Select Committee hearing – Selected Science and Innovation matters

14 June 2023

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REPUBLIC OF SOUTH AFRICA

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Introduction

- Request to the Department of Science and Innovation to address the following matters
  - Postgraduate funding for the STEM careers;
  - Innovation programmes to boost Careers in Science Innovation;
  - New technology and innovation that can assist in provision for proper sanitation in schools; and
  - How the DSI initiates, maintains and sustains corporate and other funders support.

Post-graduate funding for STEM careers

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1. Introduction

- The DSI implements its postgraduate funding programmes for STEM Careers through the National Research Foundation (NRF)
- The NRF accounts for about 95% of the total annual postgraduate students supported through Programme 4
- The remainder (5%) are supported through Programme 4 funds that go to the Agricultural Research Council (ARC), the South African National Space Agency (SANSA), and the Council for Scientific and Industrial Research (CSIR) – in support of STEM Careers in DSI identified (but aligned to the respective entities) priority areas. This limited postgraduate programme is called the Interprogramme Bursary Scheme (IBS)
- The IBS was founded in 2015/16 and is currently undergoing a five-year review and it supports less than 350 postgraduate students compared to about 6 400 students supported by the NRF.
- The sheer weight/volume of postgraduate students supported through the NRF dictates that we focus this presentation on the NRF.

2. The NRF within the National Science Landscape

Advancing Knowledge

- Support for Research
- Provision of Research Infrastructure Platforms
- Provision of Research Equipment

Transforming Lives

- Postgraduate support
- Emerging/Early Career Researcher support

Inspiring a Nation

Science engagement through:

- Education
- Awareness
- Communication

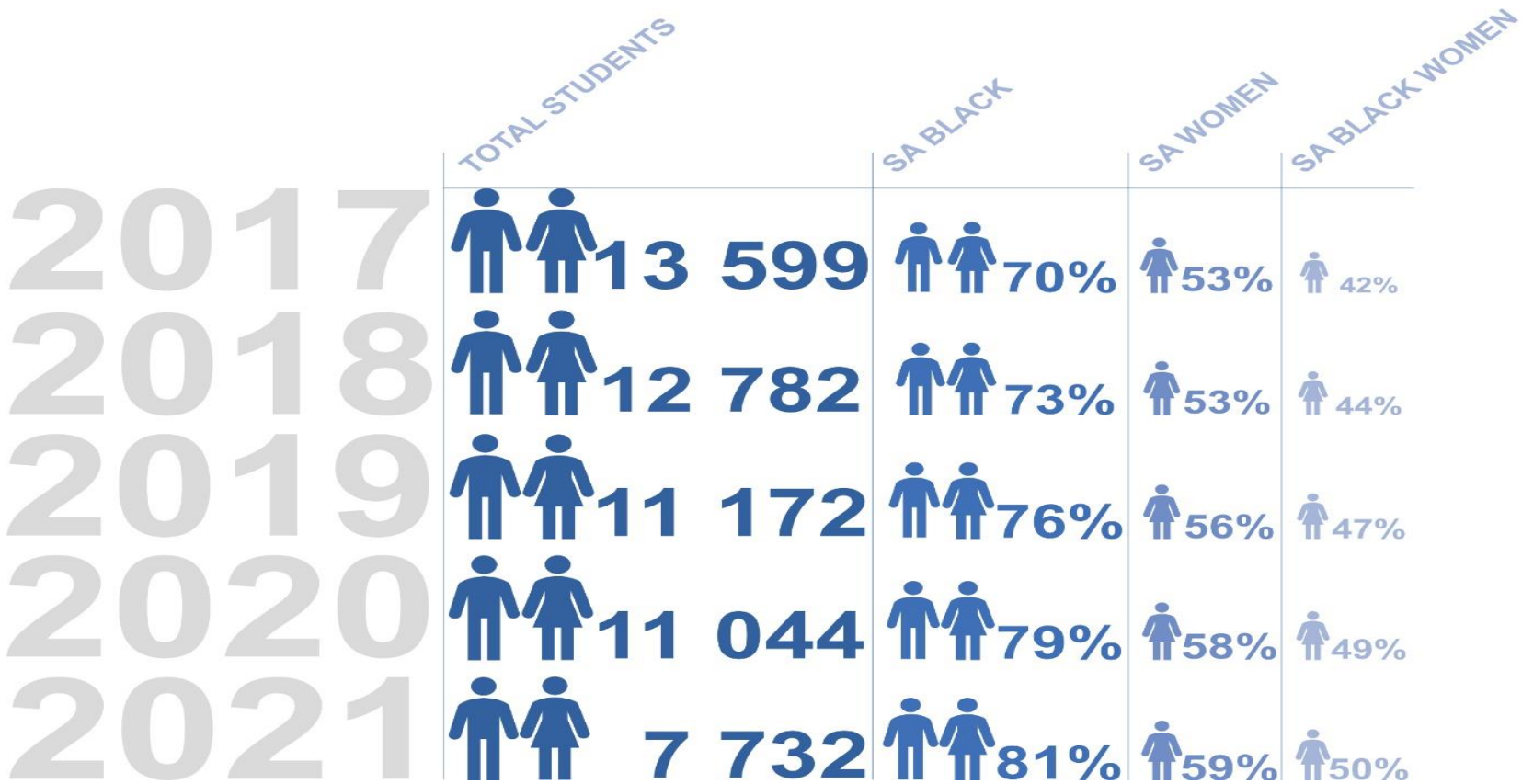
Strengthening the NSI

3. The 2013 Ministerial Guidelines in improving Equity

- Adopted January 2013.
- The fundamental principles underpinning these guidelines were as follows:
  - *Representivity;*
  - *Improved efficiencies; and*
  - *Prioritisation of science, engineering, and technology-related disciplines.*
- Equity targets:
  - *87% South African*
    - *80% Black*
    - *55% Women*
    - *4% People with disabilities*
  - *13% International*

3 (a) Highlights from the 2013 Ministerial Guidelines

SA Black and/or female postgraduate student supported

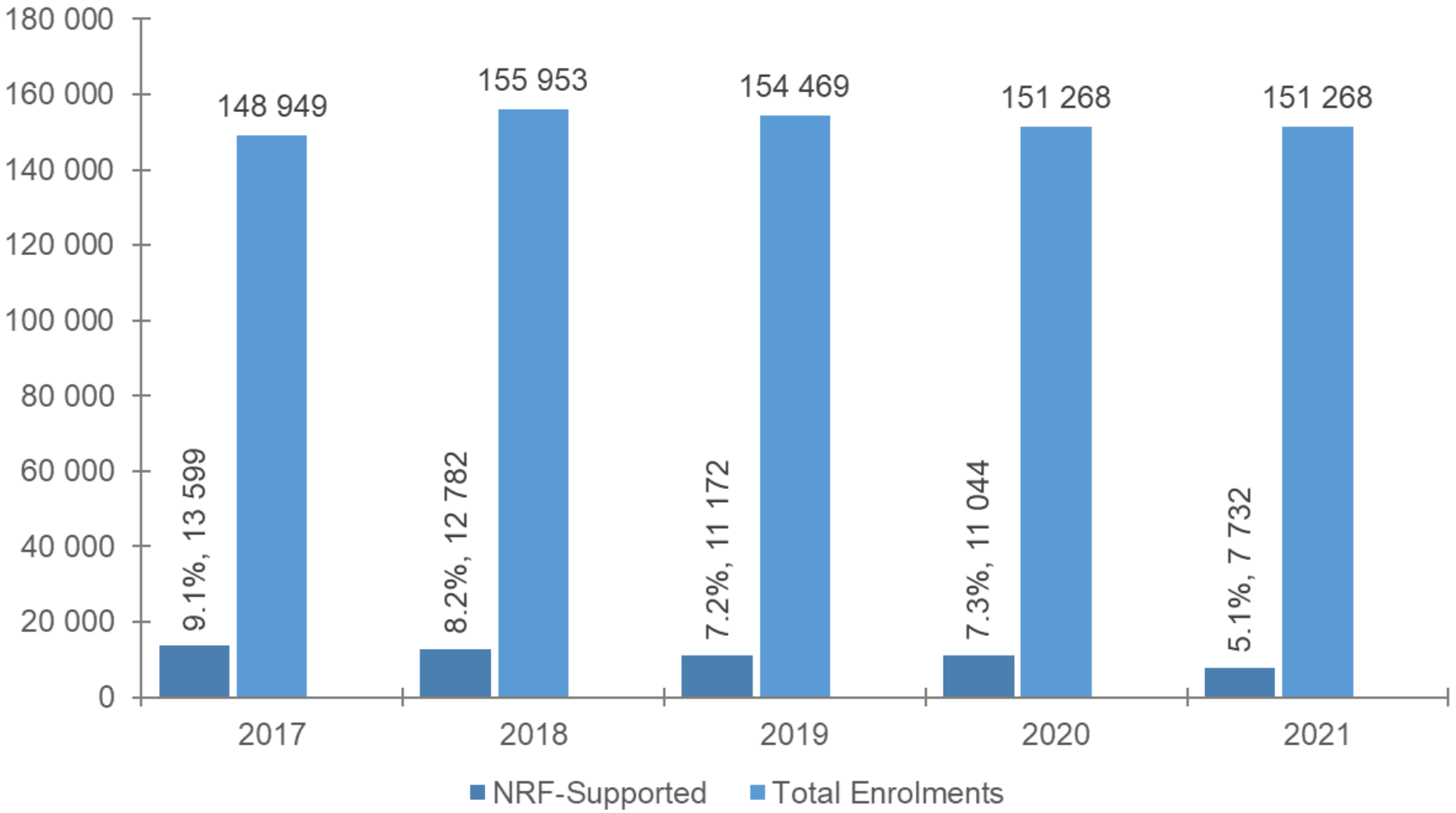


3 (b) NRF Postgraduate Student Support: Average Bursary Values and Total Investment

Year	Honours Amount	Master's Amount	Doctoral Amount	Grand Total
2017	R259 607 513	R339 387 924	R327 800 812	R926 796 249
2018	R272 786 351	R303 055 667	R314 269 658	R890 111 675
2019	R263 596 889	R261 036 477	R281 454 002	R806 087 368
2020	R268 013 523	R300 308 599	R284 917 455	R853 239 578
2021	R281 219 637	R244 563 630	R250 792 771	R776 576 038

Year	Average Honours bursary	Average Master's bursary	Average Doctoral Bursary	Average bursary
2017	R54 804	R62 341	R95 904	R68 152
2018	R60 944	R60 611	R95 060	R69 638
2019	R59 182	R67 139	R99 453	R72 152
2020	R62 198	R75 663	R103 007	R77 258
2021	R112 668	R85 095	R 106 178	R100 437

3 (c) - NRF-funded proportions of the national cohort of postgraduate students



3 (d) Key Challenges in the Implementation of the 2013 Ministerial Guidelines

- Low progression rates from Honours to Masters and Doctoral studies.
- Long time to completion and advanced age at completion.
- Transformation.
- Current bursary values are not comprehensive.
- Funding of financially needy students at postgraduate levels.
- No policy synergy with NSFAS (Undergraduate-postgraduate pipeline)

4. The 2020 DSI-NRF Postgraduate Funding Policy: Strategic Interventions

- Postgraduate students will be funded without interruption up the doctoral level.
- The NRF will prioritise funding full-time studies .
- Age limits to achieve Doctoral completion by age 35.
- Postgraduate funding pipeline for NSFAS funded undergraduates.
- 95% will be allocated to South African citizens and permanent residents.
- 90% and 55% will be allocated to South African black and female students respectively.
- Fit for purpose financial packages for PG students.
- Financially needy students, those with a disability and exceptional academic achievers will be funded at Full Cost Study.
- Alignment with DHET undergraduate bursary scheme for students at public universities.

4(a) DSI-NRF PFP vs 2013 Ministerial Guidelines

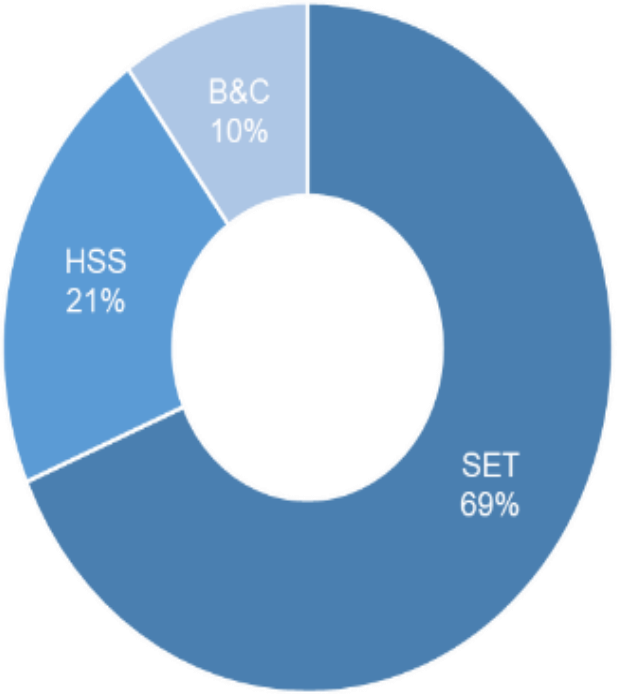
Indicator/Attribute	2013 Ministerial Guidelines' Target	DSI-NRF Postgraduate Funding Policy Target
Nationality		
(a) SA citizen incl. permanent residents	87%	95%
(b) SADC	5%	5%
(c) Rest of Africa	4%	
(d) Outside Africa	4%	
Race (Only applicable to SA citizens and permanent residents)		
Blacks (Africans, Indians, Coloured and Chinese)	80%	90%
Gender		
Women	55%	55%
Disability		
Students with Disabilities	4%	1%

4 (b) DSI-NRF PFP Targets vs NRF Actual Performance for the 2021 and 2022 academic years

Indicators		PFP Target	NRF Actual Performance 2021	NRF Actual Performance 2022
Citizenship	South African citizens including permanent residents	95%	**94%**	95%
	SADC countries and the rest of the world	5%	**6%**	5%
Gender	Women	55%	62%	61%
Race	SA Black	90%	**81%**	**85%**
	SA White	10%	**19%**	**15%**
Disability	Students living with a disability	1%	**0.4%**	1.5%

5. Postgraduate Students supported by broad fields of study

- **The NRF supports postgraduate students across all disciplines and fields.**
- In 2021, 69% of the students supported were in Science Engineering and Technology (SET);
- 21% in the Human and Social Sciences (HSS, including education); and
- 10% in Business and Commerce (B&C).
- Within SET, the highest proportion of students are in the Biological & Chemical Science (26%), followed by Medical & Health Sciences (13%).



6. New Awards for the 2022 Academic Year

Study level	Applica-tions from universities	Incomplete/ ineligible applications		Not funded by NRF due to budget constraints		Funded by NRF		Enrol-ment at HEIs
Honours	8 193	136	2%	6 248	76%	1 945	24%	**86 153**
Masters	3 502	272	8%	1 702	49%	1 317	38%	**65 146**
Extension Masters	428	28	7%	10	2%	390	96%	
Extension Doctoral	328	13	4%	0	0%	315	91%	**25 280**
Doctoral	1 627	110	7%	495	30%	931	57%	
Total	**14 078**	**559**	**4%**	**8 455**	**60%**	**4 898**	**35%**	**176 579**

Honours: **FCS 70% and PCS 30%**

Masters: **FCS 63% and PCS 37%**

Doctoral: FCS 72% and PCS 28%

7. Funding Constraints in the Postgraduate Space: Challenges

- As expected the impact of the new *DSI-NRF Postgraduate Funding Policy* has resulted in a significant decrease in the number of students funded due to:
  - ✓ Increased bursary values; and
  - ✓ Annual Inflationary increase.
- Budget allocation from DSI not increasing.
- The National Skills Fund (NSF) budget allocation has been declining over the years from R254 million in 2016/17 to R151 million in 2021/22.
- Strategy to raise private sector funding with ISFAP was affected by the COVID-19 pandemic. This initiative has been resuscitated.

8. Qualifying but not awarded due to budget constraints in the 2022 Academic year

Study level	Citizenship						South African (SA)			
	SA Citizens		SA Permanent		Other		Black		Female	
Honours	5 483	88%	725	12%	0	0%	5 161	83%	4 260	67%
Masters	1 432	84%	119	7%	150	9%	1 027	72%	899	63%
Doctoral	310	63%	24	5%	160	33%	187	60%	167	54%
Total	**7 225**	**78%**	**868**	**8%**	**310**	**14%**	**6 375**	**72%**	**5 326**	**61%**

Study level	Eligible for FCS	FCS amount (R)		PCS amount (R)	Total amount (R)
Honours	4 374	R764 067 920	1 874	R198 124 080	R962 192 000
Masters	1 191	R217 779 030	510	R54 040 770	R271 819 800
Doctoral	346	R69 308 694	148	R14 142 726	R83 451 420
Total	**5 910**	**R1 051 155 644**	**2 533**	**R266 307 576**	**R1 317 463 220**

9. International Training Opportunities under the Global Knowledge Partnership Programme

- Strengthen the NRF's capacity to identify and sustain partnerships that enhance international opportunities for **exceptional doctoral students, postdoctoral fellows, and early career/emerging researchers**, working in close collaboration with higher education and research institutions.
- Enables NRF granthholders to incorporate a period of **three to eighteen months** of international research experience into their research and education programme
- Will either undertake short-term research visits at an international institution to advance their research projects aligned to specific thematic areas. Current opportunities are:
    1. *Fulbright Foreign Student Programme (FFSP)* ***USA****;*
    2. *NRF-MINDS mobility programme* ***AFRICA****;*
    3. *NRF-Mitacs mobility programme* ***CANADA****;*
    4. *NRF-DAAD mobility programme* ***GERMANY****;*
    5. *DAAD Research Mobility Grants programme* ***GERMANY****; and*
    6. *Young Scientists Summer Programme (YSSP)* ***AUSTRIA****.*
- Refer to the Global Knowledge Partnership implementation framework at https://www.nrf.ac.za/global-knowledge-partnerships-programme-implementation-framework-for-the-2024-academic-year/?hilite=gkp

Key Innovation Programmes to Boost Careers in Science Innovation

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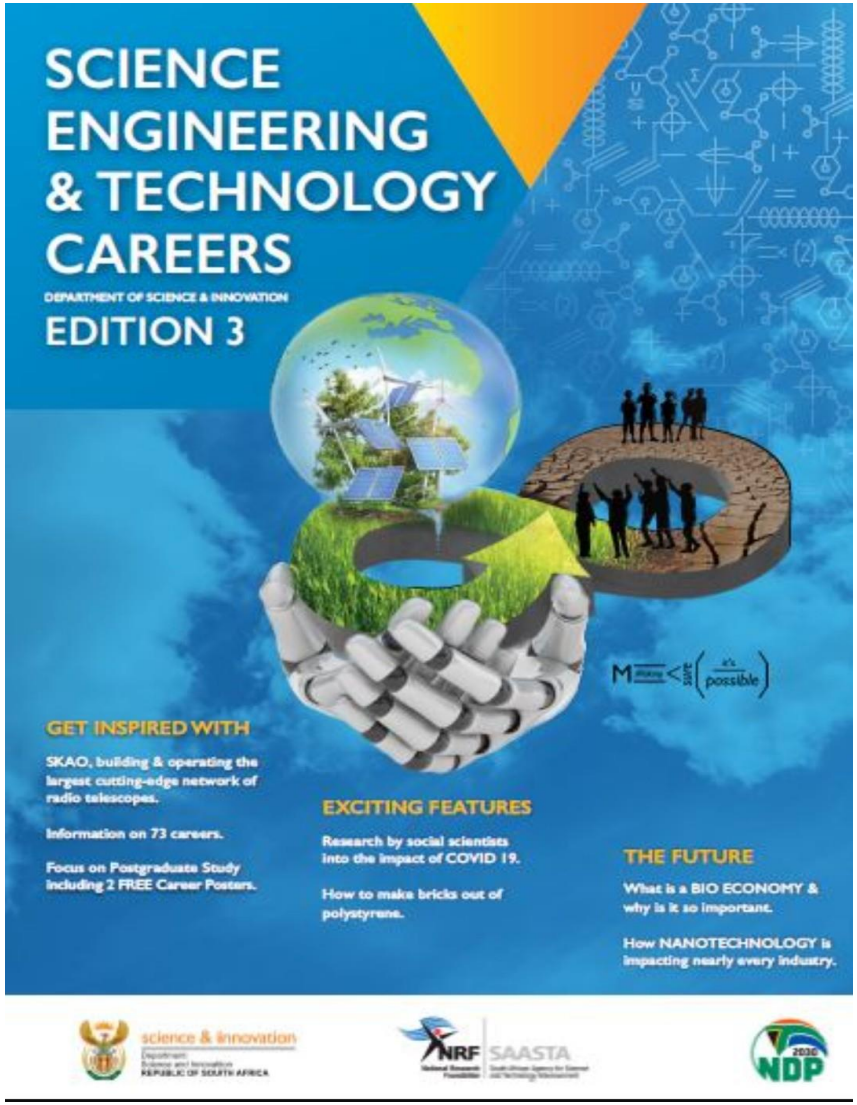
STEM career development support



- DSI produces and distributes STEM career publication targeting learners, parents and educators.
- Modes of distribution are:
  - ✓ Hard copies to schools, science centres and career fairs.
  - ✓ Online – through DSI, strategic partners websites and Whatsapp.
- The electronic version is accessible on the link below and very easy to flip through.

https://online.fliphtml5.com/oefme/oays/

Follow the link right away and flip through the publication

Bio-innovation

Bio-economy Strategy (2014)

- To be a significant contributor to the country's economy by 2030, in terms of the gross domestic product (GDP), through the creation and growth of novel industries that generate and develop bio-based services, products and innovations, with a corresponding growth increase in new and existing companies.
- Four Thematic strategic interventions**, namely** Agriculture; Health; Industry & Environments; and IK-based technology innovation.

Timeline

Nat Biotech Strategy 2001

Instruments: BRICs; NBN; PUB 2003

Incorporation of 'learnings'

Merge into TIA 2009

Bioeconomy Strategy development 2009-2013

Functioning NSI 2020

Bio-economy 5% of GDP 2050

Hydrogen & Energy

- Develop and harness technological capabilities to support a globally competitive South African energy industry, to ensure universal access to modern energy services.
- **Alternative Energy** – **HySA** completed 13 years deploying demonstrations. Deployments will bring clean energy to buildings. **Energy Storage RDI Prgm** launched a Lithium Ion Battery Precursor facility in Nelspruit & partners with global battery OEMs.
- **Renewables and Transport**– **Renewable Energy Hub and Spokes Programme** spun out GEO SUN Pty Ltd that has over R10 million annual revenue.
- **Power** – **Green Building Summer School** is a partnership with the Swiss Government and the UNIVEN to train TVET graduates to assist the DPW&I to implement Green Building Strategy across 500,000 public buildings in South Africa.
- Hydrogen Society Roadmap

HySA in Pictures

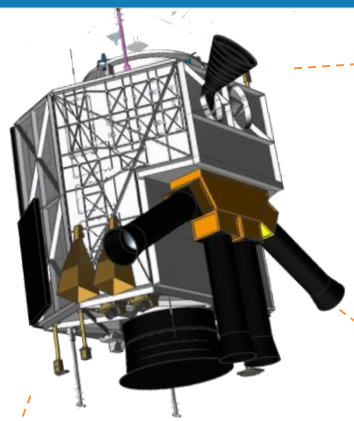
Fuel Cell Powered Forklift Launch at Impala Platinum Refineries in March 2016

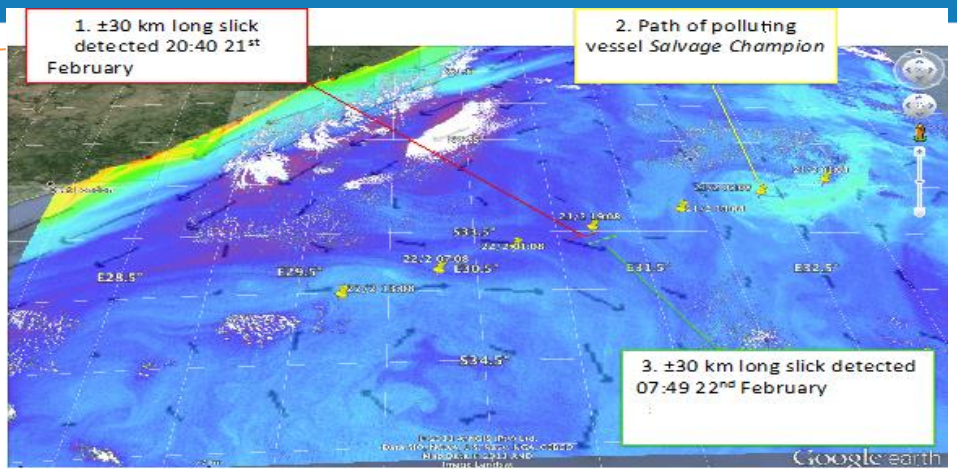
Fuel Cell Forklift refueling station

Space Science and Technology

- For South Africa to be among the leading nations in the innovative utilisation of SST that enhances economic growth and sustainable development in order to improve the quality of life for all
- Goals
  - To capture the global market share for small to medium-sized space systems
  - To support better decision-making through the integration of space-based systems with ground-based systems
  - To use space science and technology to develop applications for provision of geospatial, telecommunication, timing, and positioning products and services
  - Participation in global initiatives such as the Group on Earth Observations (GEO)

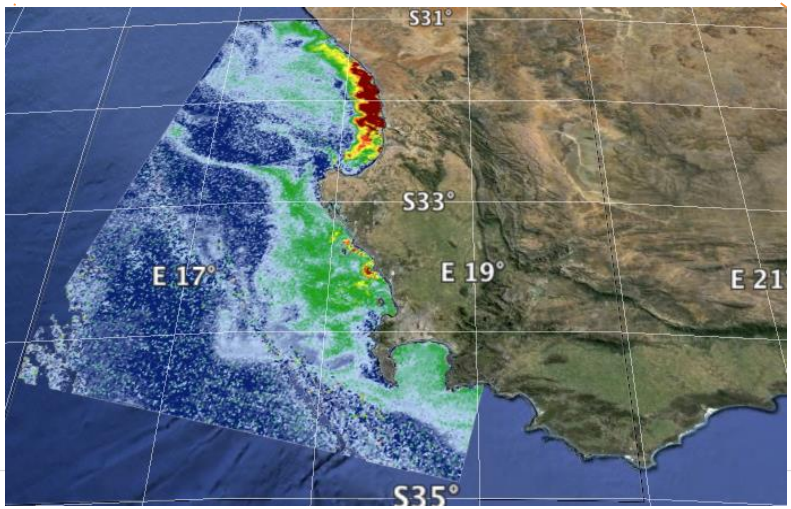
National Oceans and Coasts Information Management System





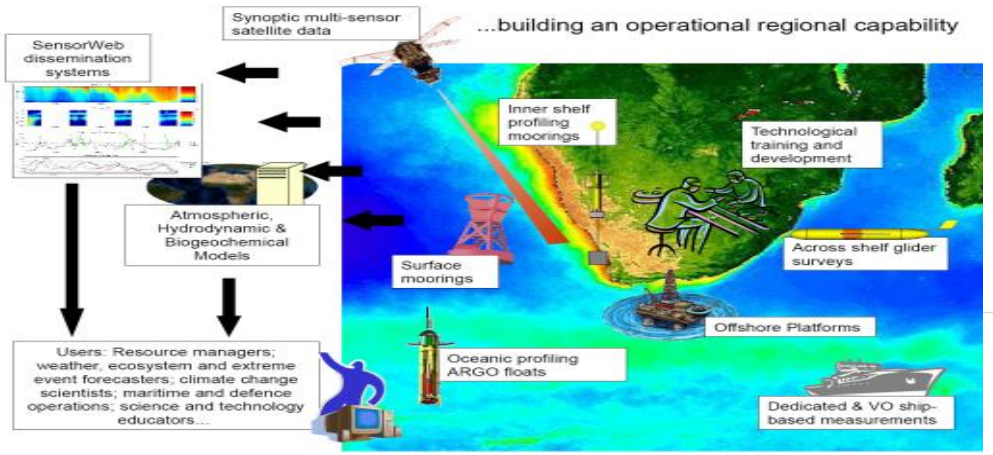
Oil Slick Detection and Monitoring

- Building a national marine observation and forecasting capability
- Data integration



Harmful algae bloom detection which may affect human health

Marine Observation and Forecasting Systems...



New Technology and Innovation for Proper Sanitation in Schools

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Water RDI Roadmap

Water Technology Demonstration (WADER) Programme

- The DSI, in collaboration with the Water Research Commission (WRC), has established the Water Technologies Demonstration Programme (WADER) to pull together the applied research and development and pre-commercialisation stages of the water innovation continuum
- More than 30 different water innovations have been demonstrated
  - including water efficiency, water treatment, alternative sources of water and bricks from urine

Water HCD

- 59 postgraduates funded
- 30 Young Engineers funded on the Young Engineers Changemakers Programme

Water RDI influence on the sector

- Contributed to the Water and Sanitation Masterplan of DWS
- Contributed to meeting the outcomes of Ch14 of the National Water Management Strategy 2

Schools Sanitation

Implemented by Water Research Commission

South African Sanitation Technology Enterprise Programme (SASTEP)

SASTEP

What is SASTEP?

- SASTEP is collaborative technology accelerator programme funded by the DSI and the Bill and Melinda Gates Foundation (BMGF) aimed at seeking innovative solutions to sanitation provision.
- The Programme is implemented by the Water Research Commission (WRC).

The vision of SASTEP

- "Upon conclusion of SASTEP, a rejuvenated South African sanitation industry should have emerged that not only creates jobs and contributes to the GDP but also is a global leader in the application of alternative sanitation technologies that provide everyone in South Africa with access to proper sanitation that minimises pollution and promotes health, safety and water security."
- This Programme aims to create a new gold standard for non-sewered off-grid sanitation which has the same convenience of a flush toilet and adds the benefits of improved sludge and effluent management through valorisation.

SASTEP DESIGN

- SASTEP is designed to accelerate innovative off-grid and non-sewered sanitation technologies and services to the market which comprises of the public sector rolling out sanitation services and the private sector seeking sanitation systems for their commercial buildings, new developments or as responsible corporate stewards wishing to impact on climate change, and social challenges of sanitation provision.
- SASTEP works with commercial partners who have designed their own innovative sanitation solutions or have licensed innovations from the “Global Reinvent the Toilet” portfolio of the BMFG. These commercial partners are onboarded onto the Programme via calls that are placed periodically.
- As a Programme, SASTEP seeks collaborative and strategic partnerships as the objectives are complex and cannot be achieved through a single partner, public department, or business. The Stakeholder map can be simply illustrated as follows:

Stakeholders

Strategic	Implementation	Research and Innovation	Influencers / Market Creators	Collaborative Partners	First Adopter
• DWS • DBE • DPW • SALGA • Presidency • Strategic Global Partners	• Municipalities • Public works • DBE (province) • SANPARKS • Developers • Mining sector • Industry • SOE	• UKZN • Innovators • Technology developers • Technology evaluators • Researchers	• Banks • DBSA (WPO) • First Adopters • Green Building Council • Investors	• Policymakers • Funders • Experts • Dtic • SABS • NCPC • SOE • Commercial Partners	• Schools (Demos) • Rural HH (Demos) • Informal Settlement (Demos) • New Developments • Eco-Parks

The SAFE INITIATIVE

- Public schools across South Africa often lack requisite sanitation infrastructure that allows learners to perform basic bodily functions in privacy and dignity without fear or danger to their health, safety, and overall well-being.
- Toilet facilities in public rural schools are often either unimproved or dilapidated. Unsafe toilet infrastructure has resulted in pupil fatalities prompting an outcry from civil society organisations and the public at large. This prompted President, Cyril Ramaphosa, on August 14, 2018, to launch the Sanitation Appropriate for Education (SAFE) Initiative, with the mandate to "spare generations of young South Africans the indignity, discomfort and danger of using pit latrines and other unsafe facilities in our schools".
- The WRC and its partners, such as the DSI and BMGF, heeded the President's clarion call to address the sanitation challenges in schools. Research conducted by the WRC indicate that inappropriate technologies and the lack of investment in infrastructure renewal, as well as little to no operations and maintenance (O&M budget perpetuates dilapidated facilities in school.

SASTEP IN SCHOOLS

- The DSI and the Bill and Melinda Gates Foundation agreed to fund the demonstrations at schools to the value of R15 million.
- SASTEP ring fenced a portion of the technology demonstration budget to support the SASTEP SAFE Extended Demo Project.
- Through this funding, the SASTEP through its commercial partners (CPs) implemented innovative and appropriate sanitation technologies within its portfolio in schools.
- Since 2020, demonstration projects have been launched in schools in Gauteng, the Nort West, KwaZulu-Natal and Eastern Cape. A total of twelve schools will receive innovative sanitation technologies. The purpose of these projects is to showcase these technologies in schools and to demonstrate their robustness, appropriateness and value proposition.

SCHOOLS BENEFITING FROM INNOVATIVE SANITATION

Gauteng

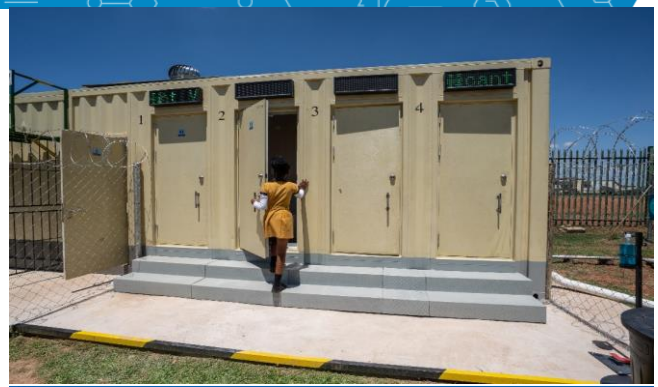
1. Tsholetsega Primary School
2. Esikhisini Primary School
3. Olievenhoutbosch Primary School

Eastern Cape

4. Barkerville Primary School,
5. Celinkungu Primary School
6. Dlungwana Senior Primary School
7. Khanyisani Junior Primary School
8. Marialinden Primary School
9. Qhobosheaneng Primary School

KZN

10. Mandosi Combined School
11. Sobantu Secondary School



SCHOOLS HANDED WITH INNOVATIVE SANITATION IN 2022/23

Name of School	Province	# of learners	Innovation	Budget
Barkerville Primary School	EC	194	Arumloo and dewdrop	R1 293 182
Celinkungu Primary School	EC	154	Envirosan Eazi split	R776 631
Tirelo Fam school	NW	128	Clear technology	R3 639 290
TOTAL		**476**		**R5 709 103**

SKILLS, JOBS AND SMMEs SUPPORTED

Name of School	Number of Job Opportunities
Celikungu Primary School	14 labourers, a janitor and an assessor
Tsholetsega Primary school	A local contractor, 2 janitors and 5 plumbers
Olivenhoutbosch and Esikhisini Primary Schools	10 SMMEs, 4 interns and 2 janitors
Tirelo Farm School	A local contractor, 15 personnel and a janitor
Bakersville Primary School	Local contractor, 3 personnel and a janitor

How the DSI initiates, maintains and sustains corporate and other funders support

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Economic Competitiveness Support Programme (ESCP)

- Targeted initiative introduced in 2012/13 after the financial crisis to enhance economic competitiveness
- (Then) DST received a small portion of the total ECSP funding – enabled the DST to experiment with various industry-relevant initiatives
  - Industry Innovation Partnerships
  - Technology Localisation and Support

INDUSTRY INNOVATION PARTNERSHIP PROGRAMME

- Key goals:
  - Leverage industry investment in RDI by stimulating increased **RDI co-funding** & participation by industry players in projects to maintain and increase their export market share
  - Mitigate against **under-investment in technology & innovation** in identified niche and strategic sectors of SA economy so as to improve their competitiveness
- Key long-term outcomes measure may be **increased sector contribution to GDP** through stronger RDI-based industrial development

Sector Innovation Funds (SIF)

- DSI intervention to enhance economic competitiveness of participating sectors
  - Create an enabling environment for industry relevant RDI priorities
  - Explore new approaches to fostering RDI partnerships with the private sector
  - Build stronger links between industry and the public science system
- **Incentivises private sector to co-invest with government in RDI activities that address competitiveness and sustainability of participating sectors**
  - Matching funding partnerships with industry partners
- Managed by Industry associations or bodies
  - Formal entities
  - Representing interest of members
  - DSI participation on governance structures
- Industry identifies challenges & determines the RDI agenda

Sector Innovation Funds (SIF)

- Objectives:
  - Increasing level of private sector RDI in South Africa
  - Improving general competitiveness of the sector
  - Increasing RDI capacity in the sector
  - Human Capital Development & knowledge generation
  - Contribution to knowledge product portfolio
  - Increased private sector investment in RDI
  - Transformation:
  - Emerging and small players in sector
  - SET base and research capacity

SIF Implementation (since inception)

- Implemented through a call for proposals process
  - Proposals are evaluated by a SIF Evaluation Panel
    - DSI, DFFE, DALRRD, dtic
- Industry associations supported:

	SIF I (13/14 – 17/18)	SIF II (18/19 – 21/22)	SIF III (22/23 – 25/26)*	**TOTAL**
CRI	15,000,005.00	10,142,900.00	0.00	**25,142,905.00**
FSA	25,000,000.00	11,000,000.00	35,200,000.00	**71,200,000.00**
MFFASA	1,763,714.00	0.00	0.00	**1,763,714.00**
MIASA	1,852,011.12	0.00	0.00	**1,852,011.12**
PHI	30,000,000.00	14,946,087.50	13,756,147.24	**58,702,234.74**
PAMSA/PAMDEV	6,380,000.00	4,500,000.00	4,500,000.00	**15,380,000.00**
SMRI	15,000,000.00	9,992,557.85	2,522,919.00	**27,515,476.85**
SAMMRI	12,000,820.00	4,800,000.00	0.00	**16,800,820.00**
WINETECH	12,000,000.00	7,500,000.00	11,500,000.00	**31,000,000.00**
SARC	0.00	0.00	4,793,660.50	**4,793,660.50**
online system	2,840,000.00	700,000.00	500,000.00	**4,040,000.00**
TOTAL	**121,836,550.12**	**63,581,545.35**	**72,772,726.74**	**258,190,822.21**

Governance

- Each SIF has a Steering Committee and a Technical Committee
- DSI represented on each Steering Committee
- Inclusive active industry participation of industry partners in these committees
- Emerging/small players?
- DALRRD (WINETECH and FPEF), DFFE (FSA, SARC) and dtic (PAMDEV and SMRI) representatives for relevant SIF Steering Committees

Key Performance Indicators

- Basket of measures at impact, outcomes and output levels
- Industry relevant skills and knowledge

Human Capital Development & Knowledge Generation	Contribution to Intellectual Property Portfolio	Transformation	Improved Competitiveness
• # of students & interns supported • # of students & interns who become employed as a result of being supported • # of publications in accredited journals	• # of knowledge or innovation products added to the IP portfolio • # of knowledge or innovation products transferred	• # of knowledge or innovation products transferred to SMMEs, emerging or Black players in sector • Proportion of Black students & interns supported • Proportion of Research teams who are Black	• Cash co-funding from industry • # of jobs created

SIF Achievements

		FSA	PAMSA/ PAMDEV	CRI	PHI	MFFASA	SMRI	WINETECH	SAMMRI	TOTAL
HUMAN CAPITAL DEVELOPMENT AND KNOWLEDGE GENERATION										
# of students fully funded or co-funded	Post doc	5	0	5	10	0	10	7	0	**37**
	Doctoral	15	1	4	15	2	9	16	24	**86**
	Masters	42	15	13	42	2	30	23	50	**217**
	Honours	6	3	3	18	0	3	2	0	**35**
	Undergrad	1	4	0	2	0	0	0	0	**7**
TOTAL STUDENTS		**69**	**23**	**25**	**87**	**4**	**52**	**48**	**74**	**382**
# interns (research) fully funded or co-funded		15	1	5	14	0	16	3	2	**56**
# of students employed		1	1	5	17	0	0	0	5	**29**
# interns who are now employed		1	0	5	3	0	2	0	0	**11**
# publications in accredited journals		4	0	2	26	0	10	24	7	**73**
CONTRIBUTION TO THE INTELLECTUAL PROPERTY PORTFOLIO										
# knowledge or innovation products added to the IP portfolio		16	2	8	16	0	22	2	0	**66**
# knowledge or innovation products transferred		9	0	0	19	0	1	0	0	**29**
TRANSFORMATION (OPPORTUNITIES FOR EMERGING OR NEW PLAYERS										
# technologies transferred to SMMEs, suppliers or emerging players/ previously disadvantaged individuals/ BEE companies		0	0	0	4	0	0	0	0	**4**
IMPROVED COMPETITIVENESS (INDUSTRY CO-FUNDING CONTRIBUTIONS)										
Co-funding Cash		24,093,357	6,772,117	12,850,373	24,373,780	-	19,255,138	13,692,341	6,850,065	**107,887,171**
Jobs created		18	0	1	0	0	0	3	9	**31**

SIF Achievements: Improved Competitiveness

- **Improved Competitiveness**
  - Key Product and process interventions:
    - Cost savings; operational efficiency & optimization
    - Pest & disease control
  - Options in terms of diversification of products & revenue generation
  - Implementation of circular & digital economy principles
  - Plantation management systems
    - Including a number directed at emerging players in relevant sectors
  - Resource use efficiencies
  - Climate change adaptation and mitigation
  - Development of high-end skills pipeline, addressing transformation starting to show impact
    - Number of students supported at Masters/Doctoral level now Project Leads in SIF III projects
      - either at HEIs or industry research organisations

SIF Achievements: Improved Competitiveness

- **Increased investment in RDI**
  - Industry co-funding: R107m against DSI Investment: R182m
    - Introduced matching funding requirement in SIF II
    - Cash only matching funding requirement in SIF III (not funded yet)
- **SOE participation**
  - SAFCOL investment in R&D projects with private sector catalyzed through DSI investment in FSA SIF

SIF Achievements: Case studies

Citrus Industry: Increased investment into RDI by the industry

- CRI participated in SIF I and SIF II, individually and through PHI SIF
  - Research for Citrus Exports SIF (2015 – 2021) resulted in an additional R37.9m RDI investment (DSI R25m (66%) and industry R12.9m (34%)
  - PHI partnership (2008 to 2021) resulted in additional R15m
  - Allowed investment into research projects that would otherwise not have been affordable
    - Significant returns on investment: increased profits, substantial cost savings and growth, including skills and job creation
- Citrus industry encouraged to commit significant additional investment;
  - Doubled the statutory levy that funds research in 2021;
  - Resulting in commitment of R150m p/a for R&D over 4 year levy cycle, from 2021/22 to 2024/25

SIF Achievements: case studies

Chilling Injury in Grapefruit

- Fruit needs to exported at low temperature to avoid pests and diseases being imported to destination markets
  - Often results in chilling injury (affects appearance of the rind, but not the fruit), which lowers prices
  - Chilling injury losses p/a can be R240m (R2/carton; 120m cartons exported)
- How to get the grapefruit to destination without damage by low temperatures:
  - Researchers knew that a molecule called lycopene protected pink cultivars of grapefruit (not produced by yellow grapefruit)
  - Investigated how to encourage lycopene production in "Star Ruby" Grapefruit" (yellow ones); resulting in 2 useful tools to increase export production:
    - Low-cost technology (shade nets) to increase lycopene content in Star Ruby grapefruit (lycopene develops best when fruits are grown in shade)
    - Colour charts that enable selection of target market based on colour of the fruit (i.e., ship under normal (4-10˚C) or sterilization (-0.6 ˚C) temperatures
- Exports to USA, China, and South Korea have grown 21-fold (1.9m cartons from 400 000) following this research
  - Income increased from R68m to R323m over 5 year period
  - Total research spend R617 506

SIF Achievements: case studies

Cape Flora shipping

- Preferred mode of transportation of Cape Flora shifted from air to sea
  - High fuel costs; carbon footprint concerns & improvements in sea freight technology
- However, the technology was not ideal for flowers as developed for fruit. Alternative technology would be a closed ventilation system:
  - Gas exchange dynamics (CO_2 and O_2 levels vital) in closed ventilation system
- Project designed to test suitability of closed ventilation system for export of Cape Flora cut flowers
  - Showed that it resulted in lower moisture loss during storage and better flower head vase life
  - Potential to reduce cold-storage energy costs & carbon footprint of exporting of Cape Flora cut flowers
- Potential annual saving of R71m p/a
  - Freight cost savings per container: ~R153 000
- Total research spend R315 907

SIF Achievements: case studies

Infrastructure and capacity building for phenotyping of plantation tree varieties for resistance to insect herbivores and fungal pathogens

- SA forestry sector loses ~ 3 000 hectares of plantations (12% of annual harvest) to tree pest and diseases infestations annually
  - Equates to R392m of roundwood lost annually with R2.05 billion in additional downstream processing lost
  - mostly introduced from other parts of the world, and posing a huge threat to stability of the sector and associated value chain
- Can be mitigated by breeding resistant trees by screening currently available varieties for resistance and selecting the most promising breeding material for propogation of stock to establish new resistant plantations
- But up until 2020, such facilities were not available in SA
- FSA SIF funded the construction and implementation of such a facility:
  - Implemented screening protocols for key diseases
  - Started development of molecular and chemical markers for rapid selection of resistant planting material
- These developments will be highly valuable for the timber industry and will reduce future losses due to diseases

SIF Achievements: case studies

Biorefinery Modelling & New Product Development

- SA sugarcane industry identified the need to diversify its product base in order to ensure long term sustainability
  - Drive to bio-economy and bio-based products is ideal opportunity
  - But there is a very large pool of potential products and new production processes are required
- Necessitated decision-support systems and techno-economic models to assess which products would be the most profitable for the industry to produce.
  - New Products Greenhouse database & Sugarcane Biorefinery Economic Assessment tools developed
  - Over 40 different products were assessed, and lactic acid, ethanol and citric acid were most promising
- A briefing note was developed for the potential manufacture of polylactic acid (PLA) from SA sugarcane feedstocks for the industry
  - Potential market opportunities for the product
  - Order of magnitude estimates for the economics to produce PLA for several scenarios with estimated capital costs
- One of the sugarcane processing companies has now approached the IDC for funding for full scale feasibility study for the production of PLA from sugarcane feedstocks

SIF Achievements: case studies

Energy Monitoring Online Dashboard

- Energy to sugar factory supplied from steam and electrical power from steam in a complex and interactive network
  - Few direct measurements to determine energy consumption
- STEP4.0 built and installed an online energy monitoring dashboard at a sugar mill to see if energy consumption can be tracked in different processes and unit operations
- Analysis of data from 2020 and 2021 identified that potential savings of between R1.9m and R9.5m p/a in avoidable coal burn.
  - In addition, issues that could be rectified to achieve some savings were identified
- Demonstrated the potential of energy consumption and tracking tools to quantify energy consumption and wastage for every operating shift.
  - Would require a structured, factory-driven energy management programme embedded in factory operations

SIF Achievements: Challenges

- Damage to trust relationship with private sector due to uncertainty of current funding delays
  - Affects confidence and willingness to invest in partnership
  - Already difficult to persuade investment into R&D given the reality of economic pressures
- Lack of dedicated budget line item for the programme
  - Funded by opportunistic funding streams
- How to expand to other sectors (that don't have RDI culture)
- Transformation
  - Involvement of Black +/ small & emerging players in sectors?
    - Small & emerging players may be included in industry associations
- Contribution to knowledge product portfolio
  - Collaborative model necessitates mostly early stage R&D
  - 'linear' model of commercialization vs reality of knowledge transfer in many industries

South African Mining Extraction Research, Development and Innovation (SAMERDI) strategy

- Vision is to "*maximise the sustainable returns of South Africa's mineral wealth through collaborative* ***research, development, innovation*** *&* ***implementation*** *of mining technologies in a socially, environmentally & financially sustainable manner that is rooted in the local community & national economy*"

AIMS	IMPACTS
Develop technological solutions to increase safety & productivity, reduce costs & extend the life of mines	Increase productivity & safety
	Optimised use of input resources
	Cost efficiencies
	Increased life of mine
Revitalise mining RDI capability in South Africa & reposition the country as top mining RDI destination	Focussed & relevant RDI
	Long-term programmes
	Capacity building
	Skills development
	Transformation

- RDI programme linked to the Mining Equipment Manufacturers of South Africa (MEMSA) to grow the local supply chain of mining capital equipment

SAMERDI aims/purpose

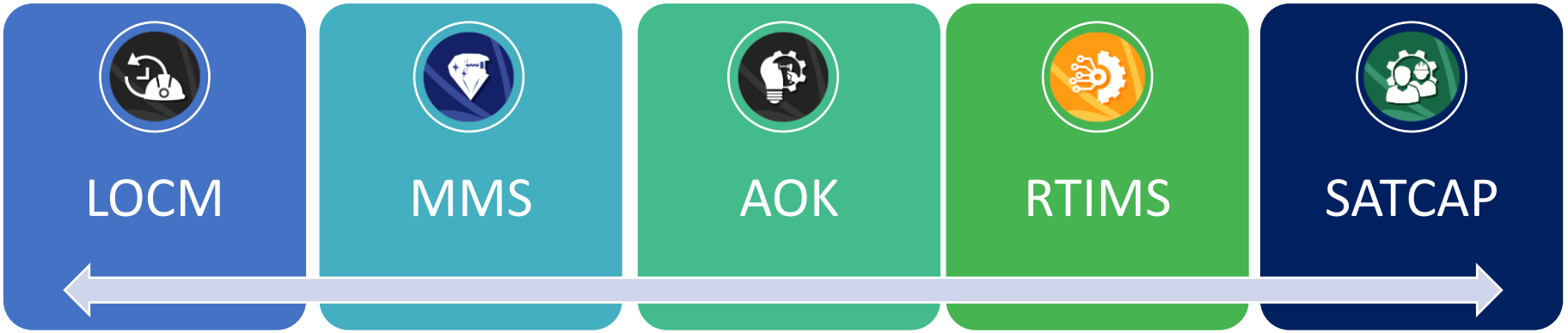
- To develop technological solutions that will improve the competitiveness of South Africa's minerals sector & impact on mines through increased productivity & safety, optimised use of input resources, cost efficiencies & increased life of mine
- To rebuild South Africa's RDI capability & reposition the country as a top mining RDI destination
- To support the capacity of local mining supply chain as partner in RDI, & its ability to adequately & timeously respond to the needs of the South African mining industry
- To be achieved through the 5 SAMERDI research programmes

DSI investment – total of R294 873 600

Financial year	Funding transferred (ZAR) (incl. VAT)
2015/16 – 2016/17	14 793 000
2017/18	27 000 000
2018/19	63 000 000
2019/20	21 138 711
2020/21	40 362 889
2021/22	63 506 000[4]
2022/23	65 073 000
TOTAL	**294 873 600**

[4] This includes an allocation of R3 795 000 (all inclusive) that was made available to the CSIR's mining cluster for Phase II of the digital twin modelling for trackless mobile machinery (TMM) collision prevention systems (CPS) project

SAMERDI research programmes



Longevity of Current Mines (LoCM) – to increase extraction efficiencies, improve occupational health & safety & reduce the costs of current conventional mining operations	**Mechanised Mining Systems (MMS)** – to provide sustainable mechanised drill, blast & mechanical rock breaking solutions in advancement to facilitate achieving zero harm, whilst maintaining & defending desired production rates at minimised costs within Au & PGM mining industries	**Advanced Orebody Knowledge (AOK)** – to create a "glass rock" environment to improve geological confidence ahead of the face, identify risks associated with geology & timeously transmit information from underground to surface	**Real Time Information Management Systems (RTIMS)** - to develop & implement smart connected systems for mining from sensor to dashboard	**Successful Application of Technologies Centred Around People (SATCAP)** - to understand the challenges, effects & impacts of mining modernisation on people in the minerals sector

- The viability of a test mine or underground facility for South Africa, which will enable mining equipment manufacturers to test & qualify their equipment in a real mining environment, is also a critical activity of SAMERDI - arrangements for the establishment thereof are being formalised

Some examples of outcomes

Mandela Mining Precinct showcased better rock drills for uptake by SA mines

The Mandela Mining Precinct (MMP) today displayed two lighter, significantly faster, quieter and more energy-efficient rock drills earlier this year, showcasing new technology that could offer safety in South African mines. The drills were manufactured by two local original equipment manufacturers (OEMs), Hydro Power Equipment (HPE) and Novatek, as part of the MMP's industry innovation challenge, the Isidingo Drill Design Challenge.

Click here to read more

Diamond wire cutting tests completed successfully

The MMP successfully conducted diamond wire cutting tests at the Eland Platinum Kukama shaft and the tests have proved successful cutting in the PGM environment and is a very good application of pillar extraction.

Diamond wire sawing ensures people-less stoping since no person enters the panel, this is because the reef extraction is done from the top and bottom accesses. The mining operation can be done on-reef and expensive waste development can be eliminated to make this mining method an even better proposition.

You can download the full report here

People-centred Industry Guidelines

The Mandela Mining Precinct under its Successful Application of Technologies Centred Around People Research Programme has developed guidelines for industry to guide Modernisation, the Inclusion of stakeholders in equipment manufacturing and Globally Benchmarked Strategy for the Engagement of Workers in Original Equipment Manufacturer (OEM) Equipment Development Processes.

Click here to read more

4IR Needs Mining, Mining Needs 4IR – Mining Indaba 2022

Participating at this year's Mining Indaba, Mandela Mining Precinct's (MMP) Research Programme Manager, Jean-Jacques Verhaeghe, encouraged attendees to apply design practices and thinking with the future in mind. He was speaking at Huawei's 'Dive into Digital Mining, Create New Value Together' colloquium, which was also attended by MMP Director, Johan Le Roux. This year's Mining Indaba took place at the Cape Town International Convention Centre from 9 to 12 May, under the theme 'Evolution of African Mining: Investing in the Energy Transition; Environmental, Social, and Governance; and the Economies'.

Click here to read more

Some examples of outcomes

Mandela Mining Precinct hands over Au and PGM Resource Atlas to Council for Geoscience

The Mandela Mining Precinct (MMP) officially handed over the Au and PGM Resource Atlas to the Council for Geoscience. The Resource Atlas was developed by the MMP in 2018 on one of the world's leading geographic information systems, ArcGIS, with the aim of developing mineral resource models to better understand PGM and gold mineral resource opportunities in South Africa. ArcGIS offers several tools to facilitate streamlining data acquisition and loading processes by allowing data custodians to upload new datasets via a web interface.

Click here to read more

Rock-hazard Innovation Challenge

The Minerals Council South Africa and the Mandela Mining Precinct ran a rock hazard open innovation challenge from 12 August 2022 to 12 October 2022. The challenge was an invitation to identify and implement new technology that will enable the development of user-friendly solutions for improving geological confidence at the face, while also making the underground mining environment safer during the removal of loose rocks after blasting and during cleaning before workers enter the area for drilling. The challenge seeks to address a two-fold problem – identifying the rock features that could be potentially hazardous and then safely supporting or removing them.

The five finalists, Council for Scientific and Industrial Research, Flyability, Ramjack Technology Solutions, RockMass Technologies, Stratafy, Reutech Mining and Tata Consultancy Services were announced in November and had the opportunity to showcase their innovations to industry and a panel of judges recently. The winner of the challenge will be announced at an in-person event in January 2023.

Click here to read more about the challenge

MANDELA MINING PRECINCT
MINDS FOR MINES

ERT & GPR Guidelines and training models

As both the Ground Penetrating Radar (GPR) and Electric Resistance Tomography (ERT) Testing and trials have concluded, findings and uses included guideline reports as well as a webinar for research dissemination

Problem / opportunity

- GPR has been recognized as a useful tool for underground, but do we fully understand the uses and benefits?
- How can ERT be applied to detect and delineate disruptive and hazardous structures – ahead of mining – in a deep-level planar orebody environment?

Solution / Innovation

- Guidelines that focus on skills and knowledge transfer and which will help guide mining operations to possibly implement their own routine in-house ERT and/or GPR activities or to make better informed decisions about possibly entering into potential service-level agreements with relevant service providers.

Guidelines are publicly available online (MMP website) for immediate uptake and use by researchers, students, and industry.

Dankie
Enkosi
Ha khensa
Re a leboga
Ro livhuwa
Siyabonga
Siyathokoza
Thank you

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