimated Performance	MTEF Period Targets		
		2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
2.1 Bio-based technologies developed	Number of successfully demonstrated bio-based technologies	New indicator	9	36	23	30	37	40
2.2 Technology Platforms managed and supported	Number of Technology Platforms that are operational and functional	New indicator	7	8	8	9	10	10
2.3 Technology Innovation Clusters managed and supported	Number of Technology Innovation Clusters that are operational and functional	New indicator	5	7	7	9	11	12

Table 14: 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	30	6	6	9	9
2.2 Number of Technology Platforms that are operational and functional	9	-	8	-	9
2.3 Number of Technology Innovation Clusters that are operational and functional	9	-	8	-	9

13.3 Explanation of Performance

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 comprehensively to 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 SA to improve the management of its renewable biological resources and open new and diversified markets in food and bio-based products. SA 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, increasing the number of jobs and businesses, fostering a healthier population and improving the economic and environmental sustainability of primary production and processing industries.

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

To address challenges and opportunities in the bio-economy, TIA has embraced continental and global thinking regarding models for the use of renewable biological resources to drive economic development and the circular economy. In doing so the Agency aims to address challenges in food security, biodiversity, environmental sustainability, health and industrial processes. The planned activities for 2023/24 and beyond will include the aspirations of the White Paper on Science, Technology and Innovation, supported by the DSI's Decadal Plan. Deliberate associations with the DSI through bilateral communities of practice are envisaged to ensure alignment and cohesion in planning and delivery.

TIA will, by means of existing and new initiatives, seek to contribute to national NSI priorities centred on, but not exclusive to, the Decadal Plan as follows:

- Intensification of agricultural R&D.
- Support for the registration of IP such as plant breeders' rights.
- The development of drought- and pest-resistant varieties and cultivars.
- Improved sector competitiveness throughout agricultural value chains.
- Funding to smallholder farmers by providing access to digital technologies for decision support.
- Access to markets by smallholder farmers by supporting phytosanitary, food safety and accreditation endeavours.
- Supporting the development of local solutions in health (digital and otherwise), including resource-poor settings.
- Further support to precision medicine technologies development.
- The localisation of biomanufacturing and the manufacturing of APIs for health, by increased internationalisation and in-bound technology transfer, and therefore rapid economic prosperity.
- The industrialisation of bio-processes and incorporation of the circular economy.
- The intensification of technology platforms for the development of high-end technological capability and infrastructure to support the generation of new knowledge by building on existing platforms for greater impact and by supporting local critical mass in next-generation technologies and systems biology.
- The implementation of bio-entrepreneurship interventions to benefit the start-up community – the interventions enable entrepreneurs to advance innovations beyond the technology demonstration stage.

In support of collaboration, linkages and alignment within the organisation, TIA 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. Deliberate endeavours will be made to create opportunities for internal partnering between TIA's Bio-economy Division and the TSP. Another opportunity for internal partnering is in cosmeceuticals, nutraceuticals and health infusions, where TIA's IKS business unit will establish facilities to assist in product development and the pre-commercial manufacturing of nutraceuticals and cosmeceuticals. In addition, the Agency will use the capabilities of its innovation infrastructure in the Technology Stations to support these initiatives.

The commercialisation of technologies developed in the NSI remains an untapped opportunity for impact, through the modalities of licensing, assignment or outright sale of developed IP and technology packages, facilitated by TIA, to start-ups and existing enterprises. Several sources of commercial opportunities include funded projects, cluster outputs, and platform outputs. Commercialisation through partnerships with the National Intellectual Property Management Office and the private sector will be an increased focus. This is to address directly the concern raised in the Ministerial Review of the Higher Education, Science, Technology and Innovation Institutional Landscape report on TIA's ability to meet the ambitious target of commercialising ventures in advanced technologies.

TIA's added effort towards delivering on its target to support the development of bio-based products is supported by its observation of the trends in venture capital financing of innovations. Venture capital investors are, to an increasing extent, investing in earlier stage opportunities, having recognised the value of taking equity stakes earlier on in the startup enterprise development process. This allows the funds invested to create value, which value can be realised upon exit from a mature investment to follow-on funders. The long-term gestational period and the high risk of life sciences projects has not deterred venture capital investment in the biotech sector globally, and this trend is expected to be mirrored in South Africa as TIA de-risks innovations. Seventy-five percent of investors that were active in Africa's venture capital landscape in 2021 were international investors, while 25% were African investors.[16] TIA notes this trend which is indicative of high interest in African opportunities by this investment type.

Global food demand will increase by 70% by 2050, with demand in Africa growing even faster according to World Bank forecasts. Africa can help meet the challenge of food security, as 60% of the world's uncultivated arable land is in Africa. To meet this demand, investment and education are needed to modernise farming practices on the continent, as has been articulated in the Cabinet-approved Decadal Plan. Commercial lending through banks and institutions is unaffordable, which creates an opportunity for impact investors in agricultural start-ups to participate in blended financing models. TIA will pursue impact investment partners who will assist TIA to address social and environmental challenges while generating balanced financial returns.

[16] *Venture Capital in Africa Report, 2021.*

The healthcare sector has seen substantial development over the last two years and is expected to continue to be a major focus in 2022 for impact investing.[17] Healthcare is the fastest growing area for impact investing and continues to be significant in demonstrating societal impact, which is a major objective for private equity on the African continent. Impact investments fill the funding gap in many areas of the healthcare ecosystem, including drug and vaccine development, physical infrastructure or epidemic prevention and response (which exceeds TIA's available funding). The trends will assist TIA to position itself to co-fund large-scale programmes and infrastructure projects with impact investors and private equity partners.

The planned strategic initiatives in support of Outcome 2 are presented in Table 15.

Table 15: Strategic initiatives in support of Outcome 2

Topic	Challenge or Opportunity	Strategic Initiative
Bio-entrepreneurship	Low level support provided to bio-entrepreneurship	Review TIA's current bio-entrepreneurship-related interventions so that the Agency's support meets the needs of the ecosystem, through several partnerships in the NSI
Bio-manufacturing	Lack of biomanufacturing pilot facilities for entrepreneur support	Develop a model and expansion plan for bioprocessing platforms infrastructure to augment existing TIA offering in partnership with industry
Transformation broadly	Low response to underserved provinces and PDIs	Deliver appropriate services to underserved provinces through appropriate mechanisms which may include satellite interventions, or a wider-reaching initiative such as new cluster focused on cannabis (in response to the Cannabis Masterplan)

13.4 Resource Considerations

Table 16: Bio-economy Division expenditure estimates

	2023/24 (R'000)	2024/25 (R'000)	2025/26 (R'000)
Income	**249 734**	**259 378**	**269 254**
MTEF ring-fenced	214 734	224 378	234 254
MTEF baseline	-	-	-
Other income (specific contracts, interest and royalties)	35 000	35 000	35 000
Operational Expenditure	**38 921**	**38 921**	**38 921**
Support and infrastructure costs	2 392	2 392	2 392
Human resources	36 529	36 529	36 529
Investment Expenditure	**210 813**	**220 457**	**230 333**
MTEF allocation	175 813	185 457	195 333
Specific contracts	35 000	35 000	35 000

14. Innovation Enabling

14.1 Outcome Three: SMMEs supported through strategically informed and regionally distributed Technology Stations

Impact statement

TIA aims to create jobs and opportunities by supporting technology-based SMMEs and co-operatives through its Technology Stations network.

[17] *EY What's Next for Impact Investing in Africa? 2022*

Outcome statement

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. To track TIA's progress towards achieving Outcome 3 over the 2020-2025 Strategic Plan period, TIA will report on the number of SMMEs accessing SET services on an annual basis.

14.2 Planned Outputs and Output Targets

In order to foster an enabling environment for innovation, TIA has developed five outputs.

Firstly, TIA will establish new technology and innovation support centres with the purpose of providing SET support to companies and individuals in targeted regions. Secondly, TIA will support the provision of SET and enterprise development support to SMMEs and co-operatives for the purposes of developing innovative products or services, thereby improving their revenue, growth and competitiveness.

Thirdly, TIA will support the participation of high-level (honours and above) students and post-doctoral fellows in TIA-funded initiatives to provide industry-relevant project experience. This will include work-integrated learning for students studying towards technical degrees. Fourthly, TIA will support the production of knowledge-based innovation products such as invention disclosures, patents, prototypes, technology transfer packages, technology demonstrators and plant-breeders rights, thereby translating the outputs of scientific research and related knowledge into innovations.

Finally, TIA will track the amount of monies contributed by third parties to investment initiatives for the purposes of funding technology development, technology commercialisation and related support activities. This measure will demonstrate TIA's relevance in the NSI through leveraging its own funding with co-funding from industry, development finance institutions and organisations in the public sector. TIA's output targets in support of providing enhanced inclusive access to SET and enterprise development support for SMMEs, grassroots innovators and co-operatives are presented in Table 17 and Table 18.

Table 17: Outcome 3 outputs, performance indicators and targets

Outputs	Output indicators	Audited Actual Performance			Estimated Performance	MTEF Period Targets		
		2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	20225/26
3.1 New centres established and supported	Number of new technology and innovation support centres providing SET support in targeted regions	New indicator	1	3	7	8	9	10
3.2 SET and enterprise support provided to SMMEs17 and co-operatives	Number of SMMEs[18] and co-operatives receiving SET and enterprise development support	3 269	1 990	3 167	2 820	3 000	3 100	3 200
3.3 High-level human capital development for competitiveness and new industry development	Number of high-level students and post-doctoral fellows funded/ co-funded	New indicator	New indicator	96	121	130	150	175
3.4 Innovation products produced[19]	Number of IP- and knowledge-based innovation products produced	New indicator	49	179	149	200	220	250
3.5 Leveraged funds[20]	Total Rand value leveraged	New indicator	R1,37b	R746,5m	R290m	R300m	R310m	R320m

Table 18: 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	5	0	1	2	2
3.2 Number of SMMEs and co-operatives receiving SET and enterprise development support	3,000	500	700	800	1,000
3.3 Number of high-level students and post-doctoral fellows funded/co-funded	130	0	30	0	100
3.4 Number of IP- and knowledge-based innovation products produced	200	30	40	60	70
3.5 Total Rand value leveraged	R300m	R40m	R65m	R85m	R110m

[18] *SMMEs incorporate grassroots innovators.*

[19] *It should be noted that scientific-related outputs (journal publications & conference papers) were removed from this indicator from 2022/23, this being the reason for the apparent drop from 2021/22 to 2022/23.*

[20] *This was Output 1.5 previously, and has been moved to Outcome 3 given the anticipated expanded interpretation of this outcome.*

14.3 Explanation of Planned Performance

TIA aims to catalyse, coordinate and enable the innovation ecosystem through systemic interventions, particularly where there are system failures and gaps. The Agency also seeks to address the myriad technological challenges faced by SMMEs, start-ups, science councils and universities by providing financial and non-financial support such as access to technological and innovation infrastructure and the provision of enterprise and business development support.

Furthermore, TIA aims to drive a strong transformation agenda focusing on women, youths and PWD through the Agency's diverse de-risking instruments that prioritises publicly funded IP. At the beneficiary level TIA wishes to do more to support these groupings. In this regard TIA intends launching dedicated women-, youth- and PWD-focused innovation support programmes in 2023/24 to ensure inclusive innovation. In so doing, the Agency will also seek to leverage off existing initiatives that focus on supporting women, youth and PWD in partnership with other organisations in the NSI.

The Agency will also secure industry partnerships, thereby leveraging TIA's resources and initiatives and demonstrating the Agency's alignment with the Decadal Plan. TIA also seeks to position innovation as central to improving the productivity and competitiveness of specific sectors.

TIA plans to support the entrepreneurship and startup community beyond the boundaries of the university to enable inclusivity and people-led development. In previous financial years TIA successfully piloted and rolled out new funding instruments, showing the agility and flexibility of TIA's strength in building a sustainable and responsive ecosystem with other stakeholders in NSI, both internally and externally.

The priority for the year ahead is to focus on internal collaboration within TIA to improve the positioning of the TSP, particularly with regard to the Seed Fund Programme and the Grassroots Innovation Programme where beneficiaries are likely already to have received technical support at Technology Stations. TIA will focus on making operational and governance improvements at the pre- and post-investment stages to simplify the progression of projects within TIA's internal ecosystem.

The re-industrialisation of SA is critical for growing the economy and increasing the rate of employment. One of the proposed STI intervention areas in the Decadal Plan is high-tech industrialisation. Modernising the manufacturing sector through support provided through the Technology Stations Network and infrastructure upgrades at Technology Stations will enable economic growth.

The recent amendments to the TIA Act provide an opportunity to facilitate the achievement of TIA's existing mandate by permitting TIA to perform such functions as are necessary in territories outside of SA and also tap into international resources. The purpose of such cross-border actions is to contribute to investment initiatives for the purpose of funding technology development, technology commercialisation and related support activities, thereby enabling a sustainable entrepreneurship and innovation ecosystem in Africa. TIA has co-created and put strategic partnerships in place with several African countries to enable capacity building, peer-to-peer learning and market access opportunities. Through its International Partnerships Programme, TIA will pursue the following objectives:

- Promote bilateral of collaborative RDI initiatives.
- Promote market access and international networking for promising local technologies.
- Facilitate focused capacity-building partnerships for skills transfer into the NSI.
- Attract investments into the NSI for technology innovation and commercialisation.
- Support regional and continental STI initiatives as contained in the African Union and Southern African Development Community Ministerial Declarations and Action Plans.
- Position the TIA brand as the thought leader in innovation in Africa and beyond through the hosting of and participation in carefully selected international platforms, events and conferences.

In view of the current economic realities in SA, the government cannot combat the continuous increase in the rate of unemployment on its own. The economy is driven by both the public and private sectors. It is vital that stakeholders in academia and the private sector compliment government efforts to enable new start-ups that are in a better position to create jobs. Accordingly, TIA aims to further strengthen the solid foundation in the Seed Fund Programme model to attract firms to the development and deployment of core sectors of frontier technologies. This would enable traditional production sectors to bring "new thinking for old industries" to benefit from multiple channels of diffusion, IP rights, patents and the exchange of knowledge and know-how.

TIA's mandate includes the provision of non-financial support that focuses on building an ecosystem beyond inventions and innovations. The Agency's role as a service provider will be enhanced at the Technology Stations and Technology Platforms support infrastructure level through the provision of SET solutions for technical challenges to individuals, researchers, SMMEs and industry to deal with technology barriers which also contribute towards improving the competitiveness of existing industries. The eighteen Technology Stations and eight Technology Platforms are mostly housed at universities and enable small business to adopt new technologies demonstrated

via TIA's acquired cutting-edge research equipment, facilities and associated world-class expertise to lower technological barriers for public and private users to engage in technology innovation. This also improves interaction between industry and academia in advancing technologies where TIA has a key role both upstream and downstream in the value chain to enable social upliftment.

Based on TIA's performance in 2020/21 and 2021/22 and its performance in 2022/23 for the year to date, the Agency risks not meeting its five-year target of the number of SMMEs accessing SET services (output 3.2). This is attributed primarily to regular delays in terms of annual funding allocations towards Technology Stations, resulting in significant financial and operational strain being experienced by them, thereby affecting their performance and ability to deliver against targets. This matter has and will continue to receive urgent attention to mitigate the risk of not achieving TIA's targets. The Agency, together with its Shareholder the DSI, has agreed to a Technology Stations funding decision model and approach that will alleviate the financial and operational strain being experienced by Technology Stations, by ensuring on-time and predictable funding allocation decisions and disbursements. Furthermore, TIA will add to its network of Technology Stations over the MTEF period, thereby enlarging the capacity to support additional SMMEs and co-operatives through an expanded footprint.

The need for skills development alongside RDI has become increasingly important for TIA, particularly given that the Agency's Shareholder, the DSI, reports to the same Minister as the DHET. Embedding skills development within TIA's programmes and interventions is important in order to present an expanded offering to entrepreneurs and citizens to combat SA's triple scourges of poverty, inequality and unemployment, particularly aligned with the country's draft Master Skills Plan.

There is a global scarcity of skills associated with cutting-edge technologies needed for the bio-economy, such as industrial biotechnology, synthetic biology, phenomics and the associated computational ("big data") biology. In response, TIA has revised its plans in relation to its Technology Innovation Cluster Programme and Technology Platforms Programme to include skills development.

By way of example, one of the objectives of the Forestry Bio-industry Cluster is to invest in advanced human capital development in biorefinery technologies, plant genomics, precision forestry and biotechnology. A key mandate of the Cluster will be to produce strong African research leaders and technopreneurs through relevant and ongoing interventions, training and defined opportunities for optimal productivity and career growth.

The Forestry Bio-industry Cluster has created an integrated, transdisciplinary environment that will expose students, researchers and visiting scientists to these technologies and their applications, enabling strategic training opportunities. Candidates receive training in industrially relevant skills. e.g. industrial biotechnology, wood chemistry, DNA fingerprinting and tissue-culture.

To effectively tackle the challenge of unemployment and economic growth, there is a need to bridge theoretical learning and experiential training by offering an environment for students to apply the knowledge acquired. This experiential training requirement is geared towards the improved capacity of graduates through the work integrated learning and graduate internship programmes. Both university and technical and vocational education and training (TVET) college graduates will be placed in TIA-funded programmes to have access to state-of-the-art equipment and platforms enabling them to work on industry related projects giving them a competitive edge in industry and contribute to curriculum improvements for future and student involvement in industry related projects. This will be done in collaboration with Centres for Occupational Excellence.

TIA's TSP has been engaging with the TVET system with the objective of enabling skills development which would support industrial development opportunities. Another focus will be on quality assurance and accreditation of the skills and human capital development components within RDI projects and programmes, with the guidance and advice of DHET. Examples of such programmes are those focused in the 4IR, as well as those focused on supporting entrepreneurship and innovation including Living Labs, Agri Innovation Hubs and grassroots innovators.

There is a quality pipeline of over a billion rands in the Seed Fund Programme consisting of proof of concepts, prototypes and clear IP strategies for 228 active projects, mostly in health innovation. TIA has partnered with OTTs at universities, incubators and regional development agencies, representing 36 active implementing partners. TIA will use its strong network of collaborating partners to source new application and manage them across the public sector to also drive public procurement spend, uptake and market entry of locally developed technologies.

In terms of TIA's response to the circular economy priority in the DSI's Decadal Plan the GCIP-SA is now part of a global network initiative aimed at promoting clean technology innovation and supporting entrepreneurs in growing their SMMEs and start-ups into viable, investment-ready businesses.

The programme commenced in January 2018, and TIA has been affirmed recently as the selected national implementer and country host for the programme, with R32 million committed in Phase 2 from the United Nations Industrial Development Organization, the founding organisation through its Global Environment Facility.

TIA successfully scouted and enrolled over 110 grassroot innovators across all nine provinces last year. TIA will continue rolling out new centres countrywide. This will ensure the provision of access to ICT and smart systems with the aim to bridge gender and generational gaps and to ensure the inclusion of the most marginalised in society.

SA has repeatedly demonstrated that its people have incredible ability and potential. It is up to TIA to help harness that ability and for this reason the Agency believes that is essential for TIA to be agile and flexible in terms of implementing its mandate to take a promising concept to commercial success. Operating within an ecosystem, TIA has a critical role as an industry builder by supporting the development of new sectors such as green economy and biotech, or emerging industries within the frontier technologies.

The planned strategic initiatives in support of Outcome 3 are presented in Table 19.

Table 19: Strategic initiatives in support of Outcome 3

Topic	Challenge or Opportunity	Strategic Initiative
Commercialising public-funded R&D for socio-economic benefit	Limited capacity to commercialise promising technologies at historically disadvantaged HEIs	Implement a commercialisation capability-building programme at public-funded research organisations (Chuma)
Transformation and inclusive innovation	The needs of women, youth and PWD are not being given sufficient attention	Launch dedicated women-, youth- and PWD-focused innovation support programmes in support of inclusive innovation
Broad public expenditure on and support of RDI	Low or no funding allocated to innovation in the public sector	Lobby for enabling legislation to set aside a portion of all public funds to be ringfenced for a South African equivalent of the United States Small Business Innovation Research programme
Coordination and leadership within national and regional innovation ecosystems	Regional innovation ecosystems in underserved provinces remain nascent and sub-optimal	Develop a Regional Innovation Strategy and plan for TIA, with an emphasis on underserved provinces
	TIA's position as an industry-builder in the NSI is sub-optimal	Establish strategic innovation programmes through thematic innovation networks Develop and implement an Enterprise Development Fund partnership strategy

14.4 Resource Considerations

Table 20: Innovation Enabling and Support Division expenditure estimates

	2023/24 (R'000)	2024/25 (R'000)	2025/26 (R'000)
Income	**163 468**	**161 879**	**179 339**
MTEF ring-fenced	46 862	48 966	48 966
MTEF baseline	25 606	31 913	38 789
Other income (specific contracts, interest and royalties)	91 000	81 000	91 583
Operational Expenditure	**19 873**	**19 913**	**19 955**
Support and infrastructure costs	896	936	978
Human resources	18 977	18 977	18 977
Investment Expenditure	**143 595**	**141 966**	**159 383**
MTEF allocation	52 595	60 966	67 800
Specific contracts	91 000	81 000	91 583

15. Administration

Administration consists of the CEO's Office, Corporate Services and the CFO's Office. Administration aims to provide an effective and efficient enabling environment for the Agency to achieve its mandate and deliver on its strategy.

15.1 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 21 and Table 22.

Table 21: Administration outputs, performance indicators and targets

Outputs	Output Indicators	Audited Actual Performance			Estimated Performance	MTEF Period Targets		
		2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
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 with no material matters in the audit report	Unqualified external audit opinion with no financial matters in the audit report	Clean external audit opinion	Clean external audit opinion	Clean external audit opinion
A1.2 Improved investment decision turnaround time for funding applications[21]	a) Investment decision turnaround time for funding applications <R1m	New indicator[22]	New indicator[23]	Did not achieve the 4-week turnaround time target (ave. was 18.9 weeks)	Will not achieve the 4-week turnaround time target	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[20]	New indicator[21]	Did not achieve the 15-week turnaround time target (ave. was 19.6 weeks)	Will not achieve the 15-week turnaround time target	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[20]	New indicator[21]	Did not achieve the 26-week turnaround time target (no decisions taken by 31 March 2022)	Will not achieve the 26-week turnaround time target	Achieve a 26-week turnaround time	Achieve a 26-week turnaround time	Achieve a 26-week turnaround time
A1.3 Support transformation initiatives in underserved provinces	Allocation of funds to underserved provinces	New indicator	New indicator	New indicator	30% of available investment funds allocated	At least 30% of available investment funds allocated	At least 30% of available investment funds allocated	At least 30% of available investment funds allocated

[21] *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.*

[22] *Average turnaround time was 54 weeks.*

[23] *Average turnaround time was 32 weeks.*

Outputs	Output Indicators	Audited Actual Performance			Estimated Performance	MTEF Period Targets		
		2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
A1.4 Support the transformation of TIA's investment portfolio	Allocation of funds to transformed recipients	New indicator	New indicator	New indicator	30% of available investment funds allocated	At least 40% of available investment funds allocated	At least 50% of available investment funds allocated	At least 50% of available investment funds allocated

Table 22: Administration output indicators and annual and quarterly targets

Output indicators	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	Clean external audit opinion	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 40% of available investment funds allocated	No target	No target	No target	At least 40% of available investment funds allocated

15.2 Explanation of Planned Performance

Administration has the following strategic initiatives (Table 23).

Table 23: Strategic initiatives in support of Administration

Topic	Challenge or Opportunity	Strategic Initiative
Stakeholder satisfaction	Long investment approval turnaround times	Comprehensively address limiting factors to shorten turnaround times, including: • Tailor funding processes and funding application assessment toolkits according to funding thresholds and Delegation of Authority levels • Utilise tiered and staged milestone-based funding approvals for high-value applications • Expand the panel of external experts • Flexible application of funding instruments under a new paradigm • Implement a fund-of-funds approach to programmes managed where appropriate through appointing fund managers who would implement programmes on TIA's behalf

Topic	Challenge or Opportunity	Strategic Initiative
Internal systems	Data system limitations (utilisation and capability) and performance data limitations (quality and availability)	• Finalise the design and implement the Enterprise Resource System • Re-establish and resource the business intelligence function
Financial Resources	Limited financial resources to meet growing project pipeline funding requirements	• Exploring appointing fund managers who would raise additional capital from external investors through leveraging TIA funding

15.3 Resource Considerations

Table 24: Administration expenditure estimates

	2023/24 (R'000)	2024/25 (R'000)	2025/26 (R'000)
Income	**100 217**	**99 792**	**108 101**
MTEF ring-fenced	-	-	-
MTEF baseline	79 717	77 292	78 415
Other income (specific contracts, interest and royalties)	20 500	22 500	29 686
Operational Expenditure	**100 217**	**99 792**	**108 101**
Support and infrastructure costs	45 970	46 545	48 737
Human resources	54 247	53 247	59 364

16. Institutional Resource Considerations

TIA's budget allocation for the MTEF period 2023/24 to 2025/26 is shown in Table 25.

Operational Costs

Support and infrastructure cost allocations have been prepared using a zero-based budgeting process focused 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).

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 SA Reserve Bank. Returns generated will be used to fund innovation initiatives.

Table 25: TIA budget allocation for the MTEF period 2023/24 to 2025/26

	Budget 2023/24	Budget 2024/25	Budget 2025/26
	R' 000	R' 000	R' 000
Administration	**175 603**	**176 269**	**184 673**
Support & infrastructure cost	50 410	51 076	53 364
Human Resources	125 193	125 193	131 309
Investments	**440 612**	**453 609**	**473 930**
Bioeconomy	210 814	220 457	230 333
Technology Stations	92 013	92 013	96 135
Commercialisation	75 620	80 602	84 213
Innovation Enabling	62 165	60 536	63 248
Total Expenditure	616 215	629 878	658 603
Total Funding	**616 215**	**629 878**	**658 603**
Allocation from DSI	460 132	480 795	502 334
Baseline (Excl. Bio-economy & Technology Stations)	198 535	207 451	219 115
Bio-economy	214 734	224 378	234 254
Technology Stations	46 863	48 966	48 965
Additional income target	135 583	124 583	130 164
Other income	10 000	11 000	12 000
Interest	10 500	13 500	14 105
Surplus/(Deficit)	-	-	-
Capex allocation:	8 000	5 000	5 000
Efficiency ratio	15%	15%	15%

17. Updated Key Risks and Mitigation from Strategic Plan

Stemming from the Strategic Plan, TIA employs a robust, systematic process at both operational and strategic level that is integrated with 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 SA's risk principles and TIA's Enterprise Risk Management Policy. TIA manages its risks at strategic, operational and project levels.

Table 26 outlines the key risks relating to TIA's outcomes together with identified risk mitigation measures.

Table 26: 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

Outcome 1

Commercialised innovations

Indicator title	1.1 Number of licensed or assigned technologies
Definition	IP 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	IP has been created
Disaggregation of beneficiaries	• Women-owned businesses or women entrepreneurs: ≥30% • Youth-owned businesses or youth entrepreneurs: ≥20% • Entrepreneurs who are PWD or businesses owned by PWD: ≥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 a public funded research organisations (inclusive of public-funded HEIs and science councils) 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 PWD or businesses owned by PWD: ≥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 PWD or businesses owned by PWD: ≥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	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 PWD or businesses owned by PWD: ≥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 of royalties, sales and exits
Definition	Amount of funds derived from commercialised innovations. This includes the tracking of royalty payments, revenue generated through the sale of equity holdings in TIA-supported companies and redemptions from exits.
Source of data	• Programme or project databases/royalty register • Invoices, statements, and GL/Financials • Contracts/awards or agreements/Letters of Intent
Method of calculation	Simple count of the combined value of royalty payments, revenue generated by the sale of equity holdings in TIA-supported companies and redemptions from exits.
Means of verification	Verification of supporting documentation
Assumptions	Third parties have available funds to spend on innovation, the ability to repay does not stifle the growth of the company/tech
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	N/A
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[24] technologies, products or services that have reached demonstration stage in agriculture, health, industrial biotechnology, IKS and other bio-based domains.
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 PWD or businesses owned by PWD: ≥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

[24] *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.*

Indicator title	2.2 Number of Technology Platforms that are operational and functional
Definition	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	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 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	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 and entreprise development support for the purposes of developing innovative products or services through the financial or non-financial support of the TIA-funded initiatives.
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 PWD or businesses owned by PWD: ≥3%

Indicator title	3.2 Number of SMMEs and co-operatives receiving SET and enterprise development support
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 funded/co-funded
Definition	Students enrolled at universities or universities of technology for an honours, master's or doctoral qualification, work integrated learning (equivalent and above) or post-doctoral fellows 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 or from other TIA projects confirming the student is being funded or co-funded through TIA initiatives. • 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 students and post-doctoral fellows 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% • PWD: ≥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 in 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 innovation (process, market, product or improved service delivery) that is quantifiable (e.g. invention disclosure, patent, prototype, technology transfer package, technology demonstrator, plant-breeders rights). 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

Indicator title	3.4 Number of IP and knowledge-based innovation products produced
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% • PWD: ≥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

Indicator title	3.5 Total Rand value leveraged
Definition	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 • Award letters • 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

Administration

Effective and efficient internal environment to effect the strategy

Indicator title	A1.1 Achieve a clean external audit opinion
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 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) not to 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 (2022/23 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-committees • 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 recipients in underserved provinces divided by (the total value of uncommitted funds at the beginning of the financial year minus total value of unspent funds at the end of the financial year) as a percentage. • Uncommitted funds exclude multi-year contractual commitments as part of agreements signed in previous years, and also funds earmarked for deployment under existing programmes.
Means of verification	Verification of supporting documentation
Assumptions	• Availability of sufficient unspent and uncommitted funds as of 1 April 2023 • Willing partners/funding recipients. • Funds are to be spent in underserved provinces
Disaggregation of beneficiaries	N/A
Spatial transformation (DDM)	Recipients in the Northern Cape, Limpopo, Free State, Eastern Cape, North West and Mpumalanga provinces; 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 transformed/ black recipients divided by (the total value of uncommitted funds at the beginning of the financial year minus total value of unspent funds at the end of the financial year) as a percentage • Uncommitted funds exclude multi-year contractual commitments as part of agreements signed in previous years, and also funds earmarked for deployment under existing programmes.
Means of verification	Verification of supporting documentation
Assumptions	• Availability of sufficient unspent funds as of 1 April 2023 • 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

Notes

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