8. Innovation & Technology

(Chapter provided by the Department of Science & Technology)

1. LEVERAGING SCIENCE, TECHNOLOGY AND INNOVATION FOR INDUSTRIAL GROWTH AND DEVELOPMENT

Situational analysis

Science, Technology and Innovation (STI) are recognised as key drivers of long-term economic growth, which today is increasingly led by the creation and distribution of knowledge for the enrichment of all fields of human endeavour. STI becomes a major source of competitive advantage, wealth creation and improvement in overall quality of life[9], but only if properly coordinated, distributed and used by stakeholders across a national system of innovation (NSI) that has the capacity to absorb and quickly adapt to new forms of knowledge and technical capabilities.

In South Africa, the centrality of STI to national development has been firmly highlighted in the National Development Plan (NDP[10]). The NDP notes that the developments in STI are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic growth and development. STIs are key to equitable economic growth because technological and scientific revolutions underpin economic advances; improvements in health systems; education and infrastructure.

[9] Ten Year Innovation Plan (TYIP) 2008-2018, Department of Science and Technology, South Africa.
[10] The National Development Plan: Vision for 2030, National Planning Commission, 2011

To realise the national potential of a fully developed STI, STI investments are essential for the country's transformation to a knowledge-based economy, as indicated in the NDP, the White Paper on Science and Technology (1996), successive IPAPs and other national policy documents.

The growing focus on STI can, in part, be attributed to the following factors:

- Substantial increase in global science, engineering and technology (SET) efforts, leading to enhanced capability and knowledge potential;
- Increased participation of developing countries in global SET activities;
- The ever-increasing levels of complexity and technological capability embedded in components/products, leading to an associated reduction in the life span of the products;
- Significant growth in higher technology - and advanced manufacturing goods, indicative of changing global exports and markets; and,
- Technology has a time-bound value, implying that continuous knowledge reinvestment is required, regardless of the type of industrial sector.

2. SCIENCE AND TECHNOLOGY INNOVATION (STI) AND ECONOMIC GROWTH: SA POLICY CONTEXT AND COORDINATION

Situational analysis

South Africa's STI policy package[11] provides a sound basis for further improvement and up-scaling of the country's industrial development interventions as stipulated in the National Industrial Policy Framework (NIPF) and as driven by the IPAP. The DST's focus in support of economic and industrial development will be structured as follows over the next five years:

[11] As articulated in the White Paper on Science and Technology (1996); the National Research and Development Strategy (2002), as well as the Ten-Year Innovation Plan (2008 to 2018).

2.1 Focus on knowledge creation

The focus on increased knowledge creation is aimed at restoring, transforming and building the human pipeline in research and development (R&D). Increase in the pool of knowledge workers is one of the key enablers towards ensuring new technological knowledge, new opportunities to develop technologies and higher levels of contribution to sustained industrial competitiveness.

Expanding knowledge generation/production capacity is essential for increased efficiency gains across the economy. The target is to substantially increase the Gross Expenditure on R&D (GERD) as a percentage of the Gross Domestic Product (GDP). After being static at 0,73% of GDP, the latest measurement indicates a small increase to 0,77%, which is encouraging. (See Figure 1 below).

Figure 1: GERD as a % of GDP

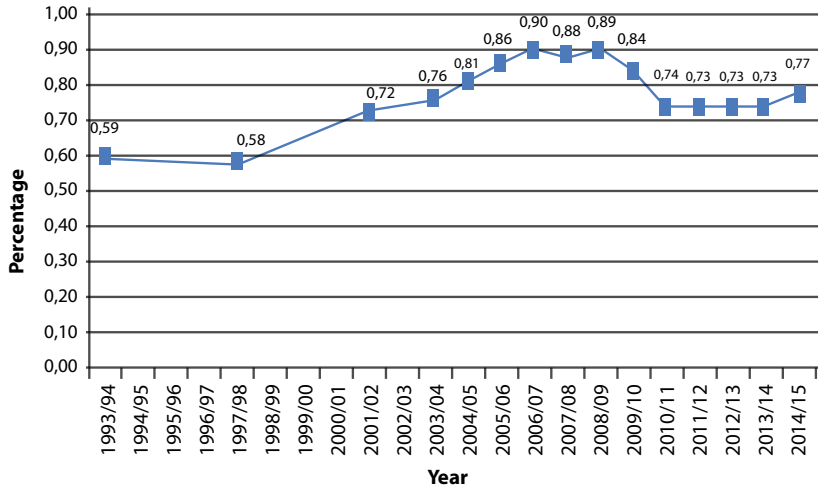
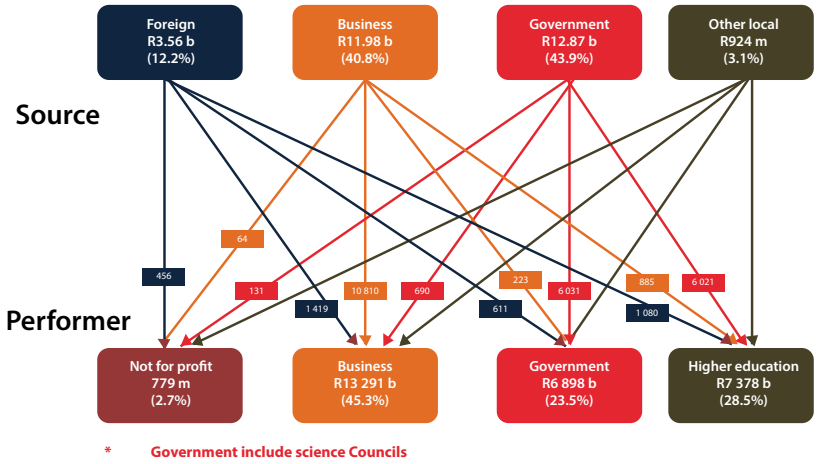


Figure 2: R&D Funding Flow Diagram



The strategic outcome-oriented goal for increased knowledge generation is to maintain and increase the relative contribution of South African researchers to global scientific output over the next five years. The proxy indicators in this regard are:

- Proxy indicator 1: 22,032 researchers supported by 2019.
- Proxy indicator 2: Publication of at least 33,700 research articles supported by 2019.
- Proxy indicator 3: Number of articles co-published with researchers on the African continent doubled.

The abovementioned indicators are achieved through various instruments and DST initiatives. Some of the main interventions described are:

2.1.1 South African Research Chairs Initiative (SARChI)

The purpose of SARChI is to substantially increase the human capital pipeline, particularly at postgraduate level. The main goal of the Research Chairs Initiative is to strengthen and improve the research and innovation capacity of public universities to produce high quality postgraduate students as well as research and innovation outputs. There are currently 199 SARChIs funded at 20 universities.

2.1.2 The Centre of Excellence (CoE) initiative

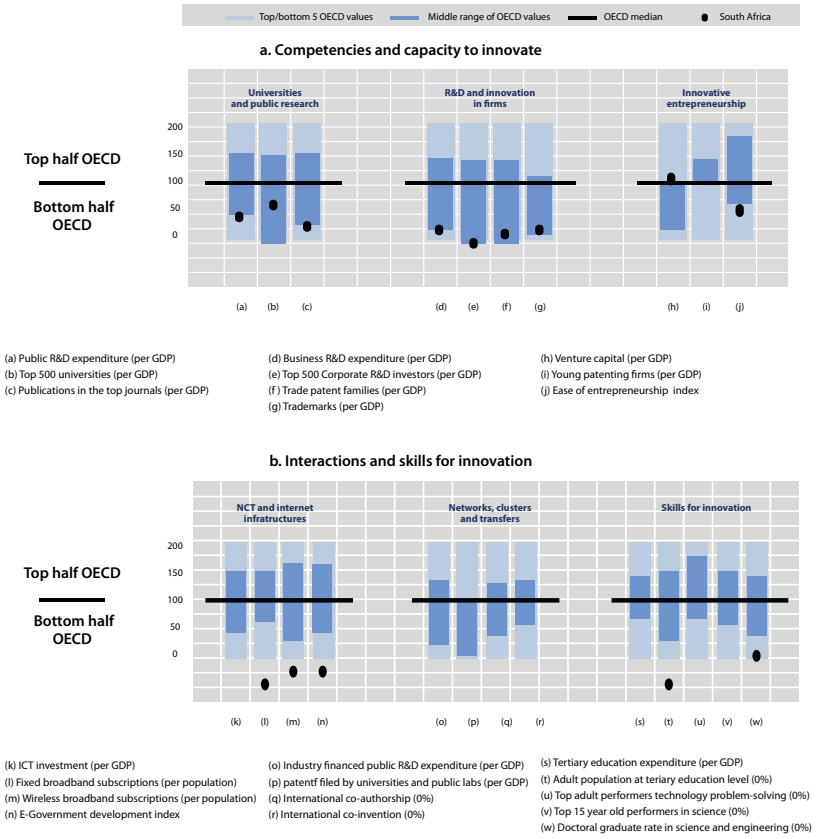
The CoE initiative is aimed at building human capital in specifically defined areas of scientific research endeavour. There are currently 15 CoEs at 7 universities.

2.1.3 The postgraduate bursary programme

The bursary programme is essential to help build the human capital pipeline; create the next generation of researchers and upgrade the quality and profile of the associated research outputs.

Despite its relatively small size, South Africa's knowledge production compares favourably with that of the OECD and the G20 countries, as depicted in Figure 3.

Figure 3. SA researcher efficiency[12]



Notes: Normalised index of performance relative to the media values in the OECD area (index media=100). For south Africa, 2012 values were used for the indicator "wireless broadband subscriptions (per population)" It is compared to value of December 2015 for OECD countries.

[12] G20 Innovation Report, OECD, November 2016

2.1.4 Postgraduate internship programme

To ensure that more graduates find employment and bridge the gap between formal training and the skills required in the workplace, the DST has instituted a dedicated internship programme. There are currently two components to this programme, namely:

- The Graduate Internship Programme, which is implemented by the National Research Foundation (NRF) and is open to students who have already obtained a degree, but who have not yet secured employment.
- The Engineering Training Programme, implemented by the Council for Scientific and Industrial Research (CSIR), which is open to predominantly University of Technology (P2 and P3) students who require practical or workplace experience to complete their P qualifications.

3.1 Increased emphasis on supply-side innovation policy measures

3.1.1 Increased impact of R&D investment through budget coordination

Since 1 April 2015, the DST has investigated options and finalised proposals on a budget coordination process which will be piloted during the 2017 Medium-Term Expenditure Framework (MTEF) process. This process is intended to maximise the use of R&D funding across various government departments.

3.1.2 Implementation of the DST Commercialisation Framework

Following the finalisation of the DST Commercialisation Framework (CF) in 2015, a series of CF Implementation Protocols (CFIPs) have been developed in consultation with key NSI stakeholders. The purpose of these (draft) CFIPs is to enable:

- The systematic assessment of DST-funded technologies and programmes to gather evidence to support DST Executive Committee decisions to fund, further fund and/or exit the Department's R&D investments pertaining to commercialisation opportunities.
- The building of a commercialisation pipeline for DST-supported R&D programmes.

- The development of effective commercialisation partnerships with industry and other public sector innovation support initiatives, both nationally and internationally.
- The draft CFIPs will be refined for adoption during the 2017/18 financial year (FY).

3.1.3 Partnerships with private industry and sector representatives

During 2016, the DST entered into several strategic partnerships with industry and private sector representative organisations. Collectively, these partnerships better enabled the coordination of activities between government and the private sector by providing opportunities to jointly identify and develop innovation policy interventions, which will enhance entrepreneurial ecosystems for technology-based companies across South Africa. These partnerships will be expanded and strengthened throughout the 2017/18 FY.

3.1.4 Increased support to SMEs for innovation outputs

The Technology Stations (TS) Programme consists of a network of 18 stations, including 3 Institutes of Advanced Tooling (IATs) which are hosted by various Higher Education Institutions (HEIs), in particular the Universities of Technology (UoTs). The TS Programme is used as an instrument to provide technology support, infrastructure and services to local enterprises with a primary focus on small and medium enterprises (SMEs). The aim is to improve their level of competitiveness. The TSP is expected to provide technological support to more than 2,000 SMEs per annum to improve innovation outputs, competitiveness and SME effectiveness.

3.1.5 Ongoing harmonisation of innovation support initiatives

The DST commissioned research in 2016 aimed at supporting government in gaining better understanding whether the current allocation and deployment of public resources to incentivise private sector investment in RDI is done in a manner that maximises the return on investments.

The research agenda is a response to ongoing concerns among policy makers that sub-optimal investment in R&D may be further negatively impacted by unnecessary duplication and/or overlap among existing public educational instruments, therefore resulting in a failure to attract and leverage significant levels of private sector investment in full or co-funding for RDI.

The research is therefore intended to assess the existence and extent of such overlaps to facilitate consensus building on the most efficient mechanisms to deploy and manage public funding across government in collaborative synergy with the private sector. The research will be finalised and the findings shared during late 2017.

3.1.6 Maturing technology for commercialisation

The mandate of the Technology Innovation Agency (TIA) is derived from the provisions of the Technology Innovation Act (Act 26 of 2008), which established TIA as an Agency to promote the development and exploitation of discoveries, inventions, innovations and improvements, in the public's interest. The objective of TIA is thus to support the State in stimulating, developing and intensifying technological innovations to improve economic growth and the quality of life of all South Africans.

3.1.7 The Sovereign Innovation Fund

The establishment of the Sovereign Innovation Fund was endorsed at the July 2015 Cabinet Lekgotla and was included as a DST action item under the Nine-Point Plan. Subsequently the Fund was affirmed in 2016 as a national imperative when the President, in his State of the Nation Address, announced that the DST will *"... finalise the Sovereign Innovation Fund, a public-private funding partnership aimed at commercialising innovations that are from ideas from the public and the private sectors[13]"*.

In November 2016, the Directors General's (DGs) of the DST, **the dti**, and the Economic Development Department (EDD), agreed to jointly motivate for the establishment of the Sovereign Innovation Fund as a public-private funding partnership that is aimed at harvesting and commercialising South African technology innovations for deployment in national and international markets. To this end the DST has drafted and further revised a Concept Note which details the rationale for the Fund. The Fund will be established in 2017 as a new national financing instrument, which will ideally involve formal equity finance funded by both the public and private sectors.

[13] 2016 State of the Nation Address (SONA). http://www.gov.za/speeches/president-jacob-zuma-state-nation-address-2016-11-feb-2016-0000 Accessed on 27 June 2016

3 Demand-side innovation policies

Such policies are increasingly important as they are based on leveraging market demand as an activator (i.e. leveraging the demand for innovation). There are various measures to increase the demand for innovation, such as are:

- Public procurement;
- Pre-commercial procurement;
- Innovation inducement prices;
- Standardisation and standards;
- Regulation.

A classification for demand-side innovation measures, developed by the OECD[14], is provided in the table below as a reference for future work, but also to help integrate the efforts across government and its respective entities.

Table 1: Demand side measures classification

Public demand	**Private demand**
• **General procurement** (innovation as an essential criterion in the tendering and assessment process) • **Strategic procurement** (the demand for certain technologies, products and/or services is encouraged) • **Cooperative** and catalytic procurement (public agencies purchase in connection with private demand)	• **Direct/financial support** (demand subsidies and tax incentives) • **Indirect/soft steering support** (awareness building; labelling and information campaigns; training and other further education; articulation and foresight; user-producer interactions)
Regulations	**Systemic approaches**
• **Regulation of demand** (to create a market; process and 'usage' norms) • **Regulation of demander-produced interface** (regulating product performance and manufacturing; regulating product information; supporting innovation-friendly private regulation activities)	• **Integration of demand-side measures** (strategically coordinate measures which combine various demand side instruments) • **Integration of demand- and supply-side logic and measures** (combination of supply-side instruments and demand side impulses or selected technologies or services; conditional supporting of user-producer interaction; pre-commercial procurement

[14] European Commission: DG Research and Innovation: 'Supply and Demand Side Innovation Policies', 2015.

In support of the national focus on leveraging public procurement, the DST is implementing the following demand-side innovation instruments:

3.1 Leveraging Public procurement

One of the most effective demand-side innovation instruments is the leveraging of public procurement. The DST implemented the Technology Localisation Programme (TLP) in support of government's drive to increase the level of local production related to public and recently, also private procurement.

The TLP provides technological support to firms and sectors to improve their competitiveness and ability to qualify and secure contracts linked to public procurement – either directly with State Owned Companies (SOCs) or through contracting with international Original Equipment Manufacturers (OEMs) that have secured major contracts with SOCs. The programme, implemented by the Technology Localisation Implementation Unit (TLIU) hosted by the CSIR, has achieved substantial success and is increasingly being recognised as the national nodal point for supplier development and technology assistance.

The success achieved to date (and the recognition of a need to further upscale the programme) has resulted in its expansion to support increased local production, most notably in the mining equipment manufacturing industry.

The TLPs interventions is offered based on several instruments:

1. Firm-level Technology Assistance Packages (FTAPs): These ensure that a third party (e.g. university or science council) provides technology assistance, such as skills, equipment, designs, manufacturing systems, etc. to an approved firm to increase its competitiveness through new or improved processes, products, and skills.
2. Sector-Wide Technology Assistance Package (SWTAP): This provides technology assistance for a range of firms in a sector.
3. Technology Development Grants: These provide funding to mature local technologies that might be used in local procurement.
4. Experiential Training Programme: This enables predominantly P1 and P2 students to complete their practical training, thereby enabling them to complete their practical qualifications.

5. Firm benchmarking: This assesses a firm's management and technological capability to define development areas, but also to transfer knowledge. There are currently more than 3,200 South African manufacturing firms in the database, which is maintained and continuously expanded with the aim of facilitating new supply chain relationships.

3.2 Strategy for the update of locally developed technologies

The strategy for the uptake of locally developed technologies is a new action which is described under the first Key Action Programme.

3.3 R&D tax incentives

The South African R&D tax incentive (in terms of section 11D of the Income Tax Act, 1962) is aimed at encouraging the private sector to undertake more intensive R&D in South Africa. The DST implements the incentive programme, working in conjunction with the South African Revenue Service (SARS) and National Treasury. The incentive consists of a 150% tax deduction on expenditure incurred on R&D activities approved by the Minister of Science and Technology. The 150% tax deduction has been in place since November 2006, and can be accessed by companies of all sizes in all sectors of the economy.

At a corporate tax rate of 28%, the incentive translates into 14 cents per Rand spent on R&D. With reduced R&D user costs, it is expected that firms will scale up their R&D activities significantly in the short term.

The 2015/16 R&D Tax Incentive Annual Report estimates that the incentive supported R36.1 bn in R&D expenditure. About 61.9% of this was in priority focus areas of the current IPAP.

About 81% of the supported R&D is in manufacturing and financial intermediation, real estate and business services, as shown in Table 4 below.

Table 4. Sectoral R&D expenditure

Sectors	R&D expenditure supported (R' millions)	% of R&D expenditure per industry
Agriculture & related	1 469.1	4.1%
Mining and Quarrying	1 982.3	5.5%
Manufacturing	24 469.0	67.8%
Electricity, Gas & Water Supply	1 048.5	2.9%
Transport, Storage & Communications	1 617.0	4.5%
Finance & Business Services	5 180.7	14.4%
*Others	300.3	0.8%
Totals	36 066.9	100.0%

* Others include Construction, Wholesale & Retail Trade and Community & Social Services.

4 Specific STI-intensive initiatives

South African researchers, engineers and innovators continue to develop new technologies with the potential to disrupt the current status quo – i.e. innovations that help create substantially new technologies, markets and value networks, in a manner that will eventually disrupt and displace existing technologies, markets and value networks over a period of time[15] .

The DST is currently funding a number of potentially high-impact[16] cross-cutting programmes requiring close integration and support from other departments. Such programmes have the potential to renew existing industries or establish new ones; making a substantial contribution to longer term, sustainable competitiveness, and the penetration of new markets.

Examples of R&D-led industry development programmes are:

- Titanium metal powder manufacturing development;
- Fuel cell development;
- The Fluorochemicals Expansion Initiative; and
- Additive manufacturing (3-D printing).
- Biotechnology (including agricultural, health, industry and IKS applications).

[15] The term is deemed to have been originally coined by Prof Clayton Christensen, Professor of Business Administration at the Harvard Business School (HBS). See also: http://www.christenseninstitute.org/key-concepts/
[16] From the perspective of economic growth, competitiveness and local value addition.

Such programmes are knowledge-intensive and based on proprietary know-how, with corresponding markets often not yet established. This implies that, in view of the technical and market risks, development funding is not easy to secure. Besides the financial aspects, speed of technical and market development is deemed key to success. To help create an enabling environment for these type of programmes, the DST has created various supporting platforms and initiatives (capacities, services, infrastructure and programmes), actively incorporated the reporting of these programmes at inter-departmental level and established joint steering committees that involve the IDC and industry from an early stage. DST also provides a focus on applications that contribute to national imperatives – such as the Operation Phakisa and the AgriParks Initiative.

The fast-moving scientific fields – particularly in the health and agricultural areas - may also require attention to policy and regulatory evolution and development, such that the opportunity to establish new or disruptive technologies can be seized

In addition to helping to prepare for the industries of tomorrow, the DST, in close collaboration with **the dti**, has also started to consider at a policy and technological level (i) the potential scenarios that the 4th Industrial Revolution could catalyse in South Africa, and (ii) the proactive responses that need to be developed to position South Africa optimally for this new global phenomenon.

Key Action Programmes

1. Strategy for the adoption of locally developed technologies

Nature and purpose of the intervention

The economic impact of research and technology development is realised when the respective technologies are absorbed in the market. During August 2016, the Lekgotla identified the need to enhance the deployment of locally developed technologies, resulting in a request to the DST, supported by **the dti**, to develop a strategy for the deployment of locally developed technologies. A review of available technologies, as well as government programmes where there are opportunities for the use of these technologies, has identified three potential areas; namely defence and security technologies, social infrastructure technologies and health technologies.

Phase 1 (2016/17 to 2019/20) will focus on identifying opportunities for deploying ready or near-ready locally developed technologies, arising from investments made by the DST and its entities. Arrangements are being made to interact with the relevant lead departments in these areas to finalise procurement modalities of potential technologies by the end of the first quarter of 2017.

In parallel to taking forward these short-term opportunities, the DST, in collaboration with **the dti** and EDD, is working on a more detailed strategy that will include looking at the measures that will be required to accelerate commercialisation of locally developed technologies and engaging with the private sector on specific areas of opportunity - for example mining technologies and equipment as identified during the Mining Phakisa.

The more detailed strategy is planned for finalisation and submission to Cabinet in the first half of 2017.

Targeted outcomes

Increased commercialisation of locally developed technologies to accelerate the creation of successful products, processes and services.

Key milestones

2017/18 Q2: The formalisation of the strategy for the uptake of locally developed technologies.

2017/18 Q4: The established of a partnership with the private sector for the deployment of locally developed technologies in one of the abovementioned focus areas.

Lead departments / agencies: DST, the dti

Supporting departments / agencies: EDD, DoD, DoH

2. Commercialisation Framework implementation

Nature and purpose of the intervention

The implementation of the DST Commercialisation Framework (CF), which was approved in 2015/16, will be guided by the refinement of a series of CF Implementation Protocols (CFIPs). The Protocols were drafted in 2016 in consultation with a range of key public sector NSI stakeholders, including the Industrial Development Corporation (IDC), the National Intellectual Property Management Office (NIPMO) and the Technology Innovation Agency (TIA).

The draft CFIPs will be refined for approval and adoption in 2017/18. This will entail the selection of suitable DST candidate projects and programmes as test cases for the assessment of commercial potential and for referral and/or follow-on funding to other relevant stakeholders across the NSI. Based on the learning obtained from these processes, the CFIP will be revised as needed.

Once approved by the DST Executive, it is expected that the CFIPs will be adapted to further enable coordination across other relevant government departments and entities. This process is envisaged to be supported and facilitated through the formal establishment of the Commercialisation Collaboration Forum (CCF) during 2017/18.

The CCF, which has been meeting on an informal basis since 2015, comprises of representatives from a range of publicly-funded technology development and commercialisation funding and support organisations that contribute directly, or indirectly, to national technology commercialisation value chains.

Going forward, regular engagements at the CCF are intended to enable the sharing of information and best practice, underpinned by enhanced contact across the various government departments and entities that are involved in technology development and commercialisation. Once formally established, it is envisaged that the CCF will facilitate the development of a National Innovation Charter and serve as a structured platform for the coordination of technology commercialisation initiatives across government and with the private sector.

The Commercialisation Framework (CF) is aimed at supporting the DST, and ultimately government as a whole, in enabling the translation of a greater proportion of publicly funded R&D outputs into socio-economically useful products, processes and services. It is envisaged that the implementation of the CF across government will be facilitated by the CCF once formally established.

Targeted outcome

Improved coordination of technology development and commercialisation initiatives across the public sector to fast-track the commercialisation of new technologies.

Key milestones

2017/18 Q3: First round DST candidate projects assessed as part of the finalisation of the CFIPs.
2017/18 Q4: CFIPs refined and presented to DST Executive for approval.
2017/18 Q4: Establishment of the CCF formalised through requesting nominations of representation from relevant government and private sector organisations.

Lead departments / agencies: DST
Supporting departments / agencies: the dti, NT, EDD, DSBD, TIA, IDC, science councils, universities, and relevant private sector organisations.

3. Harmonisation of innovation support programmes

Nature and purpose of the intervention

South Africa has strong science and technology capabilities and generally well-developed STI institutional frameworks.

However, the purpose of this DST-commissioned research is to assess the existence and extent of overlaps and redundancies between existing innovation support frameworks and programmes. This will require consensus-building on the most efficient uses of public funding across government in synergy and collaboration with the private sector. The research will be finalised and the findings consolidated with those of other related departmental research initiatives of the DPME and **the dti**, among others, in late 2017.

This intervention is aimed at facilitating harmonisation and synergies between existing and future innovation support programmes across departments and entities for increased impact on the growth of the economy.

Targeted outcome

Stronger coordination and coherence in the use of R&D in the promotion of innovation as a key driver of growth.

Key milestones

2017/18 Q3: Preliminary research findings presented to the DST Executive.

2017/18 Q4: Findings compared and consolidated with other relevant research findings.

Leading department/agency: DST and **the dti**

Supporting departments/agencies: DPME, the dti, DSBD, EDD, NT, IDC, TIA, NRF, NIPMO

4. Establishment of the Sovereign Innovation Fund

Nature and purpose of the intervention

The Fund is to be established in 2017 as a new national financing instrument, which will ideally involve formal equity finance in the form of public and private sector investments. The Fund is intended to launch from the platform of an initial contribution from government in the order of R1 billion to R1.5 billion in 2019/20. The national pool of funding will then be increased through co-investments from the private sector.

The Concept Note and Business Case towards the establishment of the Sovereign Innovation Fund will be finalised by the DST during 2017/18, together with **the dti**, the EDD and other vested departments.

Targeted outcomes

Recognising the role of science, technology and innovation (STI) in support of the National Development Plan (NDP), it is envisaged that the Sovereign Innovation Fund will serve as a structured national investment platform for a period of ten years, with the following aims and objectives:

1. Developing a strategic portfolio of investment opportunities to foster high-tech and technology-enabled entrepreneurial initiatives.
2. Creating funding certainty for high-technology developments, particularly those that will serve to modernise the South African economy and embrace the opportunities of the Fourth Industrial Revolution.
3. Establishing policy coherence through the coordination and integration of funding activities across government.
4. **Encourage private sector investment** for economic development, including the promotion of investment by both local and foreign-based companies, into productive investments, including greenfield investments, as well as into activities that will employ large numbers of South Africans which will be vital for development.
5. Strengthening national efforts to implement sustainable economic growth, considering not only the country's current challenges but also anticipating the needs of future generations (including climate change mitigation and food and water security).

Key milestones

2017/18 Q2: Revised Concept note developed and presented to National Treasury for comment and input.
2017/18 Q3-Q4: Government and private sector consultations continued.
2017/18: Finalisation of a business case for the establishment of the Innovation Fund.

Leading department/agency: DST, EDD and **the dti**
Supporting departments/agencies: DPME, DSBD, NT, IDC, TIA, and private sector

CASE STUDY:

TLIU supports traction transformer localisation project

In March 2014 Transnet awarded the largest ever locomotive contract in South Africa to four foreign OEMs - one of which was **Bombardier Transport (BT)** - for the manufacture of 240 locomotives out of the total of 1,064.

Bombardier Transport locomotives will be equipped with **ABB Traction Transformers**. Only 45 units of the Traction Transformers will be manufactured in Geneva and imported into South Africa, while the remaining units are being manufactured and assembled within ABB's local facilities, supported by sub-component provision by several local manufacturing companies.

The Technology Localisation Implementation Unit (TLIU) - which implements the DST's Technology Localisation Programme - engaged with ABB to support this localisation project. The TLIU has a well-established database of local manufacturing companies and, together with ABB, was soon abled to identify the most promising sub-component manufacturers. The three major sub-assemblies identified for local manufacture were traction transformer tanks, magnetic circuits for the main active part, magnetic circuits for the three-phase transformers and the aluminium conductor. However, to manufacture the components required for the identified sub-assemblies, a total of 7 companies had to be identified at 1st and 2nd tier supplier levels to ABB. Most the suppliers identified were small businesses.

The suppliers that were selected have been linked directly to ABB Geneva to receive manufacturing and product knowledge for the manufacture of the products. Personnel from each company have been part of a skills transfer programme with ABB and training has been conducted both in South Africa and at other ABB locations. Specific technology has been transferred to the suppliers to ensure that they meet the necessary global quality standards. The first article inspection for each component produced by the suppliers will be conducted by a joint team of ABB and Bombardier. ABB has also assisted the suppliers by placing ABB subject matter experts at certain companies for the continuous teaching and mentoring process accompanying the knowledge transfer process.

Facts and figures:

- The DST, via the Technology Localisation Programme, provided funding to the value of R9 million for this project.
- ABB has co-invested to the value of R6 million.
- The total revenue that will be generated through the project is valued at R350 million, with a local content value of R350 million.
- The project is expected to result in 55 jobs being created at ABB and 150 jobs at the 7 local supplier locations.
- The cumulative increase in revenue for the 7 suppliers is expected to be valued at R94.5 million.
- However, the greatest impact for the suppliers is that (based on their performance) they will have the potential to be included in ABB's global supply chain.

CASE STUDY:

Aeroswift - High speed additive manufacturing for large metal parts

Additive manufacturing (also known as 3D printing) has now started to prove that it is one of the technologies that is materially changing the face of manufacturing.

The *Department of Science and Technology* (DST), as part of the initiatives under the portfolio 'R&D led industry development' has been funding the development of a broad research and technology development base or additive manufacturing in South Africa, spread across most of the universities, and a number private sector partners (large and small), focusing on areas such as certification for additive manufacturing, medical applications, powder development, and general awareness. Besides, the broad technology development funding, the DST is also funding the Aeroswift project, based on its potential to unlock substantial new industrial development activities.

Aeroswift is a high speed, large volume, additive manufacturing system for metal part production; and has been exclusively developed in South Africa, by the *Laser Centre* and the *South African Department of Science and Technology*.

The Aeroswift machine is a powder-bed fusion system and has a build volume of 2m x 0.6m x 0.6m. The machine was developed to allow for the production of very large complex parts, as well as the production of large batches of smaller parts for the aerospace and other industries. By having the capability to produce large batch quantities, machine overheads are minimised and overall cost of the additive manufacturing process is reduced.

The machine utilises a 5kW laser to enable very fast build rates. The high-power laser affords build rates 5-10 times faster than that of similar technologies, which reduces the manufacturing costs of parts and broadens the application space of additive manufacturing.

In 2016, the first titanium aerospace parts were produced on the Aeroswift machine. These parts are scheduled to fly in 2017. The next phase of development will be aimed at industrialisation of Aeroswift technology for commercial use.

South Africa has the second largest titanium reserves in the world; and a national drive is taking off to develop a titanium industry that incorporates the beneficiation of titanium from ore to final product. This project, along with a number of other projects in the country (of which the most relevant is the development of Ti powder directly from ore) is focused on developing the overall titanium value chain in South Africa.

Titanium parts produced on the Aeroswift technology

The Aeroswift machine with a build volume of 2m X 0.6m X 0.6m