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Preface

We are living in a turbulent world marked by great uncertainties and disruptions borne from deep transformations in the international system of political and economic relations, which defined the post-Cold War period. In this context, science, technology and innovation (STI) are being increasingly seen as instruments of national and geopolitical interests. The recent withdrawal of United States Federal funding from a wide number of health and biomedical science research and development programmes have caused major disruptions in South Africa's National System of Innovation (NSI).

It is in this context that the Minister of Science, Technology and Innovation, Prof. Bonginkosi Nzimande, commissioned the STI Ministerial Working Group to conduct a holistic assessment of the impact of the loss of research funding to South Africa's NSI, and further to provide the Minister with practical policy considerations to ensure the long-term security and sustainability of South Africa's research and development interests.

It is my pleasure to present the Report based on the extensive work done by the Ministerial Working Group. I am immensely grateful to the members of the Ministerial Working Group for their time, energy and intellectual efforts: Dr. Thulani Dlamini, Prof. Sarah Mosoetsa, Dr. Mlungisi Cele, Mr Daan Du Toit, Prof. Francis Petersen, Prof. Thokozani Majozi, Prof Ntobeko Ntusi, Dr. Fulufhelo Nelwamondo, Prof. Sibongile Muthwa, Prof. Xoliswa Mtose, Prof. Sibusiso Moyo and Prof. Ari Sitas.

I would also like to acknowledge the contribution of the technical committee – Prof. Michael Kahn, Dr. Petrus Letaba and Mr Francois Davel - and organisations including government departments, the South African Medical Research Council, Universities South Africa, and interviewees.

Derrick Swartz, STI-WG Convenor

Executive Summary

The early 21st century has witnessed a fundamental shift in how geopolitics, ideology, and knowledge production intersect. The recent actions, by some governments in the Global North, to impose student visa restrictions on foreign students purely based on national origins, the rising climate of fear on university campuses, growing surveillance of scientists in labs, and instrumentalization of science, technology and innovation (STI) for narrow nationalistic and geopolitical interests symbolises not merely strained diplomatic ties but a more profound rupture in global intellectual cooperation. This decline is, arguably, reflective of a broader crisis: the assault on science and public institutions such as universities and public research institutes as custodians of science as a public good and its role in promoting inclusive and equitable internationalism.

At the time of writing this Report, anti-science sentiments have reached alarming heights in many parts of the world, including in countries once extolled for defending the virtues of Enlightenment thinking. However, its roots, arguably, can be traced back to decades of neoliberal policies pursued in many parts of the world. Budget cuts, privatisation, and anti-intellectualism have weakened public universities, hollowed out the humanities, and subordinated research to market logic. The defunding of institutions such as USAID was not simply a fiscal decision but an ideological one.

This threefold attack on science, the university, and the state is a global phenomenon, transcending partisan divides. It signals a crisis of legitimacy: who produces knowledge, for whom, and to what end? Liberal democratic and authoritarian regimes have sought to shape, in differing ways, knowledge to serve power rather than truth, undermining collective problem-solving and, by extension, the impact of science on humanity.

However, in this fractured global landscape marked by major unresolved historical legacies of social inequality and new existential threats such as climate change, ecological degradation and uncontrolled and dangerous use of new technologies such as Artificial Intelligence (AI), a collaborative, inclusive and coordinated STI system focused on the needs of the global majority is not a luxury but an existential necessity. With misinformation spreading faster than peer-reviewed evidence, national STI strategies must integrate across all spheres of government, from national to provincial and municipal, and raise the capacity of the NSI not only to support inclusive and sustainable national development, but also the evolution of new forms of democratic internationalism. Funding must align with policy outcomes, and scientific knowledge must benefit and be accessible to the public.

South Africa's experience offers critical lessons. During apartheid, researchers faced global isolation yet built resilient intellectual networks through civic activism, local collaborations, and indigenous knowledge systems. Science became a tool of resistance, which is evident in underground health research, alternative education models, and community-driven inquiry. Today, three decades after the collapse of apartheid, South Africa faces new pressures and threats against the democratic project. In response, the scientific enterprise is required to draw on the rich history of social innovation and solidarity that marked the struggle against apartheid rule - not to retreat into any form of autarky and narrow nationalism, but rather to pivot the NSI in support of inclusive and sustainable national development and international

collaboration based on the principles of equality, diversity and inclusive futures for all humanity.

The crisis provoked by recent funding cuts mirror, in macabre terms, unilateral steps taken just a few years ago by some advanced industrialised countries during the COVID-19 global pandemic to ruthlessly block the outflow and sharing of vital life-giving vaccines and therapeutics to much of the Global South.

Diversifying funding sources, strengthening regional alliances through BRICS and the African Union, and safeguarding intellectual freedom are essential. Crucially, science must be reconnected to social purpose, measured not just in patents but in its capacity to tackle global inequality, climate change, and the multilateralism deficit.

The Report is the outcome of a rapid-response exercise by the STI Ministerial Working Group (STI-WG), mandated to assess impacts, understand risks, and recommend strategic actions to strengthen the sovereignty and resilience of the NSI.

It addresses the immediate and long-term implications of the abrupt US federal funding cuts to South African STI programmes, that have occurred against the backdrop of intensifying global geopolitical shifts.

The STI-WG identifies the Trump administration's implementation of Project 2025 as a turning point in the structure and terms of globally funded STI collaboration.

This development has to be seen in the context of wider geopolitical shifts increasingly tilted towards science nationalism and strategic decoupling and recoupling, with increased trends towards the securitisation of scientific collaboration in fields such as semiconductors, artificial intelligence, biotechnology, genomics, materials sciences and space science and technology research. International partnerships, once rooted to a large extent in open and cooperative science norms, are now increasingly being framed in narrow security-led foreign policy terms linked to geopolitical rivalries.

The cuts threaten major South African research programmes, particularly in public health, where grants from the US National Institutes of Health, the Centers for Disease Control and Prevention, and the US Agency for International Development have supported breakthroughs in HIV/AIDS and tuberculosis research and mitigation, as well as maternal health. As a consequence, nearly R2,5 billion in research activities and over 2,000 research positions are at risk. Clinical trials have been halted, R&D value chains disrupted, and the delivery of vital public health services compromised.

The broader shocks lay bare South Africa’s over-reliance on a small number of high-value foreign funders, which now account for 17,3% of Gross Expenditure on R&D (GERD), disproportionately affecting the health sciences, universities, science councils, and NGOs. The system’s structural vulnerabilities of chronic underinvestment, siloed governance, a weakening talent pipeline, and high dependence on foreign funding in health sciences fields is explored in some detail.

The STI-WG, recognising the efforts of the most-affected organisations to fill the gaps, and noting the broader consequences for the health innovation ecosystem, proposes immediate actions that include top-slicing, re-allocation and ring-fencing funds under

the control of the Departments of Science, Technology and Innovation, and Higher Education and Training. This includes recovery of unspent National Research Foundation (NRF) funds, sub-market rate loans from financial institutions, and foreign exchange hedging protections for the science councils and universities.

However, the Report supports deeper-lying commitments to stop any further erosion in public science funding and sustained positive growth in GERD as a factor of GDP. The STI-WG furthermore advocates structural reforms, including a dual-stream funding model for mission-oriented and curiosity-driven research, a national STI funding information repository, and a robust science diplomacy framework to embed South African priorities in global STI engagements.

It argues the case that unless drastic measures are taken by Government, with concurrence and commitment of Organised Business, Labour and Civil Society, to tilt the political economy of funding of the NSI towards long-term sustainability, the country faces many serious risks and vulnerabilities to its capacity to exercise sovereign jurisdiction over its long-term future. Although the recent US Federal funding cuts affect parts of the NSI, notably the health sector, the crisis could be seen as a proxy – the proverbial canary in the coalmine - for a wider set of threats to the sustainability of our national economy and society in the face of a disruptive and unpredictable geopolitical landscape.

The STI-WG firstly affirms and defends the integrity and sustainability of the 'public good' purposes of STI commons by stabilising funding, protecting research infrastructure, preserving gains in human development, raising gross expenditure on research and development and improving efficiency in capital allocation across the research and innovation system. Secondly, we propose aligning the Decadal Plan to more deliberately build the resilience and impact of the NSI through mission-driven block grants and competitive grants for blue-sky and use-oriented basic research in support of long-term national priorities.

Effective interdepartmental coordination, alignment and strategic coherence must be fostered through the Presidential Plenary, and the Interministerial Committee on STI, as provided for by the DSTI Decadal Plan. This will be underpinned by robust and relevant metrics, and enhanced capabilities for monitoring, evaluation and learning, and social fabric and techno-economic foresight.

It is crucial to mention that strategic sovereignty does not imply autarky or isolation from the international system, but rather the capacity to co-create and shape partnerships to secure South Africa's national interests and international commitments underpinned by an enduring commitment to equality, inclusivity and democracy. Ethical, reciprocal, and transparent collaboration anchored in principles of open science, equity, and epistemic justice must be institutionalised. South Africa must build a publicly accountable and socially just NSI that can withstand global shocks while advancing inclusive development.

The Report concludes that STI policy must pivot from reactive adaptation to proactive transformation of the STI institutional landscape underpinned by a firm commitment by both State and society to placing STI at the centre of national development.

This moment of rupture offers an opportunity to assert strategic STI sovereignty not through isolation, but by leading scientifically, morally, and politically in forging a new global science order grounded in solidarity, mutual interdependence, and public good.

Glossary of Terms

AI	Artificial Intelligence
ARUA	African Research Universities Alliance
AU	African Union
BERD	Business expenditure on Research and Development
BRICS	Brazil, Russia, India, China and South Africa
CDC	Centers for Disease Control and Prevention
CoS	Category of Science
CSIR	Council for Scientific and Industrial Research
DBRI	Department-based Research Institute
DCDT	Department of Communications and Digital Technologies
DHET	Department of Higher Education and Training
DST	Department of Science and Technology
DSTI	Department of Science, Technology and Innovation
DTHF	Desmond Tutu Health Foundation
DTIC	Department of Trade, Industry and Competition
ESI	Essential Science Indicator
FORD	Field of Research and Development
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
HCP	Highly Cited Paper
HERD	Higher Education expenditure on Research and Development
HHS	United States Department of Health and Human Services
HSRC	Human Sciences Research Council
ICT	Information and Communications Technology
ICTS	International Cooperation, Trade and Security Cluster
IMC	Interministerial Committee on STI
IMF	International Monetary Fund
IPR	Intellectual Property Rights
M&E	Monitoring and Evaluation
MNC	Multinational Corporation
NACI	National Advisory Council on Innovation
NDoH	National Department of Health
NHLS	National Health Laboratory Service

NIH	National Institutes for Health
NDP	National Development Plan
NOAA	National Oceanic and Atmospheric Administration
NRF	National Research Foundation
NSF	National Science Foundation
NSI	National System of Innovation
NT	National Treasury
OECD	Organisation for Economic Co-operation and Development
PI	Principal Investigator
R&D	Research and Development
R&I	Research and Innovation
RAI	Research Activity Index
SADC	Southern African Development Community
SAMRC	South African Medical Research Council
SARChI	South African Research Chairs Initiative
SDG	Sustainable Development Goal
STI	Science, Technology and Innovation
USAID	United States Agency for International Development
USAf	Universities South Africa
WoS	Web of Science

1.0 Introduction and Background:

The post-war (1945) and post-Cold War international science funding landscape was marked by a rapid expansion of public and private investments in science, technology and innovation (STI), initially led by the United States (US) in its domestic science system, Japan, and Korea in the east, and from the early 1990's by China and India, beneficiaries of offshoring. In the early 2000's the European Union (EU) member states declared the Lisbon Agenda to raise research and development (R&D) expenditures to 3% of GDP and drove collaborative programmes such as Erasmus Plus, the Framework Programme, Horizon Europe, extended the European Research Area, and expanded collaboration with African, Asian and Latin American partner countries. African Union (AU) member states, recognising the importance of research and innovation, have adopted the goals of the STI Strategy for Africa 2034 "STISA 2034" (African Union, 2024).

Global STI systems have come under economic pressure through economic booms and busts, financial crises (Asian, Eurozone and US), the Gulf, North African and Middle East wars, 9/11, and the Russia-Ukraine conflict. Alongside are alliances such as the BRICS, the Association of Southeast Asian Nations, the African Continental Free Trade Association, and the Eurasian Economic Union. The post-1990 era of expansionist public STI investment programmes in the US and EU became constrained even as China and India surged ahead, and the Russia-Ukraine conflict has catalysed military investment, with the securitisation and weaponisation of STI.

It would be extremely naïve not to acknowledge and bear in mind that all international state-mediated science collaborations, including North-South science programmes, are linked to various kinds of foreign policy considerations and interests. However, it should also be noted that the period following the end of the Cold War in the 1990's and following decade witnessed a more 'liberal' and generous climate in international science cooperation. This was evident when challenges such as the ozone depletion crisis, climate change and global health zoonotic pandemics led to a commendable degree of global science cooperation in the Millennium Development Goals, the World Health Organisation (WHO) International Health Regulations, and the Sustainable Development Goals.

Today, there appear to be signs of a weakening of these norms, and subordination to narrow economic and security interests of Governments. This seems to be the case particularly in the context of rising geopolitical tensions and economic rivalries, and overall weakening of many cooperative parts of the international science system.

In the US, the implementation of Project 2025 (Heritage Foundation, 2023) has taken shape through a host of Trump administration executive orders that freeze and downgrade international aid, re-shape domestic science, education, environmental and industrial policy, and re-set international finance, trade, defence and political relations. The most directly affected US departments include Defense, Health and Human Services, Energy, Education, and Agriculture. Affected agencies include the United States Agency for International Development (USAID), the Centres for Disease Control and Prevention (CDC), the National Institutes for Health (NIH) especially the National Institute of Allergy and Infectious Diseases, the Food and Drug Agency, National Science Foundation (NSF), and the National Oceanic and Atmospheric

Administration (NOAA). International agencies that are impacted include the World Trade Organisation, WHO, UN Climate Change, Family Health International (FHI 360), the Global Fund to Fight AIDS, Tuberculosis and Malaria, RTI International, Joint United Nations Programme on HIV and AIDS (UNAIDS) and the Global Alliance for Vaccines and Immunization (GAVI).[1] Open science, 'the set of principles and practices that aim to make scientific research from all fields accessible to everyone for the benefit of scientists and society as a whole' (UNESCO, 2023), faces its greatest threat in a century.

The January 2025 decision of the US Government to impose immediate cuts in Federal funding for international cooperation in health and biomedical sciences sparked widespread concern in South Africa. The cuts threaten the continuity and success of several flagship public health R&D programmes, particularly those reliant on USAID, NIH and the CDC. 'South Africa is the beacon, said Dr. Harold Varmus, who was awarded the Nobel Prize in medicine and who was a director of the NIH. 'We have many important collaborative works going on there, to cut them off, I just don't understand it. It's self-destructive behaviour.'[2]

For South Africa, the negative impact of the US funding cuts foregrounds the poly-crisis of low economic growth, unemployment, inequality and poverty, the under-funded and understaffed national system of innovation (NSI), under-resourced universities, and a weakening talent pipeline. These structural constraints amplify the systemic risk posed by the abrupt withdrawal of US funding and potential cutbacks by other international partner countries such as the United Kingdom. Indeed, over the past few decades, international research and development funding, in part serve to compensate the underfunded science system, with perverse risks and consequences.

The immediate termination of financial aid and expert support to South Africa poses significant challenges to the stability and sustainability of important aspects of the country's NSI, its commitment to the WHO One Health agenda, to health security in the broadest sense, and to advances in health research, innovation, and skills development. Clinical science and clinical trials are disrupted with contingent job losses and ethical challenges.

The short-term disruptions - halted projects, loss of skilled researchers, and other spillovers - risk generating long-term risks such as brain drain, weakened research capacity, and reduced innovation. The president of the South African Medical Research Council (SAMRC) has warned 'There is a risk to the country's ability to benefit from the critical role of science as a driver of both human development and a knowledge economy' (Ntusi, 2025). The Academy of Science of South Africa (ASSAf) concurs: 'While the scale of the cuts in US funding is more readily evident in the biomedical sciences, and in HIV/AIDS research and treatment studies, we hold that

[1] https://www.ft.com/content/b5a1d178-6823-4227-8f2d-81a66edbd71e

[2] https://www.nytimes.com/2025/06/17/health/south-africa-medical-research-trump.html?unlocked_article_code=1.QE8.5XIR.G9E-DnvkqVuZ&smid=urlshare&utm_source=Live+Audience&utm_campaign=6fe00bd973-nature-briefing-daily-20250619&utm_medium=email&utm_term=0_-33f35e09ea-49895412

these financial cutbacks pose significant threats to the academy, with effects on all disciplines.'[3]

Before the cuts South Africa was close to meeting the African Union (AU) Abuja Declaration target of spending 15% of GDP on health provision, and at 0,15% of GDP was edging toward the 2013 World Health Assembly target of 0,2% of GDP for health R&D.

It should be pointed out that South Africa has a strong institutional infrastructure in place: we have a well-established network of public research institutions (e.g. the Council for Scientific and Industrial Research, Agricultural Research Council, Human Sciences Research Council, SAMRC, NRF and the National Institute for the Humanities and Social Sciences). There is a marked strength in scientific publications and citations, especially in areas like astronomy, infectious diseases, climate science, mining engineering and the social sciences. Flagship projects like the Square Kilometre Array (SKA) have positioned South Africa as a global hub in big science and astronomy. We do harbour a relatively advanced (albeit unequal) higher education sector with a critical mass of scholars. South Africa is a leading science and technology player on the continent, hosting regional centres of excellence and supporting collaborations across Africa.

It is therefore important to note that whilst the NSI exhibit a number of specific structural and strategic vulnerabilities in the way it articulates into the international science system, it can draw on many strengths and capabilities to advance its long-term strategic sovereignty. The STI-WG believes that the current 'crisis' provoked by the sudden withdrawal of US federal funding could be used as a strategic opportunity for recalibrating and renewing the NSI towards a more sustainable future.

On 2 May, 2025, the Minister of Science, Technology and Innovation, Prof. Blade Nzimande announced the appointment of a Working Group on Science, Technology, and Innovation Funding (STI-WG) to advise the Minister on the implications and impact of the recent withdrawal of funding by the US Government from key research and development programmes in South Africa.

The STI-WG Terms of Reference are to:

1. Analyse the impact and implications of the US withdrawal of funds to South African public research and innovation;
2. Analyse the current geo-political risks related to STI and how South Africa should position itself to deal with the current situation; and
3. Propose policy and strategic responses to enhance the long-term security and sustainability of the STI system and the role of the DSTI.

The STI-WG has worked to a deadline of just over one month by using an eclectic methodology of selected expert interviews, expert brainstorming, secondary data collection and internet search.

[3] https://www.assaf.org.za/wp-content/uploads/2025/04/ASSAf-Statement_Science-under-threat_30-04-25.pdf

The report comprises eight sections. Following this Introduction, Section 2 outlines the approach followed. Section 3 provides an overview of the global funding environment as contextual background. Section 4 presents the impact analysis, detailing the immediate effects of the termination of US funding for health R&D, the structure of foreign funding flows, key NSI indicators, and a bibliometric analysis of scientific publications. Section 5 explores the geopolitical turbulence affecting the NSI, particularly shifts in international STI partnerships, offering a critique of praxis, focus, priority-setting, and international relations. Section 6 considers issues of policy coherence, coordination, and governance, with specific attention to funding, incentives, foresight, monitoring, evaluation, and learning. Section 7 synthesises the findings, and Section 8 sets out a consolidated set of strategic recommendations to secure STI sovereignty and sustainability.

2.0 Approach

The Terms of Reference for the STI-WG specify three interlinked objectives:

1. Impact Analysis: Assess the scale, nature, and systemic consequences of US funding withdrawal on South Africa's public research and innovation ecosystem.
2. Geopolitical Risk Appreciation: Understand the broader geopolitical and strategic dimensions affecting South Africa's STI system, and how the country should position itself in this evolving landscape.
3. Policy and Strategic Response: Recommend feasible, forward-looking measures—both policy and structural—to enhance the long-term sustainability and autonomy of South Africa's STI funding and governance frameworks.

The STI-WG sought to address the terms of reference on the basis of ten key questions:

1. What are the impacts and implications of the recent withdrawal of funding by the current US Administration to sub-sectors of the South African national system of innovation (NSI)?
2. What are the broader structural features and dynamics of major sources of international research and development funding into the NSI?
3. How significant is international funding for the NSI to the mandates and overall performance of the system? What quantitative and qualitative evidence can be shown to demonstrate this importance across sectors and disciplines?
4. What funding models have been used in partnerships and collaborations with the major international funding providers and how have they influenced the direction, autonomy, and sustainability of the NSI?
5. What could be the likely impact of major shifts (by design or default) in the global geo-political environment on the terms and modalities of internationally funded STI collaboration within the NSI?
6. How best can we understand the major risks and opportunities presented by the current international funding regimes (linked to the NSI) in the light of changing trends in the international system?
7. What insights could be drawn from innovative funding approaches (schemes, models and mechanisms) applied in countries with comparable experiences (e.g. Brazil, India, China and South Korea)?

8. What policy and strategic options should be considered with the aim of securing South Africa's strategic funding sovereignty in STI domains vital to its national interests and international obligations?
9. What kinds of investment and funding arrangements (models) could be considered that might yield higher levels of domestic public, private and philanthropic investment in key parts of the NSI funding value chain?
10. How can the effectiveness and efficiency of current SA-International funding models be improved to ensure better outcomes in line with national development priorities?

STI-WG engaged with a range of actors – government (including Science Councils and Department-based Research Institutes), higher education institutions, business and non-governmental organisations (NGOs). A cross-cutting Technical Group supported the work of the STI-WG.

3.0 The Global Funding Environment

The NIH has been a central pillar of improvements in health care for more than a century. It is estimated that NIH-funded therapies were responsible for 48% of the 3,3-year increase in US life expectancy between 1990 and 2015, translating into life opportunity gains in the order of $8,2tn. The Trump Administration has now cancelled 2 182 NIH grants, in the amount $9,7bn, terminated researcher contracts, and will reduce essential indirect costs and reduce the 2026 NIH budget by 43%. Other cuts include the reduction of the 2025 NSF allocation from the $2bn of 2024 to $989mn. Funding to the CDC will be reduced by 11%.

NIH, CDC and USAID have been key funders and co-funders of health research across the globe (Table 1).

Table 1: NIH funding to Africa, 2024

Country	$	Africa %
Botswana	2 358 143	2,3
Cameroon	1 856 023	1,8
Democratic Republic of Congo	2 155 122	2,1
Egypt	534 007	0,5
Ethiopia	382 591	0,4
Gambia	111 191	0,1
Ghana	3 817 197	3,7
Kenya	8 147 315	8,0
Malawi	2 277 132	2,2
Mali	3 035 047	3,0
Mozambique	848 324	0,8
Nigeria	7 713 221	7,5
Rwanda	675 376	0,7
South Africa	49 475 540	48,4
Tanzania	3 155 205	3,1
Tunisia	144 460	0,1

Country	$	Africa %
Uganda	12 184 038	11,9
Zambia	1 887 177	1,8
Zimbabwe	1 538 134	1,5
Africa Total	**102 295 243**	**100**

South Africa has been the major recipient of support for clinical medicine and large-scale clinical trials in HIV/AIDS, tuberculosis and other infectious diseases; research in virology, infectious disease, immunology, epidemiology, public environmental and occupational health, bio-informatics, and data sciences.

The termination of such funding has effects on human life, talent development and associated scientific and technical services.[4] As communicable diseases such as HIV and TB have social implications, NIH funding has also benefited the social sciences and humanities research fields, which will also be impacted by cuts to NIH funding.

A number of American universities will lose Federal monies if they do not comply with demands to alter curricula and end diversity, equity and inclusion and related policies Applications for foreign student visas have been suspended even though foreign students make up some 15% of the student body of the leading United States universities, with Columbia (40%), Johns Hopkins (29%), MIT (30%) and Harvard (28%) facing precarity.

The distribution of international funding to South Africa across the main Fields of R&D (FORD) is shown in Table 2.

Table 2: Main international funders by Fields of R&D, 2024

	Medical & Health Sciences	Natural Sciences	Engineering & Technology	Agricultural Sciences	Social Sciences	Humanities
NIH	X	X			X	X
UKRI	X	X	X	X	X	X
HHS[5]	X	X	X		X	X
NSF		X	X		X	X
NSFC		X	X	X	X	
EU	X	X	X	X	X	X
DST, India			X	X		
Wellcome Trust	X				X	X
BMGF	X			X		
CGIAR	X			X		
ERC		X			X	
Australian R C					X	X
R C Finland			X	X	X	X
USAID	X			X		
DFG		X	X			X
NKRDP (China)			X			

[4] The termination of PEPFAR is being addressed by the Ministry of Health.

[5] From Web of Science. Some research publications note the funding source as US Department of Human and Health Services (HSS); others refer to HSS .

	Medical & Health Sciences	Natural Sciences	Engineering & Technology	Agricultural Sciences	Social Sciences	Humanities
Spain		X				
CDC	X					
NORAD	X					
MEXT		X		X		
JSPS				X		
CSIR, India			X			

As previously alluded, the immediate termination of financial aid and expert support to South Africa poses significant challenges to the stability and sustainability for important aspects of the NSI, its commitment to the WHO One Health agenda, to health security in the broadest sense, to advances in health research and innovation, and skills development. Clinical science and clinical trials are disrupted with contingent job losses and ethical challenges.[6]

There are also fears among the scientific community that US government funding support for climate change research may be negatively affected by shifts in policy priorities. [7] More broadly, it is not clear if economic and fiscal pressures and associated policy shifts by the European Union (EU) would yield negative implications for other mega-science collaboration programmes in areas such as radio-astronomy, ocean sciences and paleo-sciences.

The disruption to health security extends to the wider African continent and to international collaborators and is exacerbated by collateral foreign aid cuts by the EU, Finland, France, Germany, the UK, Switzerland and the Netherlands in favour of military expenditure.[8]

Understanding the complexities of global research agendas and funding modalities is a vital component of the research enterprise. South Africa draws inspiration from best-practice STI policy, including funding and impact assessment, implementing these through organisational learning.

Fourteen country[9] research funding organisations were examined with respect to their autonomy, granting mechanisms, drivers, selection, public calls, and organisational evolution. High-level insights for South Africa include the following.

I. Empowering agencies with operational independence improves effectiveness and insulates science from political influence and volatility.
    a. Australia: The Australian Research Council and National Health and Medical Research Council have statutory independence, allowing long-term agenda setting.

[6] The termination of the President's Emergency Plan for AIDS Relief (PEPFAR) is being addressed by the Ministry of Health.
[7] https://www.science.org/content/article/trump-s-fear-factor-scientists-go-silent-funding-cuts-escalate?utm_source=chatgpt.com
[8] https://odi.org/en/insights/aid-and-defence-a-data-story-of-two-global-targets/?utm_source=chatgpt.com
[9] Argentina, Australia, Brazil, Canada, China, Egypt, Finland, India, Malaysia, Portugal, Republic of Ireland, Republic of Korea, Turkey, United Kingdom.

b. Brazil: State agencies like the São Paulo Research Foundation (FAPESP) maintain strong autonomy and continuity across administrations.
c. Canada: The Tri-Council agencies Social Sciences and Humanities Research Council, the Natural Sciences and Engineering Research Council, and the Canadian Institutes of Health Research are arm's length statutory bodies.

II. Diverse, agile granting instruments (open and thematic) drive both excellence and responsiveness to societal needs.
    a. Argentina, Egypt, and India follow dual funding streams (basic + applied research) with topic calls shaped by national development goals.
    b. Finland and United Kingdom: Maintain both open-ended investigator-driven schemes and thematic programs aligned to societal missions.

III. R&D funding is increasingly aligned with national and global missions (SDGs, climate resilience, energy transition
    a. Portugal: Used the climate framework law to guide research funding towards adaptation and resilience.
    b. Brazil: Created a national bioeconomy and ecological transformation platform tied to funding mechanisms. Co-investment with China in building a semiconductor industry.
    c. United Kingdom and Canada: Explicit integration of climate and health security into national R&I strategy.
    d. Finland: The Research Council of Finland (formerly Academy of Finland) continues to fund high-quality research.
    e. China: Investment in renewable energy research and development, material science, becoming the leader in wind, solar, battery and electric vehicle technologies, and a world player in artificial intelligence (AI).
    f. Korea: Talent development through Brain Korea 21; R&D on climate change and green technologies.
    g. Turkey: TÜBİTAK has expanded funding programs to include research on climate change, renewable energy, and health security.
    h. India's National Research Foundation drives the mission-led STI policy

IV. Consolidating fragmented funders under coherent national strategies improves targeting and efficiency.
    a. Malaysia: Tightly couples research with digital economy and water/agriculture sustainability.
    b. Ireland and Finland: Drive innovation in education, logistics, fintech, and health services.

V. Research impact extends beyond traditional technology transfer into services and public sector innovation.
    a. India: National Economic Policy 2020 encouraged the return of migrated scientific talent and remote collaboration.
    b. Egypt: Offers joint funding and mobility schemes via bilateral agreements (e.g., France and Japan).

VI. Countries with outward migration still benefit by strategically engaging their diaspora and offering re-entry grants.
    a. Ireland and Portugal: Through the Emigrant Support Programme and the Programa Regressar.
    b. Korea: World Korean Business Convention offers a platform for emigrants' businesses to exhibit and demonstrate innovative products and technologies on a global stage.

VII. Countries used OECD, International Monetary Fund, or other multilateral organisation reviews as catalysts for reform, evolution, improved governance and reallocation of funds.
    a. Ireland: Merged Ireland Research Council and Science Foundation Ireland into Research Ireland to pool funds, reduce duplication, and clarify priorities.
    b. United Kingdom: UK Research and Innovation (UKRI) merged seven granting councils to streamline research and innovation support across domains.
    c. Finland has committed GERD: R&D of 4% of GDP, with a focus on sustainability and digitalisation
    d. Korea and China: Institutionalised external review and monitoring, evaluation and learning (MEL).

VIII. Extend research capacity through science diplomacy, bilateral and multilateral agreements, and negotiate co-funding platforms with the EU, African Union, and BRICS for joint thematic calls in climate, agri-food, and digital health.
    a. Egypt: Jointly fund research with international partners.
    b. India and Brazil: Pursue co-funding platforms with OECD and BRICS countries.

Table 3 draws on the above insights to suggest principle and design implications that are relevant to the developmental challenges facing the NSI.

Table 3: Learning from the fourteen-country comparative analysis

Principle	**Design Implication**
Foster autonomy with accountability	Legal independence for funders, with performance review
Mission-oriented allocation	Define national missions - e.g. Just Transition; Climate Change; Health Security; Energy and Water Security
Aggregation, coherence and learning	Empower the Presidential Plenary; merge overlapping schemes.
Dual-stream funding	Blend of curiosity-driven and challenge-driven schemes, subject to rigorous selection
Mobility and diaspora outreach	New instruments for knowledge exchange and the global knowledge pool
Regional and global partnership	Systematic co-funding with Africa, the EU, and BRICS

4.0 Impact Analysis

This section presents the analysis of the impact and implications of US funding withdrawal, the structural features and dynamics of international R&D funding, the significance of international funding to NSI mandates and performance and R&D funding models, and suggests immediate interventions that can be implemented.

4.1 Impacts and implications

Universities South Africa (USAf) submitted estimates to the Presidency on the impact of the loss of US funding on the universities (USAf, 2025). According to the USAf and SAMRC submission to the National Treasury, the SAMRC, HSRC, Wits Health Consortium, University of Cape Town (UCT), Stellenbosch University (SU), University of KwaZulu-Natal (UKZN), Comprehensive International Program of Research on AIDS (CAPRISA), University of Pretoria, Aurum Institute, the Agricultural Research Council (ARC), and the CSIR bear the largest shocks. The Universities of Free State, Fort Hare, and Limpopo, and UNISA, are also impacted (Table 4).

Table 4: Impact of NIH termination of funding, 22 April 2025

Institution	# Grants	NIH R mn	Staff	Students	Exit	R&D R mn	NIH/R&D %
UCT	155	300	400	60	21	2 303	13,0
WITS	110	258	762	45	19	1 211	9,1
Stellenbosch University	96	320	280	40	11	2 180	12,8
SAMRC	29	237	180		6	1 125	21,1
University of Pretoria	30	150				1 185	12,7
African HRT	38	158	128	35		n.a.	n.a.
DTHF	19	112	72		4	n.a.	n.a.
UKZN CAPRISA	14	76	40		3	1 042	7,3
Aurum Institute	15	68	68		2	n.a.	n.a.

Sources: SAMRC (2025); DST (2024).

SAMRC estimates that the R1,68 bn NIH cuts place 1 930 research posts and 180 student degrees at risk. A case in point is the SAMRC BRILLLIANT Consortium trial of the B001-3 HIV vaccine that has lost its newly awarded five-year grant of $45mn.

The broader health innovation ecosystem, including NGOs, provincial health services, and university-linked consortia, is deeply affected, with a total exposure exceeding R2,5 billion. Studies on HIV and TB make up 78% of costs; 40% of total project costs are in basic sciences and 60% in clinical studies and other fields. The universities and science councils have world-class skills in undertaking collaborative research, and developing, mentoring and sustaining R&D value chains 'from clinician to clinic,' working with scientific and technical service (STS) providers.

The University of Cape Town records that 'contracted, active US-funded grants to UCT investigators total R1,67 billion[10] for the next three years: future impact of funding termination will be catastrophic for UCT, with significant knock-on effects for the country.'[11] Units such as the Institute of Infectious Diseases and Molecular Medicine

[10] It is noted that these figures may have changed in some instances due to the rapid changes since the last reports were submitted

[11] UCT submission to USAf, 2 May 2025.

will be seriously impacted. The Wits Health Consortium submission to the National Treasury estimates that 1 144 posts are at risk, including 164 researchers and 283 technicians across the various projects on its books. Stellenbosch University reports risk to 300 researchers in health-related and climate and disaster risk management R&D projects valued at R377,6mn in 2025. Half of the US funding secured is awarded to the Biomedical Research Institute that was completed late 2022 at a cost of R1,2bn. The Department of Higher Education and Training (DHET) contributed R200mn, with R1bn sourced from the university itself. The facility houses more than 500 biomedical researchers and students, including some of the world's foremost scientists in bioinformatics, tuberculosis, neuroscience, and genetics.

Three grants of R31 900 000 to the University of Pretoria were cancelled.

The USAf submission notes that the health sciences research of the universities of Free State, Fort Hare, and Limpopo, and UNISA are also affected (Table 5).

Table 5: Loss of funds to universities, 15 May 2025

University	Gap
WITS	691 000 000
UCT	475 600 000
Stellenbosch University	160 913 447
UKZN	114 501 464
UNISA	19 906 968
University of Limpopo	6 506 108
University of Free State	2 052 000
University of Fort Hare	423 360
University of the Western Cape	200 500
Total	**1 471 103 865**

Source: USAf (2025).

Over 2020-2024, HSRC received US funding in the amount R1,04bn that averaged 17% of total revenue. Seventeen projects in the amount of R315mn were ongoing. On 27 January 2025, the CDC notified HSRC to “stop spending or incurring costs that would be used to support any diversity, equity, and inclusion (DEI) programs, personnel, or activities.” CSIR losses are smaller, estimated at $3,5mn in 2025.

The CDC in 2024 funded the Wits Health Consortium, CSIR, SAMRC, HSRC, and National Health Laboratory Service (NHLS), the Eastern Cape and KwaZulu-Natal provincial Governments, several NGOs and companies.

The amount of R161mn from the Bill and Melinda Gates Foundation (BMGF) is currently unaffected.

A serious implication is the breakdown of multi-year research initiatives. Clinical trials operate on multi-phase cycles and require sustained investment to maintain validity, ethics compliance, and participant protection. Interruptions caused by donor withdrawals not only waste prior investments but also expose institutions to legal and reputational risk. At the individual level, South African researchers have built careers around global partnerships. The sudden termination of these funding lines results in academic displacement, loss of mentorship chains, and psychological tolls on young

scientists and students. From a systems perspective, it represents a failure of anticipatory governance and insufficient diversification of funding sources.

Communities are also impacted. Health research is integrated with public health services, often bringing diagnostics, mobile clinics, and monitoring tools to underserved areas. Loss of research funding thus translates into diminished service delivery and community engagement.

The impact of the US funding cuts on health and biomedical sciences should also be examined in the context of wider pressures on the political economy of funding of the NSI as a whole (Table 6).

It should be pointed out that the rapid growth of international government and philanthropic funding into the South African NSI over the past two to three decades has coincided, in part, with static and declining levels of real growth in GERD in the last few years. Furthermore, the growth spurt in large-scale international funding into the NSI was also occasioned by a generally laissez-faire, open-ended climate in which institutional actors in the science system, including universities and Science Councils, explored and negotiated with relative autonomy a diverse range of strategic partnerships across a wide range of scientific domains. Whilst on balance it has secured critical pathways for new resources to enter the NSI, it has also expanded the field of risks, notably those borne from dramatic disruptions in the geopolitical arena.

The first aspect points to an imperative to explore strategies for finding a national policy solution to static and negative real growth in South Africa's GERD over the medium and long term. The second aspect requires the NSI to consider a regulated framework within which system and institutional actors within the NSI could negotiate and direct strategic choices of international cooperation, notably in areas deemed to be crucial to South Africa's strategic STI sovereignty, such that its full risks and optimal opportunities are sufficiently secured.

Table 6: Selected R&D indicators

	Year	2013/14	2022/23	
	Financial	%	%	
1	GERD:GDP	0,73	0,61	↓
2	Cost of labour: GERD	52	44	↓
3	Other current expenditure: GERD	34	42	↑
4	Government sources: GERD	43	51	↑
5	Business sources: GERD	41	29	↓
6	International sources: GERD	13	17	↑
7	BERD: GERD	46	36	↓
8	HERD: GERD	28	36	↑
9	Health R&D: GERD	18,4	24,4	↑
10	TB, HIV/AIDS, malaria: GERD	11	15	↑
11	Social Sciences: GERD	16,8	16,5	→
12	Environment-related fields: GERD	4	11	↑
13	Foreign funding: GERD	12,9	17,3	↑
	Personnel			
14	# Researchers, FTE (excluding doctoral & post- doctoral)	12 574	11 782	→
15	Researcher FTE/1000 employed	1,5	1,7	→
16	Female researcher headcount%	44	48	↑
17	International doctoral graduates %	35	37	→

Source: DSI, 2024; DST, 2015

The indicators tell their story: GERD: GDP, the lead indicator (1) is static and below the DSTI target of 1,5%. This stasis is driven by the stock of knowledge workers - personnel indicators 14 and 15 speak to the small size of the NSI and its failure to grow. Indicators 2 and 3 suggest a shift from permanent and pensionable staff to contract staff, the academic precariat, whose costs are included in 'other current expenditure'. Indicators 4,5, and 6 show the decline in business as a source of funds, with corresponding increases by government and international organisations. The shift of expenditure toward the universities has been accompanied by a fall in business R&D. Indicators 9 to 12 speak to the health and societal challenges, with Health R&D rising. Indicator 16 reveals that female participation is amongst the highest globally. Indicator 17 shows the high proportion of international doctoral graduates that attests to the role of the universities as the postgraduate hub of Sub-Saharan Africa. Foreign postgraduate students make up some 13% of registrations, with foreign staff comprising 11,5% of all university personnel.[12] More detail on foreign funding for R&D follows as Table 7.

Table 7: Foreign funding of R&D

Sector	**R&D expenditure** R bn	**Foreign funded** R bn	**Foreign: R&D expenditure %**	**Health R&D expenditure** R bn
NGOs	1,77	1,17	66,1	1,34
Science Councils	7,02	0,88	12,5	1,34
Universities	14,90	2,59	17,3	2,96
Business	14,50	2,35	16,2	3,90

Source: DST (2024).

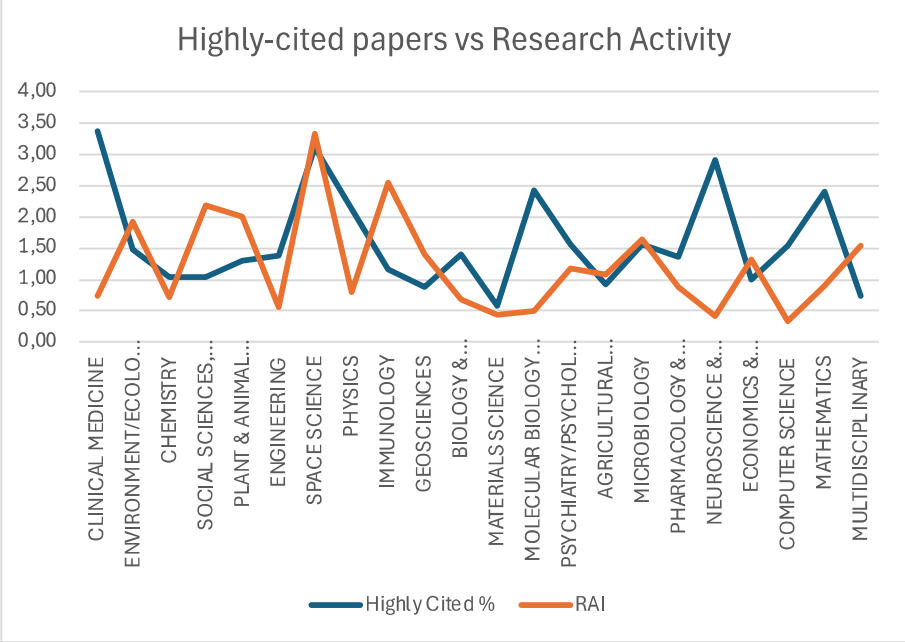
The NGO sector is strongly dependent on foreign funds (66,1%) with much of this flowing to Health R&D. Science Councils foreign funding stands at 12,5%, the Universities 17,3%, and Business 16,2%. The relationship between expenditure on Health R&D, indeed between all FORDs and foreign funding requires further examination.

The Web of Science™ allows bibliometric study of publication outputs and citations. Its Essential Science Indicators (ESI) classify publications across 22 categories of science (CoS) and also provides information on highly cited papers (HCP), a proxy indicator for quality. The ESI distribution suggests that the South African science system is of 'bio-medical' type in contrast with the 'technical' typology of North Africa, China, Russia, Japan and Korea (Glanzel, 2002).

The Research Activity Index (RAI) may be calculated for each CoS as the ratio of publications for that category relative to the country total divided by the ratio of publications for the category to the world total. A RAI score of 1,0 equates to the world average (Figure 1).

[12] https://thestar.co.za/news/2025-05-21-sa-universities-rely-on-foreign-academics-while-local-scholars-remain-stuck/?utm_source=chatgpt.com#google_vignette

Figure 1: Research activity index and % highly cited papers, 2019-2023



It is observed that Material Sciences has an RAI of 0,44, which is below the world average, with the proportion of HCPs 0,58% suggesting sub-optimal performance. Likewise, both Engineering and Pharmacology have RAI below 1,0.

In contrast, Space Sciences has an RAI of 3,33 and HCPs of 3,12% - high research activity produces highly-cited papers. On the other hand, Clinical Medicine that includes Infectious Diseases, and Public Environmental and Occupational Health, records a low RAI of 0,75 but HCP of 3,38% that exceeds the HCP of all other ESIs. Social Sciences RAI 2,19 stands with 1,04% HCP. Space Sciences, Physics, Clinical Medicine, Molecular Biology, Environment/Ecology, and Neurosciences show the highest performance, experiencing upward pull through participation in the Big Science projects that are most vulnerable to the shifts in international funding.

South African international co-authorship stands at 64,65% of publications, close to the global median value of 62,0% while China and the US are at 21,5% and 36,7% respectively.[13]

The high-impact Nature Index for publication and collaboration places South Africa at rank 24th for health sciences, with UCT in pole position followed by Wits, Stellenbosch and the University of Johannesburg, and UKZN.[14]

This bio-medical orientation manifests in an emergent health innovation ecosystem that is essential for medical device and vaccine (human and animal) industries. The SAMRC, universities of Cape Town, Stellenbosch, Witwatersrand, KwaZulu-Natal and Pretoria, Department-based Research Institutes (DBRIs) such as the NHLS are critical

[13] Five US universities are in the top twenty international collaborators with ranks of 2nd, 6th, 15th, 16th, and 18th (WoS, 2025). This collaboration will be negatively impacted by the changes in US funding and science policy.
[14] https://www.nature.com/nature-index/country-outputs/collaboration-graph/

components of these. Likewise, all universities, science councils and DBRIs are essential for other innovation ecosystem activities in engineering, materials science, aerospace, and services.

Return on investment (RoR) studies estimate that for every rand invested in health R&D, the social benefit exceeds R5 over a 10-year period through reduced healthcare burden, productivity gains, and life expectancy improvements (Wits Health Consortium, 2025).

The broader economy is open to the world, with South African companies trading abroad, holding patents and copyright awards, and listings on foreign bourses. The same holds for foreign companies that operate in South Africa. The Technology Balance of Payments indicator also speaks to openness, but its bias of strong outward flows has long been a cause for concern. South Africa remains the Gateway to Africa.

4.2 Structural features of international R&D funding

The main instruments are direct funding, funding of funders, sub-contracts/ sub-awards/ consortia, competitive grants, special purpose grants, research collaborator funding, and commercial R&D. In 2024 NIH grants and allocations to African countries amounted to $103bn, with 48,4% to South Africa, 11,9% to Uganda, 8,0% to Kenya and 7,5% to Nigeria. The Medical and Health Sciences field is the most exposed to the various US government funding bodies such as USAID, NIH, USAID and CDC. Other funders are UKRI, NSF, NSF China, EU, Department of Science and Technology (DST, India), Wellcome Trust, BMGF, CGIAR, European Research Council (ERC), Australian Research Council, Research Council of Finland, German Research Foundation (DFG), National Key R&D Program (China), Spanish Government, Norwegian Agency for Development Cooperation (NORAD), Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan Society for the Promotion of Science (JSPS), and CSIR (India). The distribution of competitive grants from selected international agencies is shown in Table 8.

Table 8: Distribution of competitive grants, %

	Higher education	Science councils	NGOs	Business	Government
NIH (2024)	48,0	0,2	16,1	30,7	5,0
CDC (2024)	0,3	0,3	79,8	16,5	3,4
BMGF (2024)	17,4	0,5	53,3	28,4	0,5
Wellcome Trust (2023/24)	45,2	0,0	22,2	32,6	0,0
UKRI (2022/23)	100,0	0,0	0,0	0,0	0,0
EU (2023)	64,3	3,2	11,2	20,8	0,5

Source: Grant databases.

In the last decade, UKRI was a significant international funder in South Africa for natural sciences, social sciences and agricultural sciences.

Donor rules often exclude infrastructure costs, prevent carry-overs, and create foreign exchange vulnerabilities.

4.3 International funding, NSI mandates and performance

Global science funding is shaped by geopolitics, changing development priorities, international accords, and science diplomacy. South Africa's scientific openness has enabled major strides in health, agriculture, environmental science, climate science, space science and higher education capacity. Such engagement is accompanied by vulnerability to exogenous shocks that challenge the resilience of the NSI. Current international funding models often constrain local autonomy, reduce institutional resilience, and perpetuate asymmetries in research design and benefits.

The White Paper on STI (DSI, 2019) observed that foreign funding is an important contribution to achieving the target of GERD: GDP of 1,5% and declares the intent '… to secure at least 15 per cent of South Africa's GERD from international sources and grow this ratio over time' (idem: 60). The subsequent Decadal Plan (DSI, 2022: 79) proposes '… to increase STI-orientated foreign investment secured by South Africa and better align such investment with national priorities and their supporting indicators. Both instruments view foreign engagement as positive. The science councils' foreign funding is below the 15% target.

International funding directly supports institutional mandates, with the SAMRC, UCT, Wits, Stellenbosch University and UKZN strongly dependent on external funds for health R&D. Major breakthroughs in HIV/AIDS treatment, diagnostics, and mother-to-child transmission prevention stem directly from donor-backed programmes. International grants sustain research infrastructure, postgraduate training, and co-publication. Interdisciplinary programmes in the social sciences are often embedded within global health research.

The European Union has invested more than R1 billion in the NSI through its Framework Programmes, with others such as the Global Health EDCTP3, also investing significant amounts. Horizon EU and other structures support work on biodiversity, climate resilience, and ecosystems. The ultimate funding decisions are exclusively those of the EU. A concern is whether South Africa will continue to enjoy direct access to Framework Programme funding when a successor 10th programme (FP10) starts in 2028.

Development cooperation partners are increasingly less active in South Africa. Development cooperation is an instrument of foreign policy and can be terminated for political considerations. They can also be administratively complicated and cumbersome to access. A significant share of development cooperation for the NSI involves technical assistance as opposed to direct funding. The added value of this technical assistance varies.

Long-term efforts of DSTI to encourage multinational companies to locate and invest in R&D capabilities have not achieved significant success. There is an opportunity to more strategically access the Department of Trade, Industry and Competition's Equity Equivalent Programmes for multinational companies to invest in South African R&D as part of these.

The DSTI has played an historic leadership role in advancing the STI programmes of the AU and SADC and often provides seed funding to launch new initiatives. This is constrained by budget limitations and insufficient institutional capabilities in the AU

and SADC with most AU and SADC programmes are dependent on non-African donors especially the EU. This dependency extends to the African Academy of Science, and Science Granting Councils Initiative. Similarly, the Science for Africa Foundation is positioned as a pan-African R&D funder, but largely exists under the control of the philanthropies. Lack of resources, primarily on the side of partner governments, but also increasingly, though to a lesser extent, on the South African side, inhibit the progressive development of these partnerships.

Europe-Africa Clusters of Research Excellence, a partnership between the African Research Universities Alliance (ARUA) and The Guilds, are funded through instruments such as BMGF, Wellcome Trust, Horizon Europe, Erasmus+, etc.), as well as NRF bilateral agreements, offer better alignment with national priorities and more symmetrical governance. Rhodes University leads a Centre of Research Excellence on Water Resources Management in partnership with the University of Ljubljana in Slovenia. UKRI's Global Challenges Research Fund (GCRF)-ARUA model, as well as NRF bilateral agreements, offer the prospect of better alignment with national priorities and symmetrical governance.

Donor funding is rarely coordinated among funders, is issue-specific, and often accessed through competitive calls. While this supports meritocracy it may skew research priorities toward donor interests rather than national development goals seeking redress and equity across the NSI. This 'agenda capture' dynamic is one of the underappreciated systemic risks facing the NSI. The funding environment is also marked by asymmetrical transparency and accountability. Donor agencies impose stringent financial and administrative reporting on recipients often without reciprocal disclosure of agenda-setting, evaluation criteria, or longer-term commitments. This makes strategic planning in recipient countries challenging.

Pressures on global STI budgets are placing co-funded multilateral science partnerships such as the Group on Earth Observations at risk, the more because of NOAA budget cuts. The NSI's biggest exposure to geopolitical risk is long-term funding for the Square Kilometre Array Observatory, to which South Africa contributes 14-17% of the total costs. Whilst the €2 billion first-phase budget is secured, this commitment is fragile, due to global supply chain pressures, and there is uncertainty regarding the long-term funding commitment over the next 50 years.[15]

South Africa's ability through the DSTI and its entities to expand international cooperation aligned with national priorities is constrained by limited resources to co-invest so that 'partner' countries make unilateral choices in orienting their investment.

A priority focus is on expanding collaboration within the BRICS, especially through the co-funding of research and innovation projects as part of the BRICS STI Framework Programme. Bilateral cooperation with China, again underpinned by co-funding, has also significantly increased.

Dynamic trends show an increasing shift toward mission-oriented funding (climate change, pandemic preparedness, and food security), regional block funding strategies (EU, BRICS), and a greater use of competitive peer-reviewed models. These shifts

[15] Based on inputs from the DSTI

must be navigated to safeguard the mandates, autonomy, and long-term viability of South Africa's science and innovation ecosystem.

4.4 Funding models: implications for directionality, autonomy, and sustainability

Many international awards reside with a US principal investigator (PI) with associated PIs in countries where the necessary field work is performed. Accurate attribution of funding and costs is complicated by these PIs having 'sub-award' status.

NIH-funded research conducted by US institutions includes an indirect cost (IDC) ranging from 15 to 97% of direct costs, with a median rate of 56%. For non-US institutions, the IDC is pegged at 8% which severely under-estimates the actual cost of conducting clinical research in the under-developed infrastructure of the least-developed countries such as Mozambique, The Gambia, and Mali.

There are additional constraints on the most effective use of grant and donor-financed projects, due to restrictions on the roll-over of unspent funds, the transfer of unfilled positions, and difficulties in hedging against variations in foreign exchange rates.

Haberer and Boum (2023) investigated the tacit and overt funding practices of the NIH and questioned the assumptions of the funding model, namely selection bias on the part of researchers from the Global North who determine the research agenda that potentially relegates 'partners' of the Global South to the role of data gatherers. This bias arises from the designation of the PI, who in most cases will be a scientist affiliated with a US institution. It is rare to find a PI based in the Global South as the project lead, resulting in asymmetries in research design and ownership. South Africa justifiably celebrates the exceptional role of the Principal Investigators of the Wits Reproductive Health Unit, UKZN CAPRISA, and the UCT Institute for Infectious Diseases and Molecular Medicine.

The point is to be made that it is incontrovertible that the US, UK and EU benefit from the exceptional relationship with South Africa's health science community, particularly in respect of R&D programmes in communicable diseases and health pandemics that present global risks.

One critique of current funding models is their failure to account for historical inequalities and infrastructural baselines. African institutions often operate in high-cost, low-resource environments but are evaluated using metrics developed in the Global North. This creates a distorted field of comparison and can penalise institutions for systemic constraints beyond their control. In practice, international funding has functioned as both a complement to and a substitute for domestic investment. This has led to what some institutions call 'donor-core integration' where international projects support basic infrastructure, salaries, and core capabilities beyond their project-specific aims.

It is important to appreciate the dual role of international R&D funding: as a catalyst for domestic innovation and as a geopolitical instrument. Over the past two decades, South Africa has emerged as a key node in global health science research networks, especially in relation to communicable disease control, public health systems, and the

social determinants of health. This has created a mutually beneficial but structurally imbalanced relationship between local capabilities and international funders.

The recent US funding cuts erode the intangible assets of trust, long-term collaboration, and the social capital built up between research institutions across borders over many decades. This has also created significant uncertainty about the reliability and predictability of US government-funded and co-funded international science collaborations.

Digital infrastructure, open science mandates, and joint intellectual property rights (IPR) arrangements are being explored as mechanisms to enhance agency within international partnerships. For instance, FAIR (Findable, Accessible, Interoperable, Reusable) data protocols can support shared governance of research outputs, a necessary evolution in the age of digital science.

5.0 Geopolitical Risks and Opportunities

The Trump administration's withdrawal from multilateralism has deepened vulnerabilities but also created new opportunities to reimagine international engagement and associated funding models.

Health sciences R&D has a long history in South Africa, especially in human and animal vaccine development, industrial diseases (especially mining), and infectious diseases. The mineral-energy complex manifests as path dependence in the basket of exports. So too the path dependence of health sciences R&D, evidenced in its 24,4% share of GERD. Allied to this dominance is the dependence of health R&D funding on a single country source. This has been noted as problematic for an extended period, as in the HESTIIL Review (DSI, 2020).

The pre-1994 science system was relatively closed; that of the democratic period, like today's economy, is open.

Internationally comparable data on foreign-funded R&D is scant, and an Internet search reveals almost no data on foreign R&D flows to OECD member and observer states, or to UNESCO member countries. Fact is that the regularity and granularity of the annual DSTI R&D Survey are exceptional among peers. It is thus difficult to benchmark the NSI foreign funding of 17,3% of GERD other than to note that this level is a global outlier, though low within Sub-Saharan African bio-medical NSIs.

The South African knowledge project includes a vibrant and increasingly vulnerable ecosystem of humanities and social science scholars working in gender studies, African philosophy, postcolonial theory, socio-economic development and the arts. These disciplines risk marginalisation through shrinking budgets and ideological delegitimisation. At the same time, we should recognise significant advances in transdisciplinary and post-colonial scholarship in recent years, notably in the wake of the Fees Must Fall crisis of 2017/18, whose strengths must not be lost in the NSI.

As a drought-prone and increasingly flood-prone country, South Africa requires robust and sustained investment in disaster management, climate science, green technology, and resilient infrastructure. The withdrawal of US support and the possible weakening

of multilateral environmental agreements could undermine climate readiness capabilities. Delays in accessing climate finance mechanisms like the Green Climate Fund and disrupted collaboration on early warning systems and climate modelling also pose a material risk to meeting the Nationally Determined Contributions under the Paris Agreement. Research investment should align with the SDGs and STISA 2034 goals.

South Africa must embed STI diplomacy not only with the Department of International Relations and Cooperation, but more strategically, science diplomacy should become an integral part of the work of the Government's International Cooperation, Trade and Security Cluster (ICTS). Links with DTIC are especially crucial. Ultimately, the NSI must move from reactive adaptation to proactive transformation. STI sovereignty does not mean autarky, but rather ensuring that external partnerships support endogenous capacity, democratic values, and inclusive development.

Managing the changed environment rests on three interdependent pillars.

- *STI sovereignty* demands a well-functioning innovation system guided by the agenda and priorities of the Decadal Plan.
- *Epistemic justice* underpins equitable knowledge production partnerships, respectful of partner cultures and values.
- *Resilience* built through increased and diversified sources of funds.

6.0 Enhancing Long-term Sustainability

In a rapidly changing, volatile and uncertain world, STI is key to inclusive economic growth, improved service delivery, job creation, and environmental stewardship, strengthening competitiveness, industrial modernisation, and the goals of the National Development Plan (DSI, 2019). Long-term sustainability requires three actions.

6.1 Promotion of innovation and research

As measured by the WIPO Global Innovation Index, except for some indicators, the NSI performance is sub-optimal. South Africa may be the continental leader, but it lags behind competitor emerging economies with its unchanged export mix. This under-performance is vested in a host of 'wicked problems' that have proven resistant to change, with consequent reduction in industry innovation activity. It is clear that GERD: GDP remains well below the targets set in a succession of policy statements, and is now heavily reliant on public funding, with the DHET block grant second in size to foreign funding. Boosting GERD must embody demand-side framing.

BERD has declined sharply, falling from 41% to just 29% of GERD over nine years. Existing instruments such as the R&D tax incentive are administratively burdensome and have proven ineffective with sparse evidence of additionality. A narrow interpretation of innovation as 'scientific discovery' excludes many forms of applied, process-driven innovation relevant to South African firms.

Merely boosting GERD cannot alter the structural constraints in the wider political economy. In the last decade, the advanced economies have turned to industrial policy

to leverage economic growth (Andreoni, Tregenna and Chang, 2019; Mazzucato, 2013). This suggests that raising the level of domestic R&D calls for strong linkages to business-led innovation activities. A mix of industrial policy and innovation policy (private and public sector) expressed through the missions of the Decadal Plan, health, energy, water and food security, climate change, artificial intelligence, and green technologies, will be pivotal.

A reimagined incentive system, tailored to innovation ecosystem behaviours, is called for. Options include performance-based co-investment grants (Canada; South Korea), innovation vouchers (Finland), and matching funds for collaborative R&D (Germany). Non-financial incentives such as procurement preferences, regulatory fast-tracking, and public recognition should complement these financial tools to shift business sentiment and rebuild trust in state-led innovation support. Engagement with industry councils and sector bodies will be key to designing effective schemes.

6.2 Alignment of international STI funding with national priorities

Engagement with international STI funders remains rich in potential but hampered by fragmentation, opacity, and misalignment. Funding flows from bilateral donors, multilateral agencies, and philanthropic actors are occasionally routed through intermediaries, such as NGOs, without direct public accountability. This diminishes the ability of DSTI to track, understand and modulate the impact of these investments.

A foundational step will be the establishment of a national repository to track international STI funding, enabling visibility into which disciplines and institutions are receiving external support, from whom, and under what terms. Such data would allow DSTI to assess dependencies, identify gaps, and design responsive policy instruments.

A more assertive role is called for with DSTI playing a stewardship role, shaping not only funding flows but also the substantive agendas they enable. This implies deeper investment in policy, planning, management and monitoring capacity, to support policy coherence, coordination, joint agenda-setting and prioritisation, STI sovereignty, and innovation-led development.

Critically, this also involves rebalancing and diversifying the foreign-domestic funding mix in disciplines where foreign support is dominant. A system that relies too heavily on external actors for its research capacity risks strategic drift, vulnerability to changes in donor priorities, and misalignment with domestic needs.

6.3 Risk management

The DSTI Programme, International Cooperation and Resources, has a risk register, which covers its work, but it looks at international relations holistically. It is monitored by the DSTI Enterprise Risk Committee. While international collaboration remains vital to the strength of the NSI, unmanaged or poorly understood risks - ranging from currency volatility and misaligned priorities to fragmented oversight and unclear administrative costs - undermine the long-term benefits of such funding. The 2003 funding crisis in HIV clinical research demonstrates how dependent and

uncoordinated funding models can leave critical national research domains vulnerable to external shocks and the re-prioritisation of international partners (Phillips, 2025).

Exchange rate fluctuations may erode the real value of project budgets mid-cycle. At the same time, inconsistent administrative requirements across funders add burdensome overheads, particularly for under-resourced research units. The current foresight capability provides limited insight into the technological maturity or alignment of international projects with South Africa's long-term development and industrialisation objectives.

6.4 Governance and advocacy

The roles of the Presidential Plenary and Interministerial Committee on STI (IMC) are crucial in agenda-setting, direction-giving and strategic policy coordination of national STI priorities and the articulation of the South African NSI in the wider political economy. It will therefore be important to consider bringing key insights of this Report to the attention of these high-level forums.

The Science Vote, which served as a coordination mechanism for the science councils, was terminated in 2004. Subsequent quantification of R&D expenditure and Scientific and Technical Activities (STA) expenditure across government proved difficult. This must not delay the phased-in adoption of STI Budget Coordination through the Medium-term Strategic Framework and Annual Performance Planning processes. As outlined in the Strategic Management Model, STI Budget Coordination will eventually cut across all spheres of government, in support of the competitiveness of key sectors of the South African economy and social development priorities and service delivery (DSI, 2024: 4).

Treasury's capacity to reorient funds in support of cross-cutting public goods, particularly in areas where STI intersects with health and environmental security, should be leveraged more proactively. Ultimately, the threshold must not only be underpinned by numeric targets but also by the strategic alignment of funding mechanisms and long-term national development priorities.

Coherence and coordination are political and strategic imperatives. In accord with the HESTIIL recommendations and the Strategic Management Model, DSTI should function as systems integrator, working with the IMC to reduce silo behaviour. DSTI should work with the Department of Planning, Monitoring and Evaluation to track planning cycles, R&D STI expenditure across government, and enhanced system learning.

At the same time, the voice of ASSAf is recognised, so too the National Science and Technology Forum (NSTF) and various sector associations. All may facilitate structured dialogue on the evolving global STI landscape. This dialogue is essential if policy responses are to be contextually grounded and forward-looking. A long overdue debate on the balance between 'own agenda' research and use-oriented basic research is called for.

7.0 Synthesis

The diagnostic of Sections 3 to 6 reveals a complex and precarious position for the NSI, caught between deepening global geopolitical re-alignments and a set of unresolved domestic structural deficiencies. The cumulative effect is strategic dependence on a declining and increasingly conditional landscape of international STI funding, exposing long-standing governance weaknesses, financial fragility, and institutional incoherence. If the STI system is to become an effective lever for national development, the modalities of international engagement must be reshaped, and domestic capacity for sovereign decision-making significantly strengthened.

7.1 Geopolitical realignment as systemic shock

The withdrawal of key international donors, particularly from the public health R&D domain, is a stress test for the NSI, revealing an unsustainable dependence on externally defined agendas and offshore funding flows. As leading STI powers repurpose international cooperation around strategic technologies and national security goals, South Africa risks marginalisation to being subcontractors and not as knowledge production equals. Yet the institutional mechanisms, strategic intelligence, and NSI financial architecture to negotiate from such a position of strength are wanting.

The geopolitical reordering is not simply a shift in funding but a change in the terms of engagement in the international science system. STI collaboration is being subsumed into broader diplomatic, industrial, and trade strategies of major powers in more stark instrumental ways than before. In this environment, continued over-reliance on fragmented, externally driven funding pipelines diminishes South Africa's ability to set its own research priorities, retain talent, and leverage STI for inclusive development. Geopolitical realignment and dynamics also provide opportunities. 2025 saw a recommitment to SA-EU cooperation at the highest level, and new BRICS and Belt and Road opportunities. A recalibration of international STI partnerships, built around reciprocal value and national interest, is essential.

7.2 Fragile architecture and coordination failures

The evidence points to continued weakness in the NSI's governance architecture. Despite commitments to a coordinated national approach, interdepartmental cooperation remains limited, and oversight over international partnerships is fragmented and generally weak. There is no cross-government strategy for international STI engagement, nor is there a central repository or monitoring capability to track foreign funding flows, assess associated risks, or align them with national priorities.

This has enabled parallel, uncoordinated bilateral agreements and has left institutions vulnerable to agenda capture, with funding often tied to specific diseases, technologies, or methodologies defined by external actors. The absence of a strong central steward, capable of orchestrating, brokering, and safeguarding the strategic direction of STI partnerships, has resulted in inefficiencies, duplication, and underutilisation of research capacity.

7.3 Institutional vulnerability and inequity

At the institutional level, the dominant modality of subcontracted, short-cycle, project-based international funding has produced serious unintended consequences. It has created fragmented research careers, with many scientists - particularly early-career and doctoral - trapped in cycles of short-term contracts, chasing funds without strategic alignment to national priorities or long-term skills development.

Funding tends to bypass core institutional support in favour of project implementation, leaving research infrastructures undercapitalised and organisational capabilities underdeveloped. This model neither builds institutional resilience nor ensures continuity of expertise. In addition, the pattern of funding concentrated in metropolitan universities and science councils perpetuates unevenness across the NSI and deepens knowledge inequities.

The overly complex R&D tax incentive, intended to stimulate private sector engagement, so far has failed to unlock major systemic shifts in business investment for innovation. Meanwhile, public sector research institutions lack discretionary capital to support high-risk, possibly high-impact innovation. The unintended focus on ‘own agenda’ basic research may be inappropriate.

7.4 Outlook

The comparative analysis shows that many countries have recognised the need for research-industry linkages to reduce dependency and anchor international STI engagement within national development mandates. The role of multi-national corporations (MNCs) in the deployment of their R&D laboratories is of central importance. These approaches share key features: a state agenda-setting function; diversified and blended finance instruments; strategic foresight and risk monitoring; and a commitment to building talent and institutional capacity.

South Africa has yet to institutionalise these features in a coherent model. The lack of long-term mission-driven funding, the absence of a consolidated STI financing mechanism, fragmented policy and coordination, and weak innovation-industry policy coherence hinder the ability to absorb shocks and adapt to fast-changing global conditions.

The HESTIIL Review (2020) and the STI-WG have diagnosed systemic weaknesses in the NSI, though they approach the issues from different vantage points. The HESTIIL Review is broad and structural, while STI-WG is concerned with the impact of US research funding cuts and the foreign donor funding landscape. Nonetheless, their findings converge and reinforce the importance of several key areas: fragmentation, lack of coordination, and siloed operations; dependence on external (especially the US) funding; a legacy of underdeveloped institutions; the need to pivot toward mission-oriented innovation and research evaluated by impact metrics; and addressing the talent pipeline.

In short, the evidence suggests that STI sovereignty is not a question of isolationism or self-sufficiency, but of building domestic strength, coherence, and agency in the face of external turbulence. Achieving this requires deliberate reconfiguration: of

governance, of funding instruments, of institutional capabilities, and of the terms under which South Africa participates in international STI collaboration.

The final section sets out a framework of recommendations to restore systemic resilience, enhance knowledge equity, and secure South Africa's capacity to define, fund, and implement its own STI agenda in a volatile world.

8.0 Recommendations: Securing STI Sovereignty and Sustainability

It is important to note that the recommendations are directed to the Minister of Science, Technology and Innovation for the attention of the national Government. This is informed by the view of the STI-WG that whilst it was appointed by, and reports to, the Minister of STI, the scope of challenges and policy measures to overcome these challenges affect a number of government departments.

Furthermore, the scope of recommendations also requires support from the business and philanthropic sections of society in the quest to bolster the strategic sovereignty and sustainability of the NSI. Therefore, we believe that the recommendations require a whole-of-government and a whole-of-society approach.

The STI-WG tenders eleven (11) recommendations that may be progressed with partner Ministries, in consultation with USAf and affected Science Councils, to ensure NSI resilience across the natural sciences, technologies, humanities and social sciences:

8.1 SAMRC-USAf requests to mitigate the impact of US Federal funding cuts:

Key Issue: US Federal funding cuts have imposed catastrophic consequences for vital health and biomedical research programmes, key to supporting human health and health innovation requirements.

The STI-WG notes the commendable steps taken by the SAMRC and USAf in seeking to secure short-term relief funding from the National Treasury. To date, these efforts have entailed the following:

- Commitments secured from mainly international funders totalling around R1 billion, which is contingent on the National Treasury contribution to the value of R400 million via Section 16 for 2025.
- Further proposals to National Treasury for increasing the baseline allocation disbursement to SAMRC by R400 million over a three-year period (2025-2027) to offset some of the losses from the US funding withdrawals.

At the time of writing this report, it has not yet been established whether, and to what extent, there has been a resolution to the request for immediate relief and, for that matter, any forward commitments on increased baseline allocation to SAMRC.

If substitutionary funding is secured on the strength of a combination of Government, philanthropic and corporate sources to bridge the significant funding gap caused by

the sudden cuts in US Federal funding for the 2025-2027 period. It will be important for short-term funding measures to support all science councils and regional innovation outside of major metros.

However, the STI-WG is of the view that a longer-term assessment of the future size and shape of health and biomedical science research collaboration should be undertaken. It is therefore **recommended** that a joint Review, led by the DSTI, DHET and NDoH in collaboration with its entities and institutions, be undertaken into the future structure and modalities of funding of all the major health sciences programmes impaired by the US funding cuts.

8.2 *Additional contingent financial interventions*

Key issue: US Federal funding cuts have caused variable shortfalls in health research programmes at a number of Universities:

The STI-WG has identified six further measures available, as additional contingent sources of funding - within existing budget envelopes - that the Government could consider in different combinatorial ratios for relief to those Universities not covered by the interventions noted under 8.1. above. These measures would require policy support from the Ministries of Higher Education and Training, Science, Technology and Innovation, with the support of the Minister of Finance. It would also require a collaborative engagement with all universities to ensure that the process takes into account differential levels of financial exposure (particularly the HDIs) and individual financial positions of the institutions.

8.2.1 Once-off top-slicing of the Research Output Allocation

In consultation with the USAf the Minister of Higher Education and Training (HET) through the upcoming Annual Ministerial Statement could agree on a once-off top-slice of the research output unit to create a within-budget ring-fenced saving to support R&D in the health sciences and other affected fields in the most affected universities.

8.2.2 Divert a portion of Earmarked Grant funding

In consultation with USAf, the Minister of HET could ring-fence a portion of Earmarked Grants for the same purpose.

8.2.3 Ringfence a portion of the National Skills Fund

In consultation with USAf, the Minister of HET could also ring-fence a portion of National Skills Fund resources for the same purpose, subject to the conditions of §8.2.1.

8.2.4 Utilise unspent National Research Foundation funds

With the support of the Minister of Science, Technology and Innovation, the NRF could be requested to collate a database of all unspent funds accrued by the South African Research Chairs Initiative (SARChI) programme, Centres of Excellence, and Centres

of Competence. This quantum may also be ring-fenced for distribution as in §8.2.1 above.

8.2.5 Facilitating University Loan Finance

The Ministers of STI and HET, in concert with the Minister of Finance, may facilitate universities' deployment of reserves as well as the generation of sub-market rate bridging loans from the Development Bank of Southern Africa (DBSA) or the Public Investment Corporation (PIC) - Industrial Development Corporation (IDC), and commercial banks.

8.2.6 Foreign exchange hedging

Grant awards are generally made in foreign currency and drawdowns into Rands are subject to foreign exchange rate fluctuations. Donor contracts rules require foreign exchange gains to be returned to the donor, whereas losses are borne by the beneficiary. To protect against this loss beneficiaries must be permitted to hedge through forward foreign exchange contracts.

8.2.7. Own Contributions by Affected Universities:

Finally, if the above measures are to be considered by Government, with the involvement of the affected universities, it will also be necessary for Universities to make own contributions towards the total relief package required to cover the gaps left by US Federal government funding cuts.

The STI-WG is however of the view that even if a combination of the above short-term and contingency interventions can tie SAMRC and Universities over the gap left by the US Federal Government funding cuts, it will however not address the underlying *structural problems in the political economy of STI funding*. Whilst these measures are definitely needed to provide short-term relief, it will only buy the NSI a relatively short window period within which to consider the future scope, form and functions of these programmes (refer to recommendation 8.1. above).

As contended in the Impact Analysis (Section 4.0.), we should correlate the significant levels of growth in international science funding into the NSI, at least in part, with static and downward pressures on GERD in recent years. For this reason, the STI-WG places the issue of long-term growth in GERD for urgent consideration.

The STI-WG is of the considered view that positive and sustained growth of GERD over the coming decades is in the ***national interests of the Republic of South Africa*** if we bring into perspective the critical dependence of nearly all aspects of national development and our international obligations on science, technology and innovation. The STI-WG cannot think of a single domain of policy and socio-economic development, including those identified in the DSTI's Decadal Plan, which can be materially advanced in South Africa's national interests and international role without placing STI at the core of Government, Industry, Education and Society. For this reason, measures specified below are of crucial pertinence:

8.3 *Increase GERD and Recalibrate Incentive Instruments*

Key Issue: Static and low-growth GERD in recent years poses intolerable risks and vulnerabilities to the strategic sovereignty of the NSI.

It is recommended that:

- the Minister of STI, through the STI IMC, requests the State President to convene the 2025 STI Presidential Plenary, with the view to negotiate and secure a **GERD Strategic Compact**, between State, Organised Business and Labour, involving clear commitments from both Government and Business to progressively to raise GERD to 1.5% of GDP by 2035.
- Government examines all incentives available to the business sector, including reform of the R&D tax incentive to international best practice, better aligned with the innovation behaviours of firms, tax exemptions and the use of Special Economic Zones.
- DSTI, in conjunction with DTIC, to identify and mitigate obstacles to Multinational Corporate investment in R&D facilities in ways enabling the widest possible mutually-beneficial feedback loops and value-chain engagement by domiciled innovation actors – particularly black and female-owned SME's, social enterprises and cooperatives.
- DSTI, in conjunction with DTIC and National Treasury, consider the introduction of co-investment grants, innovation vouchers, pooled challenge funds, and concessional loans to diversify funding streams to stimulate innovation and BERD.
- DSTI, in collaboration with STI Ministries represented in the STI IMC, considers collaboratively reviewing and increasing baseline funding to all Science Councils and department-based research institutes and entities in targeted strategic priority areas identified in key national policy statements, including the Decadal Plan.
- The Government considers setting progressive targets for State-owned Enterprises to raise RDI investment and expenditure to support national STI priorities.
- DSTI and DHET consider implementation of a dual-stream funding model based to more effectively drive (a) mission-driven block grants for long-term national priorities[16], and (b) competitive grants for blue-sky and use-oriented basic research.

8.4 *Strengthening STI articulation, coherence, coordination and governance*

Key Issue: Achieving the highest degree of strategic articulation, coherence, coordination and governance within the NSI and the socio-economic system is critical for ensuring efficient and effective deployment of scarce resources, energies and capabilities to build our economy.
It is recommended that:

[16] While the immediate focus on health is justified, parallel strategic investment should be prioritised in areas such as climate science, space and astronomical science, renewable energy, materials science, nanotechnology, agri-tech, and digital innovation.

- DSTI, through a fully-capacitated NACI, should provide robust data-driven and strategy-oriented support to the STI Presidential Plenary and Interministerial Committee on STI to ensure more effective agenda-setting and whole-of-government and whole-of-society support for policy measures to improve systemic coherence and coordination.
- DSTI's role shifts beyond coordination to strategic stewardship by empowering it to guide, align, and monitor major international STI engagements against national development goals and international commitments;
- DSTI strengthens the quality of cross-government STI Budget Coordination to target high-priority STI areas.
- DSTI establishes Strategic Compacts with all STI-intensive Departments to secure greater articulation of Decadal Plan instruments and policy domains outside of the DSTI. This includes, *inter alia,* DSTI compacting with:
    - Trade, Industry and Commerce, to align Decadal Plan, Industry Master Plan and new Industrial Policy priorities and programmes in support of innovation;
    - National Department of Health on major innovations in support of the National Health Insurance scheme and domestic production value chain of critical health vaccines, therapeutics, etc;
    - Department of Electricity and Energy on supporting innovations to diversify, stabilise and expand the national energy grid to marginalised communities;
    - Department of Mineral and Petroleum Resources and the Department of Electricity and Energy to support major innovations in beneficiation of strategic and high-value minerals and domestic development of renewable energy regimes, reduction, capture and utilisation of carbon from hard-to-abate sectors;
    - National Department of Agriculture and the Department of Land Reform and Rural Development to support innovations to bolster the growth of agricultural production, particularly in under-developed regions and black emerging farmers, and sustainable rural livelihoods;
    - Forestry, Fisheries and Environment to support innovations in natural environments and oceanic habitats to support long-term sustainability and new sources of natural capital;
    - DHET to support innovations in skills development in support of major Decadal Plan strategic priorities; and
    - Department of Communications and Digital Technologies and the Department of Small Business Development to support major Decadal Plan strategic priorities.

- DSTI to collaborate with DTIC, DHET and COGTA on practical strategies to provide full-spectrum and coordinated support for sub-national (Metros, Districts and Local Government) Innovation ecosystems and incentivise these appropriately.
- DSTI to consider implementation of the HESTIIL Review recommendations related to enhancing the overall productivity, efficiency and scalability of the core innovation drivers of the NSI.
- DSTI to promote and expand science diplomacy coordination in collaboration with DIRCO and STI-intensive line function departments.

- The DSTI must create a platform for the nurturing of the areas of strength in the system, over and above the redressive action that needs to be prioritised. It needs to nurture a dialogue with all our areas of strength to help redefine relevance and excellence appropriate to our location as a knowledge system on the southern-most tip of Africa.

8.5 *Strengthen the talent pipeline and empower the research precariat*

Key Issue: The long-term stability and sustainability of the NSI's core research and academic staff is indispensable for securing its strategic sovereignty and future development.

It is recommended that:

- DSTI and DHET collaborate on practical strategies to secure fair employment contracts and social protections for researchers, especially those on externally funded projects.
- DSTI and DHET expand fellowships, postdoctoral schemes, and diaspora engagement initiatives targeting early-career scientists, with particular emphasis on black women and rural-origin researchers.
- DSTI and DHET, in consultation with Home Affairs, consider instituting a Programme to attract and retain leading international scientists to assist in building strategic capacities in the NSI in support of sovereign STI goals.

8.6 *Restructure international collaboration for equity and impact*

Key issue: The deliberate and systematic alignment of the major STI international partnerships to all available science diplomacy instruments can significantly contribute to derisking and rebalancing South Africa's exposure to future instabilities in global funding markets.

It is recommended that:

- DSTI in conjunction with DIRCO, facilitates integration of STI priorities into foreign policy through a national science diplomacy framework.
- DSTI requires that all major international partnerships include co-investment provisions, local agenda-setting, equitable data/IP ownership, and long-term institutional capacity building[17].
- DSTI negotiates a shift from subcontracting to institutional grants that enable staffing continuity, infrastructure development, and systemic growth.
- DSTI, with DIRCO, explore strategically aligned co-funding with the AU, BRICS, EU and other partners.

[17] The Science Granting Councils Initiative (SGCI) and the AU–EU Research and Innovation Partnership provide good examples of structured, co-funded, and regionally coordinated STI partnerships that could advance knowledge equity and reduce over-reliance on northern funders.

8.7 *Advance knowledge equity and epistemic justice*

Key issue: Policy attention should be given to ensuring that international science partnerships do not further reinforce and reproduce existing inter-institutional and spatial inequalities in the NSI.

It is recommended that:

- DSTI ensure that national priority-setting processes include voices from marginalised communities, the humanities and social sciences, and historically disadvantaged institutions.
- DSTI, with NRF, strengthens existing instruments to ensure effective inclusion and leadership roles of historically disadvantaged institutions in major international collaborative research partnerships. The interventions here should be two-fold: amending the rules of engagement to ensure a bias towards leadership by HDIs in partnerships, but also critically, building institutional capabilities for such leadership roles at HDIs - for example, several have under-capacitated research offices.
- The Sibusiso Bengu Development Programme of DHET should be expanded by establishing a dedicated, ring-fenced funding instrument to enable HDIs to lead major international and national research collaborations, such as competitive consortium grants or principal investigator-led awards that position HDIs as anchors in multi-institutional projects. Such instruments would directly advance epistemic justice, strengthen institutional capacity, and disrupt the persistent marginalisation of less-resourced universities in global research networks.

8.8 *Improve STI measurement, institutionalise a funding information repository, and risk monitoring*

Key issue: South Africa does not currently have a nationally integrated STI funding database with which to monitor, measure and assess risks and opportunities.

It is recommended that:

- DSTI, through NACI, strengthen governmental STI measurement capability, introduces new STI metrics, and ensures that data is captured once and used many times.
- DSTI, through NACI, compile and maintains a database on all funding flows, including sources, recipients, conditionalities and Fields of R&D.
- DSTI, through NACI, develop and implements a standardised national risk assessment framework for international STI partnerships, including agenda alignment and administrative burdens.

8.9 *Institutionalise foresight, and monitoring, evaluation and learning systems*

Key issue: Improvement of the foresight capabilities of the NSI is vital to support policy innovation in rapidly changing local and global landscapes.

It is recommended that:

- DSTI ensures building of NACI's foresight capability to conduct both techno-economic and social fabric studies, and monitoring, evaluation and learning capabilities to track global funding trends, assess systemic vulnerabilities, and inform proactive policy.
- DSTI, through NACI, institutionalise a library of country STI profiles to inform policy, allocation mechanisms, and mission-oriented goals suited to local ambitions and constraints.

8.10 *STI Sovereign Risk Advisory Council*

Key Issue: High-level Strategic Intelligence Oversight is Vital to Assess and Monitor Sovereign Risks to South Africa's NSI.

The STI-WG noted the serious existential risks and vulnerabilities felt by South African society (and the wider African continent and Global South) at the outbreak of the global COVID-19 pandemic in 2019/20 when Governments of several advanced countries, notably those in the G7 nations, unilaterally embargoed export of critical life-preserving health technologies such as active pharmaceutical ingredients (API's), vaccines, Personal Protective Equipment and therapeutics) – even when, in some instances, stocks of restricted health goods far exceeded their domestic needs.

The recent escalation in trade wars and geopolitical issues tied up in tensions between the US and China pose new and indeterminate risks to non-aligned and smaller nations. South Africa, like many other non-aligned States, might be caught up in and detrimentally affected by efforts to isolate, for example, China from gaining access to various classes of technology. More fundamentally, however, is the imperative of the Government routinely scanning the geopolitical and global economic environment to identify current and future threats to STI strategic sovereignty, and grappling with practical strategies of mitigating against risks and exploiting new opportunities for diversifying risk. For this reason, the STI-WG is concerned about the Government, at the highest level, raising the level of strategic intelligence over STI sovereign risk management.

It is recommended that:

The Minister of STI considers a proposal to the President to establish a new **STI Sovereign Risk Advisory Council (STI-SRAC)** to advise the Government at the highest levels on the following matters:

- Strategic national technology risk management: advising on current and future all-domain sovereign technology risks facing South Africa, with specific emphasis on security of supply (locally produced, imported) to sectors in the economy deemed as critical to its national interests – health, energy, food, minerals, and information and communications technologies.
- Optimal technology pathways: identification of future pathways to secure the security of supply to support national development imperatives.

- Role of basic and applied science in supporting new and emerging technologies: advice on new areas of scientific investment to support new technology innovations across all domains of STI.
- Social, cultural, economic and political considerations to be taken into account in major strategic choices of technological futures.
- Policy and regulatory measures to mobilise whole-of-government and whole-of-society support for, and coordination of efforts to, develop the strategic sovereignty of South Africa's NSI[18].

8.11 *Establishing a fully-fledged Sovereign Innovation Fund*

Key Issue: The creation of a Sovereign Innovation Fund can significantly boost scalable investments in technological innovation.

South Africa's export basket remains dominated by natural resources.[19] As these resources are not renewable and the result of geophysical processes over a very long span of history, the people of South Africa should enjoy some benefit from their extraction and export. Sovereign wealth funds have been created by countries such as Norway (Norwegian Oil Fund) and Saudi Arabia (Saudi Arabian Public Investment Fund) for the expressed purpose of providing financing support for projects of strategic significance to the national economy and deriving their finances from equity and rents/tariffs on natural resources as well as shares in state-owned enterprises. The resources thereby mobilised should be devoted to the production of public goods and services that benefit the population as a whole and could help ensure that South Africa achieves its stated objective of devoting 1,5% of GDP towards funding research and development within our National System of Innovation

It is recommended that the Minister of STI consider proposing to the national Government to consider:

- Creating and growing a scaled Sovereign Innovation Fund (SIF). This will catalyse the growth of innovative, high-growth, and high technology small and medium enterprises to address systemic inequalities, facilitate inclusive GDP growth, job creation, poverty alleviation, and improvements to government's service delivery systems. Providing grant funding to the Fund of Funds platform will incentivise private sector VC fund managers and institutional funders to participate and scale up the programme to improve the success rate of technology based SMME's, to address the high-risk funding gap and to provide hands on support, problem solving and fast decision making to ensure local and imported IP is commercialised.
- Co-financing should be explored through blended finance instruments, including venture capital, private equity, and philanthropic match-funding. DSTI and National Treasury should establish a Philanthropic Partnership Facility to enable pooled co-investment in strategic STI areas, matched by public funding. The Fund should be governed by an independent board comprising DSTI, National Treasury, DBSA, the private sector, and the Science Council

[18] Useful lessons might also be learned from the Office of S&T in the White House and Central Science and Technology Commission in China

[19] https://comtradeplus.un.org/

representatives. Oversight should be linked to the Industrial Development Corporation or DBSA's Innovation Division.

9.0 Concluding Remarks

The STI-WG has dealt with matters of exceptional complexity against a compressed timeline. The Convenor, Dr. Derrick Swartz offers deep appreciation and sincere gratitude to the various stakeholders who contributed to the work, to the members of the STI-WG, to the NACI Research Fellows, and the Secretariat. We also wish to express our appreciated for the confidence of the Minister of Science, Technology and Innovation, Professor Bonginkosi Nzimande for having commissioned this important investigation.

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Annexure

Convenor: Dr. Derrick Swartz
Dr. Mlungisi Cele, Director-General, DSTI
Dr. Fulufhelo Nelwamondo, CEO, NRF
Prof. Ntobeko Ntusi, CEO, SAMRC;
Dr. Thulani Dlamini, CEO, CSIR
Prof. Sarah Mosoetsa, CEO, HSRC.
Prof. Francis Petersen, Chairperson, USAf
Prof. Thokozani Majozi, President and Chairperson, ASSAf
Prof. Sibusiso Moyo, DVC, Stellenbosch University
Prof. Sibongile Muthwa, VC, NMMU
Prof. Ari Sitas, Extraordinary Professor, Stellenbosch University
Prof. Xolisa Mtose, VC, UniZulu
Daan du Toit, DDG, International Relations and Cooperation, DSTI
Prof. Michael Kahn, NACI Research Fellow
Dr. Petrus Letaba, NACI Research Fellow
Francois Davel, Director, International Relations and Cooperation, DSTI

Focus Group 1 – Impact Analysis
Convenor: Dr. Mlungisi Cele
Members: Dr. Derrick Swartz; Dr Fulufhelo Nelwamondo; Prof. Ntobeko Ntusi; Prof. Sibusiso Moyo; Prof. Thokozani Majozi; Dr. Thulani Dlamini; Prof. Michael Kahn; Dr. Petrus Letaba.

Focus Group 2 – Geopolitical Risk Assessment
Convenor: Prof. Sarah Mosoetsa
Members: Dr. Mlungisi Cele; Dr. Derrick Swartz; Prof. Sibongile Muthwa; Prof. Ari Sitas; Prof. Michael Kahn; Dr. Petrus Letaba.

Focus Group 3 – Strategic and Policy Response
Convenor: Prof. Francis Petersen
Members: Dr. Mlungisi Cele; Dr. Derrick Swartz; Prof. Xolisa Mtose; Daan du Toit; Prof. Michael Kahn; Dr. Petrus Letaba.