technology innovation
AGENCY
Innovating Tomorrow Together

ANNUAL PERFORMANCE PLAN | 2021/22

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

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FOREWORD BY CHAIRPERSON

I am pleased to present the Technology Innovation Agency's (TIA) Annual Performance Plan for the Financial Year 2021/22.

TIA enters the Financial Year 2021/22 against the backdrop of the second wave of the COVID-19 pandemic that has wreaked havoc on the health of our people, their livelihoods and the economy. In the last year alone, the aftermaths of the pandemic saw 35 800 people lose their lives, approximately 1.3 million infected, the GDP contracted over 50% by the second quarter of 2020 and unemployment rising to 30.8%. In response to these, the South African Government implemented extensive measures to mitigate the impact of the pandemic, ranging from lockdowns, economic relief and introduced stimulus packages to manage the economic fall-out arising from the effects of the pandemic in the country. All these required the Treasury to redirect budgets towards COVID related initiatives and hence effecting budgets cuts to all government departments. Like all government entities, TIA had to contend with budget cuts and reprioritisation of its funding and other resources towards the pandemic.

These developments, put the South African National System of Innovation (NSI) to a test, helping us to assess its resilience and ability to deploy the capabilities that the government, under the stewardship of the Department of Science and Innovation (DSI) has invested in over the years. There is no question that, in this, TIA played its part through a range of interventions in the Technology Platforms, Technology Stations and fast-tracking the deployment of various invested technologies in the economy.

TIA's Annual Performance Plan for the year ahead, therefore, 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. This being the second year in implementing the Strategic Plan 2020-2025, TIA's annual plan has been designed to respond to the government's imperatives around COVID-19 challenges. The annual plan emphasises efforts to enhancing commercialisation of technologies that address the health of our people, food security, heightening exploitation of our biological resources and increasing investments in technologies that contribute to economic revival and reindustrialisation of the South African economy.

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

Having proven the strategic importance of technology stations and platforms in responding to COVID challenges, TIA will work closely with the DSI to continue investing in these capabilities, strengthening their offerings and ensuring that they continue to play a central role in the deployment of research output and support to SMMEs and companies, thereby reducing the challenges of unemployment and joblessness that threaten the SMME sector.

Budget cuts are real and the fiscus is constrained. In this environment, the agency is challenged to intensify efforts to building partnerships that will bolster the execution of its mandate through co-funding initiatives, exploitation of resources and other forms of expertise and capabilities that lie in other areas of the eco-system. In so doing 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.

The Department's launch of the Innovation Fund represents a significant development in government's efforts to increase the rate of commercialisation in South Africa. This will ensure that partnership with the private sector is driven through a structured framework that is designed to increase the rate of industrialisation leading to the creation of viable companies that will develop products, create jobs and grow exports to international markets of novel South African technologies. The initial deployment of the innovation fund gives TIA a good start during this pilot phase, giving the agency an opportunity to build the requisite capabilities to fully implement and utilise this instrument as more funding becomes available.

Lastly, the TIA ministerial review commenced in November 2020 with the aim of evaluating the effectiveness of TIA's programmes, the agency's positioning in the NSI, and to recommend measures to the minister on ways to enhance the agency's execution of its mandate. The TIA Board and management welcome this initiative as an opportunity to reflect and look for ways to strengthen the organisation, ensuring that it fulfils the purpose for which it was intended and is appropriately geared to respond to shifts in the landscape as circumstances dictate.

I wish to thank colleagues at the Department of Science and Innovation, in particular, the Director-General and his senior leadership, my colleagues in the TIA Board, and the TIA management and staff for all their contributions in putting this plan together.

Butana Mboniswa
Interim Chairperson of the Board

OFFICIAL SIGN-OFF

It is hereby certified that this Annual Performance Plan (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 2021/22.

SIGNED BY:

Petro Dekker
Executive: Corporate Services
Signature: _____

Dr Vuyisile Phehane
Executive: Bio-economy
Signature: _____

Brian Mphahlele
Executive: Commercialisation
Signature: _____

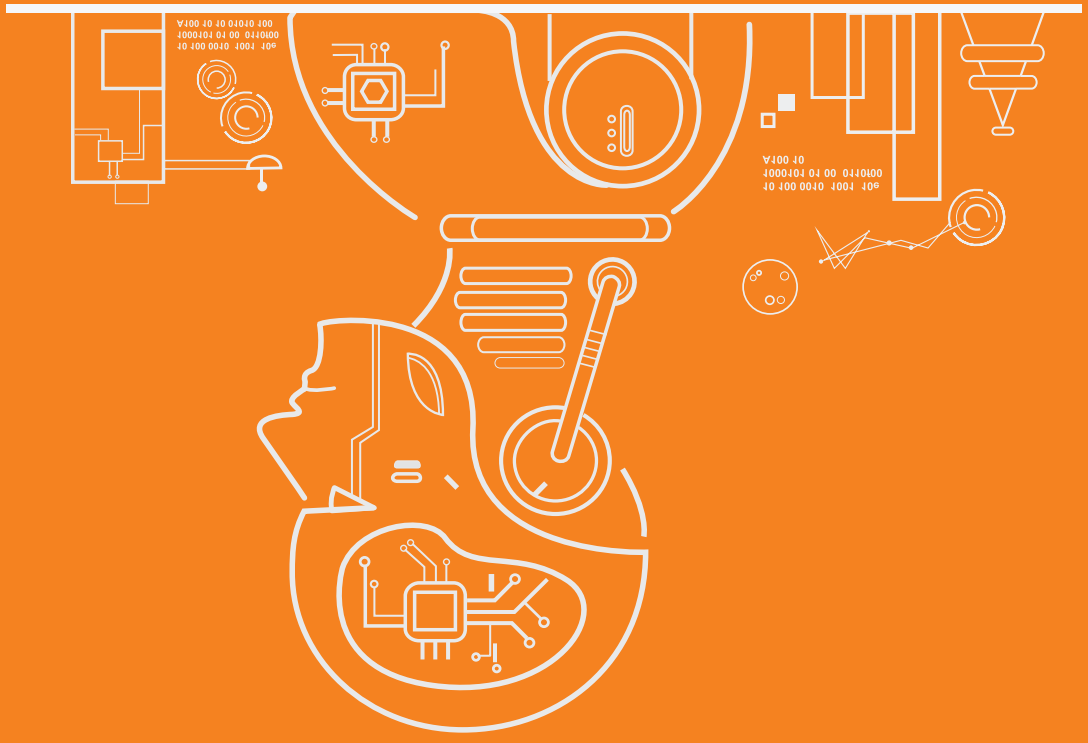
Tandokazi Nquma-Moyo
Acting Executive: Innovation Enabling
Signature: _____

Ismail Abdoola
Chief Financial Officer
Signature: _____

Patrick Krappie
Acting Chief Executive Officer
Signature: _____

Butana Mboniswa
Interim Chairman of the Board
Signature: _____

PART A: MANDATE



1. UPDATES TO RELEVANT LEGISLATIVE AND POLICY MANDATES

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) (hereinafter "PFMA"). Its mandate is derived from the provisions of the Technology Innovation Agency Act (Act 26 of 2008), read together with Sections 19-23 of the Science and Technology Laws Amendment Act (Act 7 of 2014), which establishes TIA as an agency to promote the development and exploitation, in the public interest, of discoveries, inventions, innovations and improvements. TIA's objective is to support the state, through the DSI, in stimulating and intensifying technological innovation to improve economic growth and the quality of life of all South Africans by developing and exploiting technological innovations.

2. UPDATES TO INSTITUTIONAL POLICIES AND STRATEGIES

TIA's strategic programmes are aligned to the following policies and strategies.

2.1 UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

The sustainable development goals seek to end poverty and hunger in the world; combat inequalities within and among countries; build peaceful, just and inclusive societies; protect human rights and promote gender equality and the empowerment of women and girls; and ensure the lasting protection of the planet and its natural resources. Countries committed to the sustainable development goals aim to create conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all, considering different levels of national development and capacities. The goals are integrated and indivisible and balance the three dimensions of sustainable development, i.e. economic, social and environmental.

Over the five-year period, with respect to contributing to ***Goal 1 – No Poverty; Goal 2 – Zero Hunger; Goal 3 – Good Health and Well-being; Goal 8 – Decent Work and Economic Growth; Goal 9 – Industry, Innovation and Infrastructure; Goal 10 – Reducing Inequality and Goal 11 – Sustainable Cities and Communities***, through directed funding of innovation and commercialisation TIA stimulates industry and the broader economy through which the above goals are addressed. TIA has planned to accelerate the translation of indigenous knowledge outputs to products and services that can contribute to redressing socioeconomic vulnerabilities in marginalised communities in South Africa; ensuring increased inclusivity that encourages the participation of women, youth and persons with disabilities; as well as contributing to the conservation of the country's natural resources.

2.2 AFRICAN UNION AGENDA 2063

Agenda 2063 is a strategic framework for the socioeconomic transformation of Africa over the next 50 years. It builds on and seeks to accelerate the implementation of past and existing continental initiatives for growth and sustainable development. A 10-year Science, Technology and Innovation Strategy for Africa was adopted during the 23rd Ordinary Session of African Union Heads of State and Government in 2014. The strategy, which promotes competitiveness through human capital development, innovation and value-addition, is part of the African Union's long-term, people-centred Agenda 2063. This is underpinned by science, technology and innovation (STI) as multifunctional tools and enablers for achieving continental development goals. Agenda 2063 calls for diversifying sources of growth for Africa's economic performance and, over the long term, lifting large sections of the continent's population out of poverty. The strategy also fosters social transformation, economic industrialisation and entrepreneurship. TIA plans to increase collaboration with research institutions across the continent through the implementation of joint technology development programmes and provides technical competence and entrepreneurial capacity to increase the application of knowledge outputs in stimulating socioeconomic transformation.

2.3 NATIONAL DEVELOPMENT PLAN 2030

The National Development Plan recognises that developments in STI fundamentally alters the way people live, communicate and transact. The plan highlights that these areas are key to equitable growth and underpin economic advances, improvement in health systems, education and infrastructure. The plan is now in its second phase (2019-2024), during which "the country should lay the foundations for more intensive improvements in productivity".

2.4 ALIGNMENT WITH THE 2019-2024 MEDIUM TERM STRATEGIC FRAMEWORK

Government's 2019-2024 Medium Term Strategic Framework (MTSF) serves as the implementation plan for the second phase of the National Development Plan. Seven priorities are identified to guide planning by all stakeholders.

Priority 1: A capable, ethical and developmental state
Priority 2: Economic transformation and job creation
Priority 3: Education, skills and health
Priority 4: Consolidating the social wage through reliable and quality basic services
Priority 5: Spatial integration, human settlements and local government
Priority 6: Social cohesion and safe communities
Priority 7: A better Africa and world

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

2.5 NATIONAL SPATIAL DEVELOPMENT FRAMEWORK 2050

The National Spatial Development Framework 2050 is a strategic long-term plan that seeks to set out national spatial directives for all forms of infrastructure investments and development spending targeted by government in partnership with the private sector. In realising this, one of the key thrusts of the plan is *"technology, innovation, resilience and disruptions in the space economy"*, wherein South Africa will attend to the roll out of fast broadband access across South Africa; support the development of highly automated mining activities; and promote automation in key economic sectors such as manufacturing and agriculture, among others. TIA will increase the footprint of its innovation infrastructure to contribute to the plan's aspirations of *"a focus on innovation and knowledge generation, packaging and sale, expansion, modernisation and re-gearing of the higher education sector towards growing and supporting innovation"* over the medium-term by ensuring that the interventions it undertakes lead to inclusive localised development.

2.6 WHITE PAPER ON SCIENCE, TECHNOLOGY AND INNOVATION

Cabinet's adoption of the 2019 White Paper on Science, Technology and Innovation in 2018/19 signals material policy shifts for activities related to STI to address aspects such as transformation and inclusivity, and strong linkages within the NSI. These include strengthening the culture of innovation within government and society; improving policy coherence and more effective budget and programme coordination within the NSI; implementing monitoring and evaluation systems; creating a more enabling environment that advances innovation; developing local innovation ecosystems; and increasing investment in technology-based SMMEs and support to grassroots and social innovation projects.

2.7 DSI DECADAL PLAN

The process to compile the new DSI Decadal Plan is ongoing. The plan will serve as the implementation plan for the 2019 White Paper on Science, Technology and Innovation. The timeline for finalising the Decadal Plan has been revised by the DSI to the first quarter of the 2021/22 financial year. The DSI 2020-2025 Strategic Plan is expected to be amended following the conclusion of the Decadal Plan compilation. TIA will align itself with the plan once it is finalised.

2.8 ALIGNMENT WITH DSI RESEARCH, DEVELOPMENT AND INNOVATION ROADMAPS

Over the years, the DSI has developed several research, development and innovation (RDI) roadmaps. These serve as key guiding national frameworks to guide research and development (R&D), investment decisions and collaboration among various stakeholders in the NSI. In implementing its activities under the various sub-programmes, TIA will continue to be informed by these roadmaps, which among others, include water, advanced manufacturing, information and communications technology (ICT), human settlements, waste management and research infrastructure. Over the strategic period, TIA will work closely with the DSI to ensure that there is greater alignment and translation of planned outputs to better inform decision-making and policy formulation.

2.9 BIO-ECONOMY STRATEGY

The Bio-economy Strategy seeks to use South Africa's bio-based resources to be a significant contributor to the country's economy by 2030, through the creation and growth of biotechnology-based industries. In turn, these new industries will generate and develop bio-based services, products and innovations in which new and existing companies will provide and utilise such solutions. The strategy provides a framework for investments and action by all concerned stakeholders in the NSI. Effective implementation of the Bio-economy Strategy, therefore, forms one of the four strategic pillars for TIA in the current strategic cycle and will be implemented with greater intensity. Over the five-year strategic period, TIA intends to undertake a renewed and deliberate emphasis on indigenous knowledge systems (IKS) as a key basis for promoting economic inclusion and transformation, with great potential to lead to the creation of new industries.

2.10 THE DISTRICT COORDINATION SERVICE DELIVERY MODEL

In August 2019, Cabinet approved a new district-based development model that will synchronise planning by all spheres of government at national, provincial and local levels, who will act in partnership with civil society, including communities, business and labour, at district level countrywide in the development of South Africa's municipal districts and metros. Termed, 'Khawuleza ("hurry up")' the model seeks to secure maximum coordination and cooperation among various stakeholders.

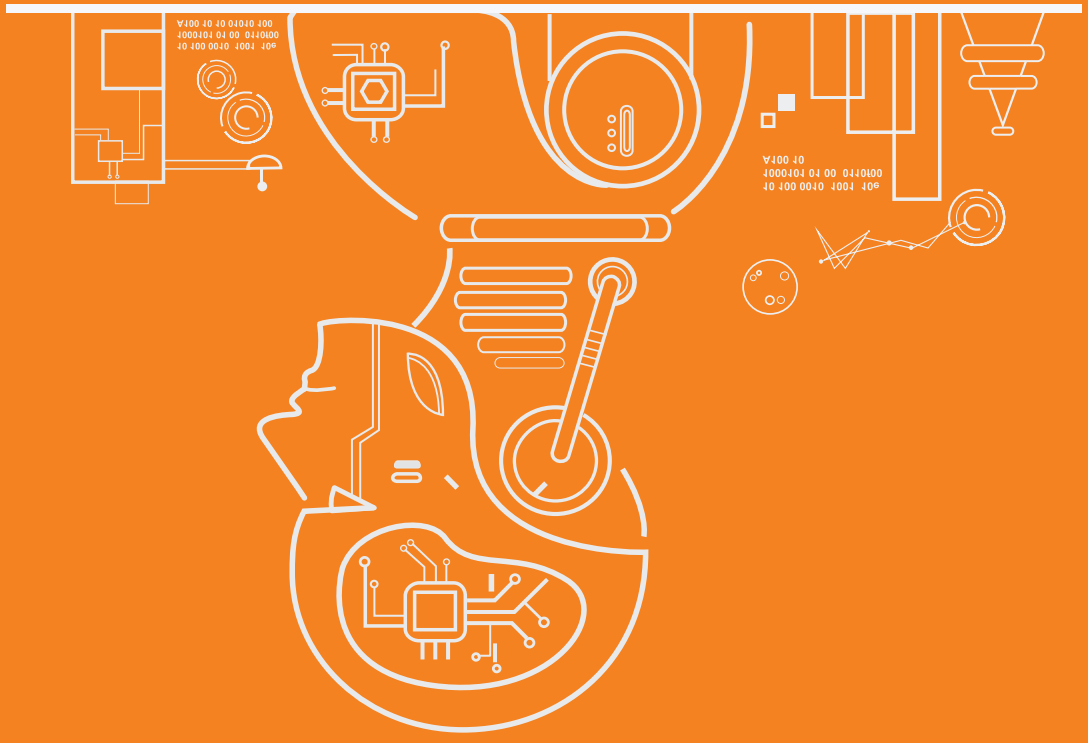
Government seeks to change the face of rural and urban landscapes by ensuring interconnectedness between urban and rural development, with a deliberate emphasis on local economic development. The district-driven model is directed at turning plans into action and ensuring proper project management and tracking. Shortcomings in previous service delivery models necessitated a new approach to development that would be more practical, achievable, implementable, measurable and clearly aligned to the key priorities of government.

The District Development Model is being implemented over a five-year period commencing in 2020/21 and will be rolled out throughout all 44 districts and eight metropolitan municipalities. The DSI is championing the implementation of the model in Ekurhuleni, Zululand and Ugu districts. TIA will deploy its funding and programmatic capabilities in these three priority districts. In addition to these prioritised districts, TIA will continue to work with the DSI through established structures led by ASSAf (Academy of Science of South Africa) to identify further collaborative opportunities to support innovation-related initiatives at district level.

3. UPDATES TO RELEVANT COURT RULINGS

Not applicable.

PART B: STRATEGIC FOCUS



4. UPDATED SITUATIONAL ANALYSIS

In developing this APP, the TIA Board and Management undertook a review of the external and internal environment to assess the factors that are likely to influence the organisation's ability to deliver on its strategy during 2021/22. An analysis of strengths, weaknesses, opportunities and threats (SWOT) is presented in Table 1.

TABLE 1: TIA SWOT ANALYSIS FOR 2021/22

STRENGTHS

- The uniqueness of TIA's offerings and extent of TIA's mandate
- Solid foundation of key programmes, e.g. Technology Stations, Technology Platforms and Seed Fund
- Strong pipeline of near-market technologies for greater impact in the future (TRL7[1] and above)
- Good baseline of strategic partnerships and strengthened relationships with key stakeholders, including greater shareholder confidence
- A track record of a sound governance and control environment
- Pockets of capable staff and robust IT capabilities with a demonstrable ability to function optimally, despite budget cuts, remote working, etc
- TIA's attractive brand equity across selected stakeholder networks
- TIA's strong Bio-economy focus

WEAKNESSES

- Operational inefficiencies related to (among others) turnaround times, processes, policies and systems, as well as significant time spent on a large historical portfolio
- Top heavy, thin on the ground, with a lack of appropriate skills, a high vacancy rate and insufficient capacity in key focus areas, e.g. commercialisation
- A lack of brand equity and alignment with certain stakeholder expectations in specific contexts
- Limited geographical footprint in distressed communities
- Poor communication, marketing and public relations capabilities, resulting in low media coverage, market awareness, etc.

[1] *TRL = Technology Readiness Level*

TABLE 1: TIA SWOT ANALYSIS FOR 2021/22 (CONTINUED)

OPPORTUNITIES

- Potential host/implementer of the Innovation Fund
- New policy thrusts in the MTSF and the White Paper on STI 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, technologies, etc. (particularly locally)
- Increased transformation within TIA's portfolio with regards to historically-disadvantaged higher education institutions and individuals, women, youth and persons with disabilities (due to the introduction of TIA's B-BBEE Policy, Transformation Framework and thematically-focused calls)
- Several of TIA's core sectors are aligned to national priority areas (e.g. ICT and Health) in relation to the Fourth Industrial Revolution (4IR), artificial intelligence (AI) -driven trends in digital health and telemedicine, etc.
- Increased focus on Bio-economy strategy will improve South Africa's strategic positioning
- Increase in demand for innovation/tech-based investments by industry, government and the funding community, leading to the potential for new funds (e.g. Clinical Trials Fund), programmes (e.g. IKS Platform) and partnerships
- Implementation of the District Development Model
- DSI and Department of Higher Education and Training (DHED) now reports to the same Ministry, offering opportunities to leverage partnerships with sector education training authorities and other DHED initiatives

THREATS

- Reducing fiscal allocation, with weakening economic conditions, leading to further potential budget cuts
- Negative market perception, resulting into a lack of confidence in TIA by the market
- Emerging players/competitors encroaching on TIA's core activities
- Lack of national co-ordination to upscale key focus areas
- Delays in commercialisation due to stringent regulatory requirements in critical focus areas e,g. health, industrial biotechnology
- Disruptions of technology development and commercialisation activities as a result of unrest at universities, COVID-19 related delays and others, leading to deferral of royalty payments, additional costs incurred by projects/programmes, etc.
- Inability of South Africa to respond to changing megatrends and emerging opportunities

A report[2] published by the UK-based innovation foundation Nesta, outlined their findings of an international comparative study of innovation agencies in various countries to investigate best practice in terms of designing and running an innovation agency. It also examined the type of policies and programmes that would be considered most effective for a particular context. The study found that there is no single model for a 'successful' innovation agency. Instead, there are a variety of roles that innovation agencies can perform. These are:

- Market and System Fixers: seek to address failures in markets and networks that impede business innovation and investment in R&D, often without preference for specific technologies or sectors.
- Industry Builders: focus on transforming an economy or creating new sources of economic competitiveness by investing in the development of a set of new sectors or technologies.
- Mission Drivers: aim to induce innovations that address major societal and economic challenges, often in policy areas of significant traditional R&D spending such as defence, energy, the environment or health.

TIA's mandate and role in the South African NSI aligns to the role of "Industry Builder". The report defines the mission for an industry builder as follows: *Industry Builders focus on transforming an economy by developing a specific set of new sectors or technologies, for example in green-tech, biotech, or nanotech industries*. Activities that lead to the creation of innovative businesses are centred around making direct investments or providing funding for companies in selected sectors or industries, whilst also investing in the wider support 'ecosystem' for innovative businesses (such as investments in incubators or accelerators). Activities are also driven by the intent to commercialise and internationalise business innovations. TIA's mandate and structure is well aligned with this role and it delivers its funding and support instruments in line with the Nesta defined 'Industry Builder' role.

TIA developed planned strategic initiatives to implement over the medium term. These included, at a high level: enhancing commercialisation; enhancing the role of the bio-economy in economic development; and positioning Technology Stations for enhanced SMME support. Progress has already been made in achieving the outcomes envisaged within these initiatives.

Efforts to modernise the Technology Station facilities have begun, and at least 60% of Technology Station national facilities are accredited with relevant standards such as ISO, SABS and SANAS to adequately address SMME pilot production needs. The Technology Station Programme (TSP) has already concluded a pilot concept note that will see the Technology Station positioned to adopt opportunities arising from the 4IR partnership with Centre for High Performance Computing (CHPC) at the CSIR. Additionally, TIA and the Small Enterprise Development Agency (SEDA) have signed a collaboration agreement for the next two years for implementation co-location and shared services of Technology Stations with rapid accelerators and tech-incubators in partnership with Technology Transfer Offices (TTOs) nationally. This also integrates the grassroot innovators programme with township hubs and tech development centres.

[2] *How Innovation Agencies Work: International lessons to inspire and inform national strategies, May 2016, Report location: https://www.nesta.org.uk/report/how-innovation-agencies-work/*

The focus on commercialisation outcomes has led to TIA's participation with the University of Pretoria on the Tuksnovation Seed fund programme – an ICT accelerator programme supporting ICT start-ups to commercialise innovations at the University. The Commercialisation Division has proactively positioned TIA to participate in and effectively manage the Innovation Fund, with the DSI already having approved funding for several TIA-supported projects to the value of R40 million specifically for commercialisation activities. The approved Enterprise Development Strategy will guide future activities and outputs in this area over the medium term.

Addressing progress made in regard to bio-economy outcomes, it can be reported that the ABIPP (Agriculture Bio-Economy Innovation Partnership Programme) Phase 1 was successfully concluded by the Agriculture sub-programme. Various strategic and collaborative partnerships, consortia and platforms were able to deliver on their main outputs, such as the development of breeding production technologies, technologies to manage plant pests, weeds and pathogens of economic importance. The second phase of ABIPP commenced in line with the DSI-approved ABIPP business plan for the period 2021/22-2023/24. The Health sub-programme was able to strengthen its partnership with the South African Medical Research Council through the joint management of COVID-19 diagnostics projects concerning the development of test kits and diagnostics and issued call for applications in health-related projects at HEI's (Higher Education Institute) and Science Councils, in medical devices, diagnostics and digital health. The IKS sub-programme has received funding from the Innovation Fund, and its allocation will be co-invested with the earmarked R51 million Natural and Indigenous Product Programme Fund, an initiative of TIA and the IDC which aims to support indigenous knowledge holders and SMMEs with technical assistance and commercialisation. Opportunities in the four thematic areas of African traditional medicines, cosmeceuticals, nutraceuticals and health infusions have been earmarked for investment.

5. EXTERNAL ENVIRONMENT ANALYSIS

5.1 THE COVID-19 PANDEMIC CONTEXT

South Africa has been severely affected by the global COVID-19 pandemic. The virus laid bare the fault lines in South Africa, with inequality, poverty and unemployment worsening due to the government-imposed restrictions associated with the national lockdown. For example, while the uptake of digital technologies has accelerated phenomenally in business, education, services and entertainment, the digital divide has widened between those with access to fast and reliable Internet access and those who do not. The effects of this are profound and will be felt for years to come.

The sharp decline in economic activity and curtailment of personal movement has led to a significant decline in current and projected tax collection, necessitating appreciable cuts in public sector budgets. However, it is the business sector which has experienced the brunt of the economic shocks, particularly those reliant on physical proximity for economic activity such as personal services (e.g. entertainment and tourism), mining and manufacturing. There has been a rise in business closures, retrenchments and associated job losses and loss of livelihoods, affecting households severely.

Prior to the global outbreak of the COVID-19 pandemic, South Africa's sovereign credit rating had been reduced to sub-investment grade. This has increased public sector borrowing costs and dissuaded foreign direct investment among other effects. South Africa's economy was already in distress, and the effects of the COVID-19-related national lockdown have exacerbated matters. Extremely challenging economic conditions are expected to persist going forward, requiring a redoubling of efforts to support economic recovery. These efforts will build on TIA's existing stakeholder network through leveraging resources in a collaborative and strategic manner.

The pandemic has demonstrated the importance of having strong NSI institutions with deep capabilities to respond rapidly to emerging national or global crises, thereby contributing to the nation's resilience. During the early period of the pandemic in South Africa, TIA's Technology Platforms were able to pivot and respond rapidly to national priorities such as COVID-19 testing and related activities. They continue to play a key part in the national COVID-19 response as well as within global efforts. This was only possible due to a long period of sustained financial support to Platforms through the Technology Platforms Programme as a key pillar in implementing the Bio-economy Strategy. The Technology Stations were able to respond in a similar, albeit reduced, fashion to the needs of SMMEs during the pandemic through participation in the National Ventilator Project and the continued provision of much-needed science, engineering and technology (SET) support to SMMEs, for example.

These two instances illustrate TIA's pivotal role in the NSI to continually invest in and upgrade scientific and technological capabilities necessary for innovation and entrepreneurship. While investing in discrete technology development projects will remain an important part of TIA's mandate, it is the economy-wide capabilities to innovate which are arguably more important for sustainability and lasting impact in the medium to long term. Continued and increased investment is therefore essential to ensure deep and strong scientific and technological capabilities for South Africa's socioeconomic growth and development.

In the same vein, the South African government, under the leadership of the DSI, has been an adherent to using foresight as a tool to envisage a range of different futures, and making strategic choices in the present to move the country towards a desired future state and away from less desirable states. Having strong technological and innovation-related capabilities in strategic areas is indeed important to realising shared national visions, particularly to respond to crises such as pandemics and other national disasters.

The global pandemic emerged during a time of heightened nationalism despite worldwide collaborative efforts to combat the disease and develop a vaccine. Not surprisingly there has been an unprecedented demand for

medical services globally. As a result, global medical supply chains have become increasingly insular, threatening South Africa's ability to provide effective and adequate healthcare to its citizens as it may be unable to secure critical supplies of medical equipment, diagnostics and any new therapeutics, vaccines or diagnostics developed. The sector already has a growing reliance on imports leading to a significant economic burden. The COVID-19 pandemic has heightened the importance of stimulating, supporting and growing the local medical industry.

Nevertheless, South African researchers and innovators have mobilised rapidly in response to the pandemic. This included the development of a reverse transcription polymerase chain reaction capability to substantially reduce the turnaround time for diagnosing active infections as well as to assist and relieve significant pressure on pathology services; increasing access to polymerase chain reaction reagents to reduce reliance on international supplies; and the development of serological tests to enable monitoring and surveillance as the pandemic progresses. Personal protective equipment (PPE) supply chains were also improved in advance of, and in anticipation of, increased demand. Universities, tech-start-ups and innovation hubs responded rapidly to alleviate the pressure with innovation activities focusing on the restricted and extended use of PPE, re-usable PPE and the development of alternative PPE items. Under the guidance of the National Ventilator Project, companies accelerated the development of continuous positive airway pressure solutions. This included supporting the development and localisation of non-invasive ventilators. South Africa's vaccine manufacturer is preparing to manufacture an approved COVID-19 vaccine locally, and scientists are also researching the use of plant-based technologies for the manufacturing of potential COVID-19 vaccines.

These vital innovations are critical in ensuring that South Africa maintains its security of supply and access to critical medical supplies to sustain the response to the pandemic. Post COVID-19, the local manufacture and procurement of medical products will furthermore create jobs and uplift the economy.

5.2 RESEARCH AND INNOVATION LANDSCAPE

An analysis of the performance of the South African NSI is found in an annual National Advisory Council on Innovation (NACI) publication on STI indicators. The 2020 STI Indicators Report contains a great number of indices which can be used to gain a deeper understanding of South Africa's latest positioning in regards to research and innovation outputs.

The Global Innovation Index (GII) is an indicator of the efficiency of the NSI, i.e. the extent to which inputs (resources) devoted to innovation result in innovation outputs. South Africa`s ranking on the GII is lower on all three dimensions of measure than in previous years. In the GII 2019 report, South Africa experienced a drop in its ranking from 58th in 2018 to 63rd. Infrastructure and creative outputs were the GII sub-indices where South Africa's results were poor. South Africa's score on the efficiency ratio was 0.55 in 2019, which ranks it at 83rd. This implies that the South African NSI is not able to effectively convert inputs into outputs in the innovation ecosystem. Data analysis also reveals that the NSI efficiency has been on a decline for several years. This gives an opportunity for NSI actors to improve upon their performance given the resources available as a country.

Scientific research output and patent registration are also two measures of the health of an NSI. South Africa's publication output decreased from 371 per million population in 2017 to 360 per million population in 2018. While this trend was also observed in high-income countries, it was not the case in upper-middle income countries who saw an increase in research publications in the same time frame.

A decline in the number of patents to the Companies and Intellectual Property Commission (CIPC) has been observed. During the 2008 to 2018 period the annual average was 7 250 applications. The decline in the number of patent applications has taken South Africa back to levels experienced a decade ago. The number of South African patents as a share of foreign patents at the United States Patent and Trademark Office has also declined. This follows a period in which granted patents doubled from 91 patents in 2008 to 182 patents in 2019. NACI has flagged this decline as an issue that requires further investigation. However, in 2019, South Africa was ranked 30th in the world according to the number of patents granted by this organisation.

In line with TIA aspirations to enhance its regional presence and make available its offerings across all provinces, an analysis of the trends at provincial level must also be undertaken. The NACI report showed that Gauteng has the highest proportion of South Africa's total R&D expenditure (44.7%), followed by the Western Cape (24.1%) and KwaZulu-Natal (10.8%). This is in line with the TIA portfolio of investment, as these provinces are South Africa's main economic and academic hubs where technological and scientific activities are mostly conducted. Provinces with the lowest share of R&D expenditure are the Northern Cape (1.5%), Mpumalanga (1.6%) and Limpopo (2.2%). The data reveals a great disparity in R&D expenditure among the various provinces. Gauteng and the Western Cape provinces dominate innovation activities and attract the overwhelming share of funding from all sources of R&D funds. An extract from the 2020 South African STI Indicators Report is shown in Table 2.

TABLE 2: PROVINCIAL R&D EXPENDITURE TRENDS (2017/18)

	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpuma-langa	Northern Cape	North West	Western Cape
Total R&D expenditure (R million)	2 300	2 149	17 319	4 172	854	715	576	1 306	9 328
Provincial GDP	331 093	217 849	1 507 082	692 222	311 686	323 722	90 883	279 733	596 043
Provincial expenditure as a percentage of GERD	0.7	0.99	1.15	0.61	0.28	0.22	0.64	0.47	1.57
BERD (R million)	707	1 105	8 285	1 679	223	304	565	60	2 927
Proportional business sector R&D expenditure by province	4.5	7.0	52.2	10.6	1.4	1.9	3.6	0.4	18.5
Propotional higher education sector R&D expenditure by province (%)	7.8	6.9	32.8	11.0	2.8	1.2	3.5	1.4	32.7
Propotional science councils sector R&D expenditure by province (%)	4.4	0.9	53.1	8.6	1.7	1.9	1.5	3.8	24.1
Propotional government sector R&D expenditure by province (%)	12.1	3.5	41.9	8.9	3.7	4.5	2.6	4.1	18.7
Propotional not-for-profit sector R&D expenditure by province (%)	1.2	0.7	36.2	26.1	6.5	2.7	11.0	0.4	15.2

Financing the NSI continues to be a challenge. In 2017/18, South Africa's gross domestic expenditure on R&D (GERD) as a percentage of GDP was 0.83%, which remains below the DSI's aspirational 1.5% target. South Africa's GERD performance is approximately half the global average and considerably lower than upper middle-income countries (1.46%). Business expenditure on R&D (BERD) as a percentage of GERD also declined from 58.6% in 2008/09 to 41.0% in 2017/18 and as a percentage of GDP from 0.52% in 2008/09 to 0.34% in 2017/18. GERD increased from R4.1 billion in 2008/09 to R13 billion in 2017/18; an increase of 85% in 2010 Rand value.

However, South Africa's human resources ranking improved from 114th position on the Global Competitiveness Index in 2018 to 108th position in 2019. The number of researchers within the business and higher education sectors increased by 14.7% and 15.7%, respectively, between 2016/17 and 2017/18. While gains have been made in some key indices as a measure of NSI performance and health, others are now on a decline with South Africa losing its rank in global indices pointing to areas of concern. Other countries are able to use their capacities, capabilities and competencies in science and technology better.

The COVID-19 pandemic arrived at a time when NSI indicators were in decline, so it was also important to understand how South Africa's research outputs fared compared to size and efficiency of the NSI. COVID-19 did indeed trigger a wave of new research and within a few months, more than a thousand studies were available in scientific literature. An Activity Index for research related to COVID-19 in the five-year period ending June 2020 was estimated, with an index greater than one reflecting higher than average effort and an index less than one reflecting an effort lower than the world average. South Africa produced 44 publications in comparison to 5 410 publications globally. The estimated Activity Index was 1.01, indicating that South Africa is producing the expected number of publications by its research size and the average effort allocated to the field internationally. Most South African publications were in the field of public environmental occupational health (18%) and infectious diseases (11.3%).

5.3 ENTREPRENEURSHIP ECOSYSTEM

The Department of Small Business Development (DSBD) reported that the SMME sector provided employment to 10.8 million people in South Africa in the first quarter of 2019, accounting for 66% of all jobs (16.5 million) in the country. The majority of SMME employment (61%) is in the formal sector. An estimated 38% of SMME employees are female workers, a level which has been stable over the previous four quarters. Trends from previous quarters show that job creation by SMMEs (both employees and owners) reached two-million positions in this period, representing an increase of 22%. The trend shows that SMMEs are more labour-absorbing than their larger counterparts, but also that large enterprises shed jobs at a high rate. TIA provided SET support to 3 216 SMMEs in the 2019/20 period through deployment of its funding instruments. This is promising in light of the DSBD identified trends – where SMMEs are more labour-absorbing – the long-term impacts from TIA support will no doubt include job creation as technologies are developed, matured and enter the market.

The COVID-19 pandemic will no doubt affect these trends in complex ways, and efforts are underway to support the SMME sector through various interventions. Incubator 22 on Sloan conducted a survey to understand how COVID-19 will impact the SMME ecosystem in South Africa. Their findings present a harsh reality, where unemployment is likely to increase, with firms not being able to bear the shocks of the economic fallout of COVID-19. It was estimated that 55 000 South African SMMEs will not survive the pandemic, and in a worst-case scenario it is anticipated that 423 500 employees at SMMEs could lose their jobs.

However, technology is an important enabler, during the pandemic and in the transition to the "new normal". This will bring about a much faster adoption of innovation, specifically in the health, finance and education sectors. Technology as enabler brings new (and immediate) opportunities for technology firms and start-ups. The disruption caused by the pandemic has led to more start-ups focusing on non-contact deliveries, telemedicine, AI and big data analytics. Physical lockdown restrictions have led SMMEs to adopt virtual working arrangements and digital platforms to remain operational. Provision of basic services in novel ways has also led to greater focus on underserved communities, e.g. improving telecoms infrastructure and connectivity for communities to remain connected while adhering to physical restrictions.

In working directly with SMMEs, both prior to and during the pandemic, McKinsey & Company encountered several innovative responses by SMMEs to overcome challenges and grow during the COVID-19 crisis and beyond. The common strategies being pursued to support success at this time appear to be financial stability; access to new markets and customers; a stable supply chain; strong customer engagement; a healthy workforce; and a robust post-crisis strategy. McKinsey & Company has identified four areas where SMMEs can take action to mitigate these challenges and enhance efficiency, scale, competitiveness and lower costs during the crisis.

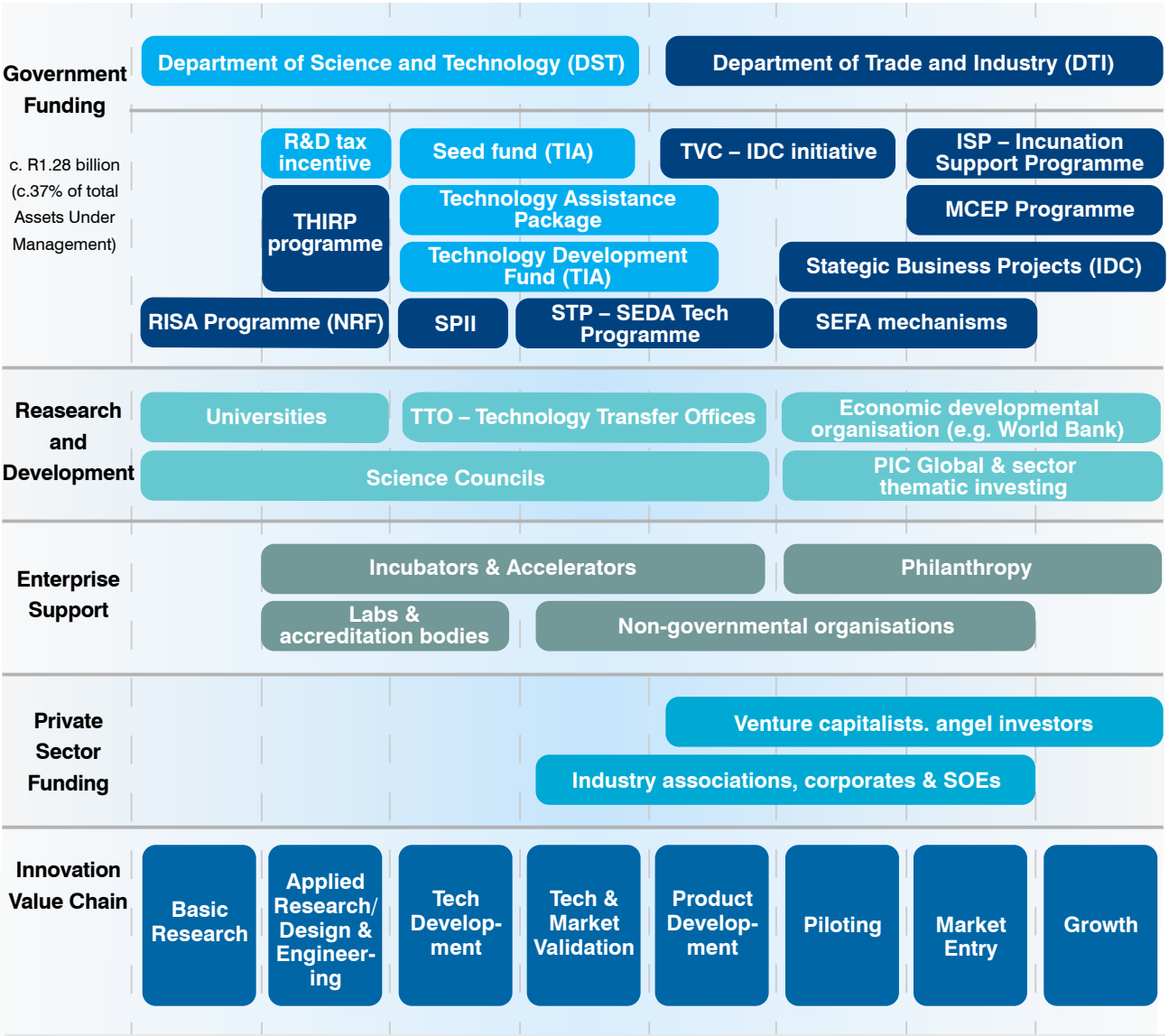
1. Leverage technology to reach new customers or provide a distinctive value proposition
2. Develop clearer market access strategies
3. Drive efficiency as well as sales
4. Develop team skills and capabilities and empower leadership

In response to the COVID-19 pandemic, the DSBD introduced several interventions to support SMMEs and co-operatives affected by the COVID-19 pandemic. These include the Business Growth and Resilience Facility; SMME Relief Finance Scheme and Small Enterprise Finance Agency Debt Restructuring Facility; Automotive Aftermarkets Support Scheme; Small Scale Bakeries and Confectioneries Business Support Scheme; Small Scale and Micro Clothing, Textile and Leather Business Support Scheme; and Spaza Shop Support Programme, among others. Notwithstanding these interventions by government, there is still expected to be a constrained financing environment which can negatively impact both the survival and growth of SMMEs in the forthcoming year.

5.4 THE INNOVATION FUNDING LANDSCAPE

The South African innovation funding landscape includes venture capital firms, development finance institutions, private equity, angel networks of investors, government, and government funding agencies, depicted in Figure 1. Although there are a significant number of funding agencies in South Africa, there remains a funding gap for early stage technology development and technology firms.

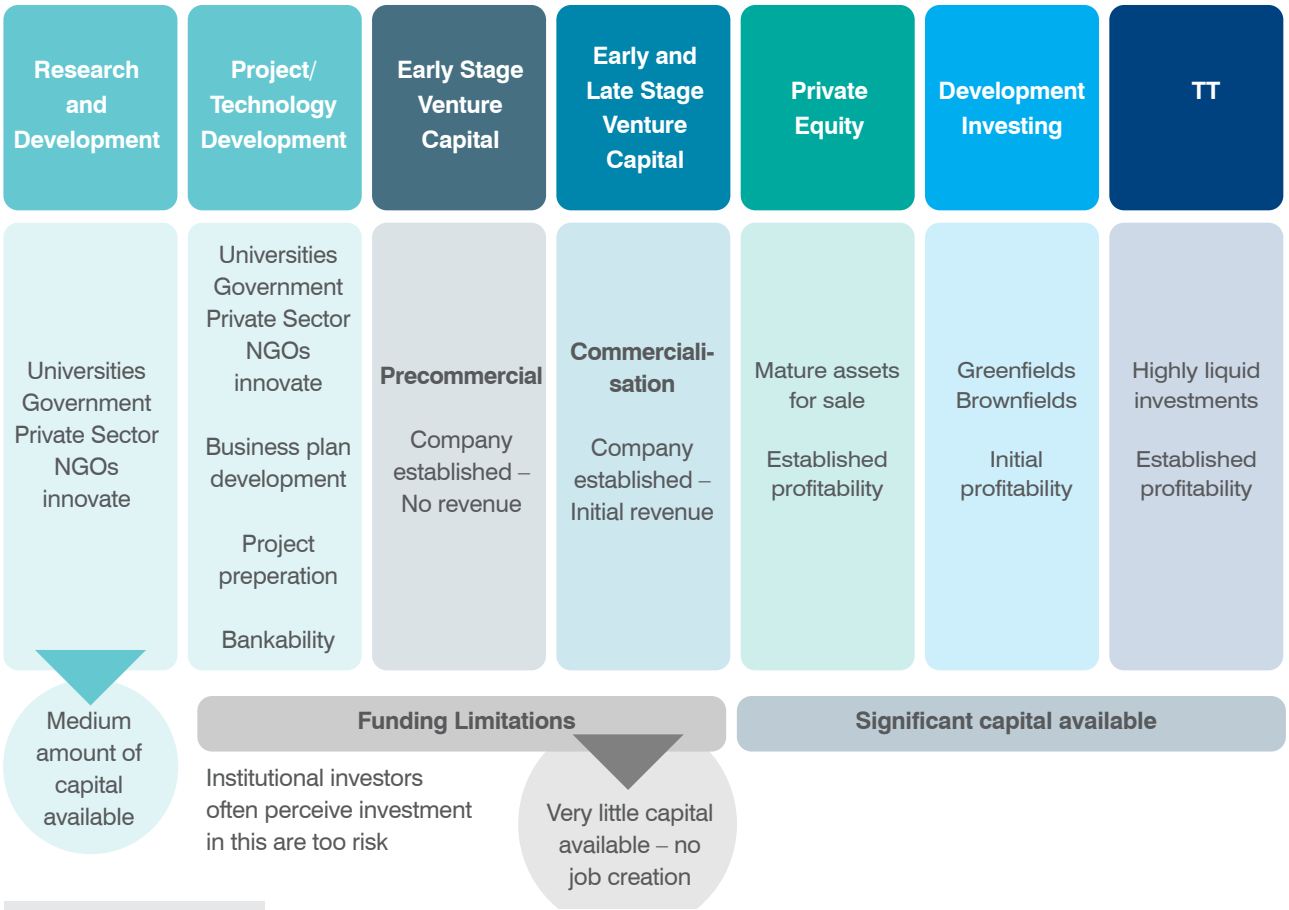
FIGURE 1: THE SOUTH AFRICAN INNOVATION FUNDING LANDSCAPE



Source: Start Up CEO Advisory and the 2017 SAVCA VC survey

The funding gap for early stage technology ventures in South Africa (Figure 2) is significant and limiting for economic growth.

FIGURE 2: FUNDING SPECTRUM AND BUSINESS PROGRESSION



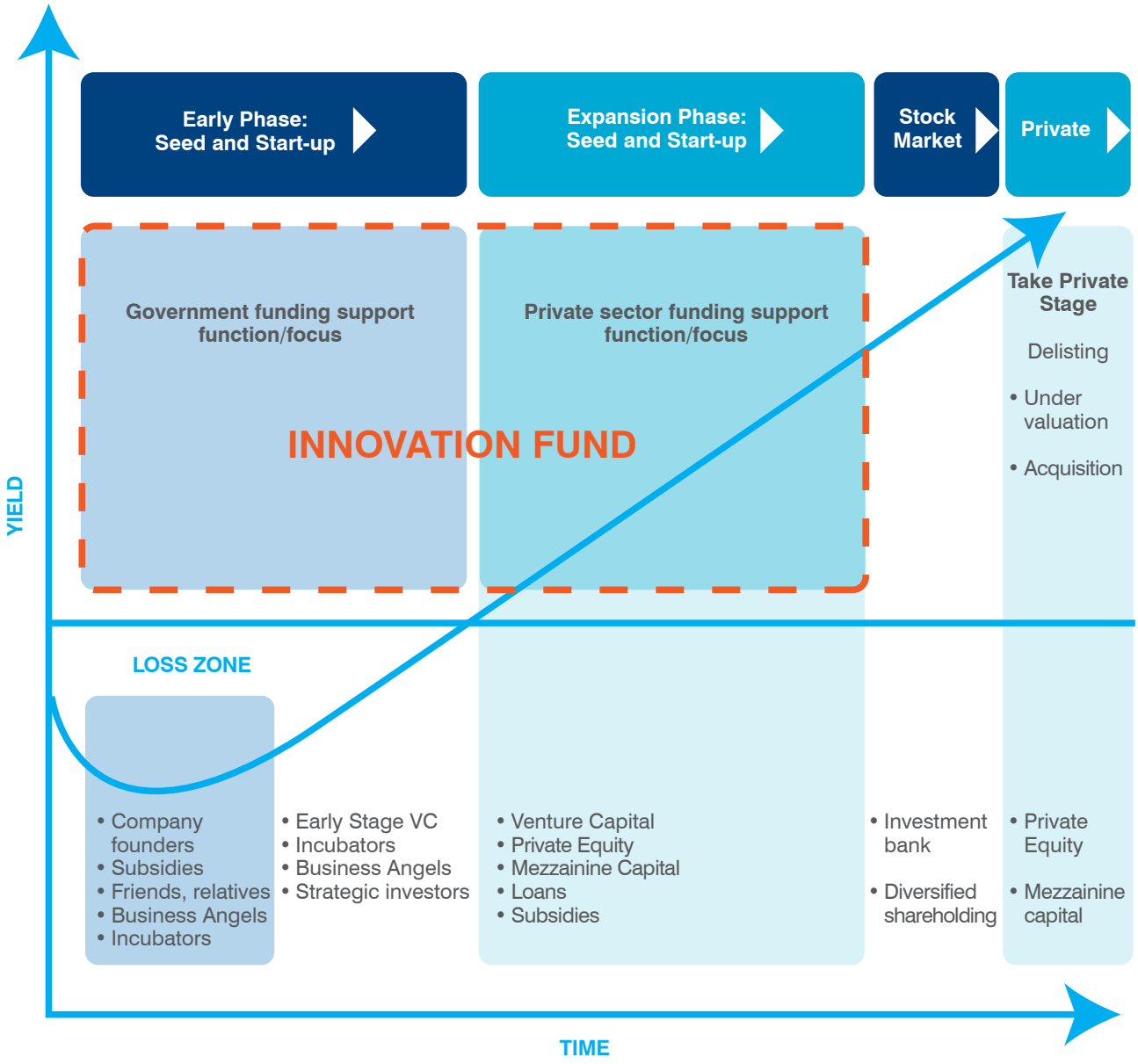
Source: TIA analysis

The Innovation Fund[3]

Notwithstanding TIA's role to support the development of innovative technologies, in 2015, the then DST identified enduring funding gaps in the NSI for the development of technology-based firms from locally developed ideas. Further scoping and stakeholder engagements in 2016 and 2017 showed that between the portfolios of the TIA and the instruments of the DSBD, the Department of Trade, Industry and Competition (DTIC) and the IDC, funding gaps to support technology-firms were still prevalent. The Innovation Fund is envisaged to bridge these gaps in partnership with private sector, and accelerate the development of a higher proportion of export-oriented technology-based firms (Figure 3).

[3] This section relates to the to-be-formed Innovation Fund, previously called (but subsequently renamed) the Sovereign Innovation Fund. There is no relation to the Innovation Fund previously administered by the National Research Foundation which ceased to exist when the staff, functions and initiatives of this pre-TIA Innovation Fund were incorporated into the new TIA circa 2008/09.

FIGURE 3: THE INNOVATION FUNDING LANDSCAPE



Source: Adapted from Natusch (2003); OECD (2013d). Policy Lessons from Financing Young Innovative Firms (OECD, 2015) and DSI Sovereign Innovation Concept Note, 2016

In 2019, National Treasury allocated funding portions of the Innovation Fund to the DSBD and the DSI. The strategic nature of these two government departments provides an opportunity to further catalyse actors within the South African innovation funding landscape. This Fund, when implemented in the collaborative manner envisaged, will advance the work TIA has contributed to date, viz., developing a pipeline of de-risked technological innovations that can be taken up in the market, while also complementing TIA's role by providing support at the firm level, gearing innovations to commercial market entry. In this regard, TIA will allocate the necessary resources to be an implementing partner of the Innovation Fund over the medium-term, lending support to the partnership model that the Fund seeks to promote. The IF has a

number of key performance indicators that are critical towards enhancing the outcomes and impacts of technologies commercialised from publicly funded intellectual property. Key to these are: number of jobs, sales and revenue, exports, etc. This implies that in implementing the Fund, TIA will put in place measures to ensure that sufficient revenue accrues to the fiscus from commercialised technologies. This will be pursued through inclusion of return on investment (ROI) expectations as defined in the IF, along with a variety of other risk funding instruments.

South African Venture Capital Industry

The South African venture capital industry plays a pivotal role in South Africa's economy, particularly to enterprise development, growth and entrepreneurship. The South African Venture Capital Association (SAVCA) 2020 Venture Capital Industry Survey (covering 2019) recorded a continued growth in deals, with a 20.9% increase in the number of deals (162 compared with 134 in 2018, predominantly in business products & services, fintech, software, consumer products & services and non-fintech financial services) and a 14.8% increase by value (of R158 million to R1.23 billion in 2019, mostly in food & beverage, agriculture, business products & services, fintech and consumer products & services). More than half (53.8%) of the number of deals were at the seed or start-up stage. While respondents to the survey expect to see a sharp downturn in the value and number of deals in 2020 due to the COVID-19 pandemic, this industry remains a key stakeholder grouping for TIA at the interface between pre-commercialisation and the marketplace.

Seed capital in previous SAVCA venture capital surveys mostly entailed grant funding available from the public sector and amounted to less than 1% of the total value of active deals. This has changed substantially with more capital – the biggest part of which is private – made available to deals comprising pre-revenue, pre-profit ventures. Seed capital now accounts for 3.7% of value among all active deals. Most active deals on record involved seed or start-up capital, an indicator of the early-stage orientation of venture capital investors. Such deals collectively make up 53.8% of the number of active deals (40.2% by value).

Figure 4 depicts the venture capital landscape in South Africa and how limited it is for supporting pre-revenue start-ups and early stage innovation projects. The plan is to further catalyse the venture capital community and incentivise it by blending public sector grant instruments with private sector to enable a higher risk appetite.

FIGURE 4: THE SOUTH AFRICAN VENTURE CAPITAL LANDSCAPE

FIGURE 4.1

Contribution by fund manager type; by deal value, all deals still invested

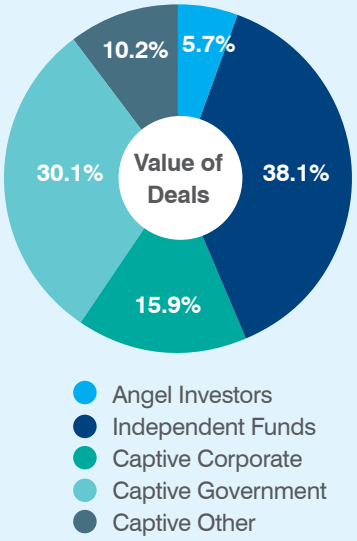
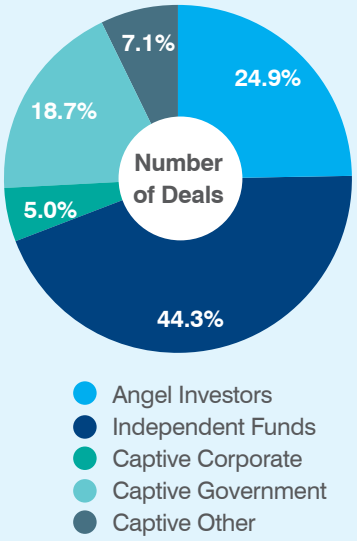


FIGURE 4.2

Contribution by fund manager type; by number of value, all deals still invested



Source: SAVCA Venture Capital Industry Survey 2020

FIGURE 4 (CONTINUED)

FIGURE 4.3
Contribution by stage of deal; by value of deals, all deals still invested

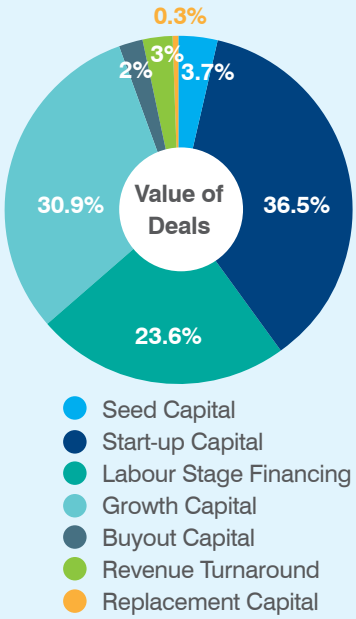
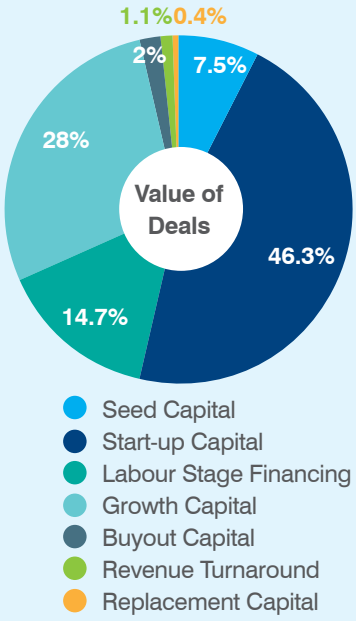


FIGURE 4.4
Contribution by stage of deal; by number of deals, all deals still invested



Source: SAVCA Venture Capital Industry Survey 2020

In addition to the private venture capital sector, the IDC manages the Technology Venture Capital Fund on behalf the DTIC as the only government venture capital instrument. As the fund focuses on fully developed, near-market technologies, the IDC remains one of TIA's key development partners as its funds have helped carry technology enterprises beyond TIA's funding capacity. TIA developed different strategies in minimising the funding deficit in technology development and the gap to commercialisation, namely the Industry Matching Fund with the private sector and other public institutional funders and incubators.

The Industry Matching Fund

TIA launched an Industry Matching Fund in 2019 as a pilot model for partnering with industry, particularly venture capital, the angel investor community and institutional investors. The Fund is a first for TIA, where public sector and private sector were able to set up complementary joint funds to bolster the support of technological innovations developed in South Africa.

TIA implemented this Fund of Funds approach as a funding and commercialisation support and acceleration strategy. This Fund of Funds model took a smaller portion of TIA money and co-invested it with the private and industrial funders. The Fund model allows TIA to keep to its core mandate, thus continuing to be a risk funder in support of technology development, while to a lesser extent, the Fund model provides a mechanism where TIA can support pre-commercialisation activities in building a pipeline for commercial investors. This strategy was also to ensure TIA participation in the upside of its investments and any other innovation outcomes that fit within its mandate to ensure sustainability. Table 3 shows the current partners and pipeline to be pursued in the year 2021/22.

TABLE 3: TIA INDUSTRY MATCHING FUND PARTNERSHIPS

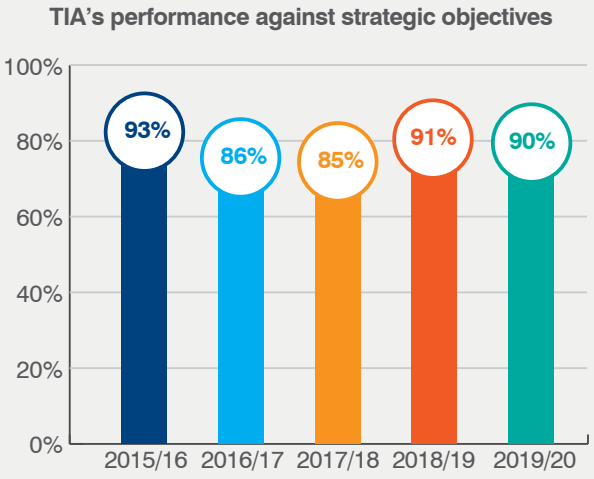
SA SME Fund (R335m) + TIA (R15m) (Limited Partners)	
Biotech Fund	
Agri, Precision Medicine, Translational Medicine, Industrial Biotech	OneBio Fund Manager
Venture Fund	
Hardware Technologies (All sectors)	Savant Fund Managers
University Technology Fund	
All Sectors	Stocks & Strauss Fund Manager
Business Angel Networks + TIA (Co-Investors)	
Matching Scheme	
All sectors, mostly ICT	Up to R1m (blended TIA conditional grant + Other Investor equity)
	Angel Investors (Jozi, Dazzle & WZ Capital)
(Pipeline: National Research Foundation, Development Bank of Southern Africa and IDC-TIA IKS Funding Programme)	

6. INTERNAL ENVIRONMENT ANALYSIS

TIA started the new five-year strategic period in the context of the COVID-19 pandemic, which was characterised by a lockdown that limited the mobility and operations of its staff, stakeholders and customers. Despite these constraints TIA managed to ride out the storm and has delivered tangible results on key elements of its core mandate of technology development and commercialisation. TIA closed the financial year 2019/20 with a performance achievement of 90%, delivering on 19 of 21 output indicators. By the third quarter of 2020/21 the agency was well under way to deliver on its APP targets for the financial year with an average achievement of 70% realised against the backdrop the COVID-19 pandemic, national lockdown and general economic downturn. This has proven that TIA is appropriately geared to deliver on its strategic plan.

TIA's high-performance culture is evident from its achievements over the 2015-2020 MTSF period as depicted in Figure 5.

FIGURE 5: TIA'S PERFORMANCE AGAINST ITS STRATEGIC OBJECTIVES OVER THE 2015-2020 MTSF PERIOD



Responding to the COVID-19 pandemic demonstrated the agility and ability to pivot as circumstances dictated, vindicating the efficacy of our mandate. The call by the Department of Planning, Monitoring and Evaluation to revise its Strategic Plan and Annual Performance Plan (APP) provided an opportunity to embed a renewed vision to respond to the pandemic, its aftermaths, impact on the fiscus and the economy. This was necessary due to the budget cuts imposed and the need to reprioritise key elements in the strategy to ensure that the available limited resources are directed to critical areas of need. TIA operates with an annual budget of approximately R450 million. This is made up of a baseline of R195 million, with R215 million assigned as ring-fenced funding. As a result of depressed economic conditions arising from the COVID-19 pandemic, subsequent lockdown and the need for budget reprioritisation, TIA saw its annual budget cut by 10% i.e., R45 million. This resulted in TIA's funding capacity for investments being significantly reduced. However, the agency was able to redirect savings from operational expenditure to fund some of the investments. In some instances, TIA received requests from its investees for relief support in the form of payment holidays, and small bridging finance interventions

Operating with a total funding of approximately R450 million, the fact that TIA fully disbursed these funds along with additional funds beyond the grant allocation, demonstrated the organisation's increasing capacity to manage funds. Key to this is the constant focus on improving assessment and approval turn-around times; an important issue identified from the various stakeholder satisfaction surveys.

The demographic profile of applicants to the Technology Development Fund is presented in Table 4. An encouraging increase was seen in African applicants from 44% in 2018/19 to 72% in 2019/20. However, the number of female applicants to TIA remains low, two percentage points lower than the 20% recorded in 2018/19.

TABLE 4: PROFILE OF TECHNOLOGY DEVELOPMENT FUND APPLICANTS IN 2019/20[4]

Demographic	Number of Applicants	Percentage
African	379	72%
Coloured	35	6%
Indian	39	7%
White	77	15%
Total	**530**	**100%**
Female	98	18%
Male	432	82%
Total	**530**	**100%**

TIA has committed to increasing access by designated beneficiaries (women, youth, Persons with Disabilities (PWD)) to its funding instruments and programmes throughout the Medium Term Expenditure Framework (MTEF). For this purpose, the TIA Board approved a B-BBEE policy for investments, that will serve as an important tool to directing resources deliberately towards designated groups and hence increasing their participation in the technology innovation ecosystem.

Table 5 shows the application breakdown per sector/thematic area for technology development applications. In line with current technology trends, ICT received more than half of the total applications to TIA. Whilst at the lower end of percentage of total applications, green technologies are receiving a fair amount of attention in line with growing focus on environmental sustainability worldwide.

[4] Data for 2020/21 not currently available

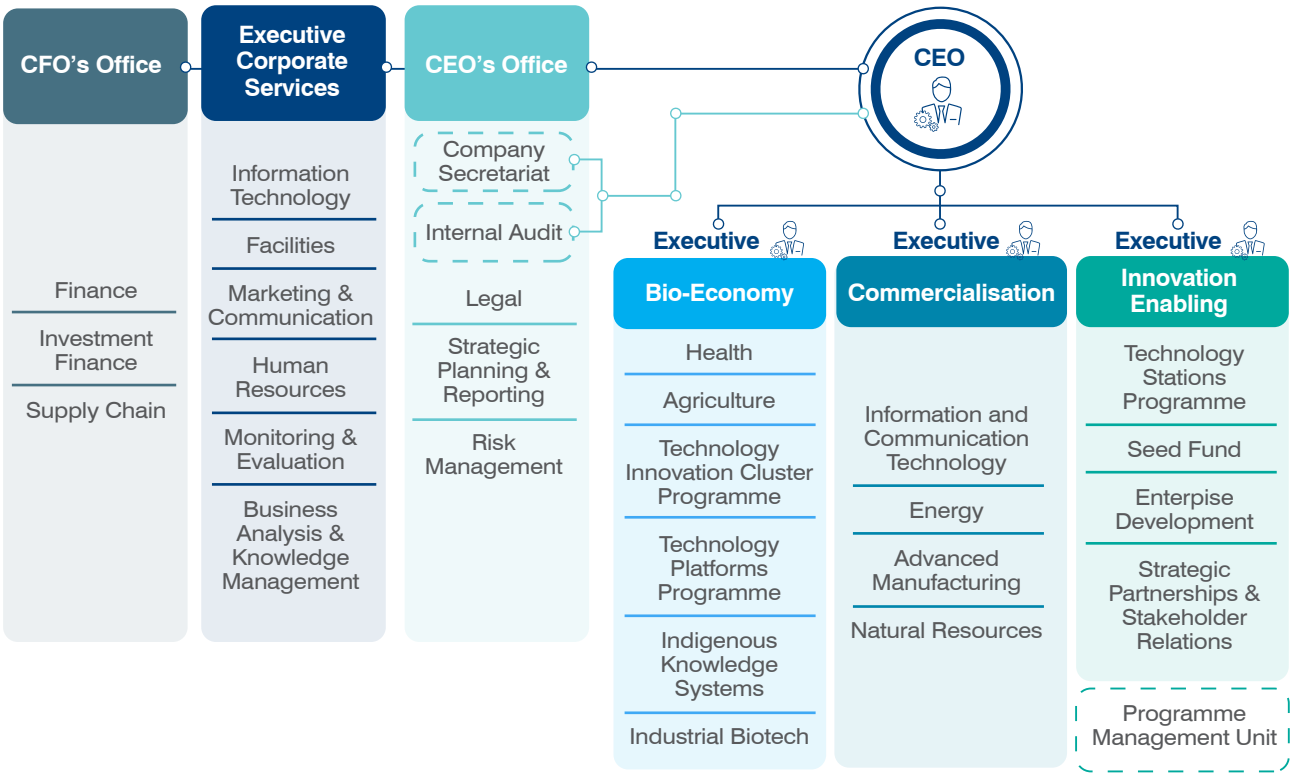
TABLE 5: APPLICANTS PER SECTOR/THEMATIC AREA IN 2019/20

Sector/Thematic Area	Number of Applicants	Percentage
ICT	305	58%
Advanced Manufacturing	54	10%
Energy	49	9%
Natural Resources	39	7%
Agriculture	30	6%
Health	19	4%

In 2019/20, TIA commercialised/pre-commercialised 40 innovations from its portfolio in addition to 77 technologies commercialised in the last strategic cycle.

The adoption of the new Strategic Plan necessitated a review of the TIA organisational structure required to deliver on its objectives. The revised Board-approved structure (Figure 6) enables the agency to progress towards a leaner, more agile organisation that is geared to deliver effectively on three priority areas of need in the NSI. The organisational structure will be aligned with the recommendations of the Ministerial Review currently underway.

FIGURE 6: TIA'S BOARD-APPROVED ORGANISATIONAL STRUCTURE



Note: The Company Secretary is accountable to the Board Chairperson. Internal Audit is accountable to the Audit and Risk Board sub-committee. The Programme Management Unit is accountable to the DSI.

Currently the structure is capacitated with well-educated staff with science, engineering, financial and business management qualifications. However, the ensuing weak economic conditions, accompanied by national fiscal constraints imply that TIA will not be able to fully populate the structure, with the vacancy rate currently at 20.9%. Positively however, key executive positions have been filled but risks remain for staff turnover as the organisation continues to compete for similar scarce skills in the market. This challenge is accentuated by tough depressed economic conditions that render monetary incentives challenging as a means of staff retention.

Additional institutional capability considerations relate to the organisation's ability to respond to the growing demand for its funding, services and service level in general. In 2019/20, TIA received 530 applications for technology development funding, representing a marginal 5% increase from 2018/19. Seventy funding applications were submitted to the Seed Fund Programme, consisting of six submitted directly to TIA, 44 to University Seed Fund partners and 20 to SMME Seed Fund partners. Three applications were submitted to TIA's new Rapid Fund and one application to the Pre-commercialisation Fund.

TIA's ability to quickly respond to the lockdown and remote working conditions presented an opportunity to consider possible changes in its working environment, by enabling staff to work remotely. This might result in a reduction in infrastructure requirements, which will enable investment in digital technologies to enhance operational efficiency.

TIA's approach to addressing its internal control environment, specifically with regards to addressing repeat audit findings, sees Internal Audit playing a consultative role in supporting management's endeavours. Internal Audit has taken a proactive assurance approach by assisting management in identifying and highlighting early warning signs, prior to the completion of transactions to reduce the likelihood of repeat audit findings. A balanced approach between assurance and advisory services has been adopted by the Internal Audit function. In this regard, the advisory approach includes collaborating with management to develop appropriate internal controls and risk mitigation strategies that, if implemented appropriately, would avoid the reoccurrence of findings. An increased Internal Audit participation in organisational governance structures also forms part of this approach. Team members attend Executive Committee meetings, Board meetings, etc., in order to ensure that there is greater insight and awareness of key strategic and operational risks, in order to proactively address these risks, before they materialise, which reduces the probability of repeat findings being raised.

TIA has defined three outcomes for the 2020-2025 strategic period with associated indicators. These relate to commercialisation, the bio-economy and increasing access for SMMEs to SET support.

Whilst the onset of the COVID-19 pandemic confirmed the efficacy of these outcomes, future endeavours will see the agency pursuing these with greater intensity, with all efforts underpinned by several principles as follows.

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

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

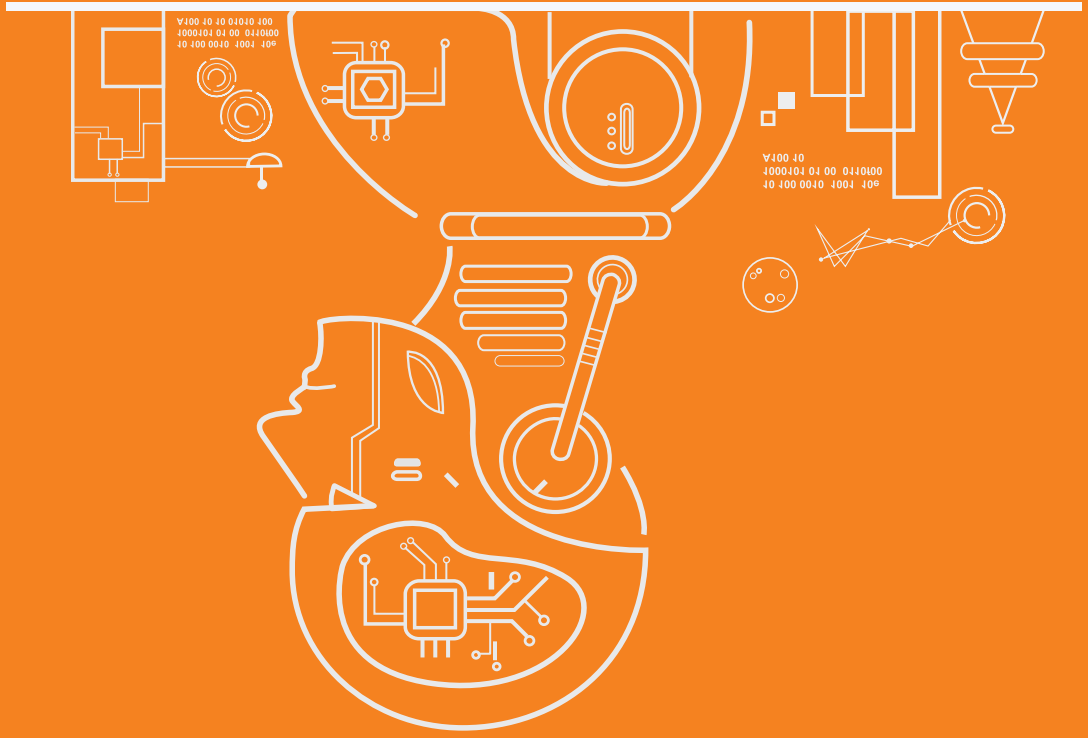
c) **Responding to communities in distress** – The implementation of the Innovation for Inclusive Development Programme will be intensified especially with regards to support for grassroot innovators and provision of access to SET support and other forms of business development and market opportunities.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

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

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

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

PART C: MEASURING PERFORMANCE



8. PROGRAMME A1: ADMINISTRATION

8.1 FINANCE AND SUPPLY CHAIN

The Finance and Supply Chain Division, guided by the sound principles of the PFMA, National Treasury regulations, the TIA Act, TIA policies and procedures, but not limited to, continues to support the fulfilment of the organisational mandate year on year. Through tough economic conditions, and the introduction of the "new normal" of doing business due to the COVID-19 pandemic, 2020/21 brought about unprecedented change resulting in an introspection into the organisational service delivery model. The sub programme continues to ensure that the efficiency ratio target of 70:30 is attainable through robust financial management, planning and control.

For 2021/22, the Division will ensure that governance and compliance are key drivers in delivering on the annual performance plan, with key focus areas being the following:

- **Value for money:** As a result of budget cuts in the previous year, and being a value driven entity, emphasis will be placed on best value for money. Tender processes will be administered in an open and transparent manner. TIA Supply chain management will endeavour to improve on the current 30% sourcing of goods and services from previously disadvantaged individuals to address inequality.
- **Open and effective competition:** Opportunities should be presented to all bidders in a free and transparent manner, allowing all an opportunity to bid, with the avoidance of any irregular, fruitless and wasteful expenditure. There should be zero tolerance for any favouritism or nepotism to any bidder.
- **Ethics and fair dealing:** All TIA employees should conduct themselves in a proper manner without compromising their integrity.
- **Accountability and reporting:** Both TIA and the service providers must hold each other accountable for their actions, with sound reporting methods being built into each bid. Through the adherence of policies and procedures in place each sub-programme will be held accountable for their procurement actions.
- **Equity:** The organisation will continue to promote business with previously disadvantaged individuals. Our objectives are to prioritise working with SMMEs and with previously disadvantaged individuals in support of developing and transforming the South African economy. All procurement will address equity as a key element.

Budget cuts in the previous year have entrenched the concept of reprioritisation towards investment spend with a focus on the core objectives of the organisation. This has been demonstrated in the prior year through future planning, continuous monitoring and evaluation between the core divisions, instilling tighter controls and improved turnaround times. However there remains a large unfunded pipeline of investments, which has placed greater emphasis on the organisation to leverage additional funding through various partnership models.

8.2 RISK MANAGEMENT

The Risk Management function is primarily responsible for coordinating and facilitating the risk management process, proactively promoting risk awareness, and monitoring and overseeing the management of key risks facing the organisation. TIA's risk management process is integrated and central to its strategic planning process. The agency proactively manages strategic and operational risks impacting on the accomplishment of its strategic goals and objectives. TIA's enterprise-wide risk management activities and initiatives are consistently aligned to best international practices (Committee on Sponsoring Organisation Enterprise Risk Management Framework, ISO31000 on Enterprise Risk Management Framework, King IV Report on Corporate Governance in South Africa, the Public Sector Risk Management Framework, and Institute of Risk Management South Africa risk principles).

8.3 INTERNAL AUDIT

The primary objective of the Internal Audit function is to provide TIA's Board and management with an independent and objective level of assurance. Internal Audit serves as the key assurance function to provide value and demonstrate impact to the organisation by partnering and collaborating with management, to improve TIA's operations, its internal control environment, risk management and governance processes. Internal Audit assists TIA to accomplish its objectives, by bringing a risk-based, systematic and disciplined approach to evaluating and improving effectiveness and efficiency, developing recommendations for improvements in the internal control environment and supporting the stewardship and accountability in TIA's spending of public funds.

Internal Audit's objectives support and are aligned to the achievement of TIA's outcomes and priorities for 2021/22 and beyond. Internal Audit focuses on ensuring that (among others):

- Risk areas are adequately identified and addressed;
- Breakdowns in key internal controls are identified, reported on and that in response to these instances, that appropriate improvements can be recommended and agreed with management for implementation;
- Assets are safeguarded and financial and operational information is reliable; as well as
- Non-compliance with TIA's corporate governance, policies and procedures, applicable regulations and statutory requirements are identified and that implementation plans are put in place to address and resolve these matters.

While there is a direct correlation between audit and risk, there is a clear separation between the Internal Audit unit and the Risk management unit. Specifically, Internal Audit is an independent function that reports to the Audit and Risk Committee, while 'Risk' is a management function that reports to the CEO. However, to support enterprise risk management, emphasis will be placed on assisting management with matters such as: the formation of a functional risk management committee, development of pragmatic Risk Appetite and Risk Tolerance levels, ensuring that TIA's risk adopted principles are in line with best standards, and to provide advice on appropriate risk management strategies and tools to be adopted to improve the maturity of the enterprise risk management function.

8.4 STRATEGIC PLANNING AND REPORTING

The Strategic Planning and Reporting Sub-programme is responsible for driving the agency's planning and institutional reporting obligations in line with shareholder and government frameworks, in alignment with best practices for similar entities. It is responsible for keeping abreast of government planning frameworks as led by the Department of Planning, Monitoring and Evaluation. Tracking transformation and commercialisation outcomes in line with the vision articulated at strategic level forms part of the sub-programme's outputs. Research and intelligence are embedded in this function with a focus on keeping abreast with trends and drivers affecting the innovation landscape that have the potential to negatively impact the implementation of the agency's mandate.

8.5 LEGAL SERVICES

The Legal Services Sub-programme provides legal support to TIA, both in respect of transaction support and for TIA's internal business processes. The unit's work primarily covers four areas, namely contracting and deal structure, advice and opinions on commercial law and IP, due diligence processes and litigation. Minimising of risk is the primary focus of all the unit's activities. Due diligence processes and the drafting and vetting of agreements are done in such a way as to ensure that all relevant legislation, including the PFMA and TIA Act, are complied with, and that best practice principles are applied at all times.

The unit's main focus will be to continuously explore new ways to improve turnaround times with regards to contracting. This represents a critical area of attention if TIA is to effectively address consistent stakeholder complaints regarding the organisation's service delivery. Specific, initiatives will include the following:

- Filing of vacancies with the best possible candidates, ensuring that the sub-programme, along with its processes, are structured in such a way as to enable resources to be utilised to the maximum advantage of the organisation, considering the effect that budget cuts have had on the agency's ability to fill vacancies.
- Investing in strong/enhanced IP management capabilities through appropriately qualified staff; in-sourcing and outsourcing approaches. This is particularly important considering the strategic emphasis to commercialise IP from publicly-funded research institutions.
- Standardising contracts as a measure to reduce duplication of effort and fast-tracking the contracting process.
- Investing in automated business processes to ensure that the unit's resources are utilised as efficiently as possible.

8.6 HUMAN RESOURCES

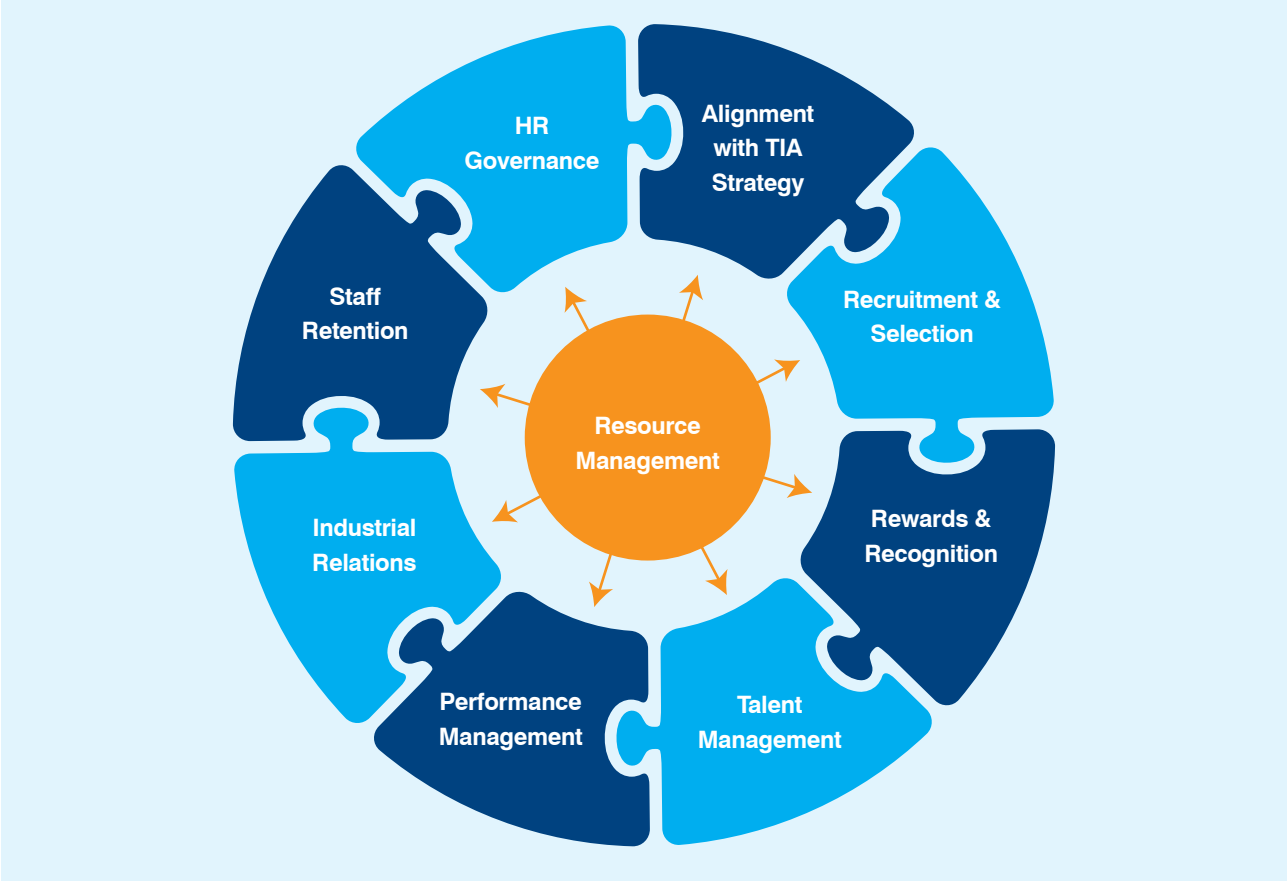
Human Resources is responsible for implementing and maintaining the full human resources value offering (Figure 7), adding value to TIA by ensuring that each sub-programme is adequately resourced and capacitated to deliver on the strategy. Human Resources focuses on recruitment and selection as well as reward and recognition in line with approved budgets. It drives talent management, performance management, succession planning and promotes staff wellness.

In line with the new strategy, a revised organisational structure was approved by the Board to redirect the organisation's resources to deliver on the key priorities of bio-economy, commercialisation and innovation enablement through enhanced access for SMMEs to SET support.

Initiatives in the new financial year will include implementation of a holistic talent management strategy. Key among these are:

- Capacitating the organisation with specialised skills for commercialisation;
- Design and implementation of a succession management plan; and
- Strengthening the "Employee Value Proposition" through non-monetary rewards, particularly considering the current economic conditions.

FIGURE 7: THE HUMAN RESOURCES VALUE OFFERING



8.7 FACILITIES MANAGEMENT

Facilities Management supports the organisation by providing a conducive working environment, through the acquisition and management of office infrastructure, security services and office support services.

Following the lockdown announcement, TIA employees were able to adjust to a remote working environment very quickly and productively. This then raises the question if the expensive infrastructure is still a necessity in its current form. Key initiatives for the next year will include, among others:

- Considering current versus required office infrastructure, which can also increase TIA's regional footprint;
- Strengthening alignment and compliance to the Occupational Health and Safety Act; and
- Providing improved and responsive security management services.

8.8 BUSINESS PROCESSES AND SYSTEMS

Business systems are crucial for the enablement and support of TIA operations. In addition, optimised business processes and workflows enables effective automation to enhance performance. Various functional systems were implemented and maintained to provide effective solutions, recognised for their responsiveness, agility, speed and information security while meeting customer expectations.

The lockdown period forced the organisation to embrace its digital strategy holistically for workforce transformation. With employees working remotely, business systems and collaboration technologies operated normally rendering remote access securely without vulnerabilities. Business continuity management plans were fully invoked during this period ensuring successful continuity across various platforms.

In the next financial year, the sub-programme's focus will be as follows:

- Enhance business process coherence for agility in creating a digital workforce that leverages the multi-faceted potential of technologies implemented to achieve operational excellence.
- Continuous system improvements and integrations will be pursued, informed by user requirements, providing customer satisfaction and business intelligence in delivering the mandate.
- Cybersecurity Management – Business confidentiality, continuity and security are of utmost importance with more employees exposed to digital platforms within and outside the organisation. Proactive network monitoring management will be maintained and enhanced for adequacy to prevent any threat vulnerabilities.
- Preservation of intellectual asset – This focus areas seeks to maintain TIA as a knowledge hub to coordinate and facilitate technology innovation initiatives locally and regionally. It is anticipated that TIA will drive the creation of communities of practice with NSI partners for collaboration and business improvements. Retention of organisational intellectual assets for knowledge management and business intelligence is a major imperative across the TIA business.

8.9 MONITORING AND EVALUATION

Monitoring and Evaluation (M&E) works closely with the various business units to evaluate and report on business performance against key strategic objectives.

Going forward TIA needs to establish a rolling evaluation programme to regularly review its main programmes and initiatives. Doing this in both a formative and summative fashion will enhance TIA's internal M&E capacity and competences, generate information and data to inform any necessary structural amendments (to improve, enhance or terminate programmes), and build an evidence base to attract additional funding as part of TIA's business development efforts.

TIA will explore entering into partnerships with organisations in the NSI with the requisite expertise to not only undertake programmatic evaluations on behalf of TIA but to also build up the monitoring, evaluation and learning competencies across TIA, i.e. beyond the M&E sub-programme.

8.10 MARKETING AND COMMUNICATIONS

The role of Marketing and Communications is to provide strategic communication support to raise awareness of the TIA objectives and achievements within the NSI and the communities it serves.

TIA's commercialisation/pre-commercialisation success goes largely unnoticed and unrecognised due to an absence of a coherent and strategic communications capability. Therefore, marketing and communication remain a challenge in terms of the kind of communication, the target audience as well as the frequency of the communication. Progress has been made with regards to internal communication initiatives as well as communication to business partners, however more focus needs to be placed on communication to the communities which we serve. A lot of good news stories remain untold.

Furthermore, TIA will strive to strengthen its brand visibility through marketing opportunities that will strategically re-position the TIA brand favourably in the NSI. The agency will identify opportunities to promote TIA's offerings and projects (innovators) through various platforms and co-branding opportunities with the DSI and other stakeholders within the NSI that are aimed at enhancing STI.

TABLE 6: PROGRAMME 1 OUTCOMES, OUTPUTS, PERFORMANCE INDICATORS AND TARGETS

Outcome	Outputs	Output Indicators	Audited Actual Performance		
			2017/18	2018/19	2019/20
A1. Effective and efficient internal environment to successfully execute the strategy	A1.1 Reduced vacancy rate	Percentage of approved funded positions filled annually	New indicator	New indicator	New indicator
	A1.2 Good financial governance	Achieve an unqualified external audit	Unqualified Audit	Unqualified Audit	Unqualified Audit
	A1.3 Media and marketing initiatives to profile TIA and achievements from its investments	Number of media platforms used to promote TIA initiatives	New indicator	New indicator	New indicator
	A1.4 Improved turnaround times on investment decisions	Improve on investment decision turnaround times[6]	27 weeks	46 weeks	54 weeks

[5] The vacancy rate as at quarter 3 of 2020/21 amounts to 20.9%. It is estimated that by 31 March 2021, the vacancy rate will be reduced to 15%.

[6] The time-frame in each target is reflective of 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 application.

Annual Targets			
Estimated Performance	MTEF Period		
2020/21	2021/22	2022/23	2023/24
Indicator not measured in 2020/21[5]	80% of approved funded positions filled by 31 March 2022	85% of approved funded positions filled by 31 March 2023	90% of approved funded positions filled by 31 March 2024
Unqualified Audit	Achieve an unqualified external audit report for the 2020/21 financial year with no new material matters identified by 31 July 2021	Achieve a clean external audit report for the 2021/22 financial year with no new material matters identified by 31 July 2022	Achieve a clean external audit report for the 2022/23 financial year with no new material matters identified by 31 July 2023
Indicator not measured in 2020/21	Four platforms (print, online, media and social media) to profile TIA initiatives by 31 March 2022	Four platforms (print, online, media and social media) to profile TIA initiatives by 31 March 2023	Four platforms (print, online, media and social media) to profile TIA initiatives by 31 March 2024
32 weeks	Achieve 4-week turnaround time on investment process for funding applications less than R1m by 31 March 2022 Achieve 15-week turnaround time on investment process for funding applications >R1m & < R15m by 31 March 2022 Achieve 26-week turnaround time on investment process for funding applications >R15m by 31 March 2022	Achieve 4-week turnaround time on investment process for funding applications less than R1m by 31 March 2023 Achieve 15-week turnaround time on investment process for funding applications >R1m & < R15m by 31 March 2023 Achieve 26-week turnaround time on investment process for funding applications >R15m by 31 March 2023	Achieve 4-week turnaround time on investment process for funding applications less than R1m by 31 March 2024 Achieve 15-week turnaround time on investment process for funding applications >R1m & < R15m by 31 March 2024 Achieve 26-week turnaround time on investment process for funding applications >R15m by 31 March 2024

TABLE 6: PROGRAMME 1 OUTCOMES, OUTPUTS, PERFORMANCE INDICATORS AND TARGETS (CONTINUED)

Outcome	Outputs	Output Indicators	Audited Actual Performance		
			2017/18	2018/19	2019/20
A1. Effective and efficient internal environment to successfully execute the strategy	A1.5 Support transformation initiatives through TIA Operations	**Recruitment** Recruitment initiatives which will move TIA demographics closer to the Economic Active Population (EAP)	New indicator	New indicator	New indicator
		Procurement Support women and youth owned businesses through procurement initiatives	New indicator	New indicator	New indicator
	A1.6 Capacitate the organisation with the required commercialisation and IP management skills	Appropriately qualified staff Implement initiatives to upskill resources in terms of commercialisation and IP management skills	New indicator	New indicator	New indicator
		Availability of required resources Create a panel of service providers for in-sourcing/ outsourcing approaches			
	A1.7 Provide learning opportunities to interns and graduates	Number of interns/ graduates upskilled through exposure to TIA operations	New indicator	New indicator	New indicator

[7] TIA needs to focus on the recruitment of African males and Coloured males to align with the EAP. TIA expects to have closer alignment with regards to African males achieved by 31 March 2021.

Annual Targets			
Estimated Performance	MTEF Period		
2020/21	2021/22	2022/23	2023/24
New indicator[7]	Recruitment initiatives which will move TIA demographics closer to the Economic Active Population by 31 March 2022 % of total procurement with: • Black women owned businesses – 20% • Black youth owned businesses – 10%	Recruitment initiatives which will move TIA demographics closer to the Economic Active Population by 31 March 2023 % of total procurement with: • Black women owned businesses – 22% • Black youth owned businesses – 12%	Recruitment initiatives which will move TIA demographics closer to the Economic Active Population by 31 March 2024 % of total procurement with: • Black women owned businesses – 25% • Black youth owned businesses – 15%
New indicator	Identify and implement initiatives to upskill resources in terms of commercialisation and IP Management skills by 31 March 2022 Create a panel of service providers for in-sourcing/ outsourcing approaches by 31 March 2022	Identify and implement initiatives to provide further support and develop resources in terms of commercialisation and IP Management skills by 31 March 2023	Identify and implement initiatives to provide further support and develop resources in terms of commercialisation and IP Management skills by 31 March 2024
New indicator	7 interns	10 interns	12 interns

TABLE 7: PROGRAMME 1 OUTPUT INDICATORS, ANNUAL AND QUARTERLY TARGETS

Output indicators	Annual target	Q1	Q2	Q3	Q4
A1.1 Percentage of approved funded positions filled annually	80% of approved funded positions filled by 31 March 2022	No target	No target	No target	80%
A1.2 Achieve an unqualified external audit report	Achieve an unqualified external audit report for the 2020/21 financial year with no new material matters identified by 31 July 2021	No target	An unqualified external audit report for the 2020/21 financial year with no new material matters identified by 31 July 2021	No target	No target
A1.3 Number of media platforms used to promote TIA initiatives	Four platforms (print, online, media and social media) to profile TIA initiatives by 31 March 2022	1	1	1	1
A1.4 Improve on Investment decision turnaround times	Improve Investment decision turnaround times to 24 weeks by 31 March 2022	No target	No target	No target	Improve Investment decision turnaround times to 24 weeks by 31 March 2022
A1.5(a) Recruitment initiatives which will move TIA demographics closer to the Economic Active Population	Recruitment initiatives which will move TIA demographics closer to the Economic Active Population	No target	Recruitment initiatives which will move TIA demographics closer to the Economic Active Population	No target	Recruitment initiatives which will move TIA demographics closer to the Economic Active Population
A1.5(b) Support women and youth owned businesses through procurement initiatives	% of total procurement with: Black women owned businesses – 20% Black youth owned businesses – 10%	No target	-	No target	% of total procurement with: Black women owned businesses – 20% Black youth owned businesses – 10%
A1.6 (a) Appropriately qualified staff – Implement initiatives to upskill resources in terms of commercialisation and IP Management skills	Identify and implement initiatives to upskill resources in terms of commercialisation and IP Management skills by 31 March 2022	No target	No target	No target	Identify and implement initiatives to upskill resources in terms of commercialisation and IP Management skills by 31 March 2022
A1.6(b) Availability of required resources – Create a panel of service providers for in-sourcing/outsourcing approaches	Create a panel of service providers for in-sourcing/outsourcing approaches by 31 March 2022	No target	No target	No target	Create a panel of service providers for in-sourcing/ outsourcing approaches by 31 March 2022
A1.7 The number of interns/graduates upskilled through exposure to TIA operations	7 interns/graduates	7	7	7	7

TABLE 8: PROGRAMME 1 KEY RISKS

Output Indicator	Risk	Mitigation
A1.1 Percentage of approved funded positions filled annually	Delays in filling prioritised positions	Monitor recruitment through a recruitment dashboard and address delays when it occurs
A1.4 Improved turnaround times on Investment decisions	Delay in investment decisions leads to stakeholder dissatisfaction and reputational risk	Monitor turnaround times and create exception report dashboard for reporting to Exco
A1.5 Support women and youth owned businesses through procurement initiatives	Lack of women/youth owned specialist suppliers	Targeted procurement strategy and processes for sourcing of women and youth owned suppliers
A1.6 Appropriately qualified staff – Implement initiatives to upskill resources in terms of IP management skills	Delay in providing appropriately qualified staff	Outsourcing/insourcing initiatives

TABLE 9: PROGRAMME 1 EXPENDITURE ESTIMATES

Output Indicator	2021/22	2022/23	2023/24
Income	**97 906**	**97 525**	**98 095**
MTEF ring-fenced	-	-	-
MTEF baseline	87 407	87 025	87 595
Other income (specific contracts, interest and royalties)	10 500	10 500	10 500
Operational Expenditure	**97 907**	**97 525**	**98 095**
Support and infrastructure costs	47 506	47 792	47 976
Human resources	50 401	49 733	50 116

9. PROGRAMME 2: COMMERCIALISATION

9.1 OUTCOME 1: COMMERCIALISED INNOVATIONS

Under this outcome TIA has identified five outcome indicators, as follows.

1.1 Number of licensed or assigned technologies
1.2 Number of projects involving industry in execution
1.3 Number of successfully diffused technologies
1.4 Number of products of launched
1.5 Total value of signed agreements entered into with other parties

Through this strategic thrust, TIA will intensify efforts to:

- Increase the rate of translation of locally developed technologies;
- Foster closer collaboration between the South African research community and industry;
- Support the exploitation of IP from publicly funded institutions and the South African entrepreneurial community;
- Ensure that these are commercialised in a manner that promotes economic growth and the competitiveness of industry;
- Introduce an unprecedented enterprise development approach that seeks to provide market access and help funded companies secure commitments;
- Respond to the imperatives of transformation and inclusive development; and
- Put in place an effective regime for the prevention of leakage of intellectual property from publicly funded research.

TIA will focus on leveraging local and global partnerships to support the translation of knowledge from higher education institutions, science councils and the private sector into commercialised innovations that will have a positive impact on the lives of all South Africans. The agency will also take advantage of the so-called 4IR to stimulate the economy and address some of the social challenges faced by many South Africans. In growing its pipeline of technologies developed and supported towards commercialisation, the Programme will, according to the TIA B-BBEE Policy for Investment, ensure that historically disadvantaged individuals, women, youth and persons with disabilities will form a representative portion of its funding beneficiaries. Over the medium term, disaggregated targets have been set for commercialisation of technologies developed by women, youth and persons with disabilities. These are contained in the accompanying technical descriptors for each output indicator under this Programme.

Innovation Fund

TIA will work closely with the DSI in structuring the newly introduced Fund with particular emphasis on providing input into the Innovation Fund's investment policy, investment strategy and governance arrangements.

A sum total of 20 TIA projects were initiated in the previous year and TIA will work closely with the DSI to ensure successful implementation. The agency's efforts into the future will seek build on past commercialisation successes of 110 technologies introduced in the market, to intensify the translation rate of publicly funded IP. Key outputs in this regard will include licenses, assignments, start-ups and spin-out companies as well as distribution, manufacturing and sales agreements for products, processes and services. All these will serve as critical interventions in government's efforts to promote economic recovery leading to competitiveness, job creation, economic growth and sustainable development. In pursuing this outcome, emphasis will be placed on driving transformation in the ownership of IP, while ensuring that the benefits of commercialisation accrue to marginalised and previously disadvantaged segments of society, including deliberate and directed diffusion efforts.

Special focus on supporting university R&D outcomes to achieve commercialisation

Universities are by design focused on generating knowledge without a concomitant focus on exploiting that knowledge for commercial purposes. As a result, many technological innovations developed by these institutions have not been taken up in the market. TTOs at various universities are an important source of new knowledge and intellectual property which can serve as a source of investment pipeline for TIA. The agency will work closely with TTOs to provide the necessary support to de-risk both the technology and commercial aspects of various projects in order to attract other funders/investors who will ensure successful commercialisation. TIA will also work closely with the National Intellectual Property Management Office to identify disclosed intellectual property for commercialisation.

Broadening the TIA investee pipeline – opportunities to support retrenched high-tech skilled technology developers

The advent of the COVID-19 pandemic has impacted the world negatively, and South Africa is no exception. The South African economy has been under stress for a while and this has been exacerbated by the pandemic. As a result, most companies were left with no choice but to retrench some of their employees, leaving many families and societies in distress. Some of these retrenched individuals have advanced skills in high-tech areas that could assist the country on its journey of economic recovery. TIA will therefore explore meaningful engagements to leverage such skills base. This will ensure that qualifying individuals will earn an income while assisting the country to recover economically.

Investment turnaround times

TIA has recognised the impact of long investment turnaround times which have resulted in displeased stakeholders. Therefore, it is very important to resolve the turnaround time issue so that it can regain the trust of customers and the shareholder. Addressing the issue of turnaround times will assist in ensuring that TIA reduces its pipeline to a more manageable size where applicants can receive feedback about their applications faster. Various initiatives will be undertaken to reduce the time it takes to approve funding applications, and this includes redesigning processes and educating potential applicants on our mandate which informs what TIA can and cannot fund. A benchmark study will inform the turnaround time which TIA should be measured against and this will be communicated to all applicants.

Other planned strategic initiatives are outlined in the table below.

TABLE 10: PROGRAMME 2 PLANNED STRATEGIC INITIATIVES

Initiatives	Key actions
Artificial Intelligence (AI)	• Formulate TIA AI strategy • Liaise with the Republic of South Africa AI Institute
Commercialisation audit	• Scope the intended audit for legacy projects • Determine commercial attractiveness • Establish TIA claim
Reviewing funding instruments	• Benchmark TIA funding instruments • Moderation of current instruments
Effective DSI Funds deployment (Innovation Fund)	• Infusion of best practice in the roll-out • Formulation of founding documents
Enterprise development	• Reconfiguration and consolidation of enterprise development
Regime for prevention of IP leakage	• Partner with NIPMO to strengthen disclosure mechanism from TTOs, including operationalisation of IP Enforcement Fund • Review and include stricter IP management clauses in existing and future contracts • Deploy Innovation Fund as an instrument to reduce dependence on international venture capital

TABLE 11: PROGRAMME 2 OUTCOMES, OUTPUTS, PERFORMANCE INDICATORS AND TARGETS

Outcome	Outputs	Output Indicators	Audited Actual Performance		
			2017/18	2018/19	2019/20
1. Commercialised innovations	1.1 Technologies licensed or assigned	Number of licensed or assigned technologies	New indicator	New indicator	New indicator
	1.2 Joint collaborations between academia and industry, TIA and industry, or between academia and industry	Number of projects involving industry in execution	New indicator	New indicator	New indicator
	1.3 Technologies diffused for inclusive development	Number of successfully diffused technologies	New indicator	New indicator	New indicator
	1.4 Products launched	Number of products launched	New indicator	New indicator	New indicator
	1.5 Leveraged funds (co-investment with other parties, financial and/or follow-on funding)	Total Rand value leveraged through signed agreements entered into with other parties	New indicator	New indicator	New indicator

* New indicators, therefore no historical data is available.

Annual Targets			
Estimated Performance	MTEF Period		
2020/21	2021/22	2022/23	2023/24
1 by 31 March 2021	9 by 31 March 2022	11 by 31 March 2023	15 by 31 March 2024
20 by 31 March 2021	15 by 31 March 2022	17 by 31 March 2023	20 by 31 March 2024
1 by 31 March 2021	9 by 31 March 2022	8 by 31 March 2023	10 by 31 March 2024
13 by 31 March 2021	22 by 31 March 2022	23 by 31 March 2023	30 by 31 March 2024
R700m by 31 March 2021	R239m by 31 March 2022	R194m by 31 March 2023	R237.5m by 31 March 2024

TABLE 12: PROGRAMME 2 OUTPUT INDICATORS, ANNUAL AND QUARTERLY TARGETS

Output indicators	Annual target	Q1	Q2	Q3	Q4
1.1 Number of licensed or assigned technologies	9	1	1	3	4
1.2 Number of projects involving industry in execution	15	3	3	5	4
1.3 Number of successfully diffused technologies	9	1	1	3	4
1.4 Number of products launched	22	2	7	7	6
1.5 Total value of signed agreements entered into with other parties	R239m	R5.5m	R104.7m	55.7m	73.1m

TABLE 13: PROGRAMME 2 KEY RISKS

Output Indicator	Risk	Mitigation
1.1 Number of licensed or assigned technologies	Inadequate stakeholder engagements as a result of the lockdown restrictions	Make use of technology to conduct meetings, thought leadership initiatives, where possible
1.2 Number of projects involving industry in execution		
1.3 Number of successfully diffused technologies	Budget constraints resulting in TIA not being able to provide financial assistance to investees during lockdown	Increase amount of leveraged funding to supplement any shortage
1.4 Number of products launched	Inability to commercialise TIA-funded technologies	Recruit and fill the vacancies for PM Commercialisation
1.5 Total value of signed agreements entered into with other parties	Inability to attract or leverage third party funding in TIA-funded technologies	Constant engagements and negotiations with other potential funders
1.6 Commercial	Defaulting by licensees	Ensure minimal abuse of royalty holidays
1.7 Project delivery	Project overruns	Grant reasonable additional funds within existing terms
1.9 Commercial	Deal re-negotiations	Moderation of funding terms in alignment with best practice

TABLE 14: PROGRAMME 2 EXPENDITURE ESTIMATES

Output Indicator	2021/22	2022/23	2023/24
Income	**91 068**	**91 578**	**91 705**
MTEF ring-fenced	-	-	-
MTEF baseline	89 668	91 578	91 705
Other income (specific contracts, interest and royalties)	1 400	-	-
Operational Expenditure	**17 350**	**17 471**	**17 539**
Support and infrastructure costs	800	806	809
Human resources	16 550	16 665	16 730
Investment expenditure	**73 718**	**74 107**	**74 166**
MTEF allocation	72 318	74 107	74 166
Specific contracts	1 400	-	-

9.2 EXPLANATION OF PERFORMANCE

Purpose: To support the development of technological innovations by translating knowledge into market-ready innovations. The Programme is organised according four sector-focused sub-programmes.

Sub-programme: Advanced Manufacturing

The purpose of the Advanced Manufacturing sub-programme is to support the transformation of South Africa's manufacturing industry into a competitive, high-tech and high value creation industry. The programme focuses on commercialising its invested portfolio in the areas of chemicals, production technologies, lightweight materials and electronics. It supports innovations that are aligned to the roadmaps in additive manufacturing, automation, advanced electronics, photonics and aerostructures. These also form the basis of the thematic areas that are part of the 4IR, said to transform the manufacturing sector.

The sub-programme supports and prioritises the commercialisation of innovative technologies, especially in the agriculture, forestry, chemicals, health, manufacturing and energy sectors. Its current portfolio of projects stretches across but are not limited to these sub-sectors.

The sub-programme has two projects that are near commercialisation which can be classified as "green" initiatives, contributing to the industrial development and green economy IP portfolios. These two pre-commercialisation projects, collaborating with international partners, undoubtedly will increase South Africa's global competitiveness and create brand recognition globally. Both projects receive business development support from TIA and are in the pipeline for pre-commercialisation funding. Both projects, if successfully executed, have the potential improve South Africa's export capacity, reduce the current deficit and improve economic growth.

The Advanced Manufacturing sub-programme support DSI strategies by prioritising the following:

The digitalisation of manufacturing in support of the 4IR: The sub-programme focuses on smart factories (with a focus on digitalisation), smart materials, advanced automation and robotics, nano-technologies and electronics. Our strategy focuses on rapid advances and convergences in technology which will make it easier for manufacturers to remain competitive and develop new markets. Digitalisation is integral to the technological changes occurring worldwide. Its impact on the product development process leads to a merging of design, production planning, engineering, manufacturing and services into one unit resulting in more efficient production and greater economies of scale and speed to market.

Additive Manufacturing (3D printing): With respect to processing techniques, additive manufacturing is gaining broader acceptance as a direct production process due to improved material selection, material property, efficiency and quality, making production faster and cheaper. In addition to changing how products are made, additive manufacturing changes how products are distributed (i.e., supply chain and logistic implications) as well as how products are designed (e.g., topology optimisation or part consolidation).

In the additive manufacturing value chain, the Advanced Manufacturing sub-programme supports the process of prototyping to production and commercialisation. The sub-programme focuses on areas that support the South African Additive Manufacturing Strategy. For maximum economic impact, the unit will continue to collaborate closely with Rapid Product Development Association of South Africa (the industry association) and the SA Additive Manufacturing Centre of Competence, and will continue to focus on medical technologies, aerospace, tooling and improved product development. The potential of inclusive economic growth, upskilling youth and creating jobs for historically disadvantaged individuals from this sector are appreciable.

The Advanced Manufacturing sub-programme seeks to strengthen the competitiveness, productivity and trade performance of the core productive sectors of the economy. Although collaborating with international partners, successful commercialisation of both Novelquip and Rubber Nano Products, will result in increased local sourcing and manufacturing, and job and wealth creation. Through the FibreLux Diffusion project, with support from DSI, the unit prioritised economic growth and job creation in previously distressed communities in rural areas of the Eastern Cape province.

For the current financial year, the sub-programme will pursue opportunities in chemicals and additive manufacturing.

Sub-programme: Energy

The purpose of the sub-programme is to support the development of innovative energy technologies that contribute to energy security and transition South Africa to a low carbon economy. It does this by investing in and commercialising technologies in areas of distributed energy, energy storage, fuel cells and renewable energy solutions.

The sub-programme will contribute to achieving the objectives of the Hydrogen South Africa) programme, one of DSI's flagship programmes. Additionally, the sub-programme will also contribute to the DSI's Renewable Energy programme. The themes for the sub-programme for 2021/22 will be hydrogen and fuel cells and renewables technologies.

Economic revival: The sub-programme will contribute to government's efforts of addressing the energy challenge i.e. security of supply by supporting innovative technologies that will contribute to increased generation capacity and reduced energy demand. It will also endeavour to support energy technologies that will revive existing industries such as the use of platinum in fuel cells. In supporting hydrogen fuel cells, the sub-programme will contribute to the development of the hydrogen economy.

Distressed communities: The development of distributed generation and battery storage will be supported to provide sustainable off-grid power to communities that are not connected to the Eskom grid.

The sub-programme will contribute to Priority 2: Economic Transformation and Job Creation of government's 2019-2024 MTSF, in which the DSI has identified the commercialisation of IP from publicly funded research institutions as an important sub-outcome. Matured technologies will be prioritised for commercialisation in compliance with TIA's B-BBEE policy.

The sub-programme will endeavour to increase its support for technology innovations emanating from the Mpumalanga, Limpopo, North West, Eastern Cape, Northern Cape and Free State provinces to increase their contribution to the broader energy sector. The objective is to partner with provincial agencies in order to promote a culture of innovation and solicit projects from those provinces. TIA's investments made into technologies under the Seed Fund has yielded follow-on opportunities for the portfolio, where projects that are ready to be focused towards commercialisation have been identified. As the Seed Fund has presence across a wide geographic footprint, this also provides opportunity for the sub-programme to realise its aspirations to diversify its support footprint into less-served areas.

Sub-programme: ICT

The purpose of the sub-programme is to increase South Africa's competitiveness by enabling innovators to actively participate in the development of 4IR technologies as well as contributing to ensuring the national goal of broadband universal access is achieved. In so doing, the unit seeks to achieve the objectives the ICT RDI Roadmap, with specific emphasis on AI, big data, wireless connectivity and scalable inclusive ICT solutions.

The sub-programme is implementing the TWIGGA Programme, a bilateral ICT initiative between South Africa and Tanzania as part of the DSI's Africa Programme. This initiative, launched in 2019 seeks to promote joint development of ICT solutions between South African and Tanzanian entrepreneurs, implemented by M-Lab on behalf of TIA.

In response to the DSI's post-COVID-19 coordination framework, TIA supports several technologies that are relevant to addressing the challenges of health, economic revival and distressed communities. In this regard, the agency continues to invest in health-related technologies that address diseases such as breast cancer and easy access to chronic medication. In addition, there are currently six technologies in the ICT portfolio that are at higher levels of maturity and are ready for commercialisation. The focus will be to assist these technologies to raised additional funding as well as identify effective routes to markets. This will contribute to the improvement of the South African economy as well as creating jobs.

Distressed Communities – the business unit has invested in Morai, a black-owned telecommunication company that is deploying TV white space networks in rural areas of the Eastern Cape province, specifically the OR Tambo district. This deployment will enable rural communities to be cost-effectively connected to the internet. This type of networks is made possible by the investment made in the development of the CSIR's Geo-Location Spectrum Database which aids ICASA (the national regulator) to manage and regulate TV white space networks.

The sub-programme contributes to Priority 2: Economic Transformation and Job Creation. This is achieved by strengthening transformation requirements in TIA investments. Furthermore, assisting technologies at TRL7 and above to commercialise their technologies will lead to the creation of jobs.

The business unit is currently investigating an AI Programme that will be launched in 2021/22.

Sub-programme: Natural Resources

The Natural Resources sub-programme supports national efforts in ensuring water security and environmental sustainability, as well as playing a role in maintaining a competitive natural resource sector for the country with specific focus in the mineral resource extraction and exploitation value chain.

The sub-programme strategic focus areas are water resources management, waste management (circular economy, environment), climate change and mining. It focuses on ensuring water security by using advanced technologies to sustainably improve efficiencies in solving the water crisis, supporting the development of technologies that minimise impact on the environment from waste and supporting technologies to sustainably improve process efficiencies in the extraction and exploitation of natural resources (mining) and reducing worker exposure to hazards as well as maintaining a competitive natural resources sector.

The sub-programme contributes towards the achievement of the goals of the Water RDI Roadmap and the Waste RDI Roadmap; both strategic initiatives driven by the DSI. The sub-programme supports the three key areas of the White Paper on STI, viz. green economy, mining and mineral beneficiation and water, waste and circular economy. It also manages the Strategic Industrial Bio-innovation Programme's Bioremediation Programme for the DSI.

The sub-programme's contribution to health imperatives is focused on supporting innovations that improve water and sanitation efficiencies. In addressing economic revival, the sub-programme will continue to support national initiatives related to minerals beneficiation and value addition.

The Natural Resources sub-programme supports the development of technologies in water and sanitation in alignment with the Presidency SAFE Programme which aims to ensure proper sanitation in 3 800 schools. The Water Research Commission and TIA have launched the Water Seed Fund and will issue several open calls for innovations addressing South Africa's water challenges.

The majority of the sub-programme's active projects are located in the Gauteng, Western Cape and KwaZulu-Natal provinces. It intends focusing on the Mpumalanga province in 2021/22.

In response to the economic recovery plan, as outlined by Cabinet Lekgotla, the sub-programme has two projects that have been commercialised and three projects which will be commercialised in the mining, water, waste and green economy sub-sectors. Once fully commercialised these projects will create many sustainable employment opportunities.

10. PROGRAMME 3: BIO-ECONOMY

Purpose: To support the translation of South Africa's knowledge resources into sustainable bio-based solutions that address societal challenges while contributing to sustainable economic growth. In pursuit of this outcome, TIA has identified specific outcome indicators that will be measured over the planning cycle as follows.

2.1 Number of demonstrated bio-based technologies
2.2 Number of existing Technology Platforms that are operational and functional
2.3 Number of new Technology Platforms established in targeted regions
2.4 Number of operational and functional Technology Innovation Clusters

Through this focus area, TIA's efforts will be directed towards creating new bio-based products, processes and services and promote the creation of new enterprises that will ultimately lead to job creation. In doing so, TIA will increase its efforts to grow and enhance the role of IKS as an important sector that promises greater potential to promote inclusive development and transformation.

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

Advancements in biotechnological research and resultant uptake of innovation will allow South Africa to improve the management of its renewable biological resources and open new and diversified markets in food and bio-based products. South Africa has a significant capacity for knowledge generation in the bio-economy domain, which has the potential to maintain and create economic growth, develop and grow capabilities in human resources, increase the number of jobs and businesses, as well as improve the economic and environmental sustainability of primary production and processing industries.

TIA will target the Health, IKS, Agriculture and Industrial Biotechnology sectors. The capacity to generate knowledge in these sectors and promote collaboration between the public and private sectors is essential for the enhancement of existing value chains and the creation of new ones. The successful implementation of this strategy requires alignment and engagement among multiple stakeholders and role players across the ecosystem, in collaborations. TIA's bio-economy agenda is aimed at strengthening the agency's ability to inform research and innovation in the relevant sectors and facilitate a more coherent policy environment and a more engaged public dialogue.

By focusing on the following points, TIA expects the bio-economy to yield great benefit to South Africa by:

- Ensuring food security;
- Managing natural resources sustainably;
- Reducing dependence on non-renewable resources;
- Mitigating and adapting to climate change;
- Creating jobs and improving competitiveness;
- Influencing the policy environment;
- Investment in knowledge, innovation and skills;
- Ensuring participative governance and informed dialogue with society; and
- Creating new infrastructure and instruments.

Programme 3 supports the realisation of DSI's Outcome 3 (Increase knowledge generation and innovation outputs), Outcome 4 (Knowledge utilisation for economic development) and Outcome 5 (Knowledge utilisation for inclusive development). In addition, Programme 2 contributes to the DSI's target of scaling up its network of technology platforms in support of SMMEs, entrepreneurs and co-operatives, by making the technology developed in legacy projects available for uptake. Furthermore, the opportunity is ripe for new thought leadership on how to realise the government's District Development Model through the Bio-economy Strategy. To this end, TIA's Bioeconomy initiatives will internalise the DSI's District Development model to meet the objectives of the model, ensuring TIA's contribution to government's efforts in addressing service delivery backlogs and the pursuit of alternative local economic development. The aim is to revive and improve local economic plans through the district development model. National and provincial spatial development frameworks will be engaged to align TIA with the country's National Spatial Development framework, which outlines essential sectors and socio-economic targets. Programme 3 recognises the government's imperatives for inclusivity and transformation. In response, the Programme has planned the following initiatives in support of Women, Youth and PWD:

Health

The Health sub-programme will issue calls to fund technology development with a focus on women's health issues. In particular, breast and cancer technologies (diagnosis and treatment) will be pursued, in line with the priorities of the Department of Health (DoH). The call will also include the use of existing technology platforms to identify biomarkers for application in women's health priorities, such as the determination of defects in unborn foetuses.

Agriculture

The Agriculture sub-programme already has technologies either available or in the pipeline for dissemination. These include new cultivars for improved agricultural productivity and will speak to the desired impact, mentioned elsewhere in this APP. Similarly, technologies that lend themselves to new venture creation, such as nurseries and seed banks will be prioritised. The sub-programme will encourage collaboration with women-led research groups for innovations in agricultural biotechnology and this will be a condition for funding. The technologies developed by the Agricultural Research Council ARC's Agricultural Engineering Institute can be modified for adoption by women and PWD, and include aquaculture technologies, already lined up by the sub-programme for establishment as anew cluster.

Industrial Biotechnology

The recently-formed Industrial Biocatalysis Hub (IBH) provides an opportunity to promote the transformation of the profile of recipients of support. This will include technology development for SMMEs led by women and the youth.

IP sources

The National Intellectual Property Management Office (NIPMO) has signed an MoU with TIA, which allows for TIOA to gain access to technologies lined up for abandonment, or for those technologies which have not been commercialised by HEI's. This is a rich source of registered IP for exploitation and can be categorised into technologies for women, youth and PWD to exploit, with support from the sub-programme, in partnership with technology development institutions such as the CSIR. The existing entrepreneurship centres in the country can be approached for technology-entrepreneur matching, to pair technologies with willing entrepreneurs.

TABLE 15: PROGRAMME 3 STRATEGIC INITIATIVES

Initiatives	Key actions
Clinical Trials Fund	Establish the Clinical Trials Fund
IKS Technology Platform	Establish the IKS Technology Platform
Competency-based accreditation and certification system	Support or facilitate the delivery of a competency-based accreditation and certification system for IKS
New bio-based initiatives in industrial biotechnology industry creation	Hold consultations with stakeholders in the biocatalysis, biofuels, bioenergy and algal biorefineries to establish new initiatives starting 2022/23
Aquaculture Bio-innovation Cluster Programme	Establish a new Aquaculture Bio-innovation Cluster Programme
Biomanufacturing Programme	Implement a Biomanufacturing Programme in support of SMMEs, which will promote the development and commercial application of advanced process and advanced manufacturing technologies

TABLE 16A: PROGRAMME 3 OUTCOMES, OUTPUTS, PERFORMANCE INDICATORS AND TARGETS

Outcome	Outputs	Output Indicators	Audited Actual Performance		
			2017/18	2018/19	2019/20
Enhanced role of Bio-economy in NSI	2.1 Bio-based technologies[§] developed	Number of successfully demonstrated bio-based technologies	New indicator	New indicator	New indicator
	2.2 Existing Technology Platforms managed and supported	Number of existing Technology Platforms that are operational and functional	New indicator	New indicator	New indicator
	2.3 New Technology Platforms established and supported	Number of new Technology Platforms in targeted regions	New indicator	New indicator	New indicator
	2.4 Technology Innovation Clusters managed and supported	Number of existing Technology Innovation Clusters that are operational and functional	New indicator	New indicator	New indicator

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

Annual Targets			
Estimated Performance	MTEF Period		
2020/21	2021/22	2022/23	2023/24
9 by 31 March 2021	15 by 31 March 2022	20 by 31 March 2023	25 by 31 March 2024
7 by 31 March 2021	8 by 31 March 2022	9 by 31 March 2023	10 by 31 March 2024
0 by 31 March 2021	1 by 31 March 2022	1 by 31 March 2023	1 by 31 March 2024
5 by 31 March 2021	8 by 31 March 2022	9 by 31 March 2023	10 by 31 March 2024

TABLE 16B: INTERMEDIATE OUTCOMES, LONG-TERM OUTCOMES, IMPACT OVER OF 10-YEAR IMPACT HORIZON (2030)[8] FROM 2020 BASE

Outputs	Sub-programme	Long-term outcomes			
		Productivity	Skilled Human resources	Commercialised products and services	Wealth creation
Bio-based technologies developed	Agriculture	Increased productivity by small holder farmer through access to high-value cultivars	Skilled smallholder farmers able to use high-value cultivars due to effective technology transfer and information dissemination	Agricultural technologies, products, processes and services; market-ready IP developed by science council partners such as the ARC and the CSIR through the ABIPP of the DSI	Increased wealth creation measured by an increase in the tax base due to contribution by smallholder farmers; sustained or increased contribution to GDP by agriculture
	Health	Increased productivity by technology-based enterprises in the health sector	Appropriately-trained human resources in health technologies, and regulatory aspects thereof, as well as machine learning and integration of AI in precision medicine	eHealth technologies, Medical Devices and Diagnostics, pharmaceuticals and biosimilars commercialised	Sustained or increased contribution to GDP by the health sector
	Indigenous Knowledge Systems	Increased productivity of IKS-based enterprises able to exploit value-chains	Skilled IKS-practitioners able to use high-value protected IP and know-how due to effect technology transfer and information dissemination, Skilled persons in the clinical validation of indigenous-based natural products, with accredited training from an IKS institute	Target 52 IKS-based products (African traditional medicines, cosmeceuticals, nutraceuticals and health infusions) for commercialisation in local and regional markets	Increased contribution to GDP by IKS-based technology SMMEs

[8] *Adapted from: Review of the funding systems, mechanisms, and instruments adopted by government in funding for research, development and innovation including an international bench-mark analysis (2018) National Treasury (GTAC) and Department of Science & Technology*

Impact[9]			
Poverty alleviation	**Job creation**	**Industry growth**	**Social wellbeing**
Support to various programmes of government, such as the Department of Agriculture, Land Reform and Rural Development (DALRRD); contribute to National Development Plan (NDP) target in increase of proportion of national income earned	Increase in job creation due to the availability of land through land-access programmes of government, and thereby raise per capita income; contribute to the NDP's target of 40 percent employed adults in rural areas; Contribute to additional 643 000 direct jobs and 326 000 indirect jobs in the agriculture, agroprocessing and related sectors	Growth in the agricultural sector due to reduced input costs, and increased market access	Access to safe and nutritious food
Poverty alleviation through the ability of healthy people able to retain employment	New high-tech jobs created using higher-end medical technologies	Growth in the health sector through the creation by supporting local manufacturing capacity, which ensures the security of supply in the health sector; increased rate of market entry by new pharmaceutical interventions	Reduction in ailments and deaths due to the wides-spread availability of health technologies; and improvement in TB prevention and cure. Reduced maternal, infant and child mortality. Reduction in the prevalence of noncommunicable chronic diseases; diagnosis, prevention and/or treatment of priority disease areas within South Africa, identified by the DOH; and improved access to healthcare in marginalised communities through the deployment of cheaper medical interventions
Poverty alleviated in rural areas due to the establishment of functional SMMEs utilising IKs-based technologies	Jobs created in rural areas, using natural resources developed into IKS-based products and services	Growth in IKS-based businesses; securing local and regional supply chains	Improved standard of living in communities

[9] *Impact will be measured in alignment with the NDP goals*

TABLE 16B: INTERMEDIATE OUTCOMES, LONG-TERM OUTCOMES, IMPACT OVER OF 10-YEAR IMPACT HORIZON (2030)[8] FROM 2020 BASE (CONTINUED)

Outputs	Sub-programme	Long-term outcomes			
		Productivity	Skilled Human resources	Commercialised products and services	Wealth creation
	Industrial Biotechnology	Increased productivity of enterprises using industrial biotechnology processes to improve productivity	Appropriately-trained human resources in bulk and fine chemicals technologies	Industrial bio-technologies for conversion of bulk products to fine, high-value products, and renewable biomass to generate high-value niche products such as proteins, fine chemicals, carbohydrates and oils; technologies for the production of bulk and specialty biochemicals such as nutraceuticals, flavourants and cosmeceuticals; and technologies for the creation of biofuels, bioenergy, algal biorefineries and bio ethylene as feedstock for the plastics industry	Increased wealth creation through the creation of new bio-based industries
New and existing Technology Platforms managed and supported	Technology Platforms	Increased productivity by SMMEs that have access to platform services	Increase in number of skilled human resources in SET	New and globally relevant technologies with high IP protection potential	Wealth creation in SMMEs providing services based on technologies developed at platforms
Technology Innovation Clusters managed and supported	Technology Innovation Clusters	Increased productivity by SMMEs that have access to, and participate in, clusters	Increase in number of skilled human resources in SET	Access to technologies from universities and private sector R&D entities	Increased wealth creation due to expansion of value chains by technology-enabled industries with international markets

[8] *Adapted from: Review of the funding systems, mechanisms, and instruments adopted by government in funding for research, development and innovation including an international bench-mark analysis (2018) National Treasury (GTAC) and Department of Science & Technology*

Impact[9]			
Poverty alleviation	**Job creation**	**Industry growth**	**Social wellbeing**
Poverty alleviation through the deployment of process industries in rural areas that exploit natural resources in a sustainable manner	Upstream and downstream employment as a result of the building of new industries	New industries created in which value chains for low-volume, high-value bio-based products that benefit	Improved standard of living in communities
The deployment of platform technologies through SMMEs in marginalised communities	Job creation in SMMEs	Increased competitiveness of technology-based industries	Indirect contribution to social-well-being of the users of platform-derived technologies
The deployment of cluster technologies through SMMEs in marginalised communities, focusing on the beef dairy and forestry industries	Job creation in SMMEs through the deployment of superior genomics in beef and dairy livestock	Increase in size of industry-specific clusters through increased recruitment of qualifying SMMEs into these clusters.	Indirect contribution to social well-being of the users of cluster-derived technologies, for example the use of nuclear medicine from the nuclear medicine cluster to manage disease of national relevance, such as tuberculosis, malaria and HIV/AIDS

[9] *Impact will be measured in alignment with the NDP goals*

TABLE 17: PROGRAMME 3 INDICATORS, ANNUAL AND QUARTERLY TARGETS

Output indicators	Annual target	Q1	Q2	Q3	Q4
2.1 Number of successfully demonstrated bio-based technologies	15	2	3	5	5
2.2 Number of existing Technology Platforms that are operational and functional	8	0	8	0	8
2.3 Number of new Technology Platforms established in targeted regions	1	0	0	0	1
2.4 Number of operational and functional Technology Innovation Clusters	8	0	6	0	8

TABLE 18: PROGRAMME 3 KEY RISKS

Output Indicator	Risk	Mitigation
2.1 Number of successfully demonstrated bio-based technologies	Inability for technology development to progress to the correct TRL for demonstration	Strong project management
2.2 Number of existing Technology Platforms that are operational and functional	Inability of existing platforms to enter into partnerships with funders, or secure services contracts	Appropriate operational plans vetted by TIA
2.3 Number of new Technology Platforms established in targeted regions	Insufficient funding	Funding instruments of TIA will be accessed
2.4 Number of operational and functional Technology Innovation Clusters	Insufficient critical mass to support the establishment of a new cluster	Appropriate feasibility study terms of reference will be developed

TABLE 19: PROGRAMME 3 EXPENDITURE ESTIMATES

Output Indicator	2021/22	2022/23	2023/24
Income	**241 288**	**248 921**	**249 734**
MTEF ring-fenced	206 288	213 921	214 734
MTEF baseline	-		
Other income (specific contracts, interest and royalties)	35 000	35 000	35 000
Operational Expenditure	**36 006**	**37 320**	**37 276**
Support and infrastructure costs	1 476	1 530	1 536
Human resources	34 530	35 790	35 740
Investment expenditure	**205 283**	**211 602**	**212 458**
MTEF allocation	170 283	176 602	177 458
Specific contracts	35 000	35 000	35 000

Sub-programme: Agriculture

The Agriculture sub-programme seeks to contribute to the development of a competitive, broad-based, inclusive and sustainably growing agricultural sector in South Africa. This will be done through investment into strategic national sector priorities and value-chain focused initiatives that will contribute towards the development of high impact technologies, products and services that would result into growth opportunities to enable new entrants into the sector either for SMEs, smallholder farmers, rural and township communities.

Agriculture supports technologies with the potential for commercialisation and that contribute towards competitive, sustainable and inclusive agriculture and agri-business value chains. This includes improving the diffusion of appropriate agricultural technologies to small-scale and emerging farmers.

The Agriculture sub-programme will implement Phase 2 of the ABIPP, which is hosted by TIA on behalf of the DSI, as approved by the DSI to continue to address the country's needs of food security, transformation, and increased competitiveness of the sector. The support of inclusive development initiatives will be accelerated to enable new and emerging (small scale) farmer migration to commercial scale. The opportunity is in the development of niche, higher-value crops value chains.

Food safety and nutrition remain one of the outcomes that the Agriculture sub-programme aims to contribute to especially towards food security as there is no food security without food safety and nutrition (United Nations 2030 Agenda). Food safety has a direct impact on people's health and nutritional intake. As a result, the sub-programme in partnership with the DSI is finalising a concept towards the development of the Bio-innovation programme in support of Food and Nutrition Security and farmer development support. The objectives of the Bio-innovation programme in support of increased food and nutrition security are as follows:

1) To ensure increased food and nutrition security – bio-innovation technologies, processes and scientific services;
2) To support communities and farmer development programmes with access to the appropriate interventions to increase food and nutrition security and diversification of diets; and
3) To support strategic scientific training, capacity development and technical services based on the agro-innovation hub model.

In terms of addressing economic revival and distressed communities, the Small-Scale Farmer Technology Diffusion Programme will focus on using technologies to drive inclusive development, rural economic development and transformation. This will be achieved through access to market-ready IP developed by science council partners such as the ARC and the CSIR, mining pool of TIA funded clusters, and progressing the Township/Urban Agriculture Technology Initiative which focuses on township revitalisation and economic development, through the deployment of vertical agricultural technologies and smart agriculture solutions.

It is worth noting that almost 42% of the approved funds within the Agriculture portfolio are for projects based in the Western Cape province, with 24% in the KwaZulu-Natal and Gauteng provinces. There are no TIA-funded agriculture-related projects in the Mpumalanga, Limpopo and North West provinces. This is sub-optimal considering that TIA has a national mandate. To address this, the Agriculture sub-programme will drive a business development campaign to attract technological innovation projects from these provinces throughout the country, particularly previously disadvantaged universities, and also drive the deployment of these projects to benefit largely small-scale farmers in economically depressed zones, rural and township areas.

The DALRRD recently launched the Proactive Land Acquisition Strategy Programme, following the announcement by President Cyril Ramaphosa in his February 2020 State of the Nation Address. This Programme offers opportunities for small-scale farmers and rural farming communities to access approximately 700 000 hectares of state-owned agricultural land. On 1 October 2020, the Department announced the process to be followed by members of the public in applying for available agricultural state land as part of the government's contribution to the land reform programme. The Agriculture sub-programme sees this as an opportunity to partner through the ABIPP with DALRRD to advance inclusive development through technology dissemination, and implement the Small Scale Farmer Technology Diffusion Programme of the market development and partnership opportunities with Coca Cola BevSA concerning grape juice concentrate targeting the Limpopo, Mpumalanga and Eastern Cape provinces, and the ARC concerning low chill apples targeting the Limpopo, North West and Northern Cape provinces. These targeted areas are currently underserved and their economic situations are severely distressed, and therefore require deliberate efforts to intervene to change economic fortunes by creating prospects to new entrants in the industry in the form of agro-processing start-ups and new job opportunities particularly targeting the black youth, women and persons with disabilities.

The Agriculture sub-programme is aware that the DALRRD is planning to distribute land in the Eastern Cape (43 000 Ha), Free State (83,33 Ha), KwaZulu-Natal (3 684 Ha), Limpopo (121 567 Ha), Mpumalanga (40 206 Ha), Northern Cape (12 224 Ha) and North West (300 000 Ha) provinces. Gauteng and the Western Cape provinces have no land to be distributed under the programme and the distribution situation aligns well with the sub-programme's underserved areas identified above.

In line with the national 2017-2022 Food and Nutrition Security Plan and the Bio-economy Strategy, the Agriculture sub-programme will aim to leverage technologies that are already developed to promote food security and nutrition, engage in in the design of broad-based deployment and diffusion of technology solutions, and hence demonstrate the transfer of technologies and knowledge benefits to poor people in rural communities and the informal economy, especially through co-operatives. The DSI's Outcome 3 (Increase knowledge generation and innovation outputs), Outcome 4 (Knowledge utilisation for economic development) and Outcome 5 (Knowledge utilisation for inclusive development) are met by this activity.

The establishment of the new Aquaculture Bio-innovation Cluster Programme in conjunction with key stakeholders in the sector such as the National Aquaculture Research Forum, the Department of Environment, Forestry and Fisheries, the Aquaculture Association of Southern Africa and Aquaculture South Africa will be pursued.

Sub-programme: Health

The Health sub-programme seeks to support the translation of South Africa's RDI outputs in the diagnosis, treatment and management of diseases relevant to South Africa, into products and services that will uplift the quality of life and healthcare for all South Africans. This is underpinned and enabled by collaboration with key stakeholders in targeted initiatives that grow local manufacturing capacity, ensure the security of supply in the health sector and create jobs to help revive the economy.

The Health sub-programme aims to enhance South Africa's global competitiveness in the health arena and to deliver socioeconomic value through technological innovation in healthcare products and services, addressing the diagnosis, prevention and/or treatment of priority disease areas within South Africa.

The sub-programme contributes to the DSI's three-pronged strategy in the following ways.

- The Department of Health's eHealth Strategy is aimed at developing an integrated, national patient-based information system that interfaces with other systems used in the health sector. eHealth covers technologies in electronic health records, health management information, consumer health informatics, telemedicine, virtual health care, mobile health and health research, which the sub-programme will address through its digital health focus.
- The Medical Devices and Diagnostics focus of the sub-programme will integrate the functions of the Medical Devices Cluster (an initiative in collaborative partnership with the South African Medical Research Council (SAMRC), which is the host.
- The Health sub-programme's investments in pharmaceuticals will be made in partnership with the Active Pharmaceutical Ingredients Cluster, to take late-stage opportunities through funded public-private partnerships or product development partnerships. This initiative is hosted at the North-West University and includes the participation of industry.
- There are opportunities to explore biosimilars and other innovative production technologies, such as biopharming and biologics. Opportunities also exist to assist local industry development, potentially including bioprocessing, quality control laboratories, and protein engineering or production. The outcomes of this initiative will be commercialised through strategic partners such as the BioVac Institute, in which TIA and the DSI have shareholding.
- The opportunity to manage an industry fund that will transform the South African Health Products Regulatory Authority (SAHPRA) systems and processes, and advocate for leveraging additional resources from the pharmaceutical industry in South Africa and abroad will be taken up by TIA through the Health sub-programme. This fund will improve the information management systems and appropriate strategies for staff capacity building at SAHPRA, to facilitate efficient and effective approval processes for medicines and related products.

The Health sub-programme will endeavour to improve the geographical impact of its activities through providing further support towards technical development and pre-commercialisation activities to projects in health that have been previously de-risked by the TIA Seed Fund across the nine provinces. Furthermore, through the support of the development of digital and point-of-care (POC) technologies, the Health sub-programme will enable the provision of access to quality health care in low resource settings which traditionally are located far away from major urban centres.

The Health sub-programme will support the advancement of health-related technologies through product development, validation and market testing. These efforts will be directed towards addressing the diagnosis and treatment of diseases relevant to South Africa and Africa more broadly. In so doing, TIA will seek to exploit the confluence of digital technologies and big data to improve the delivery of health care services, in line with priority 3 (education, skills and health) of the 2019-2024 MTSF, and specifically in support of DSI's Outcome 4 (Knowledge utilisation for economic development).

The Health sub-programme will also consider inbound technology transfer as a means of accelerating technology development. There must be further creation of intellectual property that will be South African owned, thus leading to the localisation of manufacturing processes. There are various considerations in attempting to significantly drive local value addition including input and raw material supply, skills and regulatory considerations which all need significant improvements including intervention in policy, incentives, financing, to support localisation efforts. Projects in partnership with the South African Medical Research Council and its Strategic Health Innovation Programme (SHIP) will also lead to local manufacture of reagents and diagnostic tests for COVID-19 (Outcome 4: Knowledge utilisation for economic development).

The Health sub-programme will support inclusive innovation by exploring innovations that would serve marginalised communities such as point-of-care technologies and m/e-health that could uplift these communities. Emphasis will also be placed on technologies that would significantly reduce costs and therefore improve access to healthcare for all (DSI's Outcome 4: Knowledge utilisation for economic development, and Outcome 5: Knowledge utilisation for inclusive development).

Local POC Diagnostics: The efficient and effective management of South Africa's burden of disease and provision of affordable healthcare as envisioned by the National Health Insurance scheme, in part, requires the enablement of rapid disease detection and testing at, or near, the site of patient care. The potential benefits of such rapid or POC diagnostics include the short turnaround time, minimal manual input, portability, low cost, and immediate clinical decision-making so that they can be successfully deployed at the primary care facility and are particularly fit for use in remote settings with poor or no laboratory infrastructure. As such the Health sub-programme will partner with the National Health Laboratory Services (NHLS) and the Medical Device Cluster to fund an initiative to develop local POC tests that would replace imports, ensure the security of supply and are targeted at South Africa's burden of disease.

AI in Health and Precision Medicine: The advent of machine learning presents an opportunity for the integration of AI in health. This, coupled with the mapped genomics of a patient, can now be leveraged to predict best outcomes. The Health sub-programme will therefore explore a precision medicine initiative with partners already in this space such as the CSIR and to propel an AI-based precision medicine agenda for South Africa.

There remains a fundamental translation chasm in the Health Innovation agenda in South Africa and Africa as a whole. For example, over the years, South Africa has established drug discovery research initiatives and funders, to ensure localisation, affordability and security of supply of medicines and related products. The government continues to invest in drug discovery research with promising results and candidates as outcomes but has limited dedicated funding to convert/translate that into products, due to the quantum of funding required to bridge the gap between pre-clinical/first in humans and clinical development (Phase IV (product registration) drug development phases). A dedicated Clinical Trials Fund, to address the most pressing and urgent needs of medical interventions that require clinical trials, is required. Particularly in the context of South Africa, such a fund will enable harnessing of previous investments, largely from the government, as well as unlocking of previously overlooked opportunities in the private sector. The Health sub-programme will lead the feasibility study (which will evaluate previous initiatives, which will include the African Clinical Research Organization (ACRO) and will establish the Clinical Trials Fund, in partnership with government, research institutions, private sector laboratories, private sector funding, and pharmaceutical companies.

Sub-programme: Industrial Biotechnology

The Industrial Biotechnology sub-programme contributes to the promotion of the green economy by focusing its efforts towards addressing national priorities and gaps in the value chain, thus contributing to the development and commercialisation of environmentally sustainable and cleaner technologies. Bioprocessing technologies are used to convert various types of feedstock or biomass into useful products, ranging from bulk products to fine, high-value products. The integrated biorefinery approach provides the opportunity to use renewable biomass to generate high-value products such as proteins, fine chemicals, carbohydrates and oils, which in turn create potential economic opportunities. The sub-programme will continue to implement the second phase of the Strategic Industrial Bio-innovation Programme (a programme which the Unit is hosting on behalf of the DSI) which focuses on supporting sector development initiatives that promote and strengthen the development of value chains for low-volume, high-value bio-based products.

The sub-programme will also support existing bioprocessing and biomanufacturing capabilities for product development and the creation of SMMEs. The establishment of biorefinery initiatives will be a priority over the next five years, particularly the development and deployment of technologies such as extraction and formulation processes within the natural products industry. The focus in this sector will be primarily on biobased chemicals and, more broadly, on bioproducts, bioremediation and waste beneficiation.

The sub-programme will also support existing bioprocessing and biomanufacturing capabilities for product development and the creation of SMMEs. The establishment of biorefinery initiatives will be a priority over the next five years, particularly the development and deployment of technologies such as extraction and formulation processes within the natural products industry. The focus in this sector will be primarily on biobased chemicals and, more broadly, on bioproducts, bioremediation and waste beneficiation.

In partnership with the CSIR and other role players, the sub-programme will establish a dedicated programme for new and existing small enterprises in the biomanufacturing sector to improve the local production of bulk and specialty biochemicals such as nutraceuticals, flavourants and cosmeceuticals, with a specific focus on building small enterprises.

In further support of economic revival, the Industrial Biotechnology sub-programme will support investments in projects, programmes and initiatives that deploy biocatalytic technologies to develop products in various industries including fine chemicals, polymers, textiles, cosmetics, flavours and fragrances, with a particular focus on technologies that reduce manufacturing costs and environmental impact and use more benign process conditions. This will be pursued through the IBH, which will be hosted at the CSIR.

The Industrial Biotechnology sub-programme currently has investments in six of the nine provinces with a large proportion of the investments going to KwaZulu-Natal, Gauteng and the Northern Cape. To expand the geographic footprint, the sub-programme will solicit investment opportunities from the remaining provinces starting with North-West and Free State through (1) the establishment of project and programme consortia, where necessary, to pool resources and expertise by facilitating partnerships between the previously disadvantaged individual (PDI) and established institutions to accelerate the development of new technologies emanating from these provinces, and (2) mining of TIA internal project portfolios within the Seed Fund, Global CleanTech Innovation Programme (GCIP) and Innovation for Inclusive Development (IID) to identify investment opportunities.

The activities of this sub-programme contribute to DSI's Outcome 3 (Increase knowledge generation and innovation outputs), and Outcome 4 (Knowledge utilisation for economic development). These activities also highlight the need for the sub-programme to find expression in the DSI's sectoral masterplans. It is clear that upon the delivery of biocatalysis and biorefineries outputs and deployment into rural areas, Outcome 5 (Knowledge utilisation for inclusive development) and Outcome 6 (Innovation in support of a capable and developmental state) where the sub-programme will increase the footprint of the DSI at the provincial level, and be able to deliver on the District Development Model, will be addressed.

The first half of 2021/22 will be used to consolidate the delivery of current initiatives including the two DSI programmes. The sub-programme will hold consultations with stakeholders in developing new initiatives for launch during 2022/23, with reference to biocatalysis, biofuels, bioenergy, algal biorefineries and bio ethylene as feedstock for the plastics industry.

Sub-programme: Indigenous Knowledge Systems

The DSI's IKS unit has previously invested in 52 IKS projects across nine provinces in South Africa. In this, the Indigenous Knowledge (IK)-Based Bio-Innovation sub-programme has partnered with the DSI to progressively on-board the investments to TIA from November 2020. The aim is to assist the DSI to ensure that products emanating from these projects are commercialised. Therefore, the TIA IKS sub-programme will assist the DSI projects with upscaling and commercialisation efforts and will harness indigenous ideas using the Ubuntu-based Bio-Innovation model. Whilst working towards mainstreaming holistic IK-based research and development, inclusive innovation that supports community-based technology demonstration will be the central guiding principle of the sub-programme. The sub-programme's focus on African traditional medicines, IK-based cosmeceuticals, nutraceuticals, and health infusions will serve as the base for technology transfer and commercialisation of IK-based innovations.

The IKS sub-programme will harness indigenous ideas by supporting the development of technologies to conduct process development, product formulation and, where necessary, the clinical validation of indigenous-based natural products. These products have the potential to benefit from increasing consumer demand for naturally produced medicines, foods, beverages and cosmetics. The IKS sub-programme aims to grow the proportion of funding dedicated to investments in indigenous knowledge-based projects and programmes in its portfolio. The sub-programme will adopt inclusive innovation approaches that make knowledge holders and communities part of the development and commercialisation value chain and thus contribute to the creation of community-based enterprises and jobs.

- **African traditional medicines:** One of the key focus areas will be to build capabilities to support the validation of efficacy and the safety of African traditional medicines and support their mainstream commercialisation. TIA will also provide financial and non-financial support that promotes inclusivity of indigenous knowledge holders in product development and commercialisation.
- **Cosmeceuticals, nutraceuticals and health infusions:** TIA 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 Technology Platforms and Technology Stations to support these initiatives.

The initiatives of this sub-programme are in support of the DSI's envisaged policy framework for the development of an IKS-based pharmaceutical industry, and the establishment of an IKS-based bio-innovation institute. The sub-programme will plug its funded projects, and contracted DSI projects into the work currently being prioritised by SAHPRA to mainstream IK-based products. These are key deliverables that are in support of the creation of employment in communities.

Collaboration with key stakeholders in the ecosystem will form an important component in the development value chain for IK-based products. In this role, TIA will provide funding for technology development, competencies and infrastructure capabilities to increase the creation of and support innovative start-ups and SMMEs. An existing partnership with the IDC through the Indigenous Natural Products Fund, for the support of the development and commercialisation of products derived from South African indigenous natural products, will be used to channel activities in IKS in a co-funding model, in which projects will be jointly assessed, and managed to commercialisation.

Furthermore, the BioPANZA initiative, a coordinating network of bio-based products, which was established in 2016 as a government-led programme that aims to advance the transformation, resource sustainability, and economic development using natural products in South Africa, will be optimised. The sub-programme will also leverage the capabilities of existing stakeholders such as SEDA for the provision of entrepreneurial support to IK-based enterprises.

The sub-programme will work closely with SEDA and its incubators as they are partners with national footprints. This will illustrate the sub-programme's contribution to the government's District Development Model. In this initiative, municipalities' respective Economic Development divisions will be approached and within them, Indigenous Knowledge holders and traders will be identified. The communities or newly formed IKS start-ups will be trained on enterprise development and will be supported financially from product idea stage to commercialisation.

The activities of the IKS sub-programme can be linked to Outcome 3 (Increase knowledge generation and innovation outputs), Outcome 4 (Knowledge utilisation for economic development), as well as Outcome 6 (Innovation in support of a capable and developmental state) where the sub-programme will increase the footprint of the DSI at provincial levels, and be able to deliver on the District Development Model.

The sub-programme will collaborate with DSI to develop a framework to recognise indigenous knowledge disciplines and to provide a competency-based accreditation and certification system to recognise these disciplines within the National Qualifications Framework prescripts.

Sub-programme: Technology Innovation Cluster Programme (TICP)

A technology innovation cluster provides a collaborative multi-stakeholder vehicle following a broadly inclusive and coherent ecosystem approach geared to identify and achieve common objectives to create a knowledge-based economy in areas of national priority. By adopting a value chain approach and catalysing collaborations among stakeholders, the TICP facilitates an enabling environment for the advancement of technology innovation and commercialisation.

TICPs are collaborative initiatives involving the relevant players' stakeholders in a particular industry players along the value chain such as entrepreneurs, companies, suppliers, associations, manufacturers and research institutions. Through this Programme, TIA catalyses the relationships and streamlines initiatives and related intellectual property developed by these partners to increase the sector's capacity to develop effective technology solutions and contribute to the global competitiveness of the sector.

The TICP sub-programme will continue the implementation of the Nuclear Medicine and Biosciences Technology Innovation Programme through the support of four projects in addressing diseases of national importance including tuberculosis, malaria and HIV/AIDS. The projects aim to stimulate a technology development environment in the sector and thereby facilitate and accelerate the commercialisation of nuclear medicine products for local production. The sub-programme will also contribute to human capital and capacity development to ensure continued skills development, especially in the emerging field of nuclear medicine.

TIA manages several initiatives that are strategically aligned with national priorities through the TICP sub-programme. These include agricultural programmes in areas such as beef and dairy genomics, animal health and forestry molecular genetics. Clusters relevant to the health sector include active pharmaceuticals, and medical devices and diagnostics

The uYilo Programme continues to advance the competitiveness of the e-Mobility industry in South Africa, and specifically in the role of energy storage through promoting the use of electric and hybrid-electric vehicles in the sector and supporting the establishment of a lithium-ion battery manufacturing value chain in South Africa. Through technology development partnerships and its Kick Start Fund project, uYilo supports higher education institutions and SMMEs in provinces across the country including Mpumalanga, Eastern Cape and Limpopo.

Progression of the long-term investment into the Animal Health Cluster for the development of animal diagnostics and vaccines will be critical for the revitalisation of the veterinary pharmaceutical sector, which currently relies heavily on imports. Full commercialisation will assist in economic revival

through contributing to potential local industry income growth and the creation of additional employment opportunities. Funding permitting, Phase 2 of the Beef Genomics and Dairy Genomics Programmes will expand their reach to empower previously disadvantaged individuals to support their entry into the formal industry where applicable. The Beef Genomics Programme will include emerging and smallholder farmers across the country for comparatively rapid genetic improvement in indigenous breed types as well as within mixed and non-descript breed types. The Dairy Genomics Programme, in collaboration with Milk SA, will utilise genomics as a tool to broaden the market for milk and other dairy products locally and internationally, to improve the international competitiveness of the industry.

The Active Pharmaceutical Ingredients and Medical Devices/Diagnostic Clusters will continue with interventions aimed at supporting and strengthen the country's local RDI capabilities and skills, expertise, infrastructure and companies across South Africa to stimulate a local industry that provides high-quality, competitively priced healthcare products locally aimed to address the disease burden. Initiatives include the support of technology development projects to develop process improvements based on new chemical technologies to manufacture critical APIs and to enhance the regulatory skills of medical device and diagnostic companies to ensure compliance with registration requirements.

As it moves into Phase 2, the Forest Molecular Genetics Programme will continue the expansion of is national footprint into the forest regions across the country in the Limpopo, KwaZulu-Natal and Mpumalanga provinces. Consortia members will include industry as well as the higher education institutions in these regions. The Programme is also looking to integrate its activities further downstream into the bio-refinery and forest products supply chain.

The TICP sub-programme co-operates with both national and provincial departments, entities (international and local), associations and market players. This activity will contribute to the DSI's Outcome 3 (Increase in knowledge generation and innovation outputs) of the 2020-2025 MTSF. The nature of TICP sub-programme allows participation with the DSI in the implementation of sectoral masterplans in partnership with other national government departments and provincial governments, to implement common flagship projects. The sub-programme furthermore contributes to human capacity development and training specifically in high-end technologies and critical skills required for South Africa. Several post-graduate students are indirectly supported through cluster technology development projects.

The sub-programme will collaborate with the Agriculture sub-programme to establish a new Aquaculture Bio-innovation Cluster Programme. The implementation of phase two of the Beef Genomics Programme will involve a new strategic partnership to be formed with the ARC's Kaonafatso ya Dikgomo (KyD) programme, a special-purpose intervention aimed at accelerating the participation of commercial-oriented smallholder livestock producers in the mainstream livestock industries.

The most recent Cabinet Lekgotla focused on economic recovery and the development of a reconstruction and recovery plan to recover from the devastation caused by COVID-19 in lives, economy, employment and businesses. Key areas that form part of the recovery include infrastructure, job creation, strengthening energy security and localisation through industrialisation.

The uYilo Programme plays a key role in the national energy plan to ensure local energy sustainability and the creation of local businesses and employment creation through its participation in the DSI Advanced Battery Consortium. The programme also supports a Kick Start Fund project aimed to add value to local manganese ore and in localising the production of high purity manganese sulphate. Both the Active Pharmaceutical Ingredient (API) and Medical Device/ Diagnostic Clusters are directed at increasing localisation the manufacture of these pharmaceutical products thereby contributing to the reversal in the decline of the local manufacturing sector and promotion of the export market. The Agricultural and Forestry Clusters directly playing a part in the creation of higher-value exports hence contributing to the trade surplus in key export markets such as the European Union and the United States.

Sub-programme: Technology Platforms Programme

The sub-programme provides funding to facilitate access to key technical infrastructure and expertise that enables technological innovation in strategic technology areas. TIA funding ensures that technology platforms acquire cutting-edge research equipment, facilities and associated world-class expertise to lower barriers for public and private users to engage in technology innovation. The value proposition of the Technology Platforms Programme is to facilitate access to cutting edge technological capabilities by investing in and supporting entities to acquire appropriate technologies and expertise that in turn lower the barriers for others to innovate. The Programme is a part of TIA investment toolbox that seeks to enable and stimulate innovation in the NSI. The sub-programme identifies and co-develops opportunities, funds and supports Technology Platforms to build long-term technological capabilities required to build the South African bio-economy.

Investments in technological infrastructure over the next five years will be guided by optimising the use of existing capabilities to support biomanufacturing endeavours for small enterprises; strengthening support for IK-based innovators in various value chains in product development, market testing and validation; enhancing access to large-scale infrastructure requirements to successfully realise integrated biorefineries; developing capabilities for technology and product development in veterinary and human health applications; and developing capabilities to exploit conversion technologies, such as big data generation and analysis to exploit local opportunities, among other measures.

The Centre for Proteomic and Genomic Research, the National Metabolomics Platform and the KwaZulu-Natal Research Innovation and Sequencing Platform will continue to support the expansion of the Distributed Platform in Omics, one the key initiatives implemented through the DSI-led South African Research Infrastructure Roadmap. These platforms will provide thought leadership in establishing high-quality R&D facilities and collaborate on providing shared services with relevant laboratories that are part of the network. The sub-programme aims to increase the overall quality of genomics-based R&D and innovation outputs that are critical for the realisation of the bio-based products.

The TIA Bioprocessing Platform supports the implementation of the Strategic Industrial Bio-Innovation Programme focusing on the localisation of various bioprocessing technologies for exploitation by South African based SMMEs. The advent of the use of serological COVID-19 tests will become increasingly important in the fight against the pandemic. Therefore, the platform will avail its capabilities to support the development of rapid diagnostics.

It is envisaged that the Centre for Proteomic and Genomic Research will continue to conduct SARS-Cov-2 testing during 2021/22 which is a crucial element in the fight against the pandemic. Similarly, the KwaZulu-Natal Research Innovation and Sequencing Platform will conduct surveillance studies in collaboration with the South African Medical Research Council to understand COVID-19 outbreaks and disease evolution that will inform policy interventions.

The Bioprocessing Platform will lead the focus on economic revival through the support of a dedicated programme for small enterprises seeking product development in the broad area of bio-manufacturing. The programme aims to provide pilot production and technology packages to small enterprises, including co-operatives. The platform will collaborate with SEDA to provide business and enterprise development support. The programme will seek to expand the TIA geographical footprint through targeted sourcing of projects from Limpopo, Mpumalanga and the Eastern Cape provinces and build on existing entrepreneurial activity in the development and commercialisation of natural products.

Technology platforms possess unique technical expertise in a wide range of areas. Some of the key interventions in the NSI will provide include the rollout of bio-entrepreneurship support, industry-relevant laboratory training, accredited training to healthcare professionals and the provision of internship and mentorship opportunities for candidates in areas such as Limpopo, North West and the Eastern Cape provinces.

Technology Platform activities speak to DSI Outcome 4 (Knowledge utilisation for economic development), by investing in infrastructure, and providing support to SMMEs and other users to develop technologies to commercialise the resultant products and processes. The COVID-19 testing and surveillance work conducted in collaboration with the SAMRC and National Health Laboratory Service supports Outcome 6 (Innovation in support of a capable and developmental state).

The sub-programme will pursue the implementation of a Biomanufacturing Programme, focusing on small enterprise support, and will also launch a technology platform in African Traditional Medicines.

Programme 3 will explore new funding avenues to develop platforms for converging technologies. Since technological advances in future will require the use of converging technologies, opportunities for development and applications of general purpose, unrelated technologies show potential for increased increases the returns to publicly-funded R&D. The use of biotechnology in primary production and industrial processing, or the application of advanced manufacturing and engineering to complex biomanufacturing requires converging technologies expertise (bio-engineering expertise, synthetic biology or genomics expertise, or nanotechnology, for example), not at a technical level, but at an innovation management level such as in funding agencies. Globally, there are large amounts of high-tech opportunities under development, such as at the International Centre for Genetic Engineering and Biotechnology (ICGEB) however, the lack of follow-on funding to translate these opportunities into new products, process or services is a hurdle. Programme 3 will lead exploitation of converging technologies to pursue biotechnological innovations. This will find application in the development of biosimilars in support of strategic partners such as the Biovac Institute, natural resources interests such as the application of nanotechnology in water remediation, the development of eHealth technologies in support of the DoH. To this end the heath sub-programme will seek appropriate collaborations under agreement with existing partners such as the SAMRC.

The case for leadership by Programme 3 in this regard is made by the existing management of the South African BioDesign Initiative (SABDI) Programme, in which collaborative integrative research projects incorporate functional genomics, structural biology, systems biology and synthetic biology. Biological sciences, computational biology, physical and engineering sciences skills are therefore crucial.

Programme 3 will continue to exploit opportunities to enter into new partnerships and collaborations that will further its objectives, and strengthen its existing partnerships, especially those established through programmes such as ABIPP, Strategic Industrial Bio-Innovation Programme (SIIP) and SABDI, which are managed by TIA on behalf of the DSI.

11. PROGRAMME 4: INNOVATION ENABLING AND SUPPORT

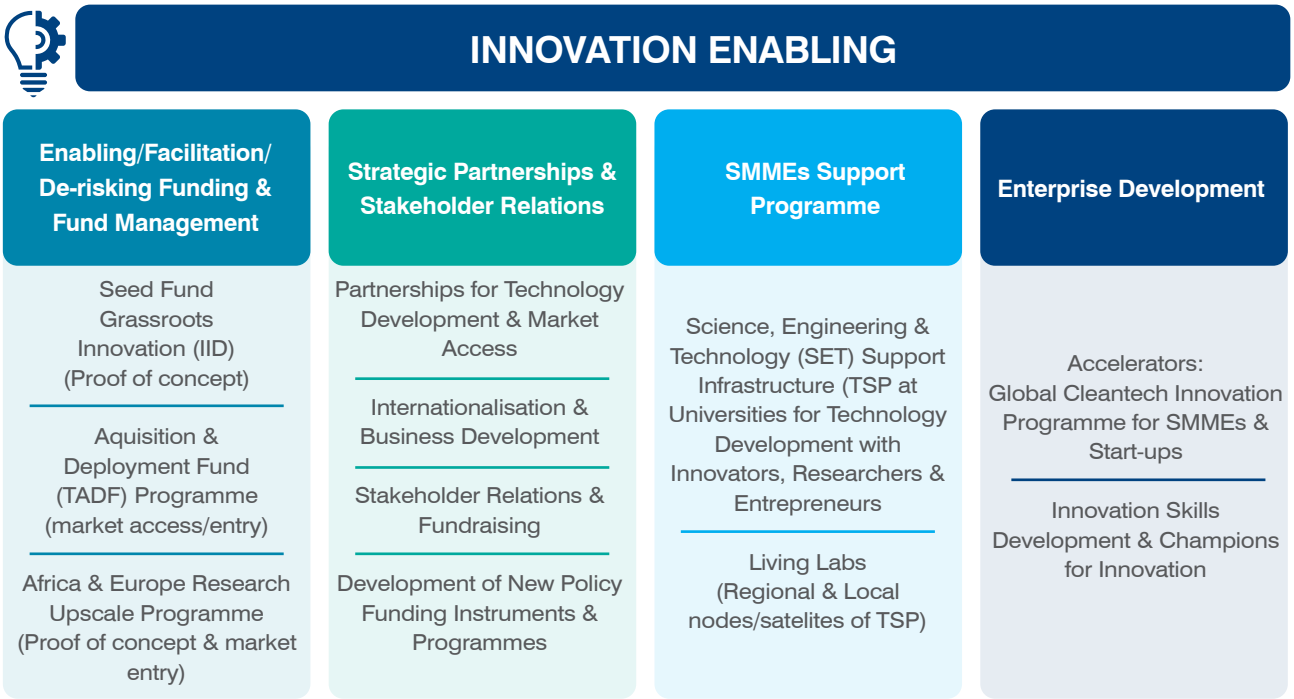
Purpose: To stimulate a culture of innovation and provide enabling support through a range of interventions which facilitate the development of innovative solutions that address societal challenges. Support is provided through innovation infrastructure and expertise, direct funding and skills development. A key characteristic of the Innovation Enabling and Support Division is the development of innovators alongside technology development. The Division targets broader society, from universities and science councils to cooperatives and communities. The Division, whilst contributing towards the targets defined in TIA Programmes 2 and 3, supports, responds and implements the following DSI's Outcomes:

Outcome 1: A transformed, inclusive, responsive and coherent NSI
Outcome 3: Increase knowledge generation and innovation outputs
Outcome 5: Knowledge utilisation for inclusive development and
Outcome 6: Innovation in support of a capable and developmental state

The Division is also an implementation mirror of Programmes 2, 3 and 5 of the DSI, namely the Innovation Priorities and Instruments Chief Directorate, the International Cooperation and Resources Programme and the Socioeconomic Innovation Partnerships Programme.

The Innovation and Enabling Division executes TIA's strategies through the four sub-programmes depicted in Figure 8.

FIGURE 8: THE FOUR SUB-PROGRAMMES OF THE INNOVATION AND ENABLING DIVISION



The Programme drives a strong transformation agenda focusing on women, youth and persons with disability in Technology Innovation. This is done primarily through its Seed Fund, TSP, Innovation for Inclusive Development (IID) Programme, and other programmes within the Innovation Skills Development Programme such as its international accelerator partnership programmes and the South African Technology Network (SATN) partnership. In 2019/20, 81% of the TSP beneficiaries were historically disadvantaged individuals, and women accounted for 45% of beneficiaries over the previous five-year period overall through Innovation Skills Development initiatives. The TSP plays a prominent role in supporting the development of assistive devices that cater to the needs of persons with disabilities. Its Product Development Technology Station at the Central University of Technology in Free State has specific focus in this area and has been supporting local communities through its social and technological innovations. Targeted calls with focused selection processes will drive the transformative agenda for the Programme. Additionally, disaggregated targets to support women, youth and PWDs over the medium term have been considered for its output indicators (please refer to Part D).

11.1 Outcome 3: SMMEs supported through strategically informed and regionally distributed Technology Stations

Under this outcome TIA has identified five output indicators:

3.1 Number of existing Technology Stations providing SET support that are operational and functional;
3.2 Number of new technology transfer centres providing SET support in targeted regions;
3.3 Number of SMMEs and cooperatives receiving SET support;
3.4 Number of honours, masters, post-doctoral students admitted within the TSs activities; and
3.5 Number of knowledge or innovation products added to the IP portfolio through fully funded or co-funded research initiatives.

Through this outcome, TIA aims to address the myriad of challenges facing SMMEs and start-ups that include, among others, access to SET support, business development and basic knowledge of how to set-up a viable company capable of competing and accessing markets. The impact of COVID-19 has been particularly acute on the SMME sector. With depressed demand conditions, the current challenges facing SMMEs have been reduced to basic issues of survival and access to markets.

Those that survived the lockdown, did so, in the main, on account of strong business capabilities and their ability to adapt and use available technologies to remain competitive. Through the TSP, TIA remains one of the few institutions that retains the capability to intervene in the sector through providing technology transfer services, product design, prototype development and other such related engineering services.

Whilst the Technology Stations, operating at 60% of their capacity during the lockdown, have been effective in supporting SMMEs, the model is no longer adequate to service the needs of an evolving innovation landscape. The increasing diversity of sources of innovative ideas has widened. These include entrepreneurs who operate outside formal systems of innovation, such as grassroots innovators, non-governmental organisations and other community-based organisations, as opposed to only the scientific community. The therefore challenge is promoting mass access to these services by small companies throughout the country, irrespective of location.

The entry of these new actors in the innovation entrepreneurship ecosystem requires that beyond provision of SET support TIA broadens its interventions in providing innovation and technology entrepreneurship skills, deliberate market access support, enterprise development and general business development support. These are particularly critical as future efforts will be geared towards enabling these actors to gain access to publicly funded IP and be empowered to translate this into products and services. In this context, key issues relating to the understanding and provision of IP and commercialisation management requires that the organisation goes beyond traditional focus on TIA investees to increase the base of future innovators and entrepreneurs who operate outside the formal systems of innovation. This implies intervening at a system level to build a strong base of expertise across the country of intermediaries and individuals in a manner that can increase TIA's capacity to execute its mandate.

In the financial year ahead, TIA will increase the base of technology transfer centres through the introduction of new models of SET support and technology entrepreneurship intermediaries. These centres will be introduced as complementary models to the existing Technology Stations. This approach will be key to driving the agency's agenda to increasing access to SET support yet pursuing the imperatives of transformation through increased spatial footprint. In this regard, efforts will be deliberately directed towards underserved and disadvantaged communities. In doing this, the agency will focus on the following priorities:

- Continue to increase the performance and relevance of Technology Stations, enabling them to serve a larger number of SMMEs and entrepreneurs. This will involve the drive to modernise facilities, ensuring that they are accredited and adequately geared to respond to the challenges and opportunities arising from 4IR and the sectoral master plans.

- Expand and diversify the suite of SET support to enhance reach to marginalised communities through models such as Living Labs, FabLabs, Idea2Product Laboratories, eKasi Labs, etc., technology incubators and walk-in centres, thereby improving spatial inclusivity. Specifically, TIA will leverage off the extensive network of technical and vocational education and training (TVET) colleges in order to expand this offering. This is particularly important considering the changing nature of sources of innovation to include grassroots innovators and cooperatives. In expanding science, engineering and technology support models, TIA will work with other partners such as industry, township hubs, accelerators and incubators to explore opportunities for co-location and shared services. The negative impacts of COVID-19 on, amongst others, employment and the performance of SMMEs require that, in addition to the innovation centre models mentioned above, a more lasting Technology Stations Strategy should be developed, with a view to locating this capability in various communities and within TVET colleges.

- Refocus its suite of skills development offerings with an emphasis on innovation, entrepreneurship and commercialisation skills aimed at increasing the growth rate of tech-entrepreneurs. Enterprise development offerings will also include mentorship, incubation and acceleration support.

The ultimate measure of success for TIA from all these initiatives should be the impact on SMMEs and start-ups with regards to sales (direct and indirect), revenue generated, licenses, distribution and manufacturing for products, processes and services. The impact will be measured in terms of job creation.

All these efforts are important in light of the imperatives arising from the National Spatial Development Framework and the District Development Model, both of which seek to promote the coordination of efforts across government at local and district level. Through this, TIA aims to increase its spatial footprint and double the number of innovators who have access to key innovation infrastructure facilities and the requisite support.

TABLE 20: PROGRAMME 4 OUTCOMES, OUTPUTS, PERFORMANCE INDICATORS AND TARGETS

Outcome	Outputs	Output Indicators	Audited Actual Performance		
			2017/18	2018/19	2019/20
3. SMMEs supported through strategically informed and regionally distributed Technology Stations	3.1 Existing Technology Stations managed and supported	Number of existing Technology Stations providing science, engineering and technology support that are operational and functional	New indicator	New indicator	New indicator
	3.2 New centres established and supported	Number of new technology transfer centres providing science, engineering and technology support in targeted regions	New indicator	New indicator	New indicator
	3.3 SET support provided to SMMEs	Number of SMMEs and cooperatives receiving SET support	2 800	3 272	3 269
	3.4 High level human capital development for competitiveness and new industry development	Number of honours, masters, post-doctoral students admitted within the TSs activities	New indicator	New indicator	New indicator
	3.5 Knowledge and innovation products produced	Number of patents, publication outputs and knowledge based products (i.e., prototypes, technology demonstrators and technology assistance packages) produced through TTO disclosures as per Intellectual Property Rights from Publicly Financed Research and Development (IPR-PFRD) Regulations	New indicator	New indicator	New indicator

Annual Targets			
Estimated Performance	MTEF Period		
2020/21	2021/22	2022/23	2023/24
18 by 31 March 2021	18 by 31 March 2022	20 by 31 March 2023	21 by 31 March 2024
1 by 31 March 2021	0 by 31 March 2022	8 by 31 March 2023	12 by 31 March 2024
New indicator	3 500 by 31 March 2022	3 800 by 31 March 2023	4 000 by 31 March 2024
New indicator	95 by 31 March 2022	121 by 31 March 2023	130 by 31 March 2024
New indicator	130 by 31 March 2022	140 by 31 March 2023	165 by 31 March 2024

TABLE 21: PROGRAMME 3 OUTPUT INDICATORS, AND ANNUAL AND QUARTERLY TARGETS

Output indicators	Annual target	Q1	Q2	Q3	Q4
3.1 Number of existing Technology Stations providing SET support that are operational and functional	18	0	18	0	18
3.2 Number of new technology transfer centres providing SET support in targeted regions	0	0	0	0	0
3.3 Number of SMMEs receiving SET support	3 500	700	1 000	1 000	800
3.4 Number of honours, masters, post-doctoral students admitted within the Technology Stations activities	95	No target	No target	95	No target
3.5 Number of patents, publication outputs and knowledge based products (i.e., prototypes, technology demonstrators and technology assistance packages) produced through TTO disclosures as per IPR-PFRD Regulations	130	No target	No target	91	39

TABLE 22: PROGRAMME 3 KEY RISKS

Output Indicator	Risk	Mitigation
3.1 Number of existing Technology Stations providing SET support that are operational and functional	Lack of adequate baseline funding leading to reduced and declining operational efficiency	Attract infrastructure funding from other government departments such as the DTIC, DHET SEDA and industry
3.2 Number of new technology transfer centres providing SET support in targeted regions	Limited resources (financial and non-financial) to deploy and establish new centres	Partner with regional agencies, municipalities and local government departments to establish co-funding models and mechanisms
3.3 Number of SMMEs receiving SET support	Limited resources (financial and non-financial) to adequately support SMMEs	Establish co-funding partnerships with other funders, government departments, industry and entities that support SMMEs such as SEDA
3.4 Number of honours, masters, post-doctoral students admitted within the Technology Stations activities	Lack of appropriate medium- to long-term projects suitable for Masters or Doctoral in Technology Stations Lack of funding to support Masters and Doctoral students in a fiscally-constrained TSP	Establish thematic or strategic funded programmes in partnership with partners or stakeholders
3.5 Number of patents, publication outputs and knowledge based products (i.e., prototypes, technology demonstrators and technology assistance packages) produced through TTO disclosures as per IPR-PFRD Regulations	Lack of appreciation of the utility of innovation products other than patents (e.g., trademarks and designs)	Partner with NIPMO and Companies and Intellectual Property Commission (CIPC) to create better awareness of all forms of innovation products across Technology Stations

TABLE 23: PROGRAMME 4 EXPENDITURE ESTIMATES

Output Indicator	2021/22	2022/23	2023/24
Income	**141 939**	**144 846**	**145 097**
MTEF ring-fenced	45 019	46 685	46 862
MTEF baseline	19 320	19 191	19 235
Other income (specific contracts, interest and royalties)	77 600	79 000	79 000
Operational Expenditure	**14 320**	**14 420**	**14 476**
Support and infrastructure costs	860	866	869
Human resources	13 460	13 554	13 607
Investment expenditure	**127 619**	**130 426**	**130 621**
MTEF allocation	50 019	51 426	51 621
Specific contracts	77 600	79 000	79 000

11.2 EXPLANATION OF PLANNED PERFORMANCE

Sub-programme: Technology Station Programme

The TSP enables universities of technology to provide technology services to SMMEs. TIA provides financial support to institutions that house Technology Stations to facilitate technical support to SMMEs in terms of technology solutions, services and training. The Technology Stations are equipped with state-of-the-art equipment and are resourced with highly competent individuals in specialised fields to develop new products and processes for industry and R&D-led entrepreneurs through serving as technology nurseries.

The TSP contributes to the development of knowledge and innovation products added to the industrial development and green economy IP portfolios through fully funded or co-funded research initiatives. It also has Initiatives to improve the technology-based competitiveness of the established primary economic sectors.

The TSP supports the introduction of new R&D-led/based products, processes and/or services into the market as this requires government through its entities to create the necessary enabling frameworks, and infrastructure to enable innovation, to support the demonstration and piloting of new technologies and upscale these where and when appropriate, and to ensure that appropriate IP protection and support mechanisms are in place.

As part of the DSI's Outcome 4 (Knowledge utilisation for economic development), with a key focus on revitalising existing traditional industries and stimulating R&D-led industrial development, the department has committed to: *"scale-up its network of technology stations/platforms in order to provide cross-cutting/cross-sector technological support for SMMEs/ potential entrepreneurs and Co-ops"*. Access to technological support is essential in new product/process development (or improvement) and in developing prototypes and concept demonstrators. TIA's TSP has several initiatives contributing to this outcome and will developed specific indicators to measure its contribution to the District Development Model.

The proposed four key strategic initiatives are to look at prospects of achieving greater returns from the TSP to provide coordinated support in helping entrepreneurs, individuals, emerging firms and destressed companies to improve their competitiveness through the application of new knowledge technologies to deliver on the following measures:

- Increase access of technological services in districts/provinces that have high unemployment rates and poor municipalities;
- Enable underprivileged society's access to Technology Stations and to prepare targeted individuals for the future labour force or/and become entrepreneurs;
- Increase skills and development of technical capabilities for youth owned enterprises;
- Implementation of the Graduate Internship Programme; and
- Promotion of inclusivity and transformation for age group 25-34, black women and people living with disabilities.

The strategic intent to increasing support and develop SMMEs, entrepreneurs and ideas trough SET interventions from Technology Stations. This will be done in the applications of high-end solutions from Technology Stations and wide-spread involvement of businesses, meaning that it is initiatives are expected to lead to spin-off enterprises, which are likely to create jobs and build capacity for economic growth.

Delivering on Bio-Economy – Emerging Start-ups: Aimed at increasing access to Technology Stations for new clientele that in the past three financial years have not received support from Technology Stations. The emerging enterprises that can be supported in the sourcing ideas and exploitation of IP from universities and/or products and services in indigenous knowledge-based solutions and agro-processing technologies to complement food security and nutritional health linked to the Sustainable Development Goals.

Commercialisation – Capacity Building: Aimed at empowering mainly university graduates and individuals at public-funded research organisations with technology and science background with an intended outcome of deal with transformation and inclusivity by creating new enterprises through non-financial support for prototyping support toward the first contract.

Expanding Geographic Footprint – Aimed at enabling Technology Stations to operate outside local area and creating nodes and satellite centre in collaborate manner with district municipalities along TVET campus and other related amenities, such as incubators, science parks and accelerators. The infrastructure extensions and expertise are envisaged to be in range of R2 million to R3 million per Technology Station.

Increased industrial growth – Optimising Investments in public-funded research organisations: Aiming at helping existing industries to improve their competitiveness and increased sales/revenue/turnover to create more jobs through the application of shared infrastructure and efficient usage of high-end equipment at universities, diffusions technology assistance packages, technology demonstrations and tooling support.

The TSP plays the lead role in driving and co-ordinating activities for TIA's third strategic outcome as defined in the 2020 – 2025 TIA Strategic Plan.

Sub-programme: Seed Fund

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

The Programme has attracted co-investment partnership with development funding institutions, public sector funders, industry and government. The model, executed using implementing partners such as offices of technology transfer and SMME support intermediaries, has now expanded to include science councils as key partners in the implementation of the programme. The Fund contributes to the DSI's Outcome 3 (Increase knowledge generation and innovation outputs) through the development of prototypes, technology demonstrators, pilot plants that advance industrialisation through innovation.

The strategic thrust of the Seed Fund in the new year will consist of five actions:

- In line with the TIA strategy, the Seed Fund will be deployed in a nimble and targeted fashion to support strategic sectoral focus areas of pressing need. For the year ahead, supporting the creation and development of new products in the health sector will be an important focus area alongside the Water Seed Fund (Water Research Commission) and the ICT Bio-economy Seed Fund (Tuksnovation at the University of Pretoria). Through the Seed Fund, TIA has launched a funding call targeting the medical device and diagnostic sectors to advance disease management. Furthermore, the organisation is pursing partnerships with medical aid insurers, namely Discovery Health Medical Scheme, where it seeks to ensure access to medicines with Discovery Health Medical Scheme involved as a partner to adopt these new seed funded health innovations.

- Through HEI Seed Fund, TIA will work with the offices of technology transfer, the National Intellectual Property Management Office and the University Technology Fund (a private venture capital fund for universities) to grow its portfolio of publicly-funded research IP towards the creation of start-ups and spin-out companies. This approach will be deliberately adopted with specific intent to promote job creation and the contribution of the start-ups into the growth and development challenges of their specific geographical locations. Specific focus will be directed towards implementing partners in the underserved provinces, specifically the Limpopo, Mpumalanga, North-West, Eastern Cape and Northern Cape provinces.

- Position the instrument as an implementing platform for the DSI hub and spoke sectoral RDI programmes at universities and science councils for the technology development deliverable.

- Position the Seed Fund as an NSI project preparation and development instrument, though co-investment partnership model with development funding institutions, public sector funders, industry, government and a de-risking instrument for the University Technology Fund.

- Institutionalise the Technology Transfer and Commercialisation Matchmaking Programme as a seed fund non-financial, market access support platform.

Sub-programme: Innovation Skills & Enterprise Development

Purpose: Facilitate technology enterprise development through skills and acceleration platforms. The sub-programme also aims to stimulate a culture of innovation thinking within the NSI, thus increasing the rate of translation of innovative ideas into novel technologies, products and services. The Programme provides focused and targeted training interventions to strengthen entrepreneurial capacity of researchers and innovators towards the commercialisation of their research outputs.

For the year ahead, the sub-programme will deliver its interventions in a re-focused manner to deliver the requisite support to budding entrepreneurs and researchers with skills for innovation and commercialisation, and supporting capability building within the NSI through directed support towards intellectual property and commercialisation management. These interventions will include the following:

1. Innovation Skills – aimed at providing, entrepreneurs, students and graduates with SET skills through placement in industry and other technical environments such as technology stations and platforms. Through this intervention, TIA aims to stimulate a culture of innovation, equipping budding entrepreneurs with the requisite hands-on skills to develop their own innovations. This initiative will be implemented directly to support, among others, grassroots innovators and other such stakeholders in the SATN, TVET, further education and training and community colleges.

2. Entrepreneurship Skills – aimed at improving the ability of innovators to establish viable start-up companies that would serve to take their technologies to market and to raise funding. This is implemented through incubation and acceleration programmes such as the GAP Bioscience, Technology Top 100, Global Cleantech Innovation Programme 1.0 and 2.0, Leaders in Innovation, and Swiss Venture Leaders, Silicon Valley Plug and Play Programme, Ireland SA Technology Challenge and Brazil Incubation Support Programme.

3. Innovation and Commercialisation Management Skills – aimed at technology management and commercialisation professionals for placement in environments such as offices of technology transfer, venture capital companies and other similar organisations. TIA implements the CHUMA programme as a specific model towards enhancing innovation and commercialisation skills and will work closely with the National Intellectual Property Management Office to grow this model in the coming year. Specifically, TIA will design and launch an IP management programme aimed at growing the pool of black patent attorneys that serve as critical skills in the commercialisation of technologies in South Africa.

4. Critical Thinking Skills – Working with Department of Higher Education and Training (DHET) and Entrepreneurial Development in Higher Education, the unit will develop an innovation awareness programme for university students to stimulate and promote a culture of innovation among students at school level, and at TVET, further education and training and community college level, equipping them with basic skills for critical enquiry and analysis and promoting awareness around the role and importance of IP.

Strategic Initiative: TIA will develop a micro-enterprise development model directed at promoting the establishment of small companies from low-risk technologies. Typically, this model should be geared towards grassroots innovators, innovators from Living Labs and the Seed Fund.

Sub-programme: Strategic Partnerships & Stakeholder Relations

Purpose: The Strategic Partnerships and Stakeholder Relations (SPSR) sub-programme was established as a business development function with the primary purpose to promote increased collaboration and funding opportunities to advance the organisation's strategic priorities. Its role is to co-ordinate the activities of the organisation to achieve the "hub-&-spoke" model, glass pipeline concept as well develop relationships to enable TIA's backward and forward integration plan.

TIA aims to attract approximately R1 billion in addition to its grant funding for disbursement purposes over the next five years. This implies that TIA should work to fully integrate itself in the NSI through effective linkages with key stakeholders and partners to leverage resources, grow its business and create an environment that enables seamless progression of innovations through the value chain.

The unit works closely with the Commercialisation and Bio-Economy Divisions to contribute to creative strategic thinking and to be able to craft strategies and assist in their execution. In so doing, the unit pursues several objectives.

1. Facilitate and establish institutional relationships, partnerships and programmes (financial and non-financial) with public research institutions, development finance institutions, industry and international partners to support attraction of market-oriented investment pipeline and the seamless transition of investments to exploitation.
2. Grow the pool of upstream and downstream global partners to accelerate innovation value chain progression and market uptake for projects in which TIA has invested in.
3. Leverage and raise global co-funding and follow-on funding to augment TIA's funding base, thereby reducing its dependence on the fiscus and ensuring sustainability thereof.
4. Provide thought leadership and ensure good stakeholder relations within the innovation ecosystem and to international partners.

Institutionalisation and Implementation of the Innovation Fund

A key initiative for the unit is to continue to support the DSI in the final design, institutionalisation and subsequent implementation of the Innovation Fund and to facilitate its transfer to TIA.

The Unit supported the DSI in the initial deployment mechanics and secured R80 million for TIA and the IDC-TIA Natural Indigenous Products Programme/Fund in the initial deployment with the rest of the allocation to the SA SME Fund and the Public Investment Corporation as other key implementing partners of the Fund. Furthermore, the unit will work closely with Small Enterprise Finance Agency (SEFA) in implementing the SMME Innovation Fund from the DSBD.

Internationalisation

The sub-programme also hosts TIA's International Partnerships programme, whose role is to coordinate and lead the agency's efforts to integrate South Africa into the international innovation discourse.

This programme constitutes an important focus area for leveraging funds, promoting joint technology development initiatives; access to knowledge networks; opportunities for capacity-building and knowledge exchange; and fosters greater connection for TIA investees with international networks and markets. In this regard, the Unit will lead and coordinate TIA's partnerships programme at bilateral, regional and multilateral levels, placing emphasis on South Africa's developmental challenges and the African agenda. Future endeavours will include, among others, building on the portfolio of multi-lateral projects, funded through platforms such as EUREKA, a network of European Innovation Agencies that collaborates in joined RDI funding initiatives. This shall include extending its international partnering beyond DSI bilateral and include the DTIC export directorate and the United States Embassy in partnership with the SA-US university network.

In support of the DSI's efforts to increase and deepen South-South collaborations, TIA will leverage off opportunities provided by the BRICS Framework, in particular, through initiatives being pursued under the BRICS Working Group on Science, Technology and Innovation Entrepreneurship Partnership. These include the establishment of the Technology Transfer Centre, the Innovation BRICS Network (i-BRICS), the latter for promoting collaboration on technology entrepreneurship and strengthening of innovation-support intermediaries, such as incubators and technology parks, accelerators, etc. Under the current Presidency of India, TIA will play the role of lead agency in South Africa for the Call for Proposals that will be issued in 2021. In addition to the BRICS, TIA will pursue strategic partnerships with countries in the global South. A notable partnership to be pursued will be that of Cuba, with a long history of friendship between South Africa and Cuba, making it a priority to cement new technological collaborations. Technology areas identified for collaboration with Cuba include COVID-19, biotechnology, artificial intelligence, robotics and nanotechnology.

Project Management Unit: Innovation for Inclusive Development

The Innovation for Inclusive Development programme is a special programme of the DSI, hosted by TIA with the responsibility to implement initiatives in three focus areas, as follows:

1. Grassroot Innovation Programme;
2. Innovation for local economic development; and
3. Innovation for sustainable human settlements.

Of these three focus areas, emphasis is being placed on growing the pool of grassroots innovators throughout the country, enabling access for them to publicly financed IP for commercialisation through the provision of a multi-tiered support package. This includes, among others, technology development, compliance with standards, IP management and mentorship. In growing this pool of innovators TIA has established other partnerships such as Insurance Sector Education and Training Authority (INSETA) and the Department of Tourism who provide co-funding, thereby augmenting the initial funding allocation from the DSI.

Supporting local economic development aims to promote the development of functional local innovation eco-systems that locate capability at district and municipality levels to manage and lead the innovation agenda in their specific localities. In this regard TIA leads a specific intervention on behalf of the DSI, i.e., implementation of the Living Labs programmes, wherein five of these have been established in different parts of the country and more of these will be rolled out in the future as part of a package to enhance access for local innovators to SET entrepreneurship and enterprise development support.

TABLE 24: PROGRAMME 5 PLANNED STRATEGIC INITIATIVES

Initiatives	Key actions
Upscaling TIA (Innovation Fund)	• Continue working with DSI to fully establish and implement the next stage of the Innovation Fund • Formalise partnership with the SEFA on DSBD Innovation Fund for early stage investment deployment with TIA • Explore Schedule 3B special purpose vehicle and financial service provider registration
Internationalisation	• Develop an export investment support programme for technology-based early stage investments with the DTIC, SEFA and the SA-EU Innovation Fund • Conduct feasibility and develop the SA-US University Joint Innovation Venture Fund with the United States through the US Embassy
Regionalisation & Living Labs	• Expand national (regionalisation) footprint through deployment of the innovation centres model • Pilot co-location with SEDA and IDC • Deploy Living Labs as nodes and satellites for at district level • Develop strategy for the expansion and deployment of Technology Stations model to TVET colleges and communities
Technology Acquisition and Deployment Fund (TADF)	• Pursue approval for insertion of TADF in the Public Procurement Bill by National Treasury as a national innovation procurement framework and instrument
Innovation Skills & Enterprise Development	• Develop a micro-enterprise development model directed at promoting the establishment of small companies from low-risk technologies. Typically, this model should be geared towards grassroots innovators, innovators from Living Labs and the Seed Fund • Conceptualise TIA Academy

12. PROGRAMME RESOURCE CONSIDERATIONS

12.1 OPERATIONAL COSTS

Support and infrastructure costs had to be reduced in 2021/22 due to the reduction in allocation as well as specific focus on improving the efficiency ratio within the agency, managed through cost saving initiatives. Human resource costs have been budgeted in line with the prior year, once again focusing on improving the efficiency ratio. This has been managed through only filling critical vacancies within the organisation.

12.2 INVESTMENT FUNDING

Investment funding remains a challenge as the applications for funding far exceed the funding available, due to the lower operational expenditure and increased efficiency ratio a slight increase in investment funding is seen, however no certainty is provided in terms of securing additional funding for specific contracted projects during the financial year.

12.3 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. To increase its funding capacity, TIA pursues strategies to strengthen its funding base, especially under the current constrained fiscal conditions. The agency will continue to focus on obtaining other sources of income to support its programmes and project funding initiatives. This will be done through contract-specific funds from the DSI including the Innovation Fund, which was secured by TIA in the 2020/21 financial year, to the amount of R80 million as well as other government institutions, and through partnerships with the public and private sectors (using hub-and-spoke model). Estimated funding through these partnerships amounts to R114 million for 2021/22.

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

Although a number of budget cuts have been implemented over the past few years as well as for the current planning cycle, the agency has seen an increase in the number and value of specific contracts with the DSI, although this funding assists the agency in terms of its efficiency ratio, the funding is not guaranteed and makes planning in terms of resources, turnaround times and list of programmes/projects very difficult as these figures are not planned for. It also does not assist the agency in addressing pipeline projects as this funding is specifically ring-fenced in terms of projects and allocations, therefore the pipeline gets bigger and the resources to manage and fund them become smaller. Ideally this funding should form part of the DSI MTEF allocation and not be specifically ring fenced over a number of years.

TABLE 25: TIA BUDGET ALLOCATION FOR 2020/21

Technology Innovation Agency: APP Budget For 2021/22	Budget 2021/22 R'000	Budget 2021/22 R'000	Budget 2021/22 R'000
Administration	**165 583**	**166 736**	**167 386**
Support and infrastructure cost	50 642	50 995	51 194
Human Resources	114 941	115 742	116 193
Investments	**406 620**	**416 134**	**417 245**
Bio-economy	199 020	205 088	205 734
Technology Stations	91 019	87 085	87 262
Commercialisation	78 400	78 981	79 244
Innovation Enabling	38 181	44 981	45 005
Total Expenditure	**572 203**	**582 870**	**584 631**
Total Funding Received	**572 203**	**582 870**	**584 631**
Allocation from DSI	447 703	458 370	460 131
Baseline (Other than Bio-economy and Technology Stations)	196 396	197 764	198 535
Bio-economy	206 288	213 921	214 734
Technology Stations	45 019	46 685	46 862
Additional Income Target	114 000	114 000	114 000
Interest	10 500	10 500	10 500
Surplus/Deficit	-	-	-
Capex Allocation:	6 000	5 000	5 000
Efficiency Ratio	29%	29%	29%

12.4 OPERATIONAL RESOURCES

The TIA organisational structure consists of 190 positions, of which 152 positions are filled and 38 positions are vacant. This translates into a vacancy rate of 20%. As a result of a limited Human Resources budget, only 14 of the 38 vacant positions were prioritised for recruitment.

Following the lockdown announcement, TIA employees were able to adjust to a remote working environment very quickly and productively. This then raises the question if the expensive infrastructure is still a necessity in its current form. Various solutions, which can also increase TIA's regional footprint will be considered going forward.

12.5 COMMERCIALISATION DIVISION PROGRAM RESOURCES

12.5.1 Operational Costs

Operational and funding costs had to be reduced in 2021/22 due to the reduction in allocation as well as specific focus on improving the efficiency ratio within the Programme. Human resource costs have been budgeted in line with the prior year, and although some positions have not been filled the focus has been on improving the efficiency ratio. This has been managed through only filling critical vacancies within the programme.

12.5.2 Investment Funding

Investment funding remains a challenge as the applications for funding exceed the funding available, This implies that the Programme will have to increase its efforts in leveraging funding from alternative sources and consider co-funding as a future model.

12.5.3 Other Income

Funding is an important enabler for the Programme to enhance its de-risking role as the primary funder of early-stage technology innovations. To increase its funding capacity, the programme pursues to focus on obtaining other sources of income to support its programmes and project funding initiatives. The Programme has secured R40 million funding from the Innovation Fund (DSI) for the commercialisation of its' mature technologies. Maturing technology development projects are expected to yield financial returns in the form of royalties, loan repayments and other forms of commercialisation.

12.6 PROGRAMME 3 – PROGRAMME RESOURCE CONSIDERATIONS

12.6.1 Operational Costs

Programme 3, as with all other Programmes of TIA, had to incur budget cuts in line with budget re-prioritisation in response to the COVID-19 pandemic. As a result, certain operational expenditure was adjusted downwards and savings were realised. This was in support of the organisation's efficiency ratio target. These savings were directed towards meeting investment obligations.

12.6.2 Investment funding and other income

The availability of funding for existing projects that required follow-on funding is always set against the priorities of funding of new investments. This implies that Programme 3 will have to increase its efforts in leveraging funding from alternative sources, in addition to the DSI (for new programmatic funding or ring-fenced DSI funding).

Programme 3 has implemented project management principles to recover unspent funds from non-performing, cancelled or completed projects, for reinvestment. Opportunities for additional income from the disposal of shares will be prioritised as an alternative source of funding.

13. UPDATED KEY RISKS AND MITIGATION FROM THE STRATEGIC PLAN

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

A risk landscape review will be performed once the priorities for the DSI Decadal Plan, the 2019-2024 MTSF, the five-year Bio-economy work plan and the five-year TSP work plan are approved. A review was undertaken to determine the emerging risk profile, the results were tabled and approved at the Enterprise Risk Management Committee, Executive Committee and the Audit and Risk Committee, which are outlined in Table 26:

TABLE 26: STRATEGIC RISK AND MITIGATION PLANS (2020-2025)

Outcome	Key risk	Risk mitigation
1. A sound governance administration	Cybersecurity threats	Continuous updates and upgrades on the network including implementation of supplier patches as released to fend off attacks
	Possible misalignment between TIA and DSI	Constant engagement and open communication including more frequent formal engagements with the DSI
	Inability to deliver on the strategy	• Reprioritisation and change of the APP • Continuous monitoring of Management performance • Appointment of GMs and the implementation of a new organisational structure that is aligned to the new strategic plan
2. A sustainable Bio-economy Strategy	Possible poor performance of investment portfolio	Recruit appropriate staff, with technical expertise and innovation management expertise, couples with project management skills Develop portfolio management competence Develop and implement a post investment management protocol
3. A sustainable innovation infrastructure	Possible budget cuts	• Re-prioritising initiatives that are relevant to the immediate strategic context (COVID-19) • Raise/leverage more funding through strategic partnerships
4. Successfully bridging the innovation chasm	Lack of optimal organisational capability	• Constant review and evaluation of the appropriateness of current controls and processes • Appointment of appropriately skilled and experienced staff
5. Facilitation of grassroots innovation	Negative stakeholder sentiment	• Develop a coherent communication strategy • Improvement of turnaround times with regards to due diligence • Annual stakeholder engagements sessions

14. PUBLIC ENTITIES

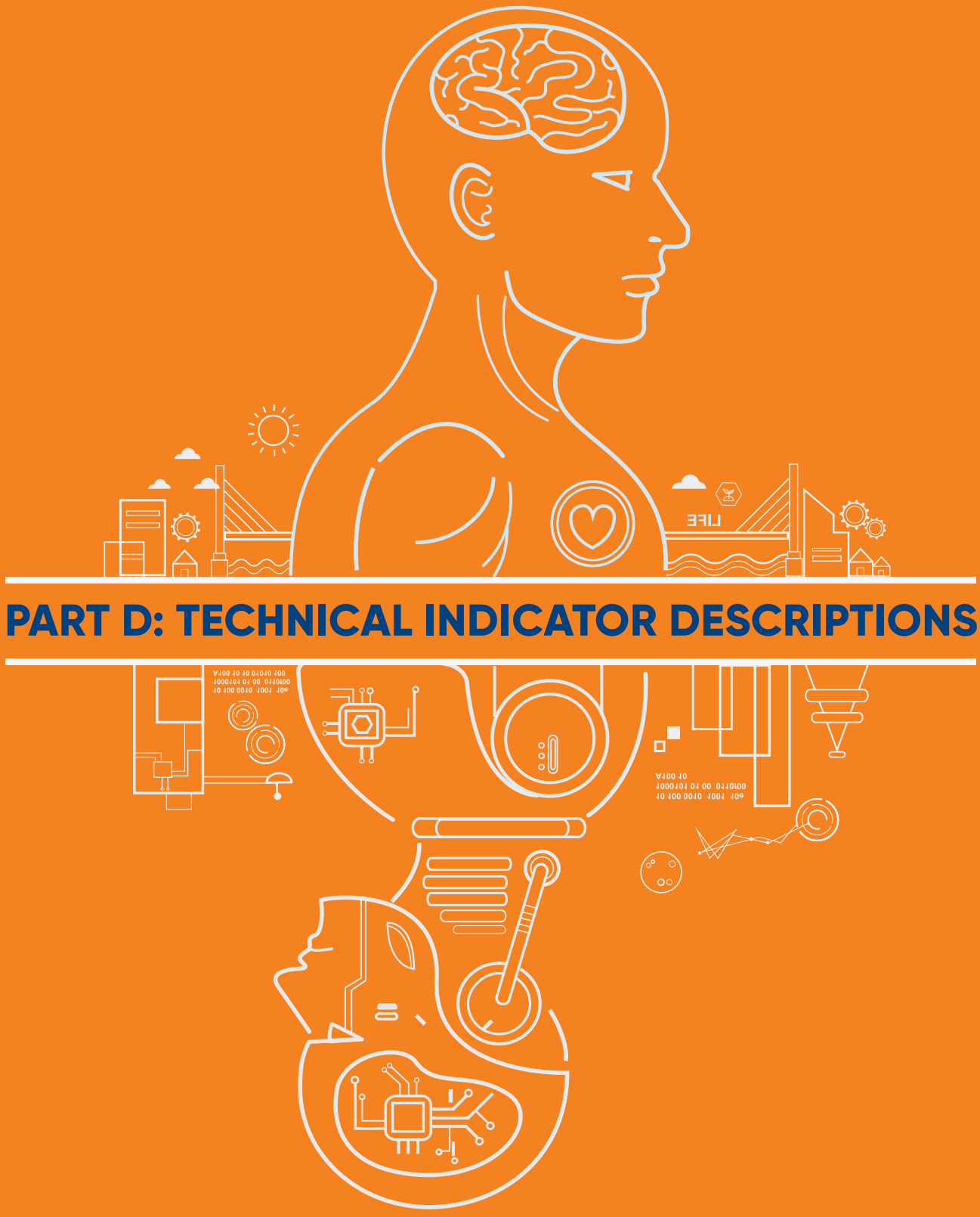
Not applicable

15. INFRASTRUCTURE PROJECTS

Not applicable

16. PUBLIC-PRIVATE PARTNERSHIPS

None



PART D: TECHNICAL INDICATOR DESCRIPTIONS

17. PROGRAMME A1: ADMINISTRATION

Indicator title	A1.1 Percentage of approved funded positions filled annually
Definition	Recruitment to fill a percentage (80%) of positions on the organisational structure, which are also included in the approved Human Resources budget allocation, to be finalised
Source of data	Organisational Structure and approved Human Resources Budget
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available That the required skills and experience are available and affordable in the market
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Cumulative
Reporting cycle	Annually
Desired performance	80% of approved funded positions to be filled
Indicator responsibility	Executive: Corporate Services and Line Management

Indicator title	A1.2 Achieve an unqualified external audit
Definition	An unqualified audit opinion on the audited annual financial statements as presented by the appointed external auditors. It is an independent statement on the compliance of the entity with the regulatory frameworks.
Source of data	Audit Report
Method of calculation/ assessment	Independent auditors report. The Auditors opinion is the only way it could be measured for example qualified opinion means that management did not comply with prescripts therefore did not meet the minimum expected standards of financial performance. Unqualified means that the Entity performed and an acceptable level and policies are effective.
Means of verification	Verification of supporting documentation including trial balance and supporting documentation
Assumptions	Assessment of materiality assessment after consideration of materiality framework Prior year recurring matters (carried over) to not affect the achievement of the target
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Non-cumulative
Reporting cycle	Annually in Q2
Desired performance	High performance –- Achieve an unqualified external audit report for with no new material matters identified
Indicator responsibility	Board and sub-committee
	EXCO

Indicator title	A1.3 Number of media platforms used to promote TIA initiatives
Definition	Media platforms (print, online, media and social media) used to profile TIA initiatives and brand
Source of data	Media platforms utilised
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	Increased awareness of TIA and its initiatives
Indicator responsibility	Executive: Corporate Services and Line Management

Indicator title	A1.4 Improve investment decision turnaround times
Definition	Investment turnaround time is measured as the time taken by TIA to process applications. Time spent by the applicant to respond to questions and to provide more information will not be included in this turnaround time calculation. This target will therefore be for TIA to reduce the time it takes to consider projects/proposals/ requests for funding and to respond to the counter party/applicant with a decision.
Source of data	Investment system
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That all transaction information is accurately recorded on the Investment system
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Cumulative
Reporting cycle	Annually
Desired performance	Achievement of 70% of the target will be deemed acceptable
Indicator responsibility	Executive: Bio-economy Executive: Commercialisation Executive: Innovation Enabling

Indicator title	A1.5 (a) Recruitment initiatives which will move TIA demographics closer to the EAP
Definition	The EAP comprises all persons of either sex who furnish the supply of labour for the production of economic goods and services as defined by the United Nations System of National Accounts during a specified time-reference period TIA will focus its recruitment initiatives to move the demographics of TIA employees closer to the representation as per the EAP
Source of data	Human Resources System
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That the required skills and experience are available and affordable in the market
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Cumulative
Reporting cycle	Annually
Desired performance	Closer alignment of TIA demographics with the Economic Active Population representation
Indicator responsibility	Executive: Corporate Services and Line Management

Indicator title	A1.5 (b) Support women and youth owned businesses through procurement initiatives
Definition	Support for transformation initiatives within the entity through operational procurement. As part of TIA's support to national priority areas, focused procurement initiatives will be implemented to target procurement with women and youth owned businesses (where applicable). Identification of ownership for measurement purposes will be performed using various sources including CIPC records, B-BBEE certificates, affidavits, or other credible sources. TIA shall utilise the definitions as contained in the B-BBEE Act for measurement purposes.
Source of data	Procurement spend analysis
Method of calculation/ assessment	Identified of procurement spend with woman owned and youth owned entities based on utilisation of supplier BEE certificates. Procurement spend identified based on value expensed in the trial balance for operational expenditure during the reporting period.
Means of verification	Verification of supporting documentation including trial balance, supplier ledger and supporting documentation
Assumptions	Availability of women and youth specialist suppliers Ownership not limited to minimum percentage
Disaggregation of beneficiaries	Women – 20% Youth– 10% Persons with disabilities – 0%
Spatial transformation (District Development Model)	N/A
Calculation type	Cumulative
Reporting cycle	Annually in Q4
Desired performance	% of total procurement with: Black women owned businesses – 20% Black youth owned businesses – 10%
Indicator responsibility	Executive: Corporate Services Chief Financial Officer

Indicator title	A1.6 (a) Implement initiatives to upskill resources in terms of commercialisation and IP Management skills
Definition	Implement initiatives (formal training, on-the-job training, secondments and any other initiatives) to upskill resources in terms of commercialisation and IP Management expertise
Source of data	Human Resources System
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available That the required training courses are available and affordable
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Cumulative
Reporting cycle	Semi-annually
Desired performance	Improved commercialisation skills, qualifications or experience
Indicator responsibility	Executive: Corporate Services and Line Management

Indicator title	A1.6 (b) Create a panel of service providers for in-sourcing/outsourcing approaches
Definition	Create a panel or service providers through recruitment and / or procurement processes to support the business in terms of key skills and experience required
Source of data	Human Resources System and / or Procurement system
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available That the required experience and expertise are available and affordable
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Cumulative
Reporting cycle	Annually
Desired performance	Improved commercialisation skills, qualifications or experience
Indicator responsibility	Executive: Corporate Services and Line Management

Indicator title	A1.7 The number of interns/graduates upskilled through exposure to TIA operations
Definition	Provide Interns/Graduates/Learners with an opportunity to gain working experience through exposure to TIA operations
Source of data	Human Resources System
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	N/A
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	To meet the target set
Indicator responsibility	Executive: Innovation Enabling Executive: Corporate Services

OUTCOME 1: COMMERCIALISED INNOVATIONS

Indicator title	1.1 Number of licensed or assigned technologies
Definition	Intellectual property that have been either licensed, assigned or sold to a third party for the purpose of commercialisation. This includes both registrable and non-registrable IP.
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Intellectual property has been created
Disaggregation of beneficiaries	Women – 30% Youth – 20% Persons with disabilities – 10%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Performance equal to or greater than planned target Achievement of 90% of the target will be deemed acceptable
Indicator responsibility	Executive: Commercialisation Executive: Bio-economy Executive: Innovation Enabling

Indicator title	1.2 Number of projects involving industry in execution
Definition	Number of projects/businesses or initiatives/programmes that collaborate with the private sector in developing and/or commercialising the technology. The collaboration can be financial or non-financial. The Joint collaborations must between TIA and academia, TIA and industry, or between academia and industry.
Source of data	Programme/Project database(s)
Method of calculation/ assessment	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 – 30% Youth – 50% Persons with disabilities – 10%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Performance equal to or greater than planned target Achievement of 90% of the target will be deemed acceptable
Indicator responsibility	Executive: Commercialisation Executive: Bio-economy 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; cooperatives; and other business formations) for social gain, directly or indirectly (products, processes or services)
Source of data	Programme/Project database(s)
Method of calculation/ assessment	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
Disaggregation of beneficiaries	Women – 30% Youth – 50% Persons with disabilities – 10%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Performance equal to or greater than planned target Achievement of 90% of the target will be deemed acceptable
Indicator responsibility	Executive: Commercialisation Executive: Bio-economy Executive: Innovation Enabling

Indicator title	1.4 Number of Products Launched
Means of verification	Verification of supporting documentation
Assumptions	The product is fully developed and ready for market entry
Disaggregation of beneficiaries	Women – 30% Youth – 50% Persons with disabilities – 10%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Performance equal to or greater than planned target Achievement of 90% of the target will be deemed acceptable
Indicator responsibility	Executive: Commercialisation Executive: Bio-economy Executive: Innovation Enabling

Indicator title	1.5 Total Rand (R) value of signed agreements entered into with other parties
Definition	The amount of funds contributed by other parties for the purposes of funding technology development, technology commercialisation and related support activities.
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Other partners will continue to have available funds to spend on innovation
Disaggregation of beneficiaries	Not applicable
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 Medium-Term Strategic Framework, as guided by the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Performance equal to or greater than planned target. Achievement of 90% of the target will be deemed acceptable.
Indicator responsibility	Executive: Commercialisation Executive: Bio-economy Executive: Innovation Enabling

18. OUTCOME 2: DELIVERING ON THE BIO-ECONOMY STRATEGY

Indicator title	2.1 Number of successfully demonstrated bio-based technologies
Definition	Bio-based technologies, products or services that have reached demonstration stage in agriculture, health, industrial biotechnology, IKS and other bio-based domains
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Availability and approval of funding
Disaggregation of beneficiaries	Women – 30% Youth – 20% Persons with disabilities – 10%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Cumulative
Reporting cycle	Quarterly
Desired performance	Performance equal to or greater than planned target Achievement of 90% of the target will be deemed acceptable
Indicator responsibility	Executive: Bio-economy

Indicator title	2.2 Number of existing Technology Platforms that are operational and functional
Definition	The number of Technology Platforms that are operational and/or functional that are supported by TIA to meet the needs of beneficiaries and stakeholders and develop into high-performing and capable facilities
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available or obtained from third parties to assist with the funding of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Bi-annually
Desired performance	Facilities are functional and operational Achievement of 90% of the agreed targets towards being functional or operational will be deemed acceptable
Indicator responsibility	Executive: Bio-economy

Indicator title	2.3 Number of new Technology Platforms in targeted regions
Definition	The establishment of new Technology Platforms in targeted geographic or technology areas
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count Once established, new Technology Platforms will be counted under indicator 2.2 (existing Technology Platforms) in the following financial year
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available or obtained from third parties to assist with the funding and establishment of such facilities That willing hosts, champions and shareholders (including the DSI) commit and agree to the establishment of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	Facilities are operational
Indicator responsibility	Executive: Bio-economy

Indicator title	2.4 Number of existing Technology Innovation Clusters that are operational and functional
Definition	The number of Technology Innovation Clusters that are operational and/or functional that are supported by TIA to undertake relevant innovation projects and activities in support of targeted industries and regions
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available or obtained from third parties to assist with the funding and establishment of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Bi-annually
Desired performance	Facilities are functional and operational Achievement of 90% of the agreed targets towards being functional or operational will be deemed acceptable
Indicator responsibility	Executive: Bio-economy

19. OUTCOME 3: SMMES SUPPORTED THROUGH STRATEGICALLY INFORMED AND REGIONALLY DISTRIBUTED TECHNOLOGY STATIONS

Indicator title	3.1 Number of existing Technology Stations providing science, engineering and technology support that are operational and functional
Definition	High-performing and capable Technology Stations providing science, engineering and technology support, responding to the needs of beneficiaries in targeted regions Technology Stations optimised to perform against pre-determined norms and standards that are set to enhance the quality of support received by beneficiaries
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available or obtained from third parties to assist with the funding and establishment of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Bi-Annually
Desired performance	Facilities are functional and operational Achievement of 90% of the agreed targets towards being functional or operational will be deemed acceptable
Indicator responsibility	Executive: Innovation Enabling

Indicator title	3.2 Number of new centres providing science, engineering and technology support in targeted regions
Definition	The establishment of new centres (Technology Transfer Centres or other centres providing a similar service) in targeted regions based on government's spatial development priorities
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count Once established, new centres will be counted under indicator 3.1 (existing Technology Stations and centres) in the following financial year
Means of verification	Verification of supporting documentation
Assumptions	That adequate funding and resources are made available or obtained from third parties to assist with the funding and establishment of such facilities That willing hosts, champions and shareholders (including the DSI) commit and agree to the establishment of such facilities
Disaggregation of beneficiaries	N/A
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	Facilities are operational
Indicator responsibility	Executive: Innovation Enabling

Indicator title	3.3 Number of small, medium and micro enterprises and cooperatives accessing science, engineering and technical services
Definition	SMMEs and cooperatives that access science, engineering and technical support for the purposes of developing innovative products or services through the financial or non-financial support of the Technology Stations network
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	An adequate number of SMMEs and cooperatives will be interested in the services offered Technology Stations possess adequate expertise and have access to adequate funding to provide and maintain infrastructure required for science, engineering and technical support
Disaggregation of beneficiaries	Historically disadvantaged individuals – 80% Women – 45% Youth – 40% Persons with disabilities – 3%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	Facilities are functional and operational Achievement of 90% of the agreed targets towards being functional or operational will be deemed acceptable
Indicator responsibility	Executive: Innovation Enabling

Indicator title	3.4 Number of high-level research graduates (Master's and Doctoral students)
Definition	This refers to students who are admitted within the TS's activities
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Number of high-level research graduates receiving/participating in TS funded activities to acquire adequate expertise and training in science, engineering and technical field
Disaggregation of beneficiaries	Historically disadvantaged individuals – 80% Women – 45% Youth – 40% Persons with disabilities – 3%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	Achievement of 90% will be acceptable
Indicator responsibility	Executive: Innovation Enabling

Indicator title	3.5 Number of patents, publication outputs and knowledge based products (i.e. prototypes, technology demonstrators and technology assistance packages) produced through TTO disclosures as per IPR-PFRD Regulations
Definition	Number of persons who have completed, or nearly completed the academic programme, which requires practical experience in order to obtain their qualifications (ranging from Diploma, B-Tech and D-Tech), or to obtain work exposure
Source of data	Programme/Project database(s)
Method of calculation/ assessment	Simple count
Means of verification	Verification of supporting documentation
Assumptions	Interns receiving/participating in TS funded activities to obtain qualification and or work exposure
Disaggregation of beneficiaries	Historically disadvantaged individuals – 80% Women – 45% Youth – 40% Persons with disabilities – 3%
Spatial transformation (District Development Model)	To be informed by and aligned with the priorities of government's 2019-2024 MTSF, as guided by the DSI
Calculation type	Non-cumulative
Reporting cycle	Quarterly
Desired performance	Achievement of 90% will be acceptable. Support the maximum number of interns within the available resource envelope
Indicator responsibility	Executive: Innovation Enabling

LIST OF ACRONYMS

ABIPP	Agriculture Bio-Economy Innovation Partnership Programme
ACRO	African Clinical Research Organization
AI	Artificial intelligence
API	Active Pharmaceutical Ingredient
APP	Annual Performance Plan
ARC	Agricultural Research Council
ASSAf	Academy of Science of South Africa
B-BBEE	Broad-based Black Economic Empowerment
BERD	Business expenditure on R&D
CHPC	Centre for High Performance Computing
CIPC	Companies and Intellectual Property Commission
COVID-19	Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
CSIR	Council for Scientific and Industrial Research
DALRRD	Department of Agriculture, Land Reform and Rural Development
DHET	Department of Higher Education and Training
DoH	Department of Health
DSBD	Department of Small Business Development
DSI	Department of Science and Innovation
DST	Department of Science and Technology
DTI	Department of Trade and Industry
DTIC	Department of Trade, Industry and Competition
EAP	Economic Active Population
EU	European Union
4IR	Fourth Industrial Revolution
GCIP	Global CleanTech Innovation Programme
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
GII	Global Innovation Index
HEI	Higher Education Institute
IBH	Industrial Biocatalysis Hub
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICT	Information and Communications Technology
IDC	Industrial Development Corporation
IID	Innovation for Inclusive Development
IKS	Indigenous knowledge systems
INSETA	Insurance Sector Education and Training Authority
IP	Intellectual property
IPR-PFRD	Intellectual Property Rights from Publicly Financed Research and Development
KyD	Kaonafatso ya Dikgomo
M&E	Monitoring and Evaluation

LIST OF ACRONYMS

MTEF	Medium Term Expenditure Framework
MTSF	Medium Term Strategic Framework
NACI	National Advisory Council on Innovation
NDP	National Development Plan
NHLS	National Health Laboratory Services
NIPMO	National Intellectual Property Management Office
NSI	National System of Innovation
PDI	Previously disadvantaged individuals
PMFA	Public Finance Management Act
POC	Point-of-care
PPE	Personal protective equipment
PWD	Persons with disabilities
R&D	Research and development
RDI	Research, development and innovation
ROI	Return on investment
SA	South African
SABDI	South African BioDesign Initiative
SAHPRA	South African Health Products Regulatory Authority
SAMRC	South African Medical Research Council
SATN	South African Technology Network
SAVCA	South African Venture Capital Association
SEDA	Small Enterprise Development Agency
SEFA	Small Enterprise Finance Agency
SET	Science, engineering and technology
SHIP	Strategic Health Innovation Programme
SIIP	Strategic Industrial Bio-Innovation Programme
SME	Small and medium enterprises
SMME	Small, medium and micro enterprises
SPSR	Strategic Partnerships and Stakeholder Relations
STI	Science, technology and innovation
SWOT	Strengths, weaknesses, opportunities and threats
TADF	Technology Acquisition and Deployment Fund
TIA	Technology Innovation Agency
TICP	Technology Innovation Cluster Programme
TS	Technology Station
TSP	Technology Stations Programme
TTOs	Technology Transfer Offices
TVET	Technical and vocational education and training
US	United States of America