



4TH ANNUAL SADC INDUSTRIALISATION WEEK

Investment in Big Data for Industrial Development and Competitiveness

Dr. Happy Sithole

Center Manager: NICIS

7th August 2019

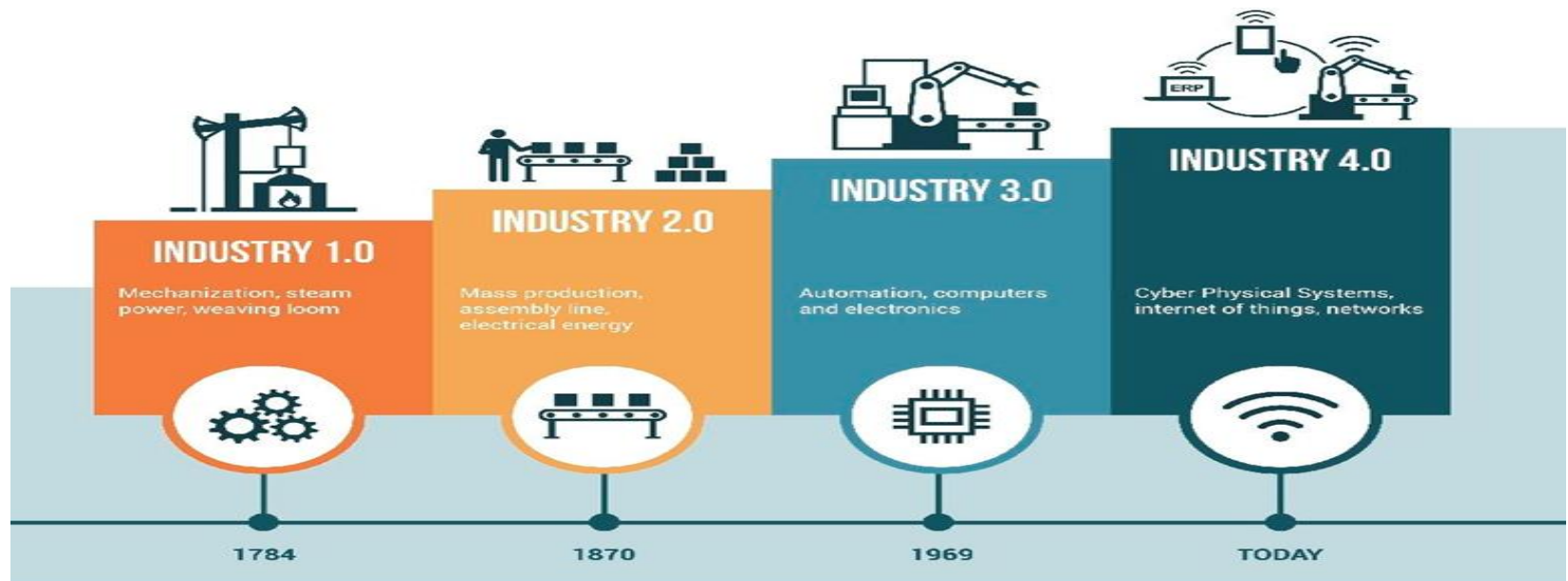


www.sadc.int facebook.com/sadc.int [sadc_news](https://twitter.com/sadc_news) youtube.com/sadc.int #SIW2019



Definitions and Concepts

The Fourth Industrial Revolution aims to leverage differences between the physical, digital, and biological sphere. It integrates cyber-physical systems and the Internet of Things, big data and HPC, robotics, artificial-intelligence based systems and additive manufacturing.



FIR Technologies

- The fourth industrial revolution is driven by technological advancement, new and emerging technologies and platforms. Some of the technologies to be embraced in the era of the fourth industrial revolution:
 - *Artificial intelligence and machine learning;*
 - *Advanced robotocs and new forms of automation;*
 - *Ubiquitous mobile internet;*
 - *Sensors and the internet of things;*
 - *Blockchain and distributed ledgers;*
 - *3D priniting;*
 - *New matterials;*
 - *Genetic advances, bio-engineereng; and*
 - *Quantum computing.*

Digital skills for youth: Opportunities & challenges



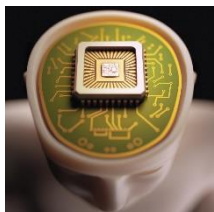
Robots



Internet of
Things



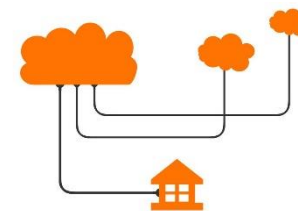
High Performance
Data Analytics .e.g
DIRISA



AI/ML/DL



HPC



Cloud
computing

4th ANNUAL SADC INDUSTRIALISATION WEEK

Under threat

TRAVEL AGENTS



TELLERS



SURVEYORS



JOURNALIST



LEGAL ASSISTANT



FINANCE ASSISTANT



BLOGGER



SUSTAINABILITY
MANAGER



DRONE OPERATOR



SOCIAL MEDIA
STRATEGIST



DATA SCIENTIST

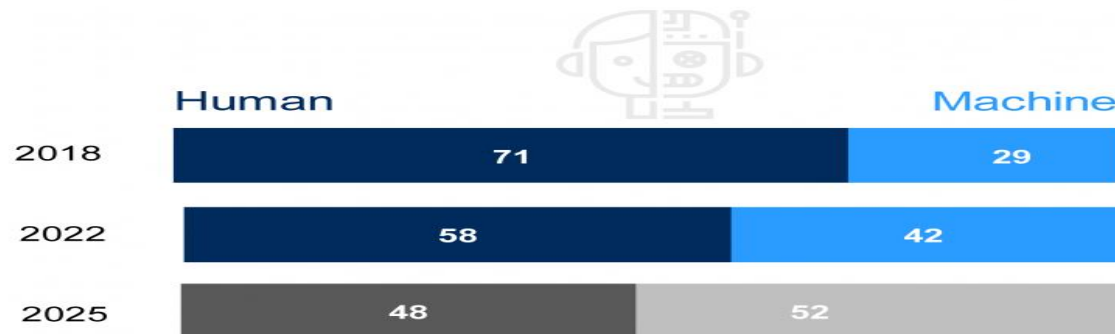


Are we preparing for the workplace of the future?



Rate of automation

Division of labour as share of hours spent (%)



Source: Future of Jobs Report 2018, World Economic Forum



Drivers of Change

Drivers of change, 2015–2020	Rank
Processing power, Big Data	1
Changing nature of work, flexible work	2
Middle class in emerging markets	3
Mobile Internet, cloud technology	4
Geopolitical volatility	5
Climate change, natural resources	6
Sharing economy, crowdsourcing	7
New energy supplies and technologies	8
Young demographics in emerging markets	9
Rapid urbanisation	10
Women's economic power, aspirations	11
Internet of Things	12
Adv. Manufacturing, 3D printing	13
Artificial Intelligence	14
Robotics, autonomous transport	15
Adv. materials, biotechnology	16

Source: World Economic Forum, The Future of Jobs Survey.

Note: Survey based on South Africa only.

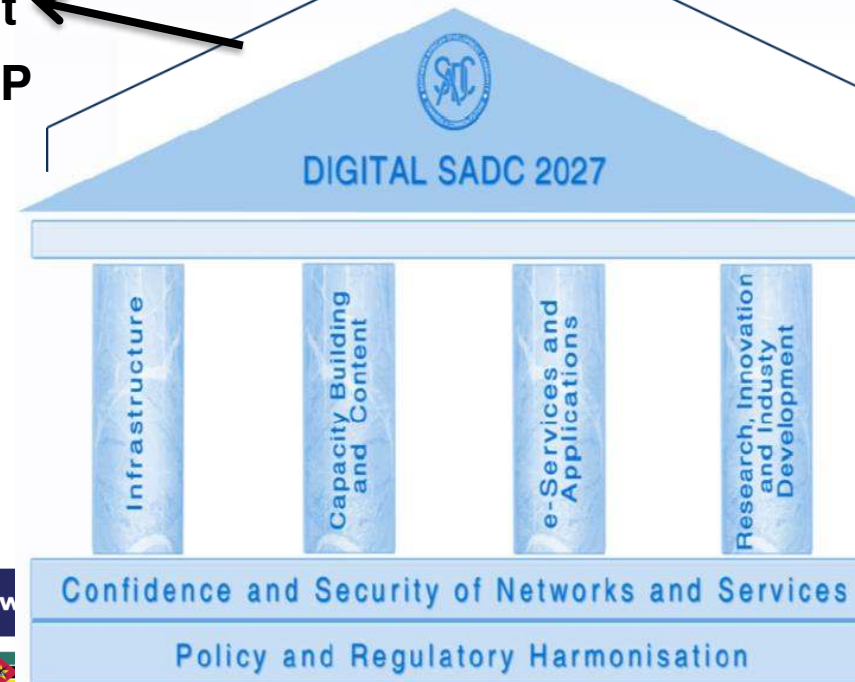
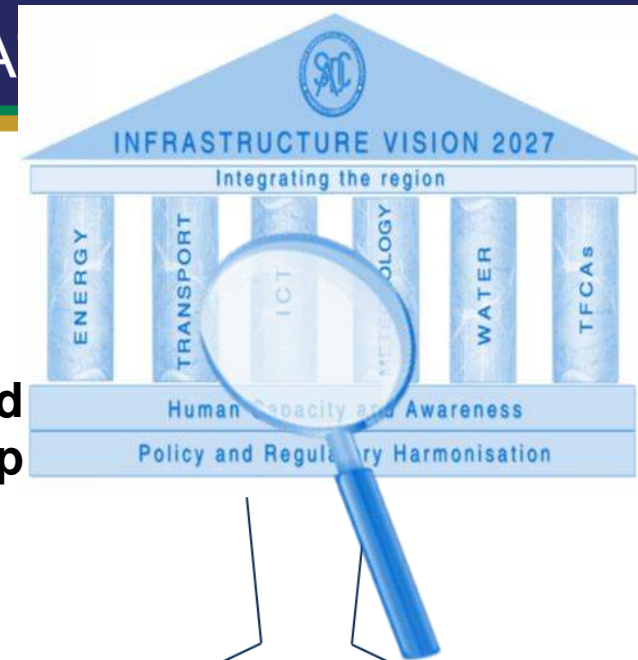
Alignment

Revised Regional Indicative
Strategic

Development Plan, RISDP
Industrialization Strategy and
Roadmap

SADC CI Framework

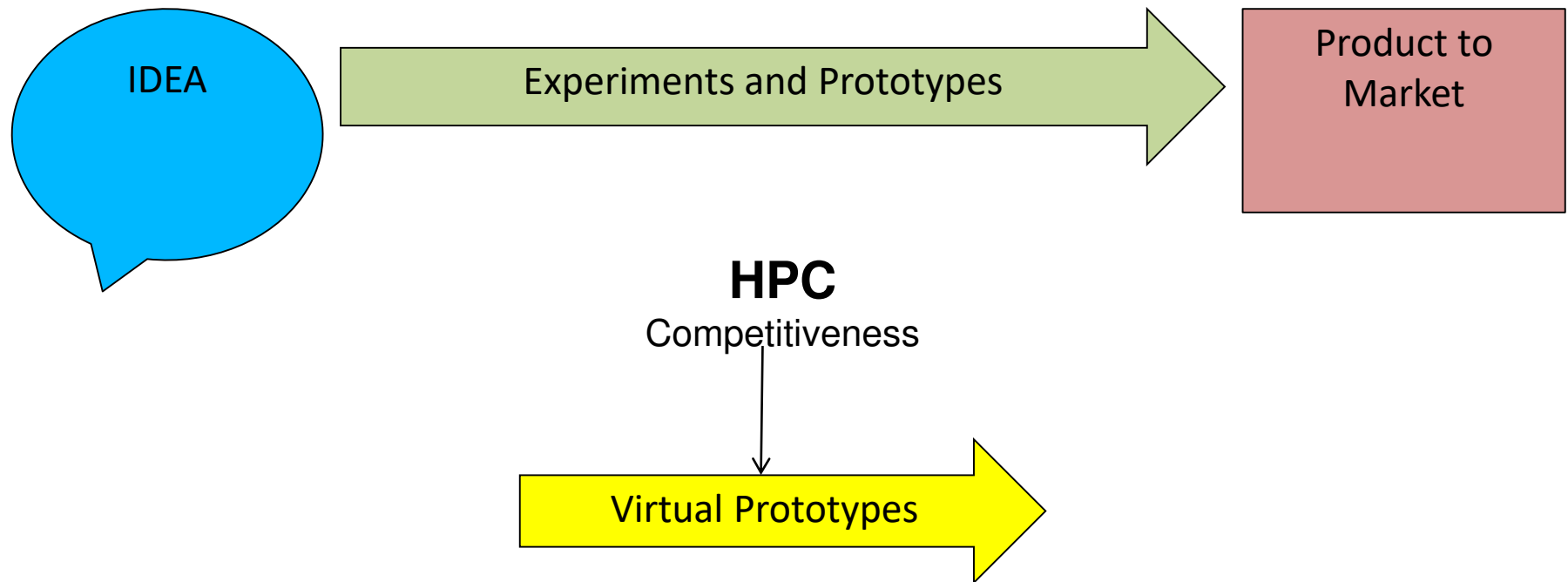
Regional infrastructure
Development
Master Plan, RIMDP



Components of the Framework

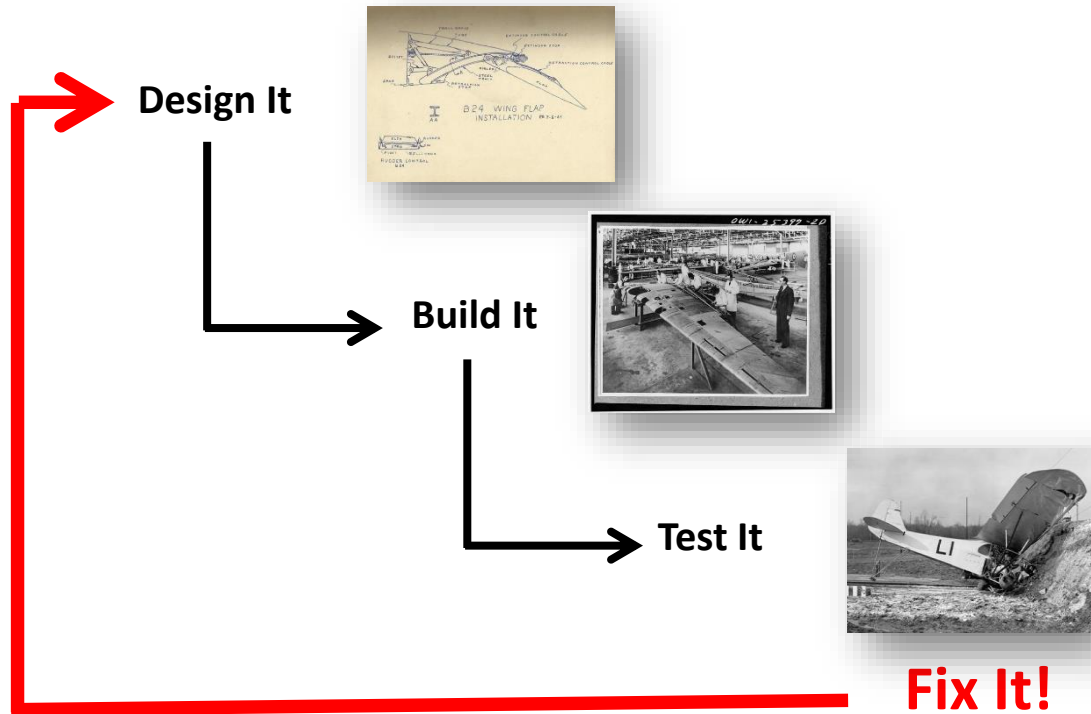
- **Policies** - To enable optimal establishment and utilization of cyber-infrastructure, generation, analysis, transport as well as stewardship of information,
- **Computational Resources** - Ranging from HPC to other computing capabilities (hardware and software) and applications areas,
- **Data** - tools and facilities (including repositories) to enable sharing and efficient data-driven discoveries, technologies and innovations,
- **National Research Networks** - Specialized broadband infrastructure networks and service providers for education, research and innovation,
- **Human Capital** - To make effective use of the Cyberinfrastructure.

Why HPC?

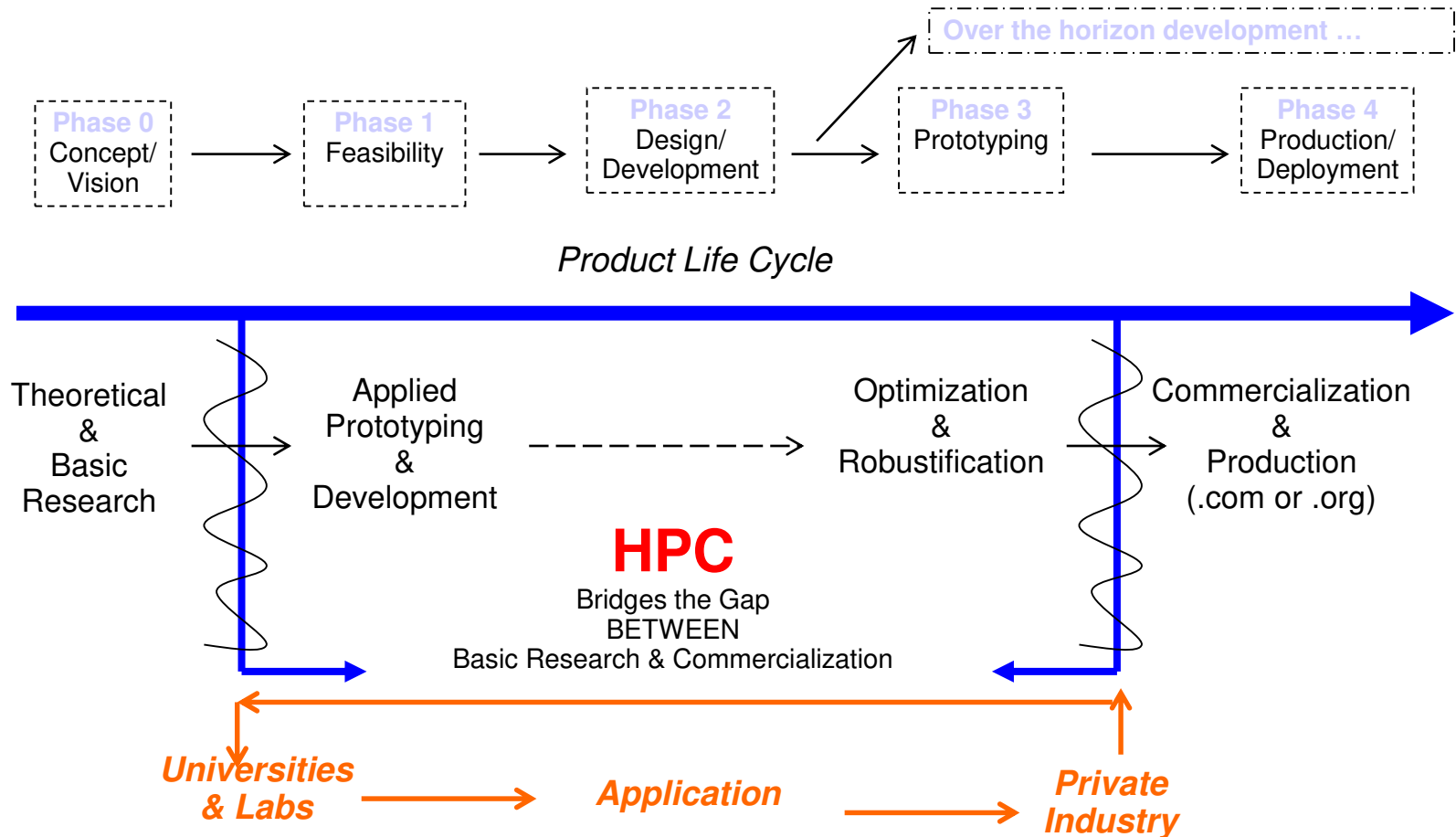


Out-Compute to Out-Compete

4th ANNUAL SADC INDUSTRIALISATION WEEK



Technology Development Continuum



4th ANNUAL SADC INDUSTRIALISATION WEEK

Integrated, Information-Based Decision Making

Human, Physical,
Virtual Sensors



Bots, Actors

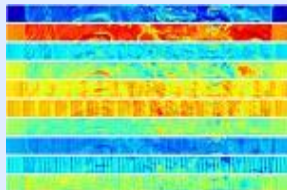


Archives

Information-
Based
Decisions

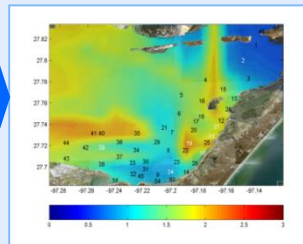
Automated
Provenance

Multimodal



Data
Fusion

Modeling



Visualizatio



Dashboard

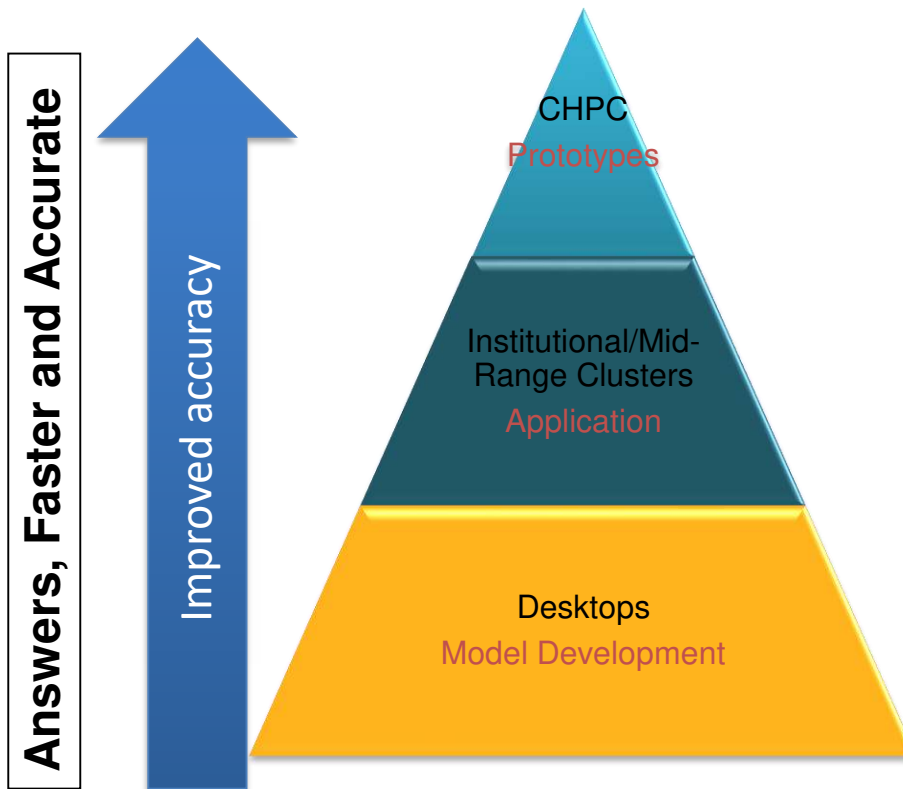


...Seamless
Computing...

Calibration



High Performance Data Analytics Trends

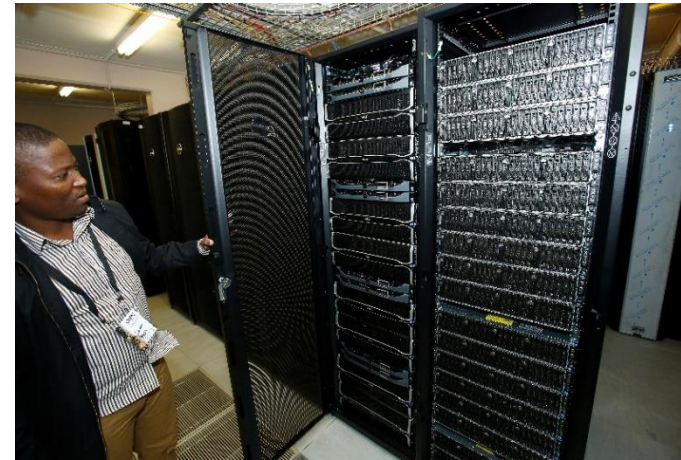


- Uptake of simulation goes beyond traditional Science and Engineering due to the “Big Data Analytics”.
- High fidelity models required for “Virtual prototyping” improve with compute intensity.
- Availability of high quality data and more processing power is enabler.
- Strengths in both domain knowledge and HPC are differentiator.

Basics of HPC



South Africa HPC PETAFLOP SYSTEM



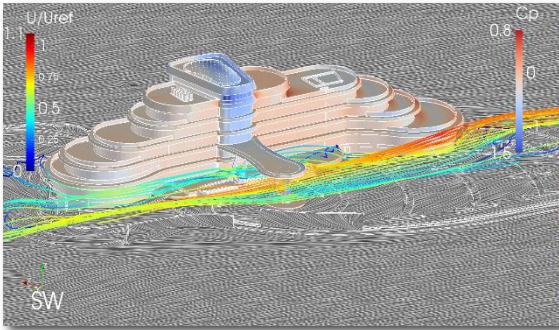
- **World-Class HPC systems**
- **Ranked amongst the fastest in the world**
- **Fastest system in Africa**
- **Utilised efficiently by academics and industry.**
- **Accessible all over the continent**

Machine Learning and AI Applications

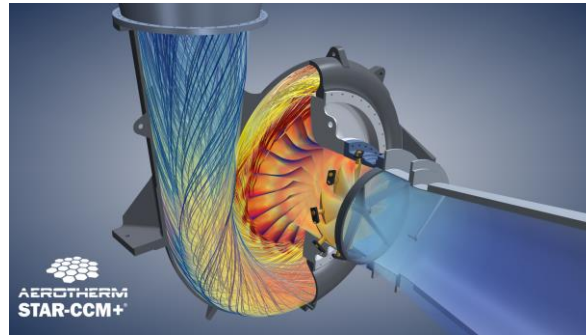


- ❑ **Graphical Processor Unit (GPU) Cluster: 30 V100's**
 - ❑ 6 nodes (36 Intel Gold 6150 CPU's; 3 V100's; PCIe)
 - ❑ 3 nodes (40 Intel Gold 6150 CPU's; 4 V100's; NVLink)
- ❑ Since **September 2018**
- ❑ Immediate Demand from users:
 - ❑ **Transfer of Chemistry Users (MD)**
 - ❑ **Resources for Machine Learning (ML) and AI**
- ❑ Machine Learning applications optimised – TensorFlow
- ❑ Big Data Analytics Focused

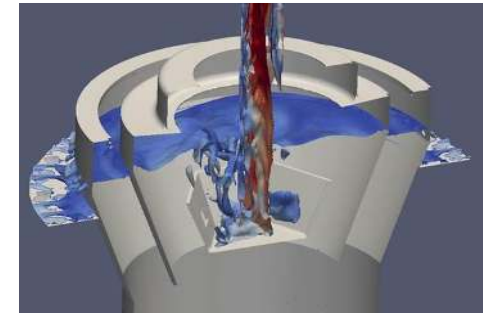
Computational Mechanics / Engineering



Building aerodynamics
(ECI-JV)

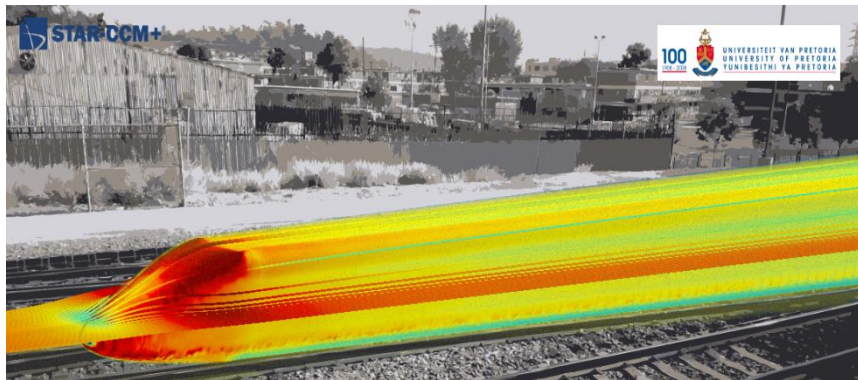


Centrifugal Steam Compressor
(Aerotherm)

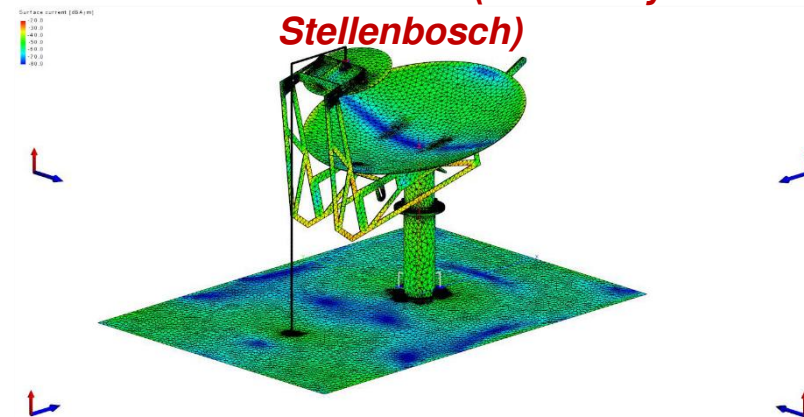


Elutriator Design
(De Beers Marine)

High-speed Train Design (UP):

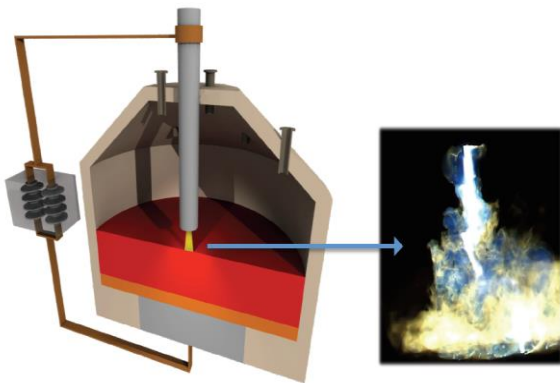


Radio-Astronomy Dish Design (University of Stellenbosch)



Mineral Processing Applications

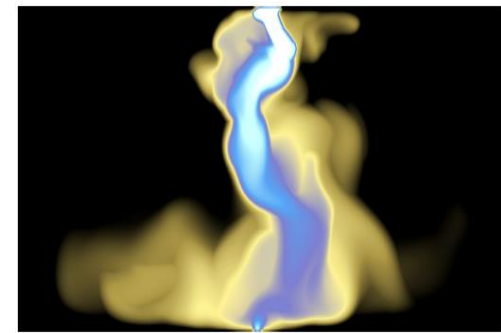
- ❑ DC Furnace **Plasma Arc electric smelting** simulations
- ❑ **CFD** and Magnetohydrodynamics (**MHD**) simulations
- ❑ Resulted in **patent** for Mintek on **arc detection technology**
- ❑ **Fully dependent** on **CHPC** for HPC resource requirements



Cross-section of DC Furnace
Showing Plasma Arc (photo)

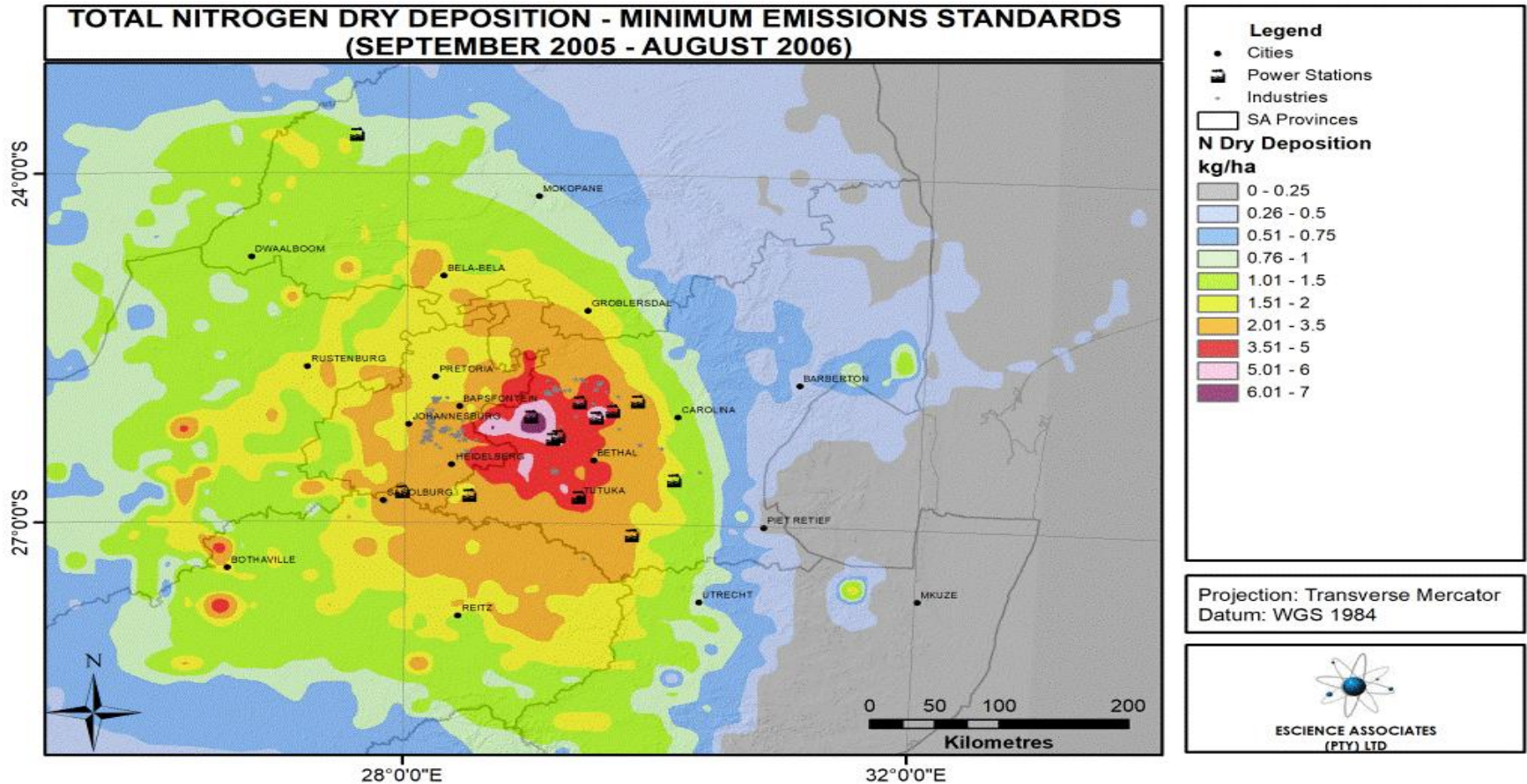


Photographic Image



Simulated

Environmental Applications



Weather and Climate Applications

South African Weather Service (SAWS)

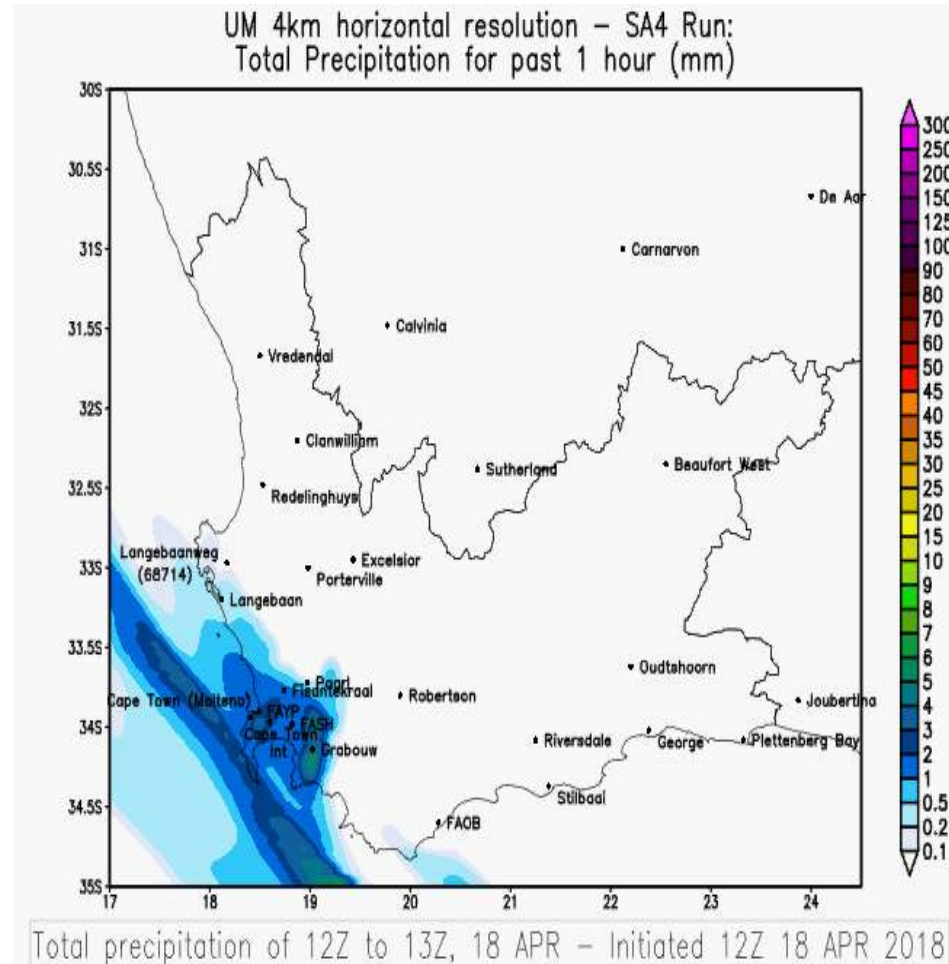
CHPC-SAWS MoU:

- ❑ CHPC is **Fail-Over Facility**
- ❑ All **SAWS Research** done at CHPC



South African
Weather Service

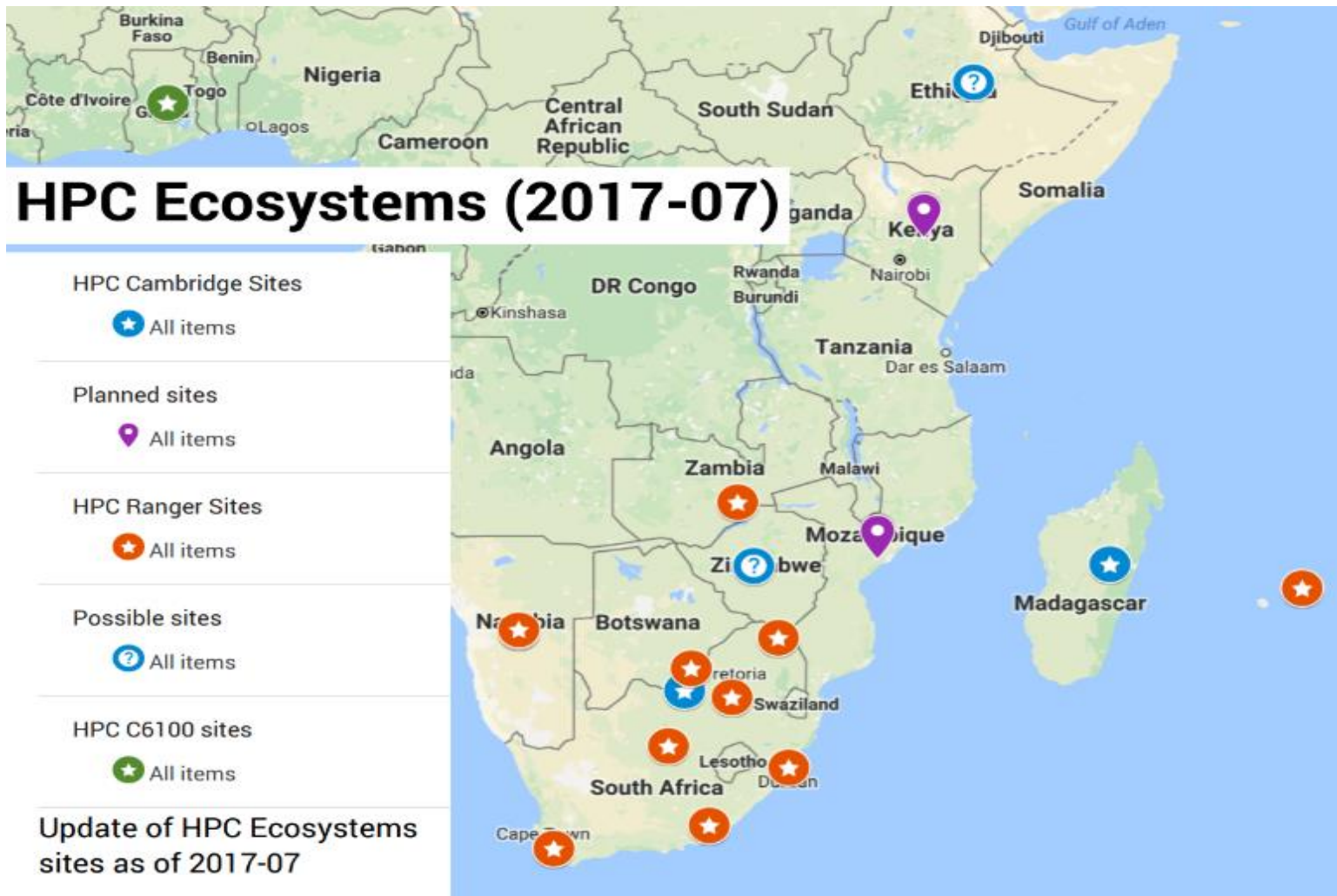
 www.sadc.int



[sadc_news](#)  youtube.com/sadc.int #SIW2019

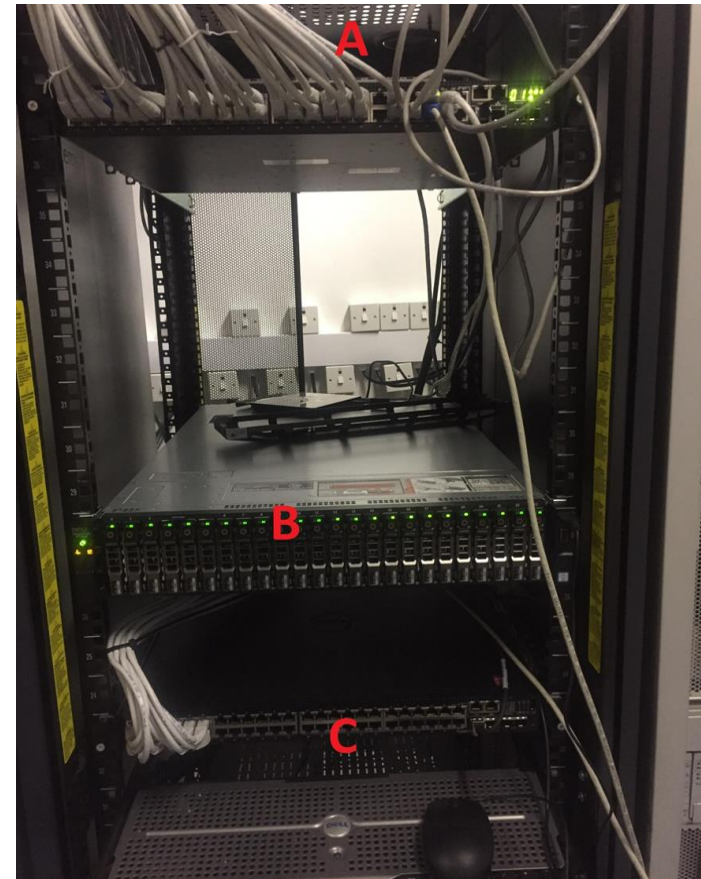


4th ANNUAL SADC INDUSTRIALISATION WEEK



	Infrastructure			Staff		
	Power & Cooling	Datacentre ID'ed	Equipment Shipped	SysAdmin / Linux	Dedicated time	SysAdmin Course
Mauritius : University of Mauritius (UoM)	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Namibia : Namibia University of Science & Technology (NUST)	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Botswana : University of Botswana (UB)	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Namibia : University of Namibia (UNAM)	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Zambia : ZAMREN	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Madagascar : University of Antananarivo (IOGA)		✓✓	✓✓	✓	✓	✓
Ghana : GSSTI	✓✓	✓✓	✓✓	✓	✓✓	✓
Mozambique : MoRENet	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Kenya : NACOSTI	✓	✓✓			✓✓	

University of Botswana HPC Cluster



ZIMBABWE CHPC



Cluster deployed in Ghana



SADC-TACC Workshop@TACC



19 Southern African scholars attend workshop at TACC – Source Stem-Trek

4th ANNUAL SADC INDUSTRIALISATION WEEK

SADC Delegates @ SC'15



 www.sadc.int  facebook.com/sadc.int  [sadc_news](https://twitter.com/sadc_news)  youtube.com/sadc.int [#SIW2019](https://twitter.com/SIW2019)



4th ANNUAL SADC INDUSTRIALISATION WEEK

US/Pan-African Workshop: HPC On Common Ground @ SC16



4th ANNUAL SADC INDUSTRIALISATION WEEK

Understanding Risk in Shared CyberEcosystems (URISC@SC17) in Denver, Colorado-US.



4th ANNUAL SADC INDUSTRIALISATION WEEK

Building the Skills

ISC'13 Champions



ISC'14 Champions



ISC'15 Runner-Up



ISC'16 Champions



ISC'17 2nd Place

ISC'18 3rd Place

ISC'19 1st Place

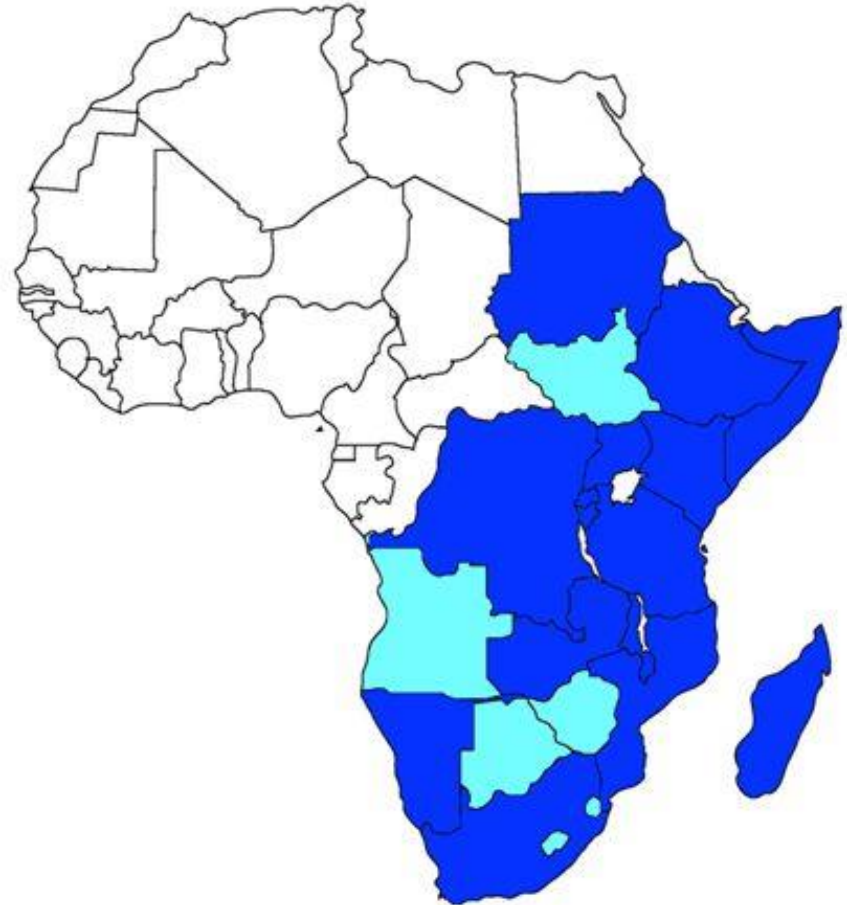
What is Ubuntunet Alliance?

- The regional Research and Education Network of Eastern and Southern Africa

(ESA) region

- NRENs from 15 countries

- TERNET, Tanzania
- Eb@le, DRC
- EthERNet, Ethiopia
- iRENALA, Madagascar
- KENET, Kenya
- MAREN, Malawi
- MoRENet, Mozambique
- XNet, Namibia
- RwEdNet, Rwanda
- SomaliREN, Somalia
- SudREN, Sudan
- TENET, South Africa
- RENU, Uganda
- ZAMREN, Zambia
- BERNET, Burundi



- Operates **UbuntuNet**, the data network interconnecting member NRENs



UbuntuNet
Alliance



Conclusion

- **Cyber-infrastructure will play a critical role in enhancing industrial development in SADC**
- **The development in Cyber-Infrastructure and skills is visible for research institutions and need to be harnessed for industrial development**
- **To enhance easy access to data, which will be key to FIR technologies, cross country connectivity need to be addressed as a matter of urgency.**
- **A regional infrastructure plan will ensure sustainability, and should be given priority.**

4th ANNUAL SADC INDUSTRIALISATION WEEK



Email: hsithole@csir.co.za
Webiste: www.chpc.ac.za

HOSTED BY



Ministry of
Industry
and Trade

CO-ORGANISED BY



As the host of the
SADC Business
Council

SPONSORED BY





 www.sadc.int  facebook.com/sadc.int  [sadc_news](https://twitter.com/sadc_news)  youtube.com/sadc.int #SIW2019



BACK-UP SLIDES

[Total Life Time Hours of Lengau: 537 million]

(La

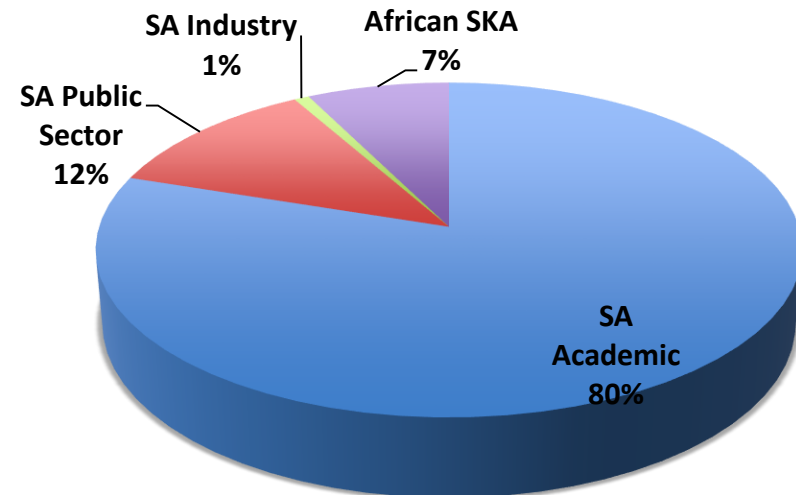
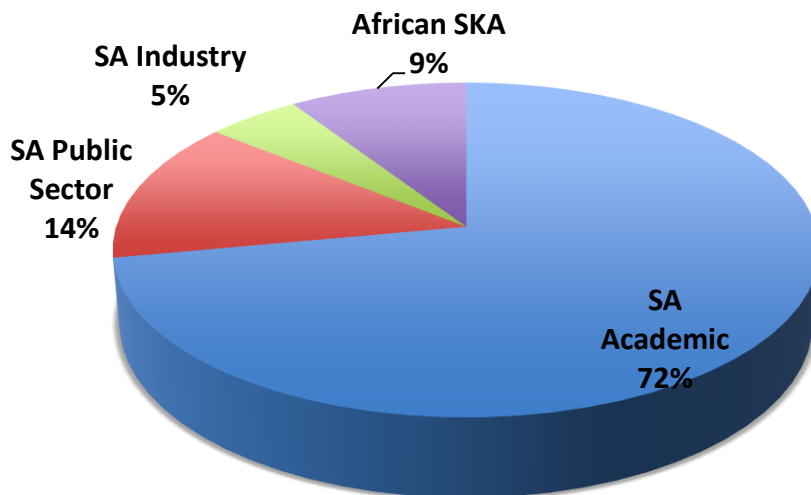
19 Jan – 18 Jul 2019

Research Programmes

210 Active Programmes

Core Hours

97 million hours



SOUTH AFRICAN ACADEMIC:

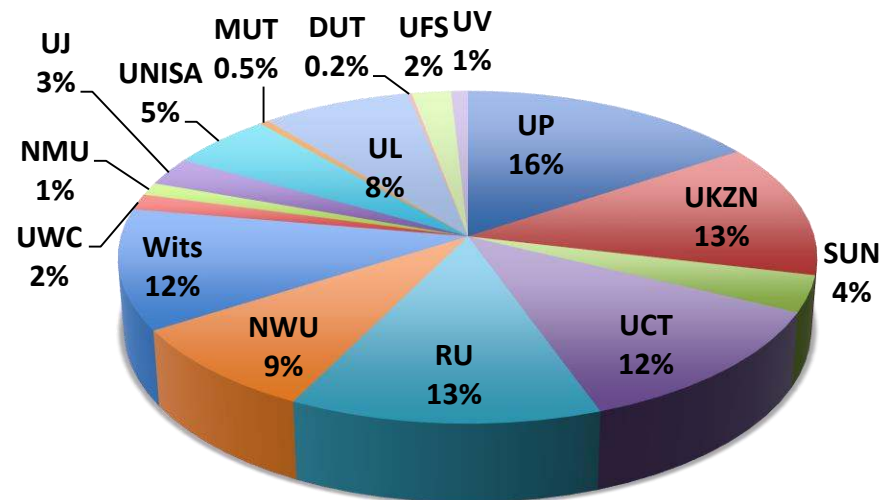
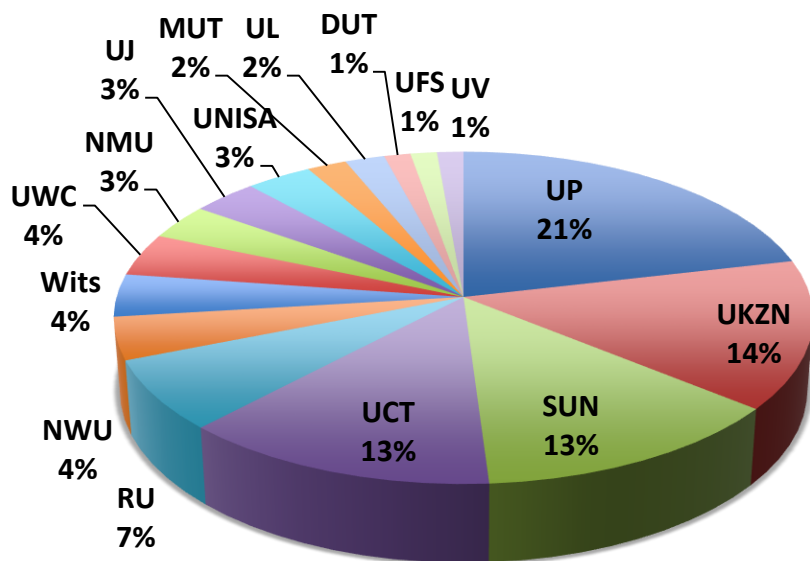
19 Jan – 18 Jul 2019

Research Programmes

151 Active Programmes

Core Hours

78 million hours



SOUTH AFRICAN PUBLIC

19 Jan – 18 Jul 2019

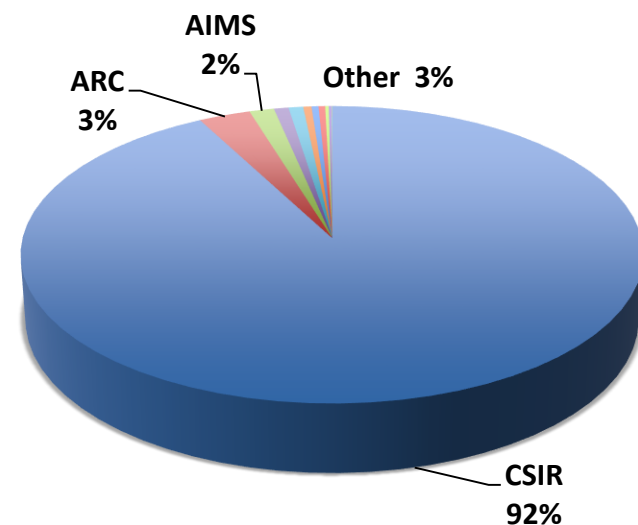
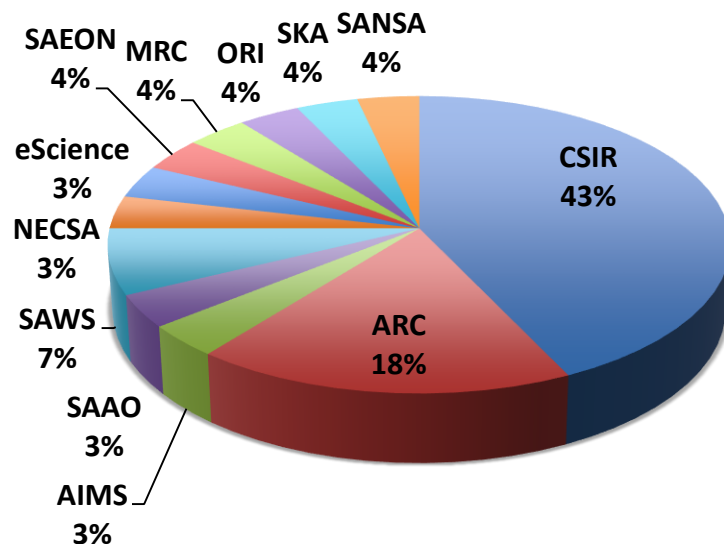
SECTOR:

Research Programmes

29 Active Programmes

Core Hours

11 million hours



SOUTH AFRICAN INDUSTRY

19 Jan – 18 Jul 2019

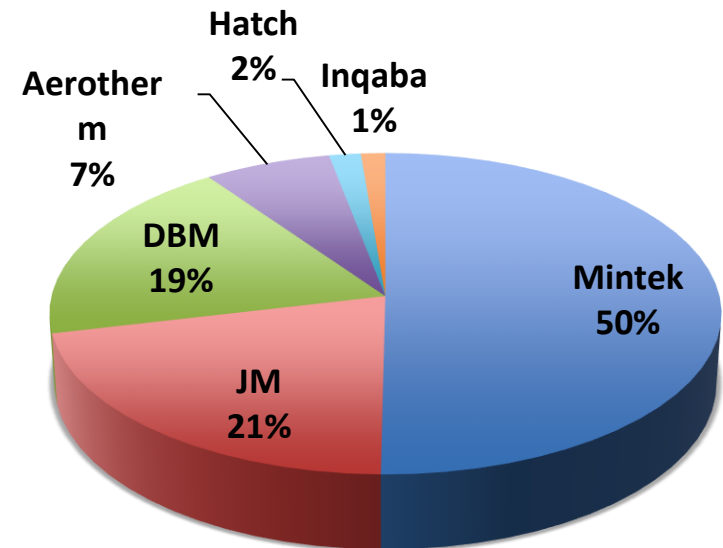
SECTOR:

Research Programmes

10 Active Programmes

Core Hours

1 million hours



Users at the CHPC Institutions

4th ANNUAL SADC INDUSTRIALISATION WEEK

AFRICAN SKA PARTNERS:

(La

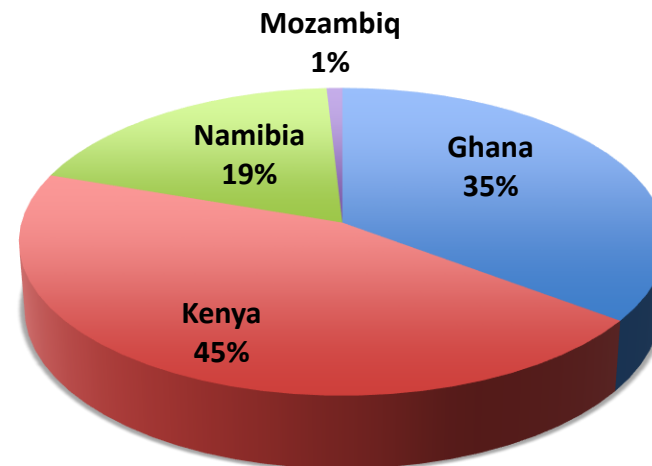
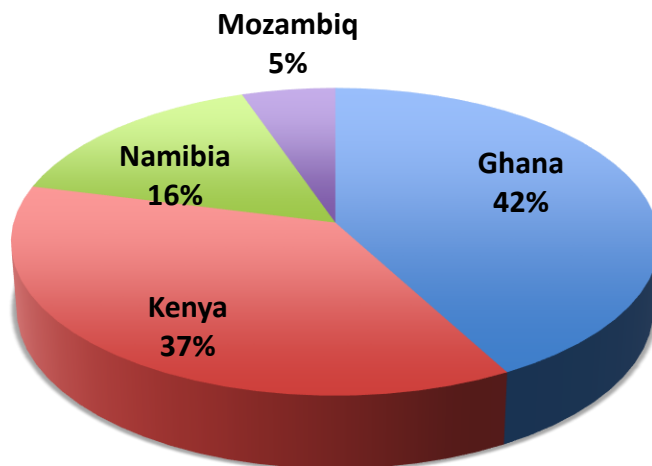
19 Jan – 18 Jul 2019

Research Programmes

19 Active Programmes

Core Hours

7 million hours



CFD Design of High Speed Trains for Transnet



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

TRANSNET

