

South African Research Infrastructure Roadmap (SARIR) and National Integrated Cyberinfrastructure System (NICIS)

Briefing to PPC on S&T

**DSI DG: Dr Phil Mjwara
8 December 2021**

M Making sure it's possible



Outline

- **Part One:** South African Research Infrastructure Roadmap (SARIR)
- **Part Two:** National Integrated Cyberinfrastructure System (NICIS)

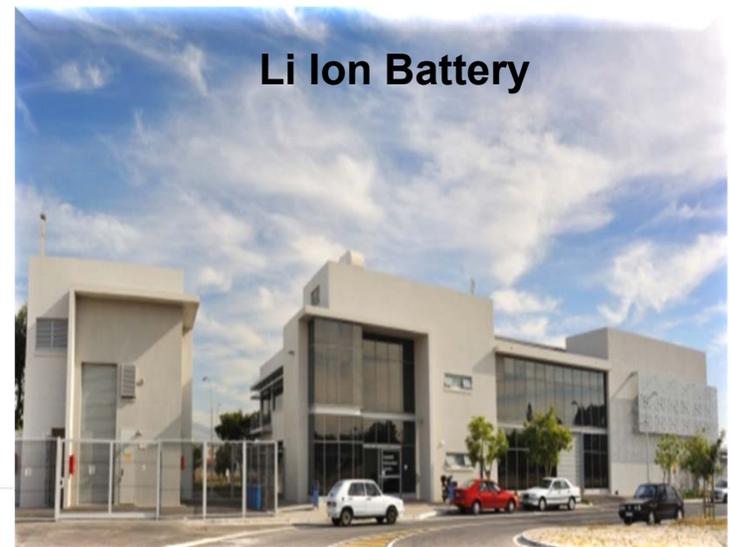
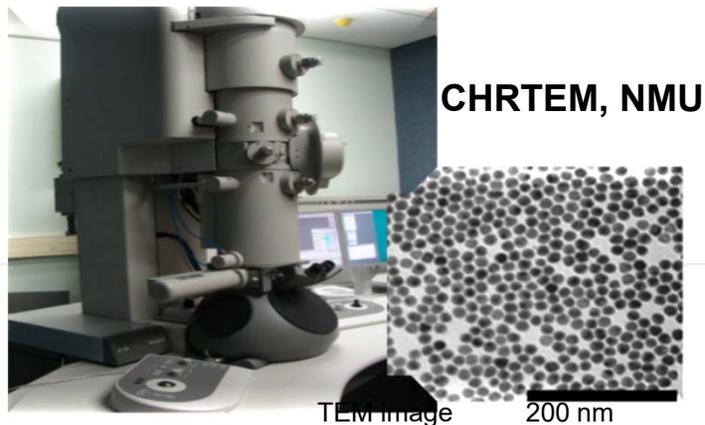
Definition of Research Infrastructure (RI)

RIs are facilities, resources and services that are used by the research communities to:

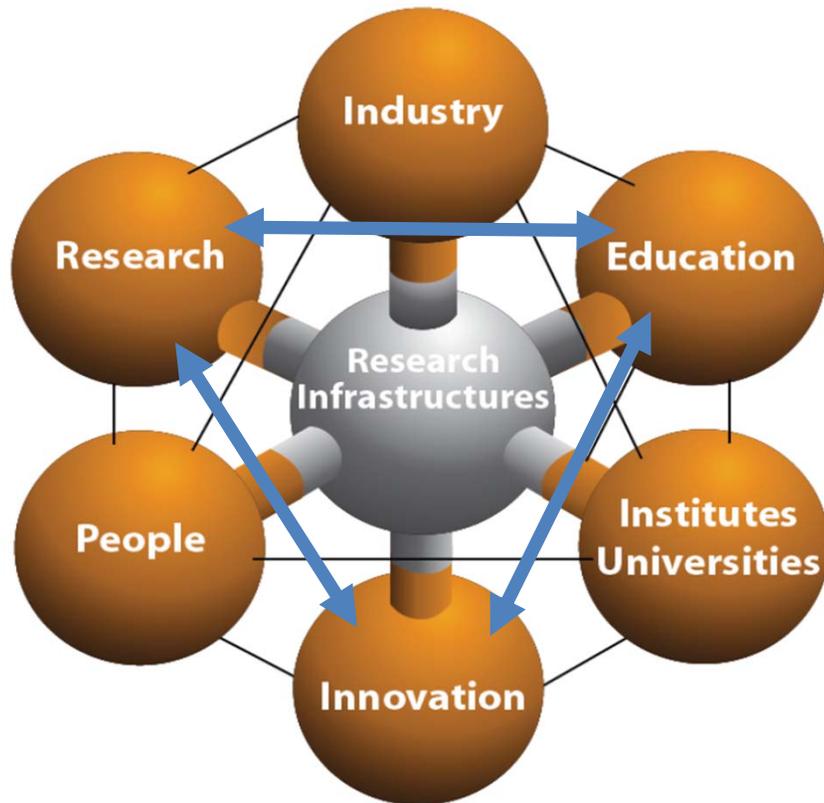
- conduct research and
- foster innovation in their fields.

They include: major scientific equipment (or sets of instruments), knowledge-based resources such as collections, archives and scientific data, e-infrastructures, such as data and computing systems and communication networks and any other tools that are essential to achieve excellence in research and innovation

**ESFRI Definition, 2013*



Research Infrastructure Ecosystem

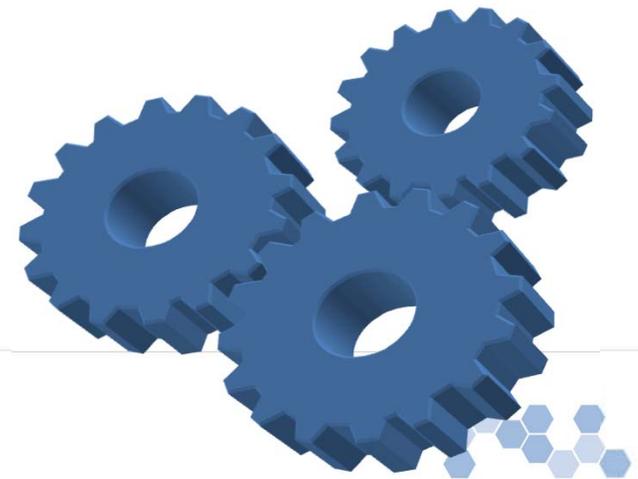
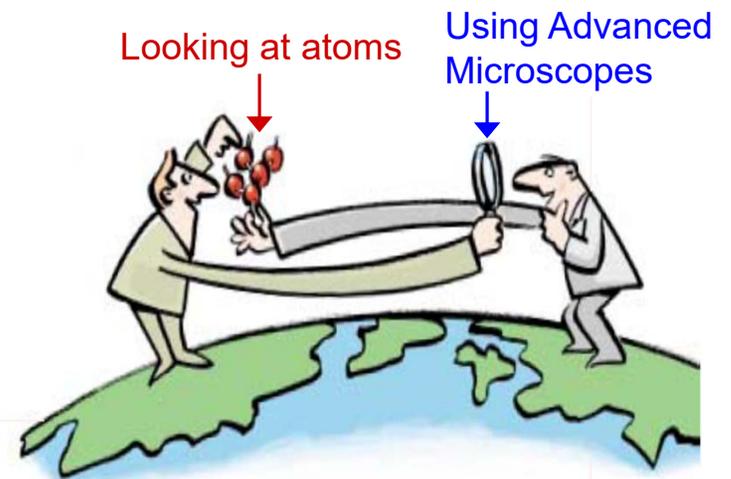


Research Infrastructures are central and an integral part of an ecosystem:

- Driving knowledge generation and exploitation;
- Accelerating technology development;
- Training for new generations of scientists and science managers;
- Technological and social innovation;
- Providing capacity to address global challenges; and
- Combining the best available knowledge, human capital and resources in one specific scientific area

New Approach to RI Provision: Collaborative National Platforms

- Focus of Research Infrastructures should be on network building, serving as engines for collaborative
 - Knowledge generation
 - Technology development
 - Training and skills development
- Foster new partnerships
 - Joint endeavors
- SARIR to guide the strategic development, acquisition and deployment of RI as a necessary and required enabler for RDI, instead of the ad hoc approach used to date.





South African Research Infrastructure Roadmap (SARIR)



SARIR: Background (1)

- Focus on national RIs not international or single laboratories;
- All major economies see RIs as an essential component of the national economy;
- Operating an RI is a service to the whole nation;
- It must be managed in a transparent and accountable way;
- Open, national RIs are key bargaining items in international relations (SKA is an example, positioning South Africa as a serious player); and
- They make a country a preferred research destination.





SARIR: Background (2)

- Most RIs are multi-disciplinary and cut across departmental boundaries;
- They are long term investments for both capital and operating costs;
- People trained at RIs have a much wider perspective than those trained only at universities;
- Good governance is key to their success; and
- A Roadmap is a living document, it needs constant updating as new areas develop (*ESFRI roadmap already through its five editions*).



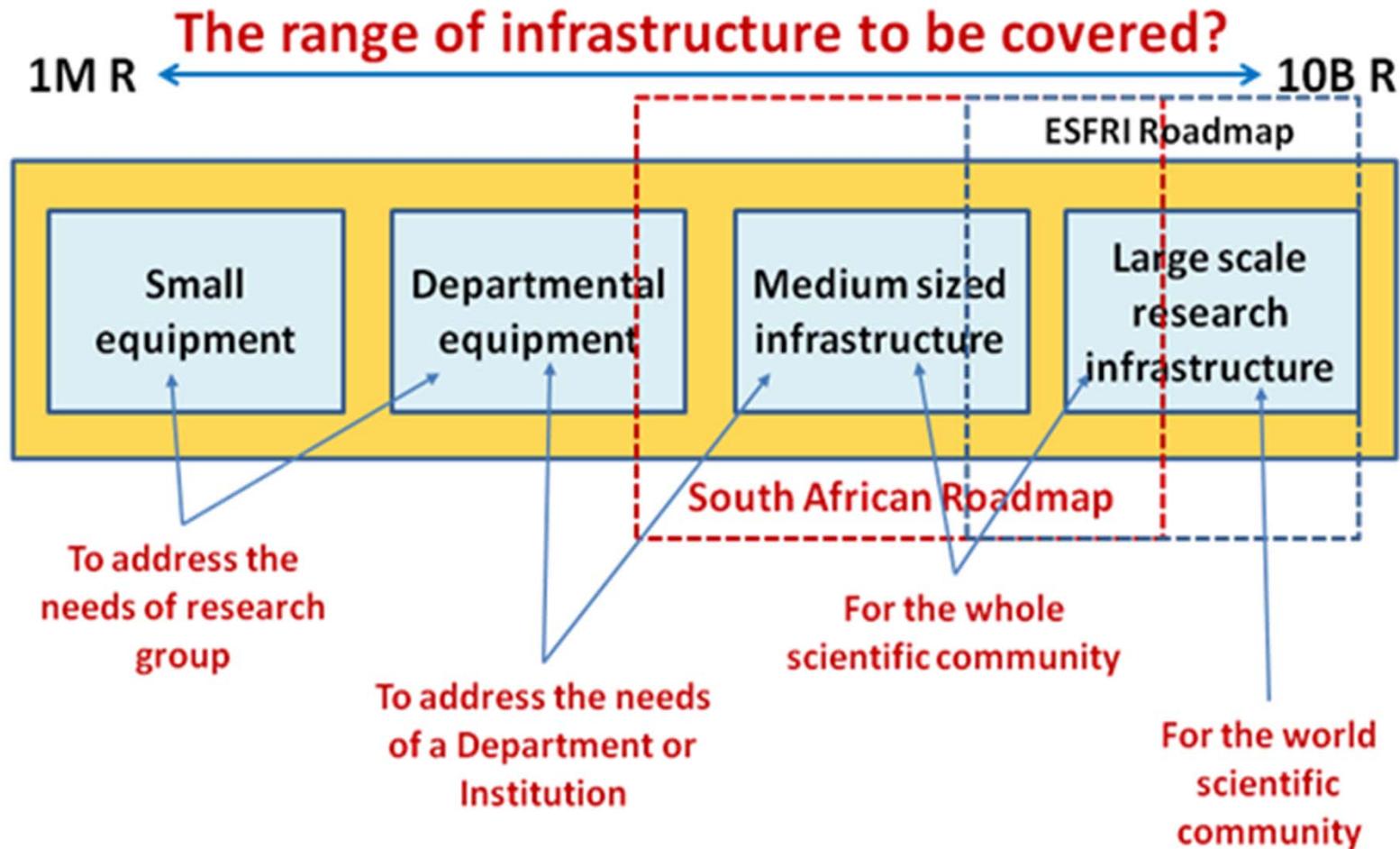
SARIR: Selection & Prioritisation Criteria

- Impact;
- Scientific excellence, novelty and innovation;
- Management plan;
- Implementation;
- Governance structure;
- Financials;
- Capacity development and transformation; and
- Monitoring and Evaluation.

The selected RIs to constitute the SARIR were subsequently ordered according to criteria such as:

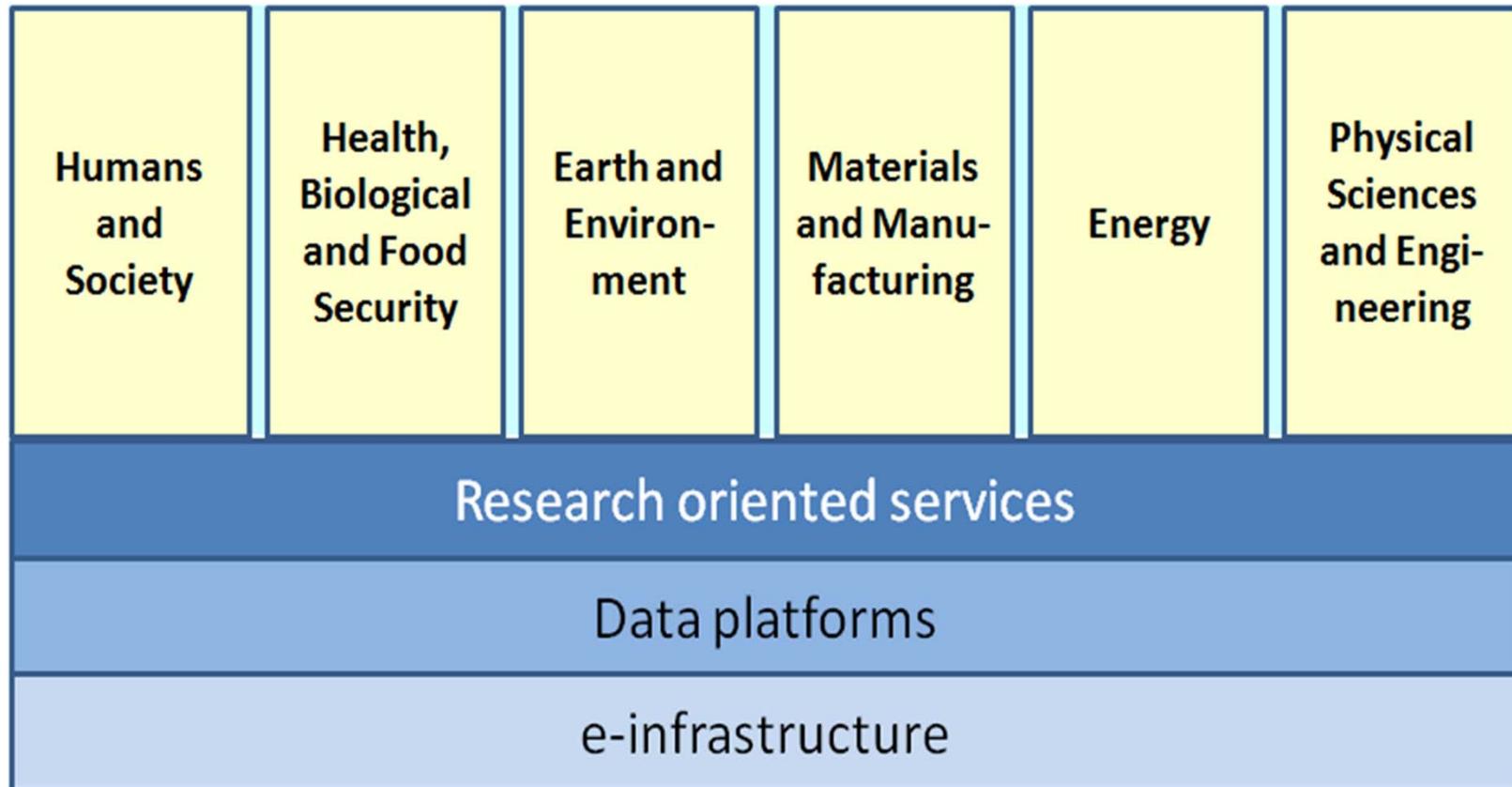
- ✓ Affordability, cost to implement, alignment with DSI priorities, spread across different scientific domains, alignment with national priorities, and extent of return on investment (translational and socio-economic impact).

Scope of the South Africa Research Infrastructure Roadmap





Thematic areas and cross-cutting requirements



Final SARIR: 13 RIs across 5 Thematic areas





SARIR: Selected RIs

Thematic area	Selected RI
Humans and Society	1. The South African Population Research Infrastructure Network (SAPRIN)
	2. South African Centre for Digital Language Resources (SADiLaR)
Health, Biological and Food Security	3. Distributed Platform for “Omics” Research (DIPLOMICS)
	4. Biodiversity Biobanks
	5. Nuclear Medicine Research Infrastructure (NuMeRI)
Earth and Environment	6. A South African Marine and Antarctic Research Facility*
	7. Biogeochemistry Research Infrastructure Platform (BIOGRIP)
	8. An Expanded Terrestrial and Freshwater Environmental Observation Network (ETFEON)
	9. Shallow Marine and Coastal Research Infrastructure (SMCRI)
	10. The Natural Sciences Collection Facility (NSCF)
Materials and Manufacturing	11. Nano-manufacturing Facility*
	12. Materials Characterisation Facility*
Energy	13. Solar Research Facility*





The 9 SARIR RIs implemented from 2016/17-2019/20

Research Infrastructure	Host Institution	Type of RI
Expanded Terrestrial and Freshwater Environment Observation Network (ETFEON)	SAEON(NRF)	Single-sited RI with a distributed observation nodal network
Nuclear Medicine RI (NuMeRI)	NPC: Necsa/Steve Biko Hospital(& UP)/Tygerberg Hospital (&SU)	Distributed RI with the primary node at Steve Biko Hospital and nodes at SU and Necsa
The South African Population Research Infrastructure Network (SAPRIN)	MRC	Distributed RI with 5 nodes located at: KwaZulu Natal, Mpumalanga, Limpopo, Western Cape and Gauteng
South African Centre for Digital Language Resources (SADiLaR)	NWU	Distributed RI with nodes located at: UP, CSIR Meraka, CText, ICELDA, UNISA
Natural Science Collections Facility (NSCF)	SANBI	Distributed RI with primary node located at SANBI and 14 node institutions
Shallow Marine and Coastal Research Infrastructure (SMCRI)	SAEON/NRF	Single-sited RI with a distributed observation nodal network
DIPLOMICS	CPGR	Single-sited RI with a distributed collaboration network
Biodiversity Biobanks	SANBI	Distributed RI with primary node at SANBI and are several node institutions (still to be established)
Biogeochemistry Research Infrastructure Platform (BIOGRIP)	UCT	Distributed RI with 3 nodes located at UFS, NWU and SU

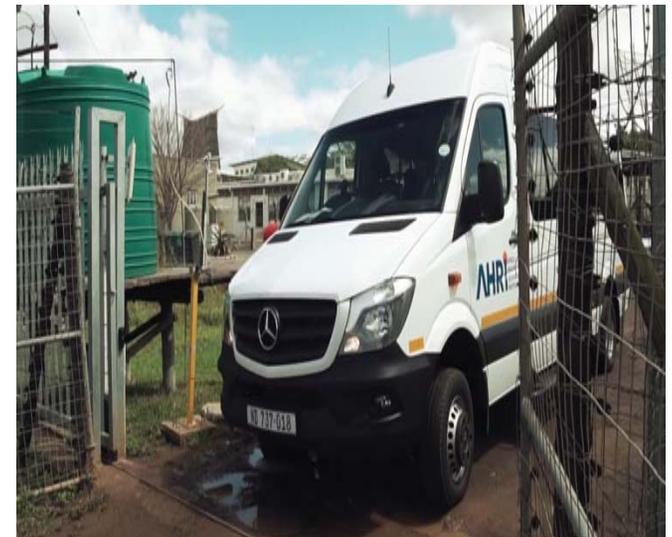


The South African Population Research Infrastructure Network (SAPRIN)

Mission: to enable impactful population-based research through supporting a network of standardised longitudinal, whole population health and demographic surveillance nodes in South Africa

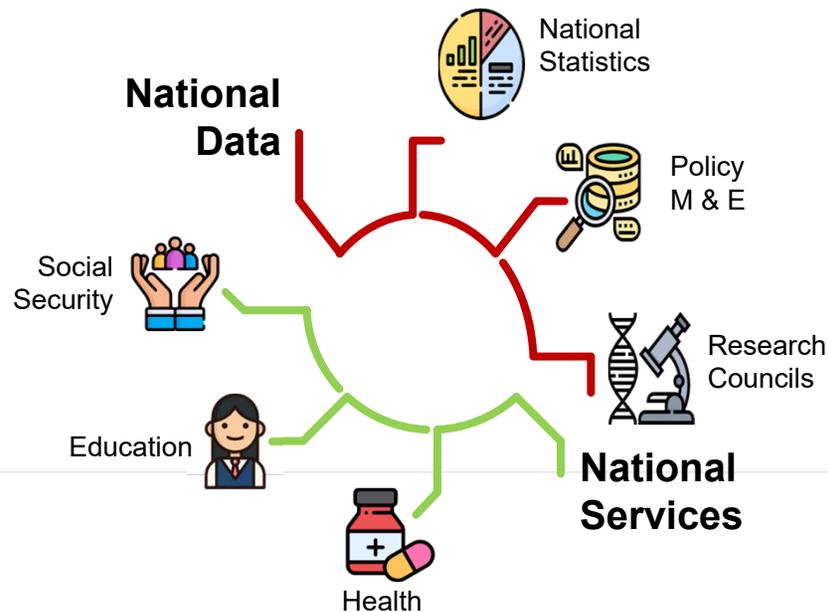
- Research Infrastructure
 - 2019: R336 million external research funding, 59 studies, 561 jobs, 165 publications, 57 post-graduate students
- Policy Impact
- Standardised Population Data
- Capacity Building, Citizen Science

SAPRIN: a distributed, ongoing, platform for population information and research



SAPRIN: A network of Population Nodes

- Existing and new nodes
- Impoverished communities, both rural and urban
- New nodes incorporate bi-directional, migration flows, linking poor rural communities with urban centres
- Nodal populations of ~100 000 individuals
- When fully consummated, will consist of ~1% of national population



SAPRIN Nodes (Research Population = 750,000)





SAPRIN: Rapid multi-nodal response to Covid-19 pandemic

- Research Infrastructure allowed a rapid response
 - The SAPRIN Covid-19 survey is conducted on 20 000 households in each of the three nodes and repeated every 15 weeks.
 - For more focussed Covid-19 surveillance, a random sample of households are surveyed every two weeks to screen for disease occurrence and study health-seeking and related behaviours.
- Relevance
 - One of few opportunities to document Covid-19 epidemic in a complete population
 - Community effectiveness studies of Covid-19 prevention measures and health service interventions
 - Look at long-term health outcomes and health service impact
- Publications
 - Harling, G., Gómez-Olivé, F.X., Tlouyamma, J., Mutevedzi, T., Kabudula, C.W., Mahlako, R., Singh, U., Ohene-Kwofie, D., Buckland, R., Ndagurwa, P. and Gareta, D., 2020. Protective behaviours and secondary harms from non-pharmaceutical interventions during the COVID-19 epidemic in South Africa: a multisite prospective longitudinal study. *medRxiv*.
 - Siedner, M. J., Harling, G., Derache, A., Smit, T., Khoza, T., Gunda, R., ... & Herbst, K. (2020). Protocol: Leveraging a demographic and health surveillance system for Covid-19 Surveillance in rural KwaZulu-Natal. *Wellcome Open Research*, 5.
 - Siedner, M. J., Kraemer, J. D., Meyer, M. J., Harling, G., Mngomezulu, T., Gabela, P., ... & Herbst, K. (2020). Access to primary healthcare during lockdown measures for COVID-19 in rural South Africa: an interrupted time series analysis. *BMJ open*, 10(10), e043763.



SOUTH AFRICAN CENTRE FOR DIGITAL LANGUAGE RESOURCES



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA





SADiLaR: What the project is about?

- **SADiLaR aims to develop and promote** all the eleven official languages to be capable of expressing all forms of knowledge, and drive their use and function in research and development, education, social transformation, trade, economic and scientific development.
- **The RI enables this through**
 - ✓ **Creating and maintaining Human Language Technology Resources** for SA's under-resourced languages – in line with its constitutional mandate 6. (1) and
 - ✓ **Builds Digital Humanities (DH) research capacity** through promoting the use of digital data and innovative methodological approaches.





SADiLaR: Impact

SADiLaR enables the creation of “the building blocks” for current and future innovation.

- SADiLaR’s core output is the generation of language resources as building blocks that can allow downstream innovation and enable future research activities
- E.g. by supporting the development of COVID terms in all of the official languages, intellectualisation is strengthened and it allows for that dataset to enable language specific applications.

Long term investment fosters innovation

- E.g. the **Aweza Covid-19** App which features localised speech technology to assist with Covid Triage and screening through speech recognition, machine translation, and text-to-speech was built on core technologies developed by the CSIR. This would not have been possible without the availability of pre-existing language resources generated by the Human Language Technology Community and Government investment over the past decades.

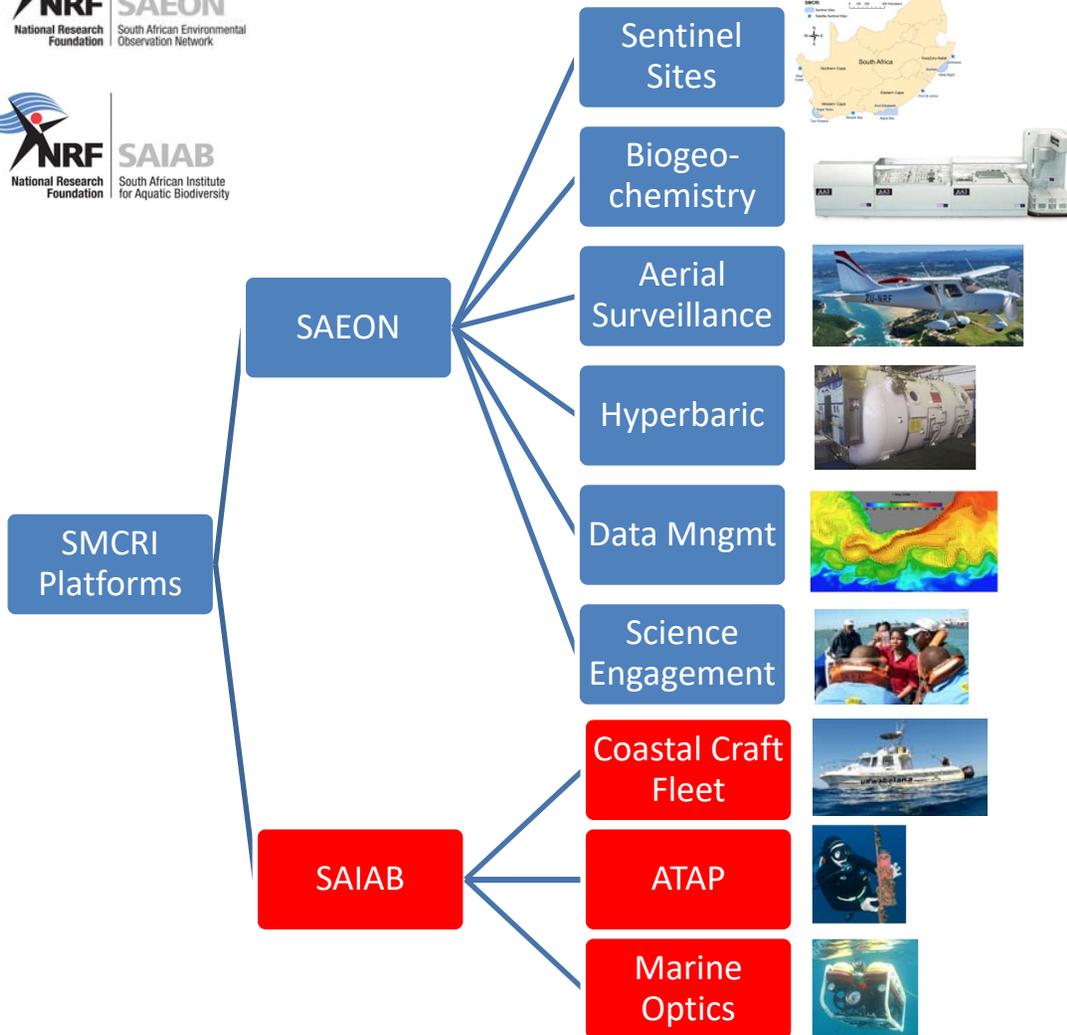


Shallow Marine and Coastal Research Infrastructure (SMCRI)



- An array of instruments and physical research platforms around the coast of SA and its sub-antarctic islands;
- To collect long-term reliable data for scientific research to help decision-makers formulate appropriate environmental policies to lessen the risk and vulnerability of the coastal zone to climate and global change;
- Tapping into SA's geographical advantage by providing access to cutting edge research platforms and data at appropriate spatial and temporal scales in all the coastal biogeographic regions from all three oceans;
- To stimulate innovative research and IP generation that is of global relevance;
- **Socio-economic impact:** improve ecosystem health (blue economy – fisheries, tourism); improve human health; advise policy on sea-level rise and storm surges; and early warning system and forecasting of hazardous marine events.

SMCRI Platforms



Latest Vessel undertaking sea trials!



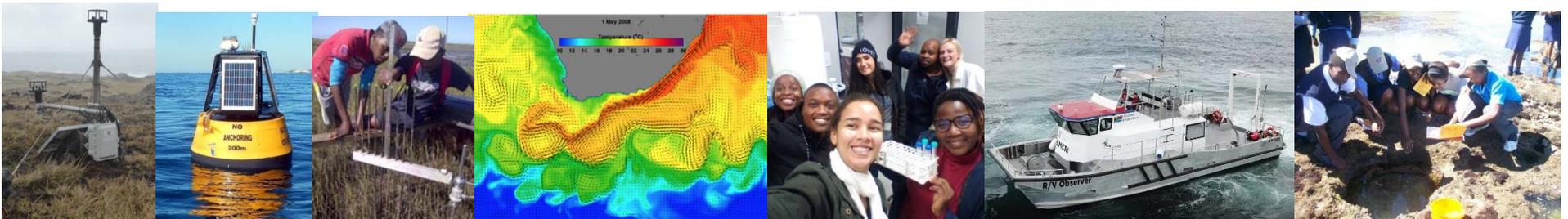
SMCRI: Socio-Economic impact

- Data and data products to:
 - improve governance and innovation in the coastal zone;
 - improve ecosystem health (blue economy – fisheries, tourism);
 - improve human health;
 - advise policy on sea-level rise and storm surges; and
 - early warning system and forecasting of hazardous marine events.



Contribution to evidence-based decision making

- Airborne Remote Sensing Platform (aircraft)
 - Kouga Municipality to survey flood damage
 - Grootbos Nature Reserve (WC)
- Decompression Chamber: 12 delegates from DoEL (DDG, Chief inspector)
- Algoa Bay Sentinel Site attracted 8 international research projects
 - MSP CoP; OAF CoP; CICLICO (WIOMSA); WIO-MSP (UNEP); One-Ocean Hub (UKRI); MARISCO (Belmont Forum); BioSCAPE (NASA); Horizon2020 (EU)



SARIR: Main NUMERI Facility



- NuMeRI is a medical imaging facility dedicated to drug development and clinical research;
- To consolidate expertise and implement new strategic initiatives relating to R&D in nuclear technologies in medicine and the biosciences;
- Core research network is embedded within the healthcare domain, which lends to a mutually beneficial environment for medical research and general practice – with public health being the common goal;
- The research conducted to contribute to the development of a range of therapies that address the national priority diseases.

NUCLEAR MEDICINE RESEARCH INFRASTRUCTURE (NUMERI), Stellenbosch University (Tygerberg Hospital):

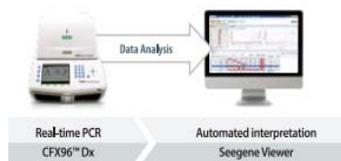
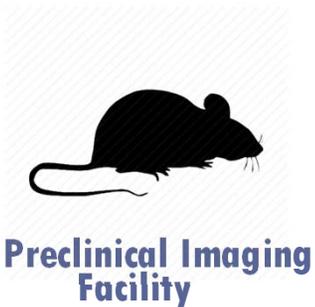
- Infection Imaging Node;
- SA's first positron-emission computed tomography (PET/CT) facility dedicated to clinical research - TB eradication;
- Only the 2nd of its kind installed in the Southern Hemisphere



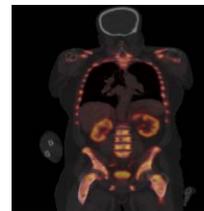
Policy Impact or Contribution to Evidence-based decision-making



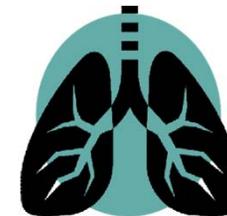
- Targeted Radionuclide Therapy;
- Infection Imaging;
- Training and curriculum



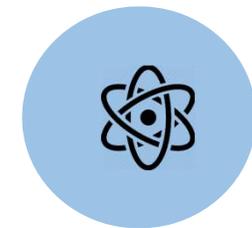
Basic & Translational Research



Clinical Imaging Facility



Node for Infection Imaging



cGMP Radiopharmacy



DIPLOMICS (the Distributed Platform in OMICS)

DIPLOMICS is a network of core and research service labs in genomics, proteomics (& metabolomics), and bioinformatics. The labs are diverse in size, service offerings, standardisation of workflows and processes, accreditation, and technology focus. Through DIPLOMICS, the aim is to support and strengthen the field of Omics by improving and promoting its research infrastructure.

DIPLOMICS

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What is Omics?

Omics is shorthand for the collective, large-scale sciences that study genes (genOMICS), proteins (proteOMICS), and metabolites (metabolOMICS) to better understand the structure and function of cells or organisms.

But what is the difference between genetICS and genOMICS, for example? It's about scale; genomics looks at the whole genome or thousands of genetic markers at a time. Similarly, proteomics studies include thousands of proteins at once rather than a few at a time.

The use of the suffix Omics has increased over the past few decades because of high-throughput technologies such as mass spectrometry for proteomics and metabolomics, and massively parallel technologies such as next-generation sequencing for genomics.



SARS-CoV-2/COVID-19 IMPACT & SUPPORT

VIDEOS PRE-PUBLISHED PAPERS

#FollowTheScience Campaign



Episode 1
Episode one debunks the myth that the vaccines give you COVID-19 and help to explain how the vaccines actually work in our bodies.
16 June 2021

Episode 2
Episode two debunks the myth that the vaccines were rushed making them "experimental" and unsafe.
23 June 2021

Episode 3
Episode three debunks the conspiracy that the vaccines carry microchips that are injected into us and used for tracking purposes.
29 June 2021

#followthescience

Only series in 4 SA languages

- **RAPID DIAGNOSTICS – qPCR**
 - 35000 COVID TESTS
- **MONITORING & SURVEILLANCE**
 - > 4000 GENOMES SEQUENCED
- **R&D – PROTEOMICS**
 - Diagnostics for predicting patient outcomes

NHLS Dx Labs

> 9 labs

> 64 trained

> R300k



Natural Science Collections Facility: Preserved specimens of plants, animals and fungi and fossils



Outcome of the research done: documenting the value of the natural science collections and associated data and use of these for benefitting society

The stuffed, stoned, pickled and pinned ... saving our living planet
#thevalueofthedead

The Natural Science Collections Facility (NSCF) invites you to our value of collections webinar series

Theme: Food Security and Agriculture

Microscopic Giants Family ties and safety nets Growing in the dark, fog or friend?!

Date: Friday, 30 July 2021
Time: 2pm
Registration link: t.ly/rLRF

Natural Science Collections Facility

Value of Natural Science Collections Webinar Series
The stuffed, stoned, pickled and pressed... saving our living planet

The Fight against Pests and Diseases

#thevalueofthedead

Date: 10 September 2021
Time: 14h00
Platform: Zoom
Webinar ID: 843 4842 5358

Parasitoid wasps: Essential for our survival
Fall Armyworms: the mist in your marinade
Urban invaders and the threat they pose

- Biosystematics Division, Agricultural Research Council - Role of collections in identifying the Fall Army Worm in South Africa

The outbreak of the Fall Armyworm (FAW), *Spodoptera frugiperda* (JE Smith) in early 2017 in South Africa, made national and international headlines.

This polyphagous pest is classified as an A1 quarantine pest on the list of the European and Mediterranean Plant Protection Organisation (EPPO), and is a quarantine pest in South Africa.



Why our collections matter

SHOWCASE NO. 2: AUGUST 2021
THE VALUE OF SOUTH AFRICAN NATURAL SCIENCE COLLECTIONS SERIES

Role of collections in surveillance of rodent populations for zoonotic diseases in Thekwini Municipal area





Conclusions

- Scientific communities acknowledged the need of creating common platforms, shared by a plurality of teams;
 - ✓ Need for new research organizational models (consortia, institutes, etc);
 - ✓ Far-reaching consequences in terms of: funding, ownership, governance, organization, stakeholders involvement and openness to outsiders, including laypeople
 - Decision-makers are faced with the question: ‘What is the net social benefit of costly RIs and the public good they produce’
 - ✓ A structured ex-ante and ex-post evaluation of the socio-economic impact of RIs is needed.
 - Large RIs in SA demonstrated significant socio-economic impact
- 

