

Developments in African Cyber-infrastructure to Support Open Science & Open Data

Policy | Infrastructure | Data | Skills | Collaborations | Partnerships
Tshiamo Motshegwa, Computer Science, University Of Botswana

On behalf of SADC CI Expert Working Group, ODOS, AOSP

ASP Online Seminar Series, 8th September 2020



National Service & Multilateral Collaborations Engagements

- Botswana Space Science & Technology Strategy
- Botswana SKA, AVN Technical Committee
- Botswana – South African Joint Commission of RSTI
- Botswana Human Resource Development Council
- Botswana Open Data Open Science (ODOS)
- African Open Science Platform (AOSP)
- SADC Cyber-infrastructure Framework & HPC Ecosystems
- SADC ICT Thematic Group
- Pan African & International Conferences Organising
 - International Data Week - IDW & ScidataCon-IDW 2018
 - International Conference of Internet, Cybersecurity & Information Systems
 - IST-Africa
 - VizAfrica – Data Visualisation
 - HELINA

About Botswana



- Member of SADC
- Population 2,2 Million
- GDP \$13.09 billion* 30% From Diamonds
- GDP (purchasing power parity) per capita of about \$18,825
- Real growth rate: 3.9%
- Best credit risk in Africa Standard & Poor's , Moody's

- Revenues: \$5.078 billion
- Expenditure: \$5.55 billion (2015 est.)
- “Middle Income” country Turkey/Mexico
- Official unemployment reached 17.8%
- Population below poverty line 30%
- Mobile penetration 159%
- Fixed 8.6%

Home of World Heritage Sites: The Great Okavango Delta from Space



Astronaut photograph ISS040-E-8209. Taken by the Expedition 40 crew [Source <http://earthobservatory.nasa.gov/>]



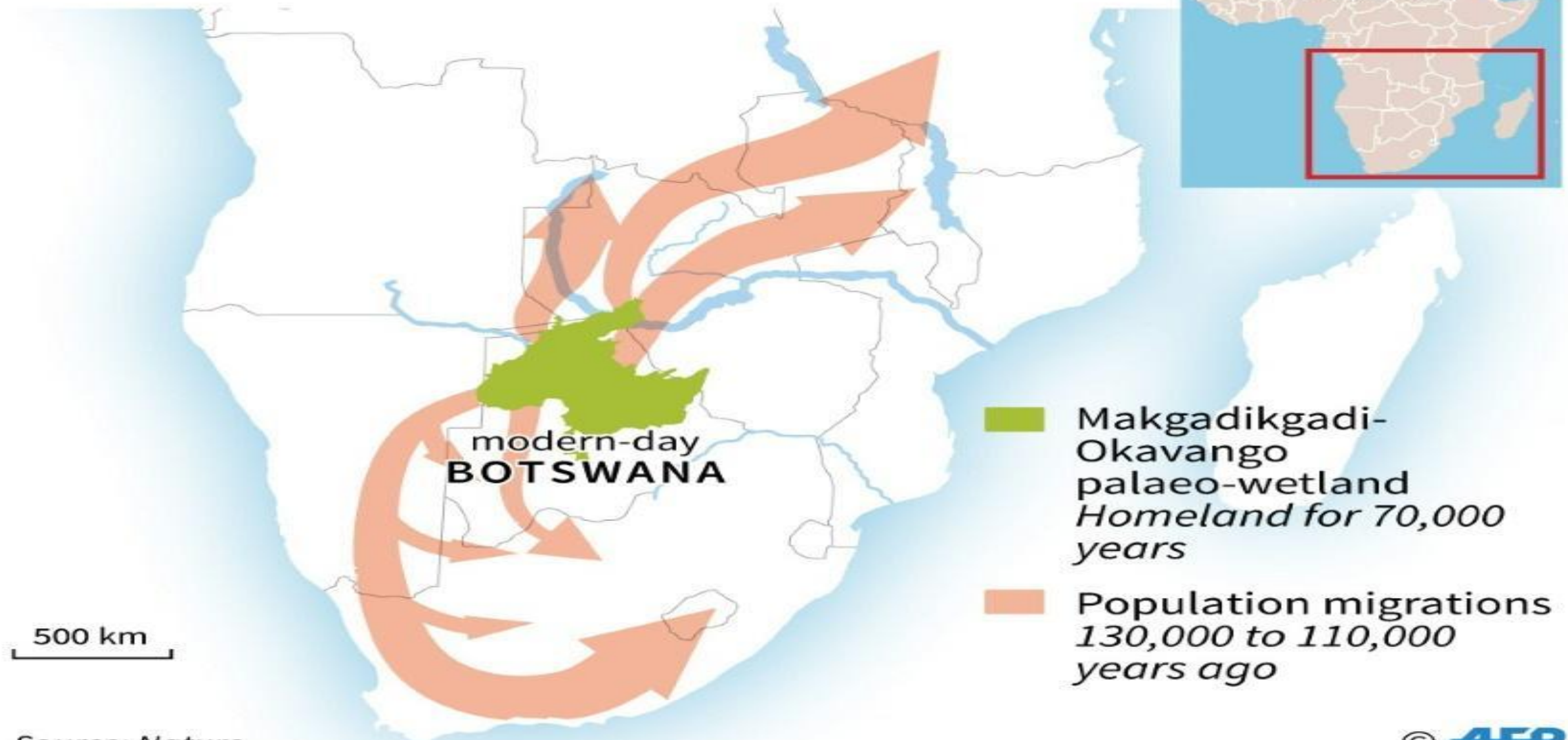
Okavango Delta and Makgadikgadi Pans

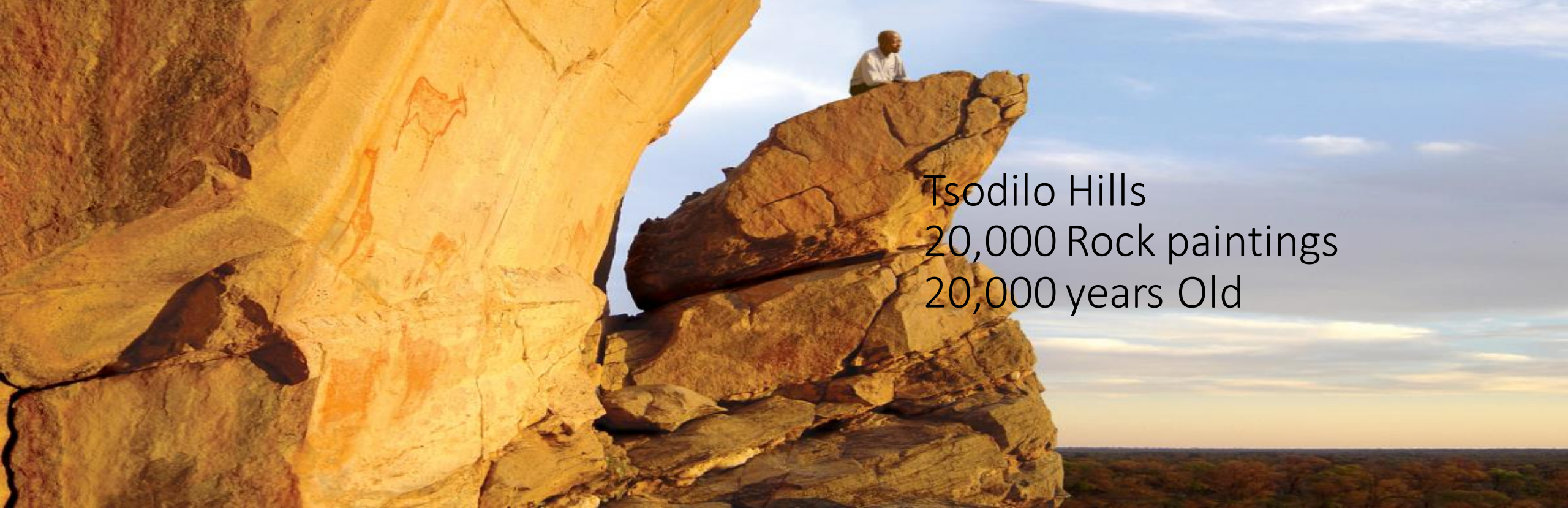




The earliest modern humans

Origins and population dispersal





Tsodilo Hills
20,000 Rock paintings
20,000 years Old

Largest & Most Valuable Diamond Mines



[Home](#) » [News](#) » [General](#) » Lesedi La Rona sold for over 500 million Pula

Lesedi La Rona sold for over 500 million Pula

Author : REARABILWE RAMAPHANE

Publishing Date : 24 October, 2017

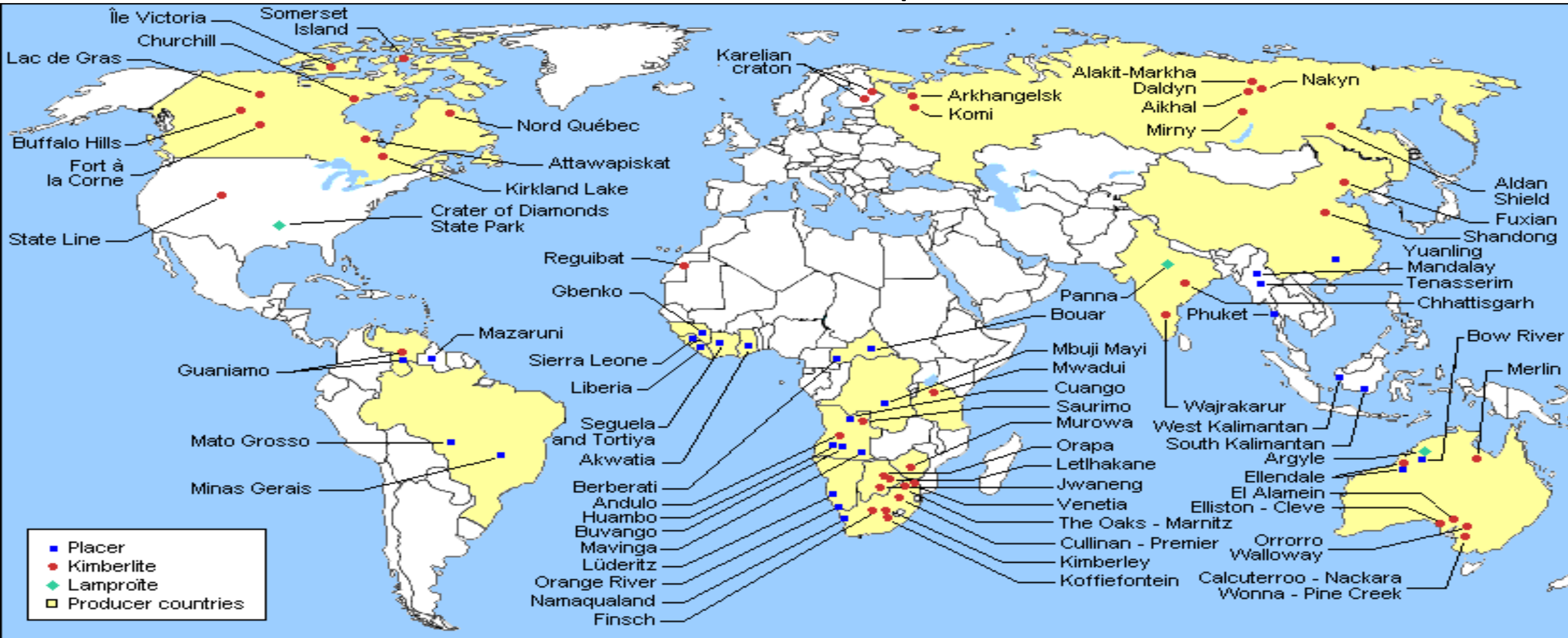


Canadian based Lucara Diamond Corporation earlier this week announced the successful sale of the historic 1,109 carat diamond, *Lesedi La Rona* for US\$53 million to a London based British multinational jeweller.

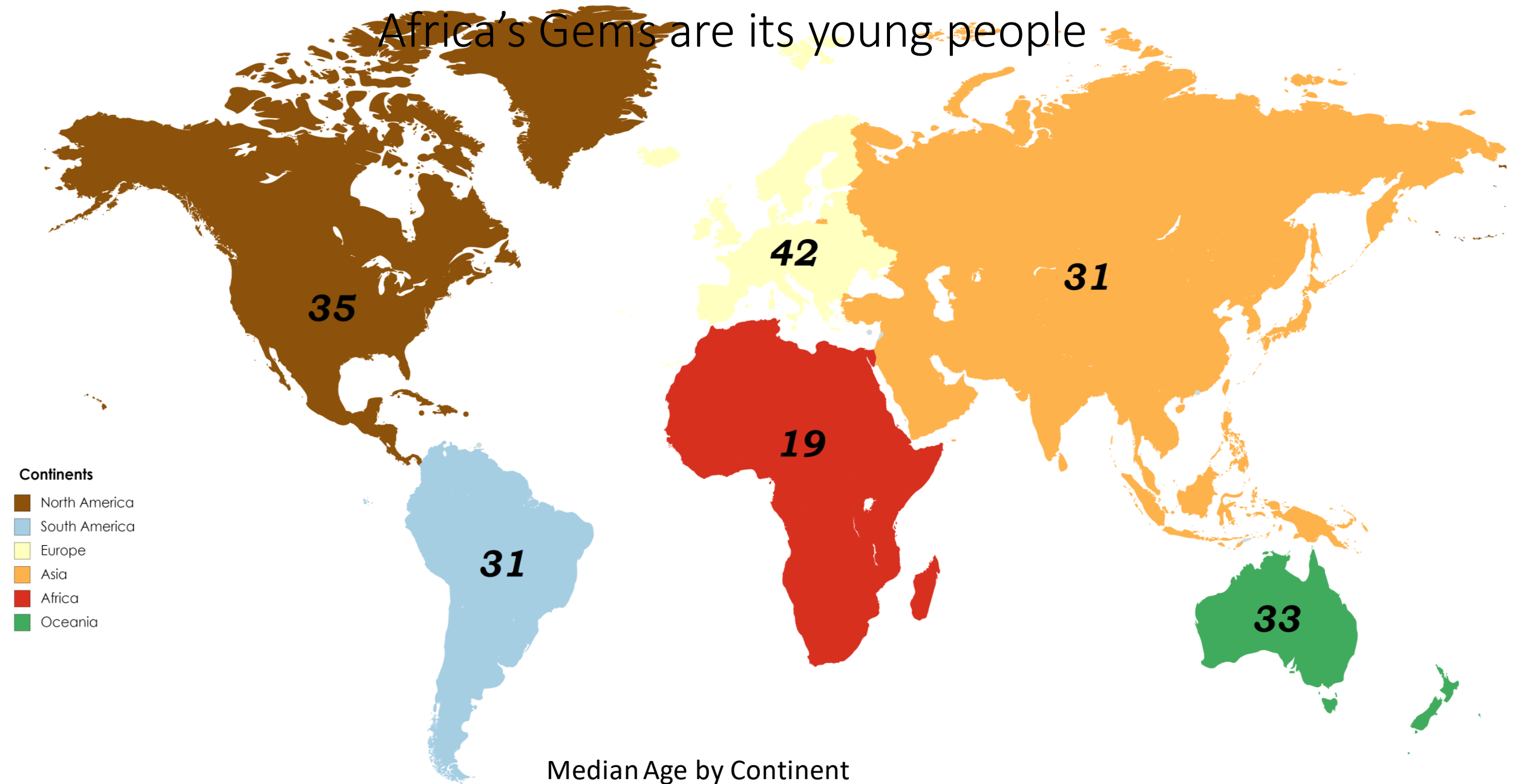


Search for the next big mine?

Worldwide Diamondiferous Deposits

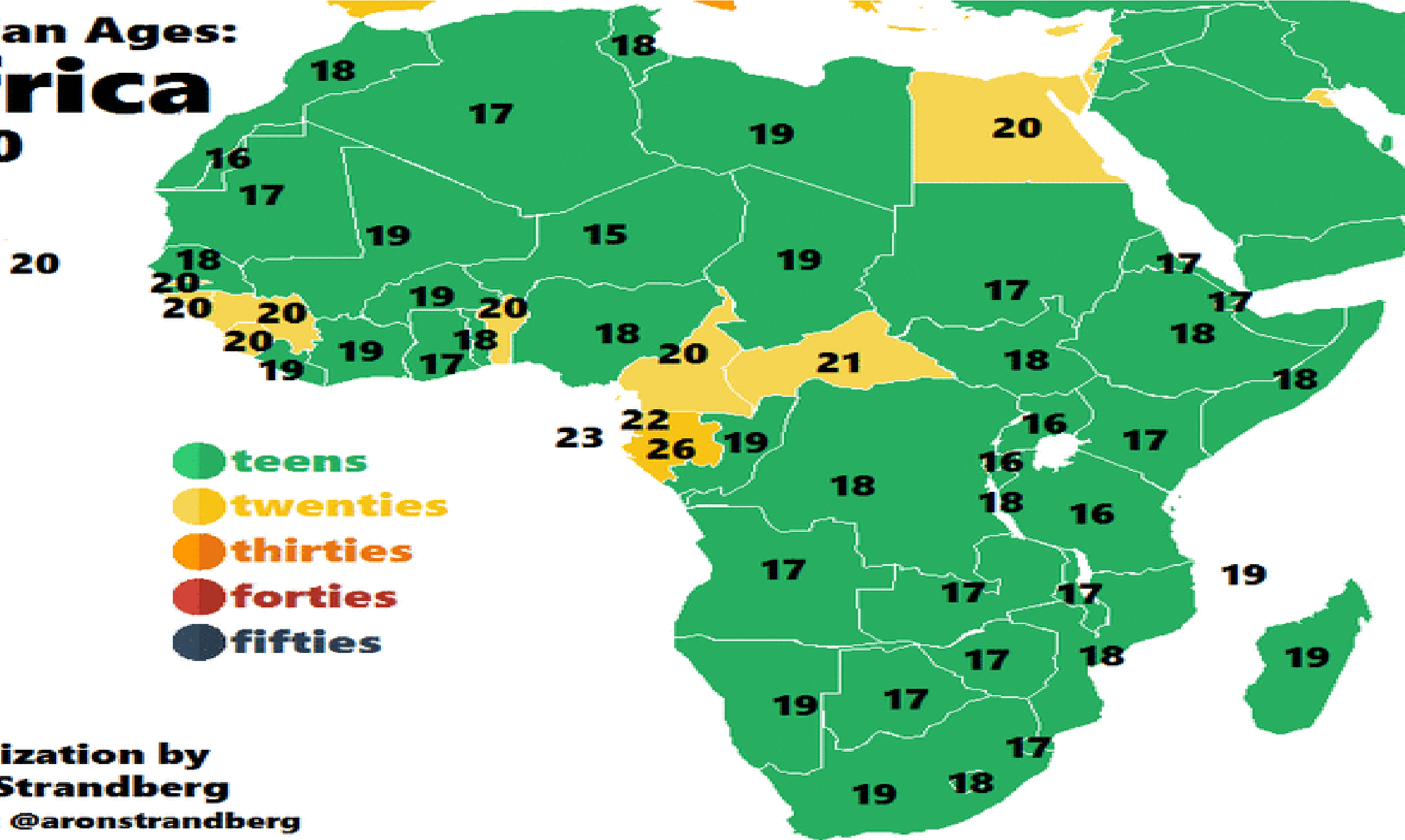


Africa's Gems are its young people



Median Age by Continent

Median Ages: **Africa** 1960



Visualization by
Aron Strandberg

Twitter: @aronstrandberg

Source: UN World Population Prospects

<https://www.pinterest.com/pin/657947826783865157/>



About University of Botswana (UB)



- Largest, oldest established university in Botswana,
- 7 Established Faculties & Schools
- Science, Engineering and Technology, Faculty of Health Sciences, School of Medicine, Business, Humanities, Social Sciences.
- School of graduate Studies & Well-resourced Library
 - 5 Stories high, 460,000 Books, 123,000 Full Text Journals, 200 Workstations
- Office of Research & Development
 - Small commercialization unit, Research management systems,
 - Digital Repository for university research
 - No research data repository
 - No Data sharing policy
 - No research data infrastructure roadmap
- 9 Research Centres (inc Okavango Research Institute)
- A detailed University Research Strategy approved 2008,
- Strategic goals and vision for research intensive institution.



African Aspirations & Visions and RSTI

Agenda 2063

The Africa we Want



SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

Regional Indicative Strategic Development Plan



STISA-2024



SCIENCE, TECHNOLOGY
AND INNOVATION STRATEGY
FOR AFRICA 2024

SUSTAINABLE DEVELOPMENT GOALS

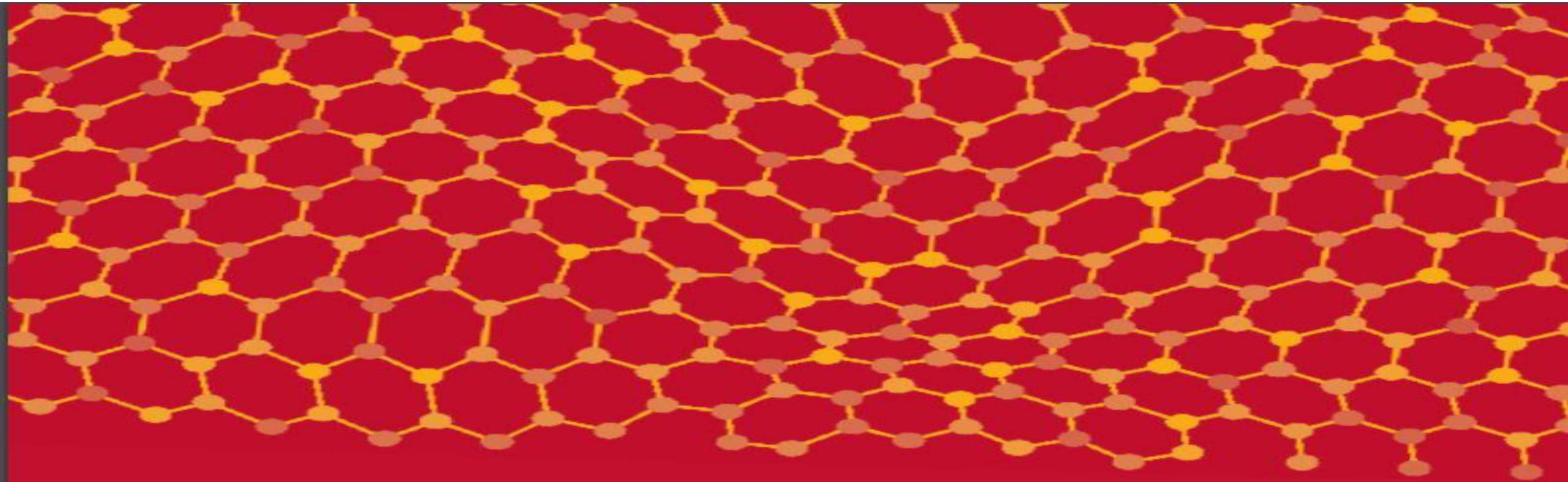


VISION

2036

Achieving Prosperity For All

Patterns & Trends - research Collaborations



Knowledge, networks and nations
Global scientific collaboration in the 21st century

EXCELLENCE
IN SCIENCE



THE ROYAL SOCIETY

Figure 2.3. **Global collaboration** see footnote 168
Fig a. 1996-2000

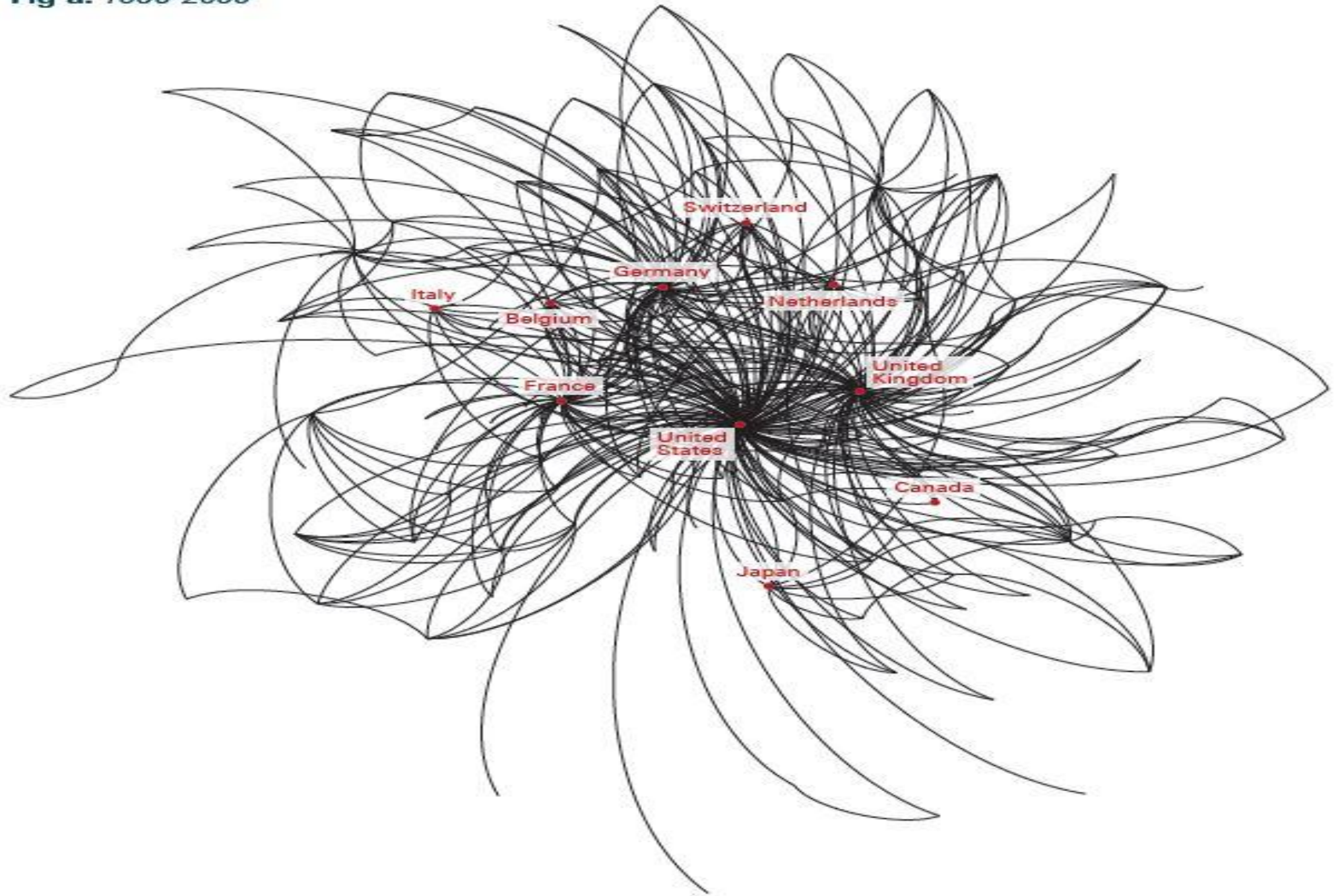


Fig b. 2004-2008

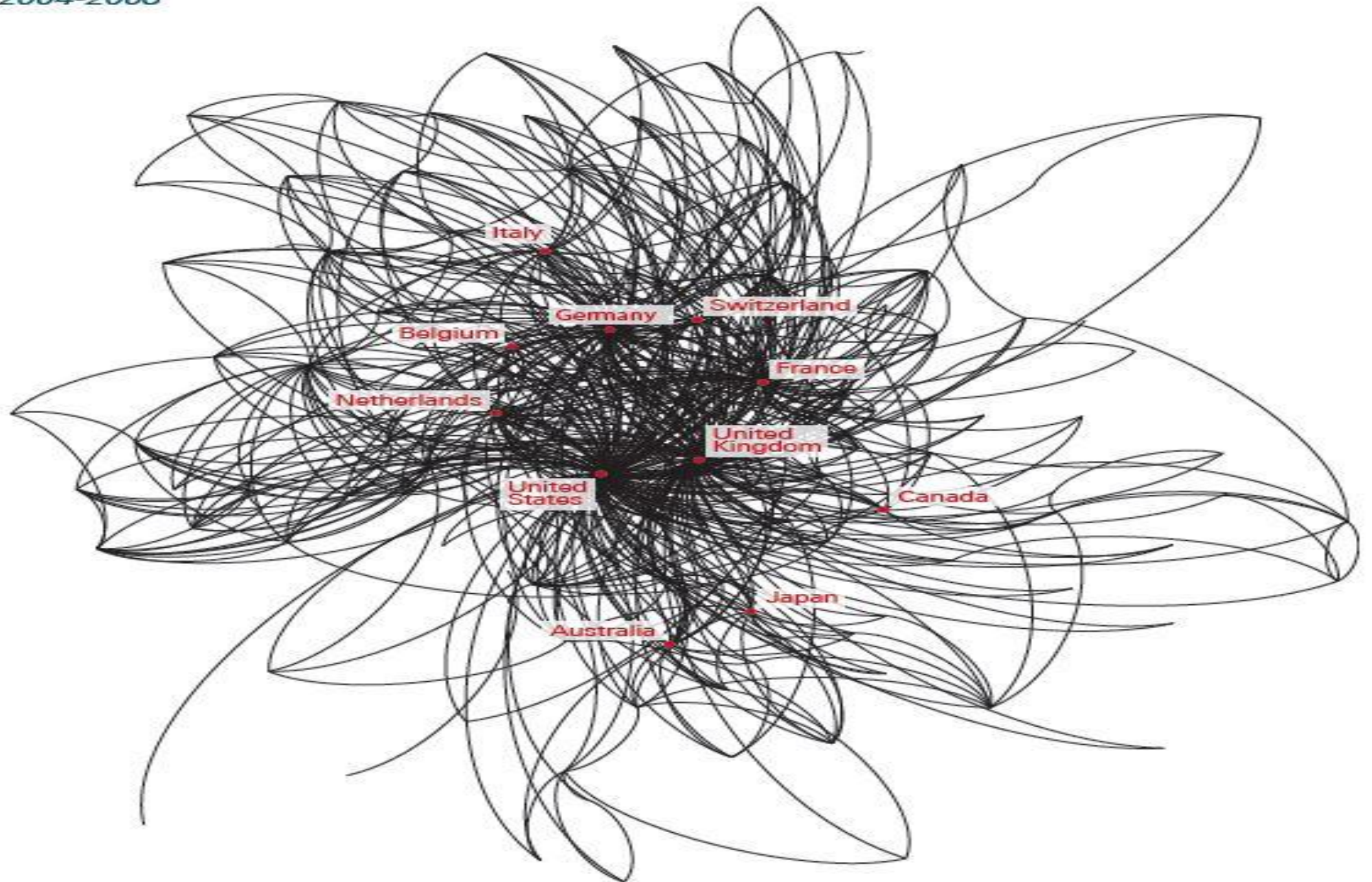


Figure 2.4. Collaboration between African countries¹⁶⁹
Fig a. 1996-2000

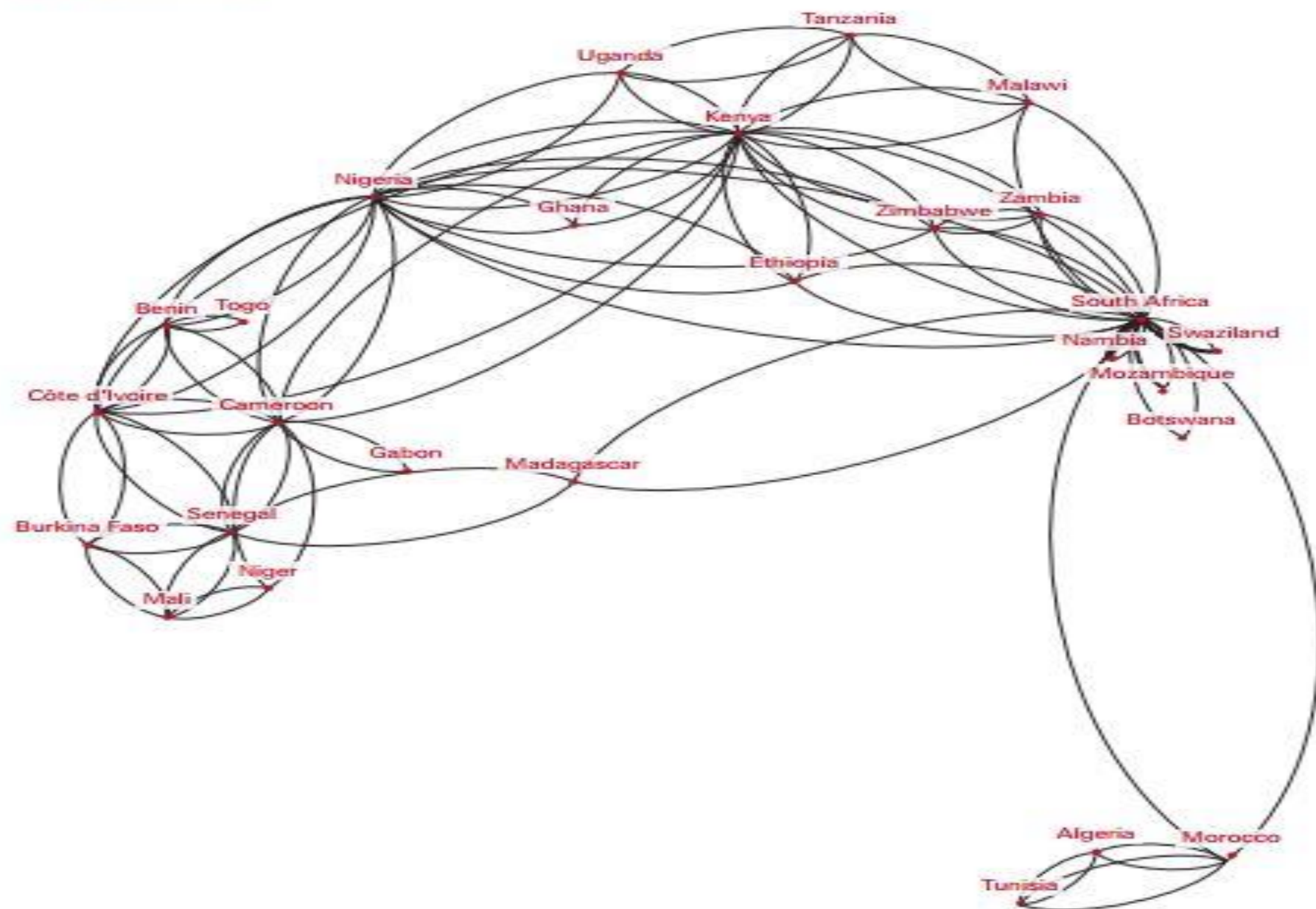
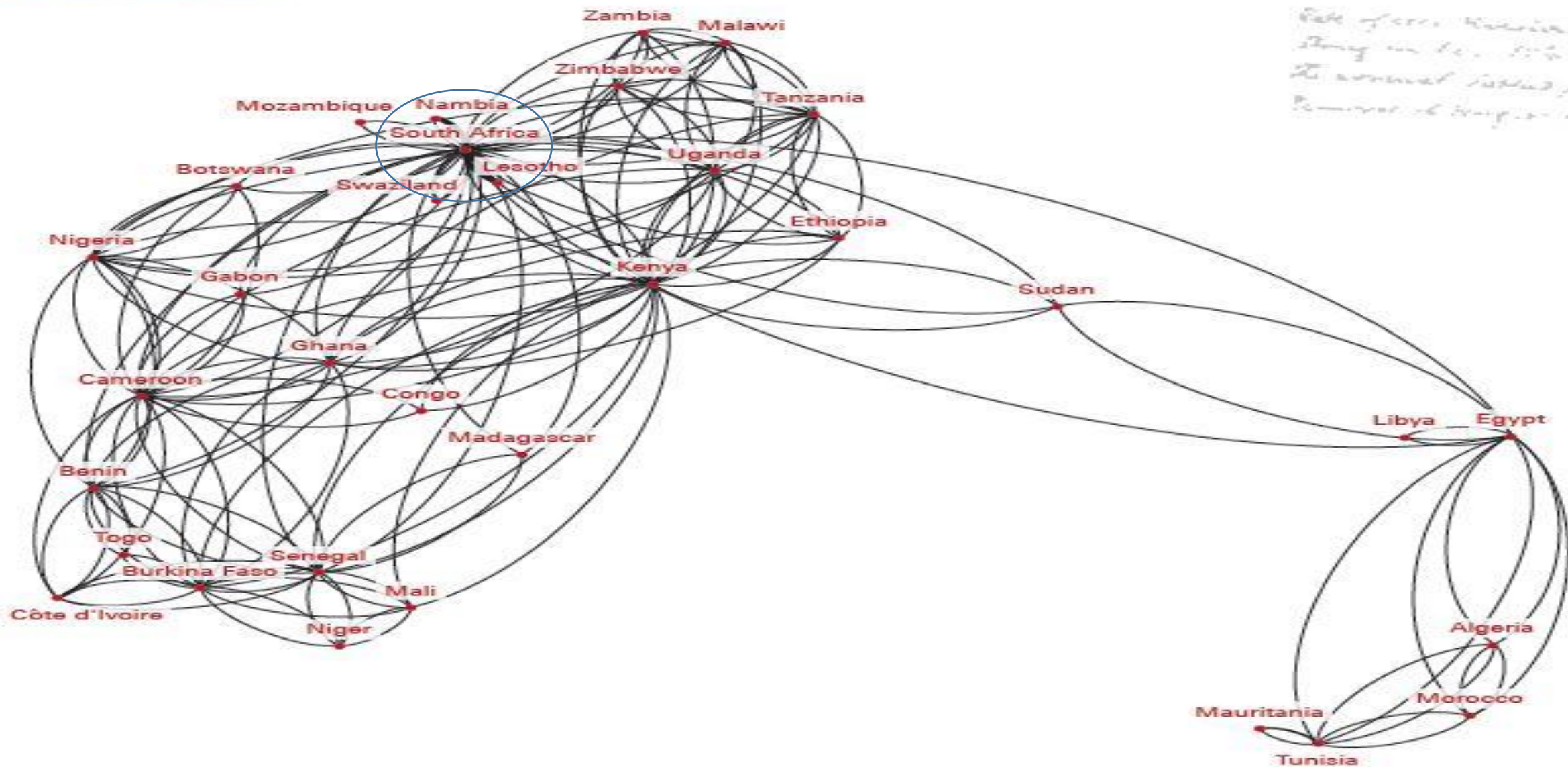


Fig b. 2004-2008



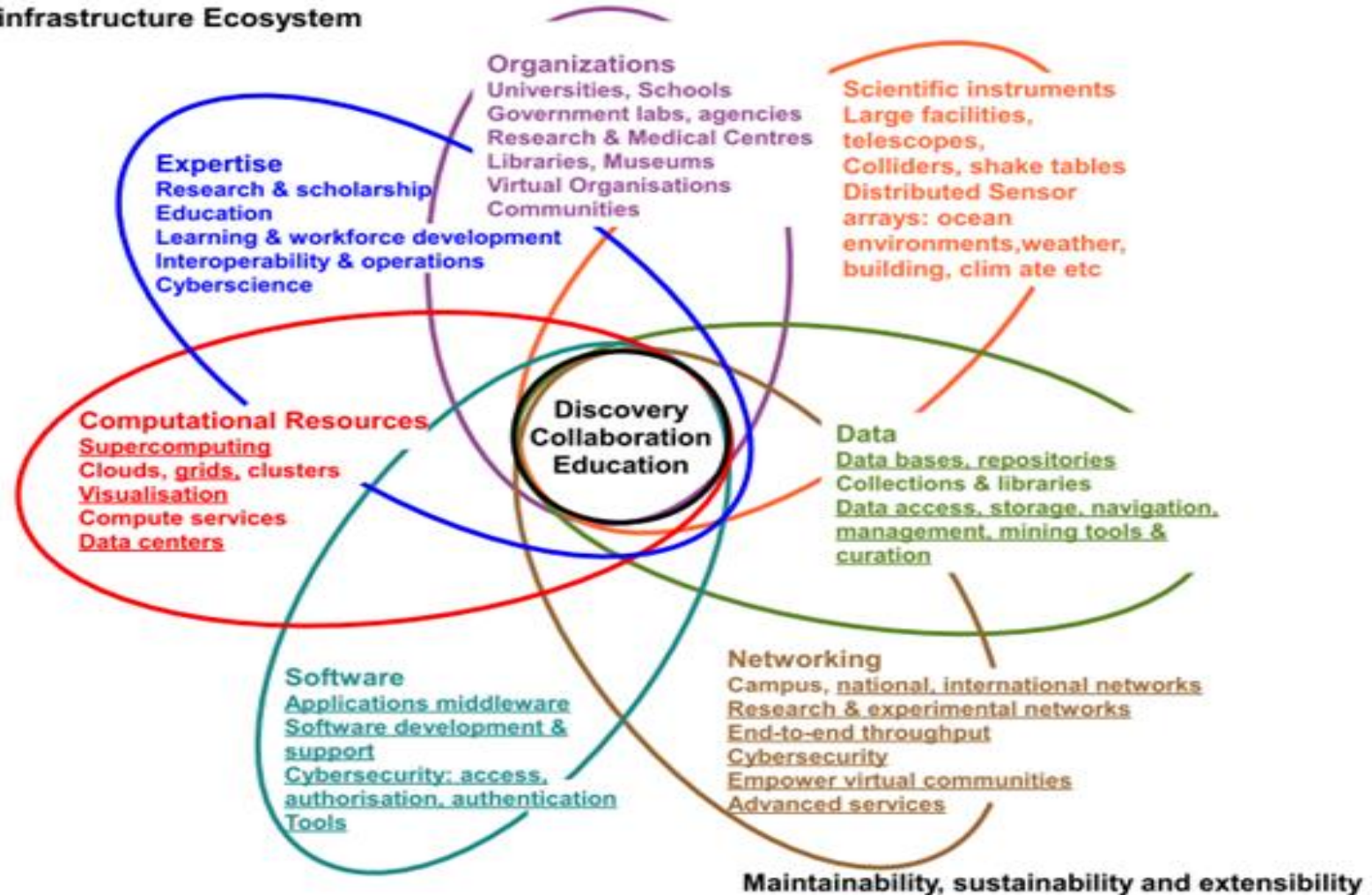
169 The methodology on producing these maps is the same as the global maps (see footnote [165]). The threshold for collaborations to be included is a minimum of 0.02% of collaborative output.

from the region—at least 13 collaborative papers between two countries in 1996–2000, and 25 papers in 2004–2008. Analysis by Elsevier based on data from Scopus.

Can Cyberinfrastructure, Open
Science, Open Data Help?

Cyberinfrastructure

Cyberinfrastructure Ecosystem



Dr Sithole's Presentation

SKA, SA Cyberinfrastructure, SADC HPC

Ecosystems

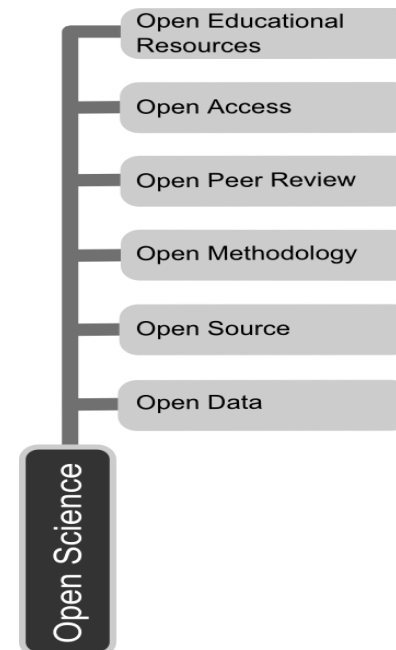
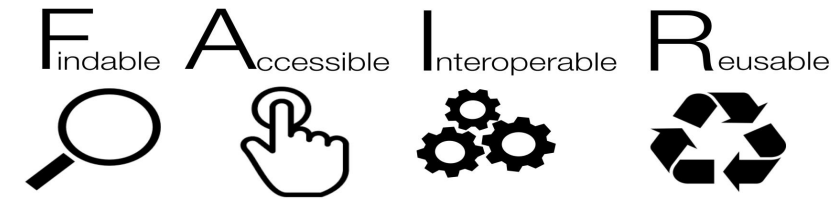
Dr Simon Hodson's Presentation

Open Data, Open Science & CODATA



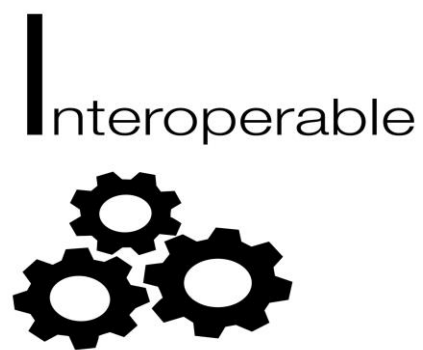
Open Science

- Open access to research literature.
- Data that is as Open as possible, as closed as necessary.
- FAIR Data (Findable, Accessible, Interoperable, Reusable).
- Data is a recognised and important output of research.
- A culture and methodology of open discussion and enquiry (including methodology, lab notebooks, pre-prints).
- Data code and analysis processes are shared for reproducibility.
- Engagement with society and the economy in research activities (citizen science, co-design / transdisciplinary research, interface between research, development and innovation).



Emerging Consensus on FAIR Data

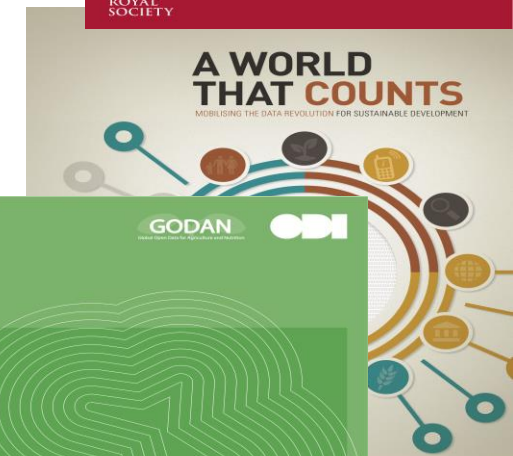
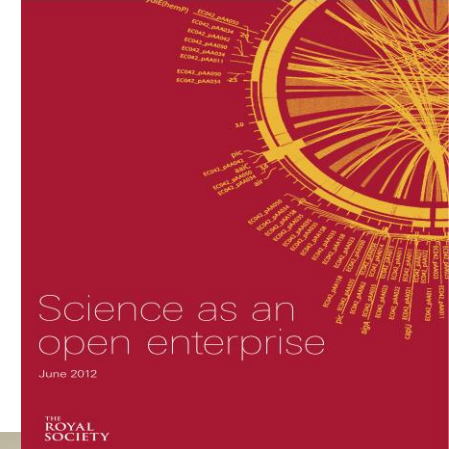
- **FAIR Data** (see original guiding principles at <https://www.force11.org/node/6062>)
 - **Findable:** have sufficiently rich metadata and a unique and persistent identifier.
 - **Accessible:** retrievable by humans and machines through a standard protocol; open and free by default; authentication and authorization where necessary.
 - **Interoperable:** metadata use a ‘formal, accessible, shared, and broadly applicable language for knowledge representation’.
 - **Reusable:** metadata provide rich and accurate information; clear usage license; detailed provenance.





Why Open Science / FAIR Data?

- **Good scientific practice depends on communicating the evidence.**
 - Open research data are essential for reproducibility, self-correction.
 - Academic publishing has not kept up with age of digital data.
 - Danger of an replication / evidence / credibility gap.
 - Boulton: to fail to communicate the data that supports scientific assertions is malpractice
- **Open data practices have transformed certain areas of research.**
 - Genomics and related biomedical sciences; crystallography; **astronomy; areas of earth systems science; various disciplines using remote sensing data...**
 - **FAIR data helps use of data at scale, by machines, harnessing technological potential.**
 - Research data often have considerable potential for reuse, reinterpretation, use in different studies.
- **Open data foster innovation and accelerate scientific discovery through reuse of data within and outside the academic system.**
 - Research data produced by publicly funded research are a public asset.





Open Science and FAIR Data: Benefits for Stakeholders

- **Government and Innovation / Development**
 - Increased impact from investment in activities relating to data; economic, innovation and research benefits.
 - Partnerships for research, development and innovation around co-design, Open Science and FAIR data.
- **Research Institutions:**
 - Development of data capacity and data skills;
 - Not losing valuable data (stored on hard drives, not annotated or reusable);
 - Shop window of research activities and expertise (Open Access, Open Data / FAIR Data)
 - Capacity to build research schools around data assets and skills, attract international collaboration and investment.
 - Build case for 'data sovereignty', data (re-)patriation.
- **Researchers:**
 - Increased data skills, expertise in FAIR data builds competitive edge.
 - Citation advantage of Open Access / Open Data.
 - Culture of certain research disciplines is already strongly in favour of Open Data / Open Science.

Astronomical Data & AstroInformatics?

SKA Data Requirements & African Countries Preparedness

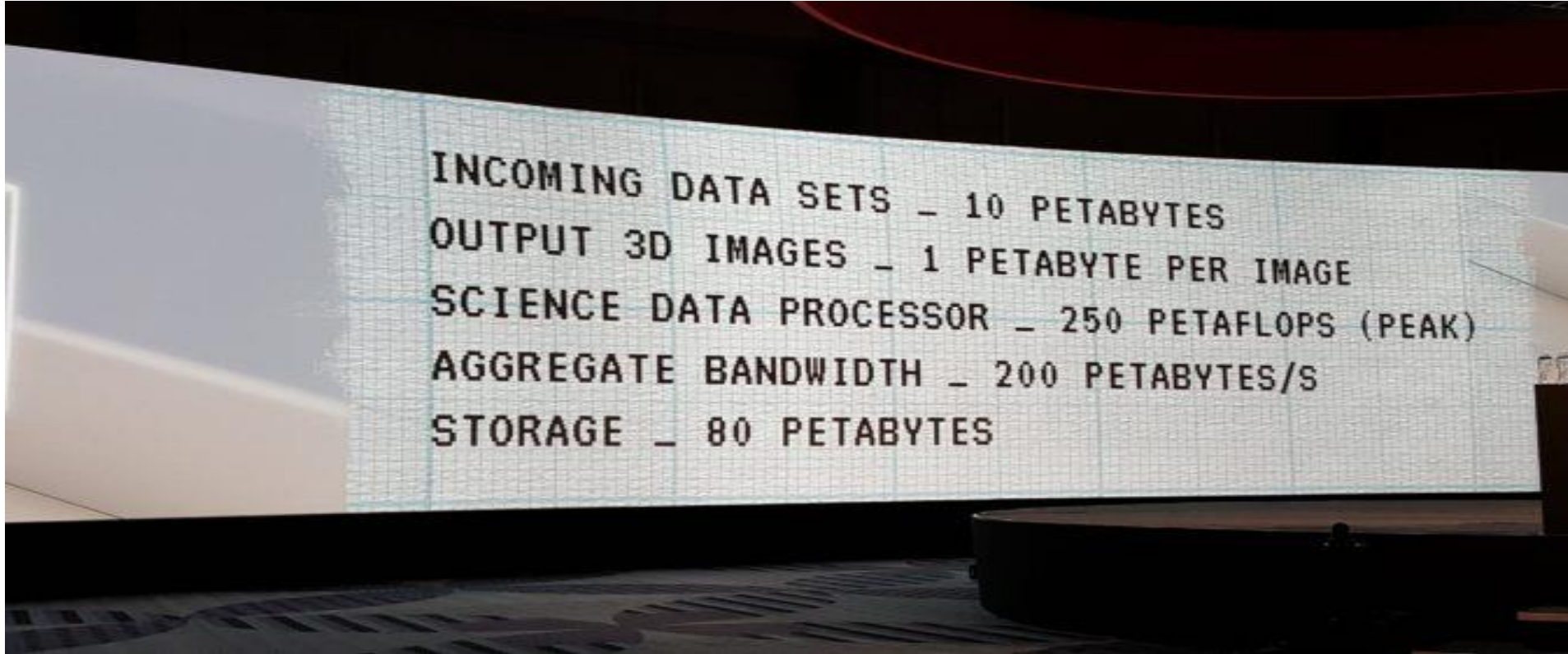


Figure 2 Showing SKA Data requirements [Source HPCWire and Philip Diamond, Director General of SKA, and Rosie Bolton, SKA Regional Centre Project Scientist Superecomputing, SC17, Keynote talk 17th November, 2017, Denver, Colorado, USA].

<https://www.hpcwire.com/2017/11/17/sc17-keynote-hpc-powers-ska-efforts-peer-deep-cosmos/>

Astronomy Data

THESIS: Challenging problems are
publishing data, providing good query & visualization
tools

Example Queries

- Q1: Find all galaxies without unsaturated pixels within 1' of a given point of $ra=75.327$, $dec=21.023$
- Q2: Find all galaxies with blue surface brightness between 23 and 25 mag per square arcseconds, and $-10 < \text{super galactic latitude (sgb)} < 10$, and declination less than zero.
- Q3: Find all galaxies brighter than magnitude 22, where the local extinction is >0.75 .
- Q4: Find galaxies with an isophotal surface brightness (SB) larger than 24 in the red band, with an ellipticity >0.5 , and with the major axis of the ellipse having a declination of between 30" and 60" arc seconds.
- Q5: Find all galaxies with a deVaucouleurs profile ($r^{1/4}$ falloff of intensity on disk) and the photometric colors consistent with an elliptical galaxy. The deVaucouleurs profile
- Q6: Find galaxies that are blended with a star, output the deblended galaxy magnitudes.
- Q7: Provide a list of star-like objects that are 1% rare.
- Q8: Find all objects with unclassified spectra.
- Q9: Find quasars with a line width >2000 km/s and $2.5 < \text{redshift} < 2.7$.
- Q10: Find galaxies with spectra that have an equivalent width in H α $>40\text{\AA}$ (H α is the main hydrogen spectral line.)
- Q11: Find all elliptical galaxies with spectra that have an anomalous emission line.
- Q12: Create a grided count of galaxies with $u-g > 1$ and $r < 21.5$ over $60 < \text{declination} < 70$, and $200 < \text{right ascension} < 210$, on a grid of 2', and create a map of masks over the same grid.
- Q13: Create a count of galaxies for each of the HTM triangles which satisfy a certain color cut, like $0.7u - 0.5g - 0.2i < 1.25$ && $r < 21.75$, output it in a form adequate for visualization.
- Q14: Find stars with multiple measurements and have magnitude variations >0.1 . Scan for stars that have a secondary object (observed at a different time) and compare their magnitudes.
- Q15: Provide a list of moving objects consistent with an asteroid.
- Q16: Find all objects similar to the colors of a quasar at $5.5 < \text{redshift} < 6.5$.
- Q17: Find binary stars where at least one of them has the colors of a white dwarf.
- Q18: Find all objects within 30 arcseconds of one another that have very similar colors: that is where the color ratios $u-g$, $g-r$, $r-i$ are less than 0.05m.
- Q19: Find quasars with a broad absorption line in their spectra and at least one galaxy within 10 arcseconds. Return both the quasars and the galaxies.
- Q20: For each galaxy in the BCG data set (brightest color galaxy), in $160 < \text{right ascension} < 170$, $-25 < \text{declination} < 35$ count of galaxies within 30" of it that have a photoz within 0.05 of that galaxy.

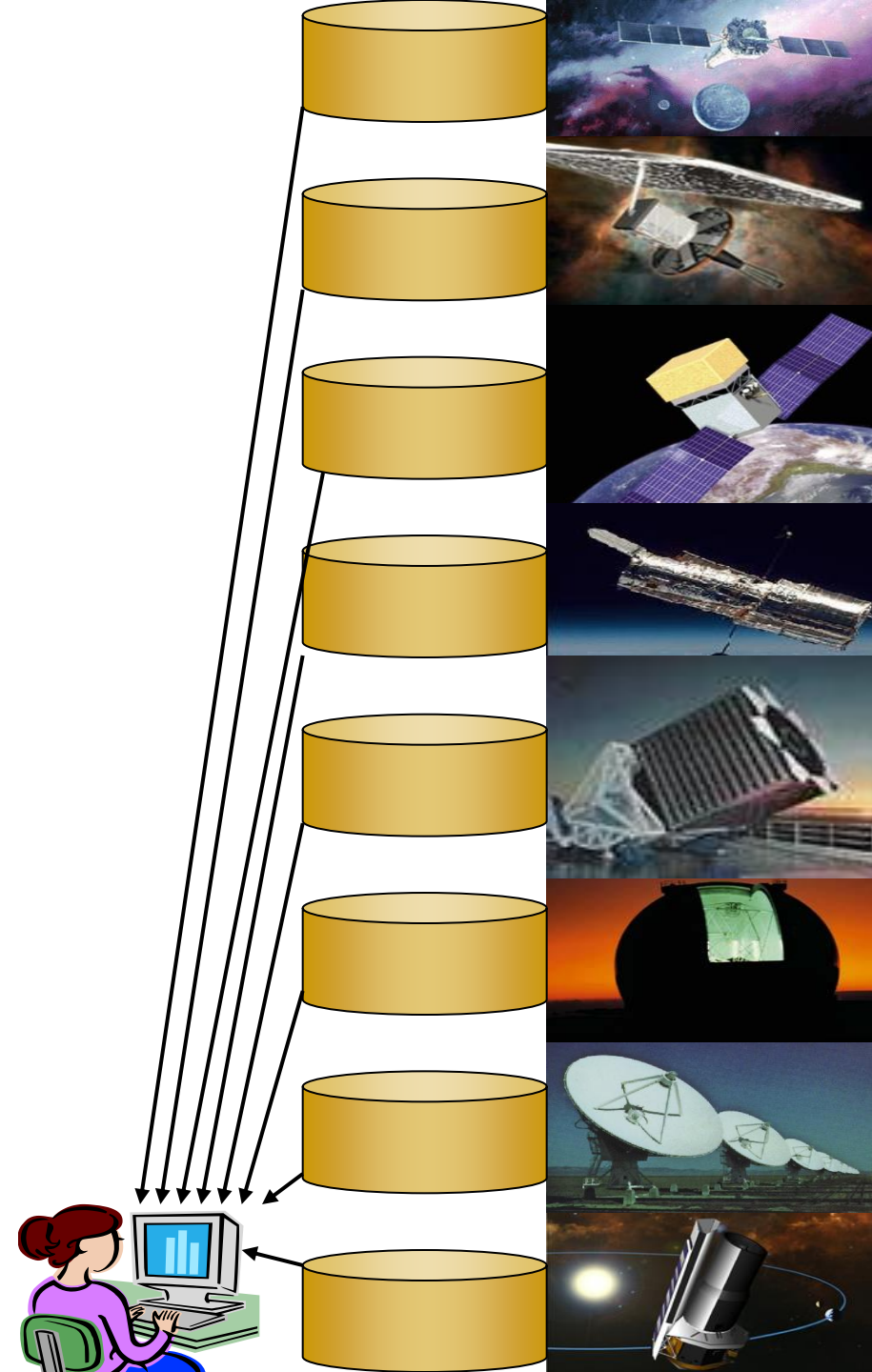
Courtesy of Jim
Gray

Also some good queries at: Sloan Digital Sky Survey <http://www.sdss.jhu.edu/>

Virtual Observatory

- Premise: Most data is (or could be online)
- So, the Internet is the world's best telescope:-
 - It has data on every part of the sky
 - In every measured spectral band: optical, x-ray, radio..
 - As deep as the best instruments (2 years ago).
 - It is up when you are up.
The "seeing" is always great
(no working at night, no clouds no moons no..).
 - It's a smart telescope:
links objects and data to literature on them.

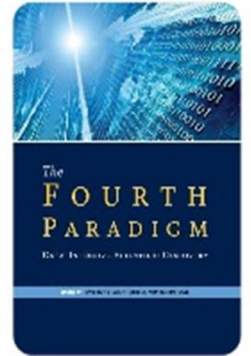
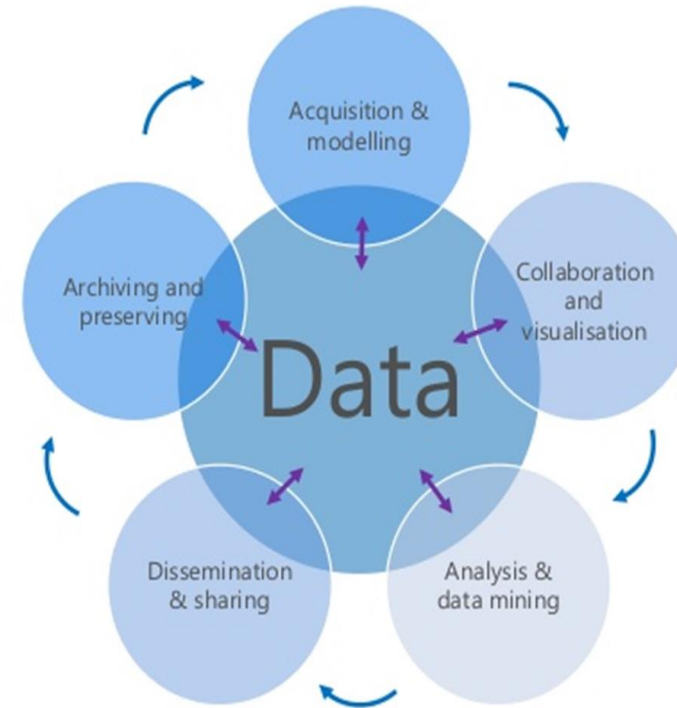
Courtesy of Jim Gray



Virtual Observatory and Education

- In the beginning science was empirical.
- Then theoretical branches evolved.
- Now, we have a computational branches.
 - The computational branch has been simulation
 - It is becoming data analysis/visualization
- The Virtual Observatory can be used to
 - **Teach astronomy:**
make it interactive,
demonstrate ideas and phenomena
 - **Teach computational science skills**

Data-intensive Research



fourthparadigm.org



Virtual Observatory Challenges

- **Size : multi-Petabyte**

40,000 square degrees is 2 Trillion pixels

- One band 4 Terabytes
- Multi-wavelength 10-100 Terabytes
- Time dimension 10 Petabytes
- Need auto parallelism tools

- **Unsolved MetaData problem**

- Hard to publish data & programs
- Hard to find/understand data & programs

- **Current tools inadequate**

- new analysis & visualization tools

- **Transition to the new astronomy**

- Sociological issues

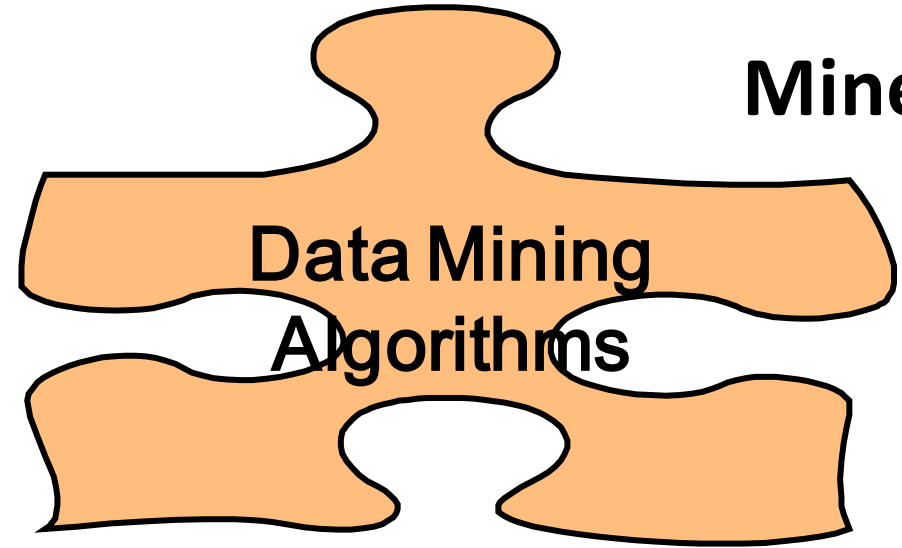
What's needed?

(not drawn to scale)

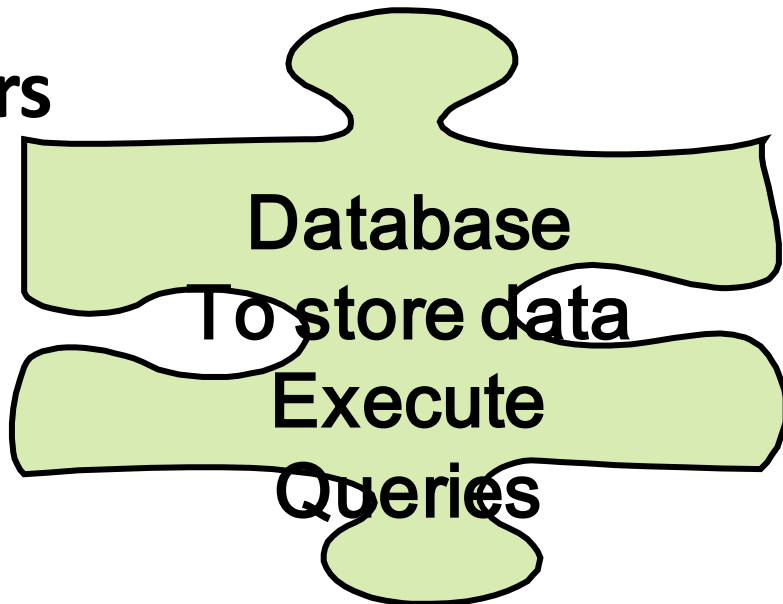
Scientists



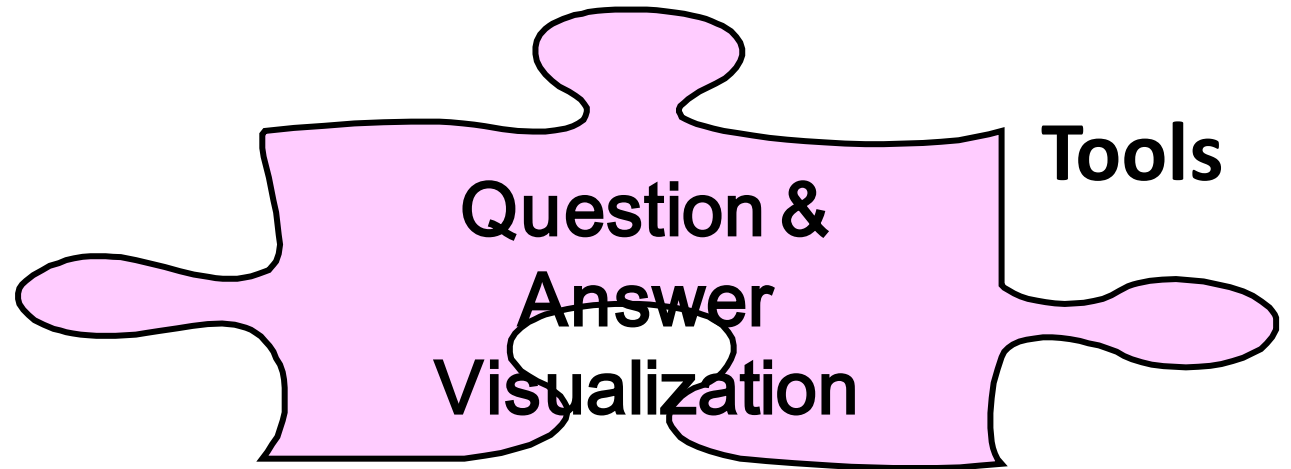
Miners



Plumbers



Tools



What are we doing in Botswana?

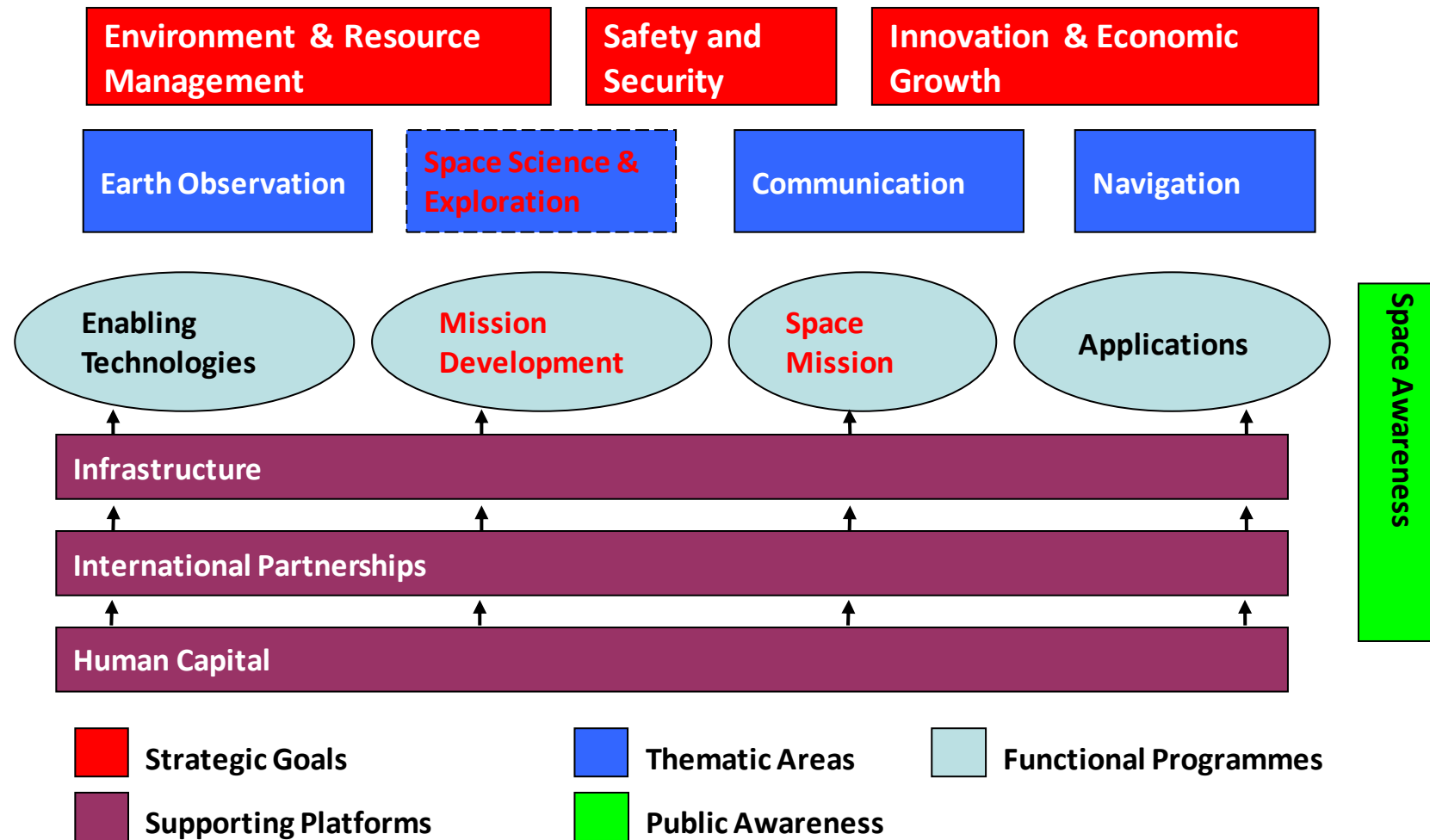
University of Botswana Cyberinfrastructure Activities

- High Performance Computing Infrastructure
 - Phase 1 (2014 - 2018) – Deployment of Texas Advanced Computing Center (TACC) Ranger based System
 - Phase 2 (2018 -) – Deployment of Texas Advanced Computing Center (TACC) Stampede based System
- Projects
 - SADC Cyberinfrastructure Regional projects – e.g. Atmospheric Physics, Weather & Climate Modelling* (next talk)
 - Participation in SADC Space Sciences Framework
- Botswana Open Data Open Science – National Dialogue on Data & Policy
 - Data Legislation, Governance and Policy;
 - Coordinated Research Data Cyber-infrastructure;
 - Data Innovations & Data for Development;
 - Data Awareness and Capacity Building
- National Space Science and Technology Strategy Development
 - Supporting Platform – Cyberinfrastructure
- Data Capacity Building & Conferences
 - VizAfrica 2019, HELINA 2019 (Following International Data Week-IDW 2018, ScidataCon-2018, ICICIS-2018)



Generic National Strategy

Building blocks



SADC Cyberinfrastructure

Regional SADC Cyberinfrastructure Framework

[SADC

member states & Working Group

Approved 30th June 2016 at Joint Meeting of Ministers of Education & Training And Science & Technology]





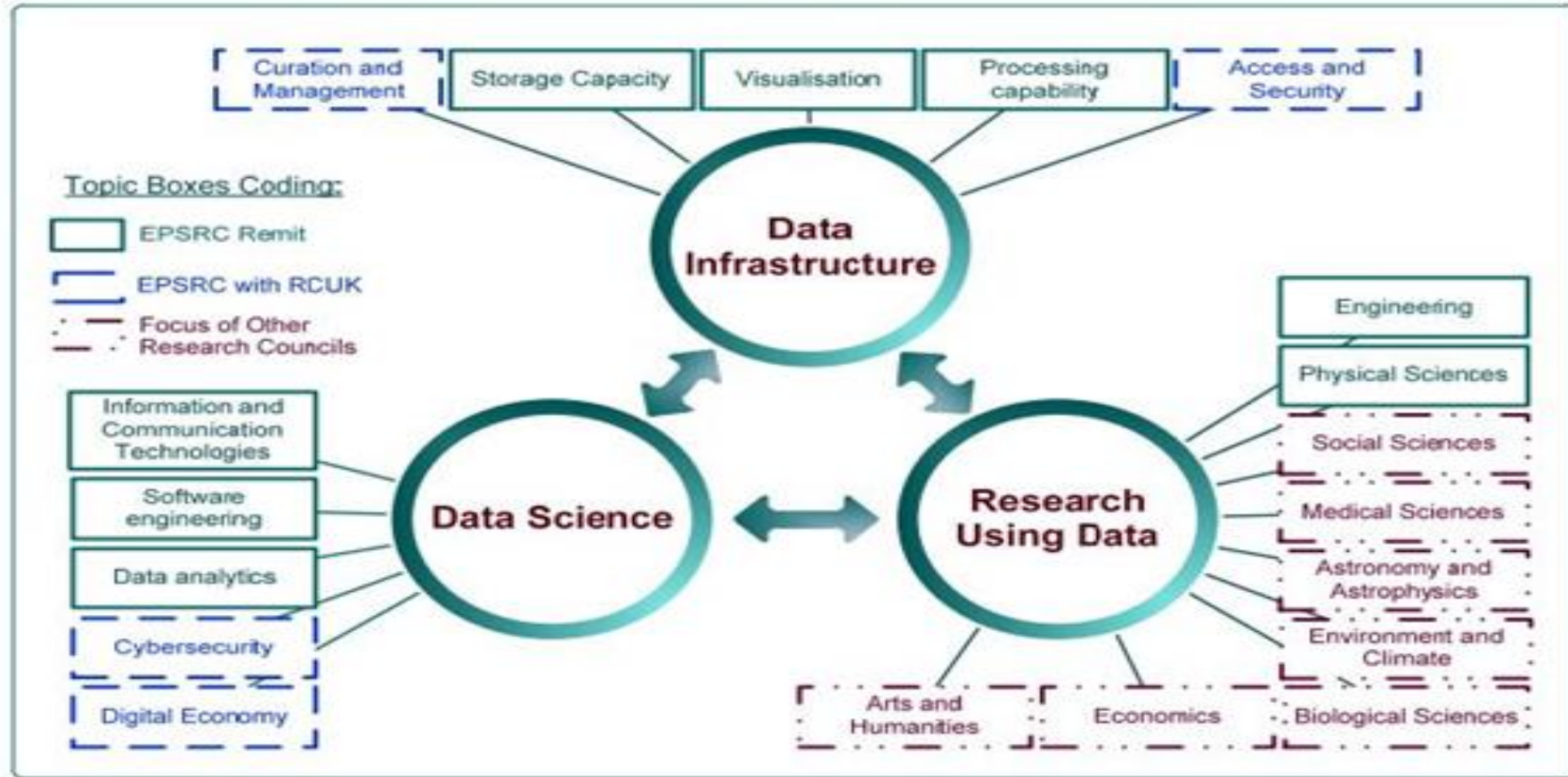
SADC 15 Members



Components of a CI

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

Data infrastructure



Source: *E-Infrastructure Roadmap* Engineering and Physical Sciences Research Council (EPSRC)

Impact of a CI

- **National Bedrock of Digital age, Digital transformation, knowledge economy and Digital economies by virtue of impact on**
 - e-Education/Leaning, E-Health, e-Gov,e-Agriculture
- **Regional Integration**
 - Collaboration using CI
 - Using CI for sectorial collaboration, e.g. energy, education, health
 - Impact on industrialization , e.g. industry 4.0
 - Technology Transfer, commercialization as a consequence of research and education advances
- **Spectrum of other consequences**
 - Citizen Science
 - Digital and Nationally shared information repositories vs libraries
 - Disciplines previously untouched by eScience/eResearch
 - Social media effect in social science, applications e.g. disaster recovery
 - Data Sharing, advancing Open Data ,Open multidisciplinary Research

Alignment

Revised Regional Indicative Strategic
Development Plan, RISDP

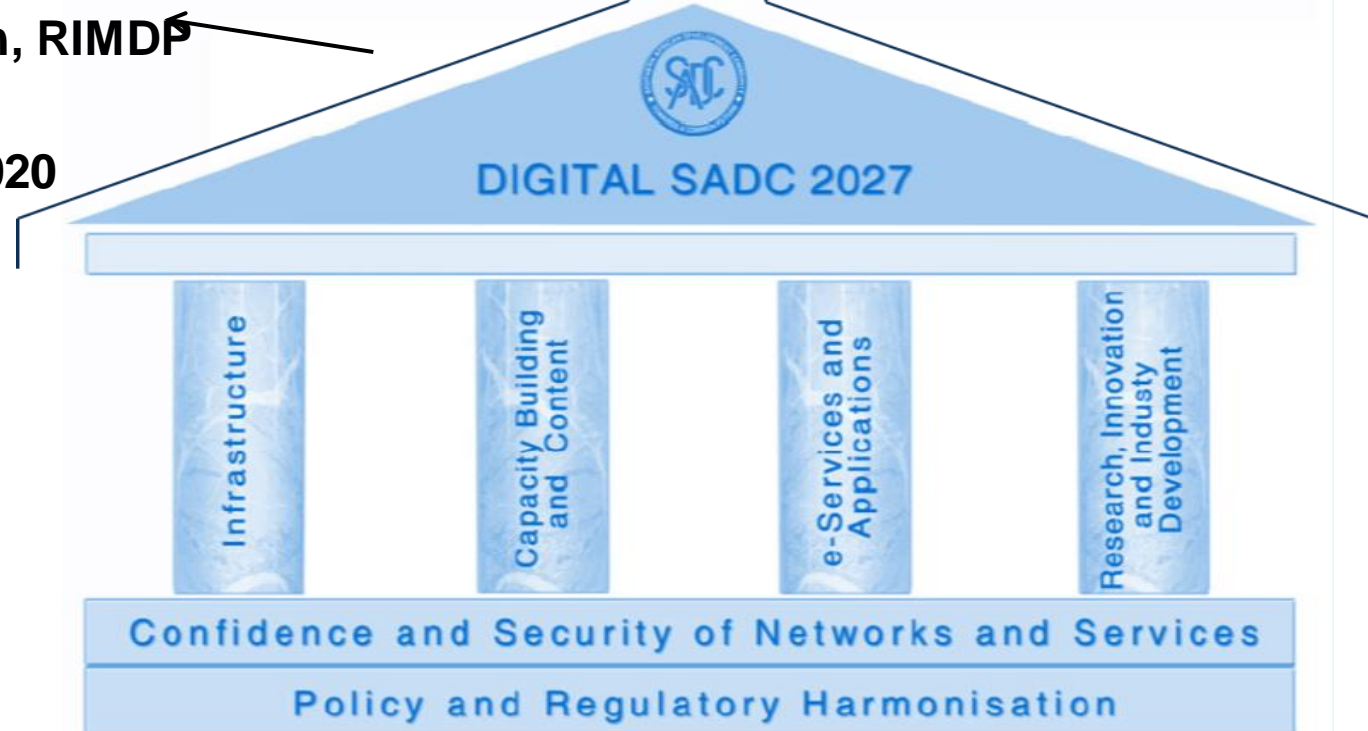
Industrialization Strategy and Roadmap

SADC CI Framework

Regional infrastructure Development
Master Plan, RIMDP

SADC Strategic Plan on STI 2015 - 2020

Protocol on STI



[Image Source] – Digital SADC
2027 & Communications
Regulators Association of
Southern Africa,
CRASA, Presentation, Antony
Chigaazira

Examples - UK e-Infrastructure

Policy paper

e-infrastructure strategy: roadmap for developing advanced computing, data and networks

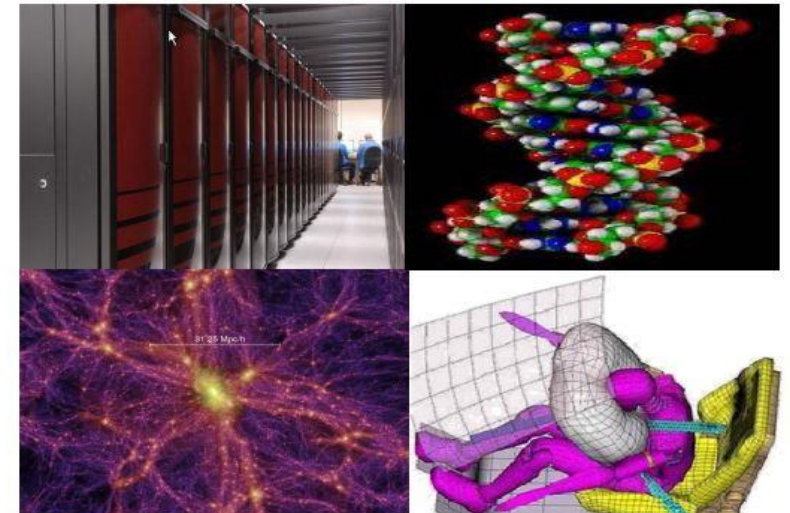
From: Department for Business, Innovation & Skills
Part of: Research and development and UK economic growth
Published: 4 January 2012

*“e-Infrastructure refers to a combination and **interworking** of digitally-based **technology** (hardware and software), **resources** (data, services, digital libraries), communications (protocols, access rights and networks), and the **people** and organisational structures needed to support modern, internationally leading collaborative research be it in the arts and humanities or the sciences. This definition reflects a broader understanding of e-Infrastructure as defined in the report “Delivering the UK’s e-Infrastructure for Research and Innovation.”*

[Research Councils UK]

A Strategic Vision for UK e-Infrastructure

A roadmap for the development and use of advanced computing, data and networks



UK e-Infrastructure Investment

~£160M of funding covering 6 strands

- Skills and training
- High capacity network
- Data storage and curation
- ***Advanced software development (£30M + £7.5M)***
- Security and resilience
- HPC hardware
 - National facilities (ARCHER)
 - Distributed facilities (e.g. DiRAC)

[Source Science and Technology Facilities Council]

European Vision



HORIZON 2020

The EU Framework Programme for Research and Innovation

European Commission > Horizon 2020 > e-infrastructures

- Home
- What is Horizon 2020?
- Find Your area
- How to Get funding?
- News, Events & Publications
- Projects

Sections navigation

- Excellent Science
- Research Infrastructures, including e-Infrastructures
- e-infrastructures**
- High-Performance Computing (HPC)



e-infrastructures

- Article
- Newsroom

By making every European researcher digital, e-infrastructures increase creativity and efficiency of research and bridge the divide between developed and less developed communities and regions.



The overarching aim of the e-infrastructure activities in Horizon 2020 is to achieve by 2020 a single and open European space for on-line research where researchers enjoy leading-edge, ubiquitous and reliable services for networking and computing, and seamless and open access to e-Science environments and global data resources.

To achieve this goal, support will be given to:

- global research and education networks providing advanced, standardised and scalable inter-domain services on-demand
- data, grid and cloud infrastructures providing access to any type of data as well as virtually unlimited data processing and preservation capacity
- an ecosystem of supercomputing facilities, advancing towards exascale
- a software and service infrastructure, achieving excellence in strategic application domains and HPC take-up by SMEs, e.g. for simulation and visualisation, and
- a globally interoperable, open and trusted infrastructure for scientific information.



Search

Related Horizon 2020 calls

Related Horizon 2020 projects

#H2020



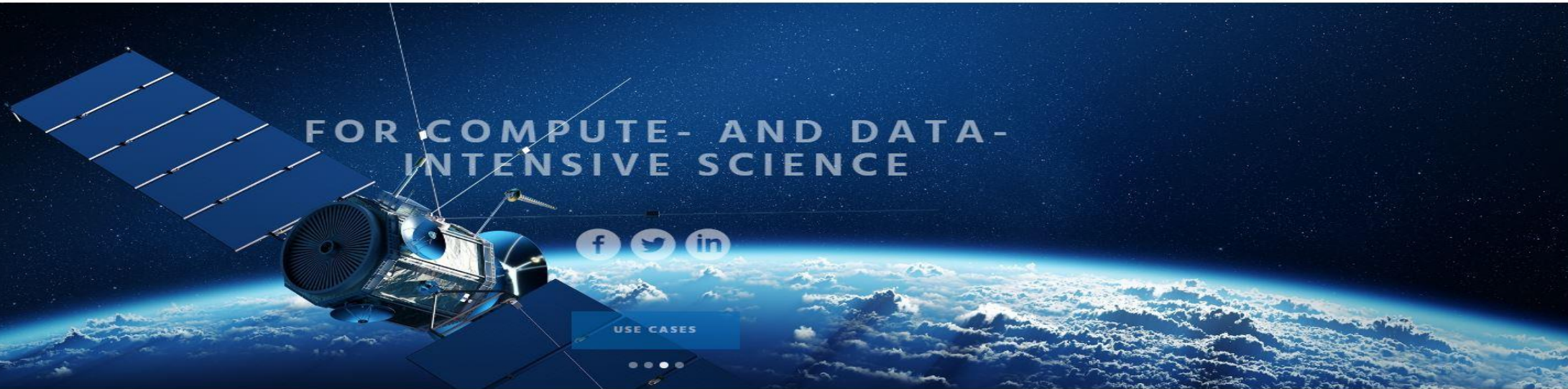
Horizon 2020 @EU_H2020

ICYMI: €30bn in #H2020 for innovative #start-ups #EU_ETIC #digitisation #environment & #security europa.eu/rapid/press-re... #InvestEUresearch eu twitter.com/EU_H2020/sta

European EGI e-Infrastructure



SERVICES | FEDERATION | USE CASES | BUSINESS | ABOUT 



EGI : advanced computing for research

EGI is a federated e-Infrastructure set up to provide advanced computing services for research and innovation.

The EGI e-infrastructure is publicly-funded and comprises almost 300 data centres and cloud providers spread across Europe and worldwide.

United States of America-XSEDE

XSEDE

About ▾

For Users ▾

Ecosystem ▾

Community Engagement ▾

News ▾

XUP



ROSIE Blooms
Science Gateway shares biomolecular data with the nation's scientists and researchers



Supporting LIGO Gravitational Wave Detections
The Laser Interferometer Gravitational-Wave Observatory (LIGO) has used XSEDE resources since 2013



Identifying Cancer DNA Changes With XSEDE Resources
Many groups, like the University of Pittsburgh Cancer Institute, have



XSEDE Helps Small University Connect
Bentley University benefits from XSEDE resources and experts

XSEDE is a single virtual system that scientists can use to interactively share computing resources, data and expertise. People around the world use these resources and services — things like supercomputers, collections of data and new tools — to improve our planet.

GET STARTED WITH XSEDE



Researchers

The National Science Foundation's eXtreme Digital (XD) program is making new infrastructure and next-generation digital services available to researchers and educators to handle the huge volumes of digital information



Service Providers

Service Providers - entities that make a resource visible and coordinated with the national cyberinfrastructure for benefit to the research community - are central to the function of XSEDE.

NEWS AND EVENTS



CIPRES: One facet in bold NSF vision

The CIPRES science gateway: A NSF investment launching thousands of scientific publications with...
[View »](#)



Dance With Algos

XSEDE resources help researchers create human-like movement.
[View »](#)



HPC for all at XSEDE16 Conference

The first five years of the NSF-funded XSEDE project culminated in an exciting and enlightening...
[View »](#)

TACC Ranger Based Cluster – (2014-)



TACC Stampede Based Cluster (2018-)





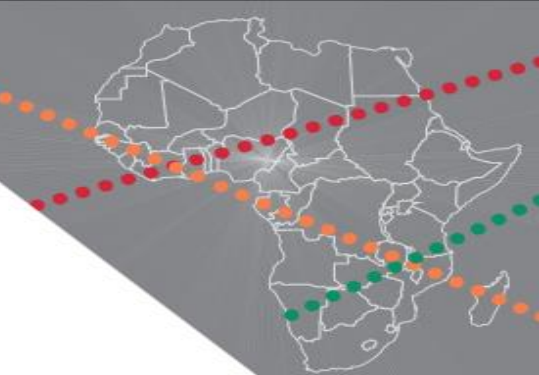
HPC ECOSYSTEMS GLOBAL MAP (2017-10+)

Slide from HPC Ecosystems Project [Bryan Johnston, AceLab CHPC]

Dr Mary-Jane Bopape' Presentation
SADC Cyberinfrastructure
Implementation Project – Weather
Modelling

SADC Member State Updates - Botswana

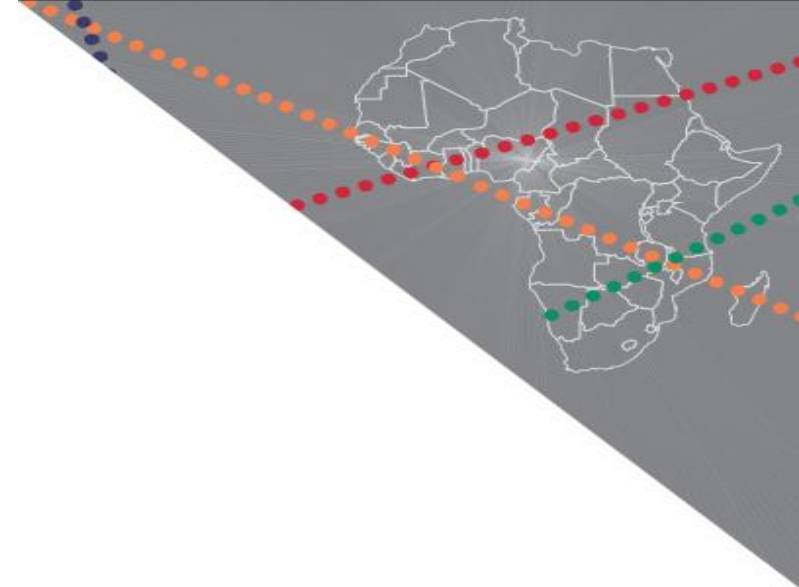
ODOS - Towards a coordinated Open Data Open Science Framework in Botswana



- National platform for Dialogue on Open Data Open Science by diverse stakeholders
- Stakeholder Engagement & Recommendations
- Contributions towards Development of Open Data Policy
- Key Areas
 - Data Legislation, Governance and Policy;
 - Coordinated Research Data Cyber-infrastructure;
 - Data Innovations & Data for Development;
 - Data Awareness and Capacity Building.

Themes

- SWOT Analysis Conducted
- Recommendations Made
- Existing Policy re-analysis
- Draft ODOS Strategy



Data Legislation Governance and Policy



S

Strengths

- **Statistics Botswana Data Frameworks exist**
- **Open Data Readiness Report, a valuable resource.**
- **Government Data Reference Model – Implementation has started in different (7) ministries.**

Weaknesses

- **Fragmentation of efforts (limited cross-agency collaboration).**
- **Need to realign related Policies and legislative frameworks to embrace Open data.**
- **Insufficient Cascading of frameworks.**
- **Lack of implementing institutions (mandate, structures and capacity).**

W

SWOT
Analysis

Opportunities

- **Open Data Readiness Report**
- **Merging of Department of Information Technology (DIT) and e-Gov-proper coordination.**
- **Existing model frameworks.**

O

Threats

- **Departments adopting different protocols.**
- **Unimplemented/partially implemented instruments surpassed by time.**
- **Exploitation of data by external parties at the expense of data producers.**

T

Example Recommendations



1. Ministry of Transport and Communications to devise a Implementation Strategy and drive recommendations of the Open Data Readiness report with explicit timeframes
2. Devise an Engagement and Communication Strategy – To reach and engage other stakeholders (especially private sector, NGO) and players identified in readiness report.
3. To seek Government endorsement of ODOS into policy framework and work towards a National ODOS Policy and related governance structures
4. Reconcile, strengthen, align and infuse ODOS into existing policy and National and institutional of frameworks.
5. ODOS Policy to be aligned with Data Protection Act.

Engagement Instruments

- Devised a Open Data Open Science Stakeholder Recommendations & Action Sheet
- For each recommendation we highlight
 - 1) Building up on our strengths
 - 2) Priority Areas/Actions
 - 3) Policy Implications

Recommendation	Action Item	Actors	Time Frame	Resource Implications	Comments

Recommendation	Action Item	Actors	Time Frame	Resourcing	Comments
<p>R001 - To seek Government endorsement of ODOS into National policy framework- Work towards a National ODOS Policy and related governance structures</p> <p>R004 - Reconcile, strengthen, align and infuse ODOS into existing policy and National and institutional of frameworks. e.g ODOS Policy to be aligned with Data Protection Act.</p> <p>R005 - Document the existing legislation, guidelines, policies etc. on open data open science.</p> <p>R006 - Document existing coordination that enhances data sharing, nationally (government, private sector, research institutes, libraries etc.)</p>	<p>R001/A001 - Action Develop draft national policy on open data open science and a strategy an implementation plan</p> <p>R004/A001 – Conduct an analysis of existing , proposed policy instruments to interrogate data component therein</p> <p>R005/001 – Conduct an institutional audit</p>	<p>Ministry of Tertiary Education, Research, Science, Technology & Innovation</p> <p>ODOS Committee</p> <p>ODOS Committee</p>	<p>Dec 2018</p> <p>Sep 2018</p>	<p>Institutional</p> <p>Institutional</p> <p>Institutional</p>	

Human Capital Development



A cyber-infrastructure training map [Source Neil Chue Hong, Software Sustainability Institute]

DATA, HUMAN CAPITAL DEVELOPMENT & CAPACITY BUILDING

○ International Center For Theoretical Physics – ICTP

- Information and Communication Technology Section (ICTS) Visiting Fellowship, 3rd – 25th August, 2019
- ITU Academy - Internet of Things (IoT) and Big Data and Statistics - 3rd August – 25th August, 2019
- Hands-on Workshop on Design, Installation and Management of HPC Data Centers for Academic Institutions 8-16 April, 2019



○ CODATA & Research Data Alliance (RDA)

- The CODATA-RDA Research Data Science Summer School, Trieste, Italy, 5th – 16th August 2019
- The Research Data Science Advanced Workshops on Bio-informatics, Climate Data Sciences, Extreme Sources of Data and Internet of Things(IoT)/Big-Data Analytics, Trieste, Italy, 19th -23rd August 2019
- RDA's 14th Plenary - Helsinki, Finland + Small Unmanned Aircraft Systems' Data IG'S Linked and Network Drones Hackathon at University of Helsinki 21- 25th October
- CODATA-Helsinki 2019 FAIR RDM Workshop, Helsinki Finland 21st -22nd October, 2019



○ UK Research and Innovation (UKRI) Global Challenge Research Fund (GCRF), DARA, DARABigData Projects

- DRAGN (Development through Radio Astronomy Global Network) workshops - Mobilization of Radio Astronomy For Economic Development, Big Data and Technologies Workshop, Chiang, Mai, Thailand, 16th – 20th September 2019



○ International Center in Astronomy Under Auspices of UNESCO – ITCA

- ITCA Colloquium 2019 : Big Data For Development, Bangkok, Thailand, 23rd – 24th September 20



○ VizAfrica 2019 Data Visualisation Conference 18-19th November 2019

- Summer School, 11- 15th November 2019
 - Basic Introduction to Linux Bash Scripting, Python For Science & Engineering in HPC, Astro Data Machine Learning and Visuali.
 - Big Data Engineering, Introduction to Development Economics for non-Social Scientist, Computer Aided Engineering (FEMAP)
 - STEM Leadership and Mentorship & Robotics – First Lego League Robotics

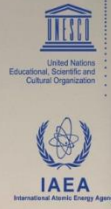


○ HELINA 2019 – Health Informatics and Data





The Abdus Salam
International Centre
for Theoretical Physics

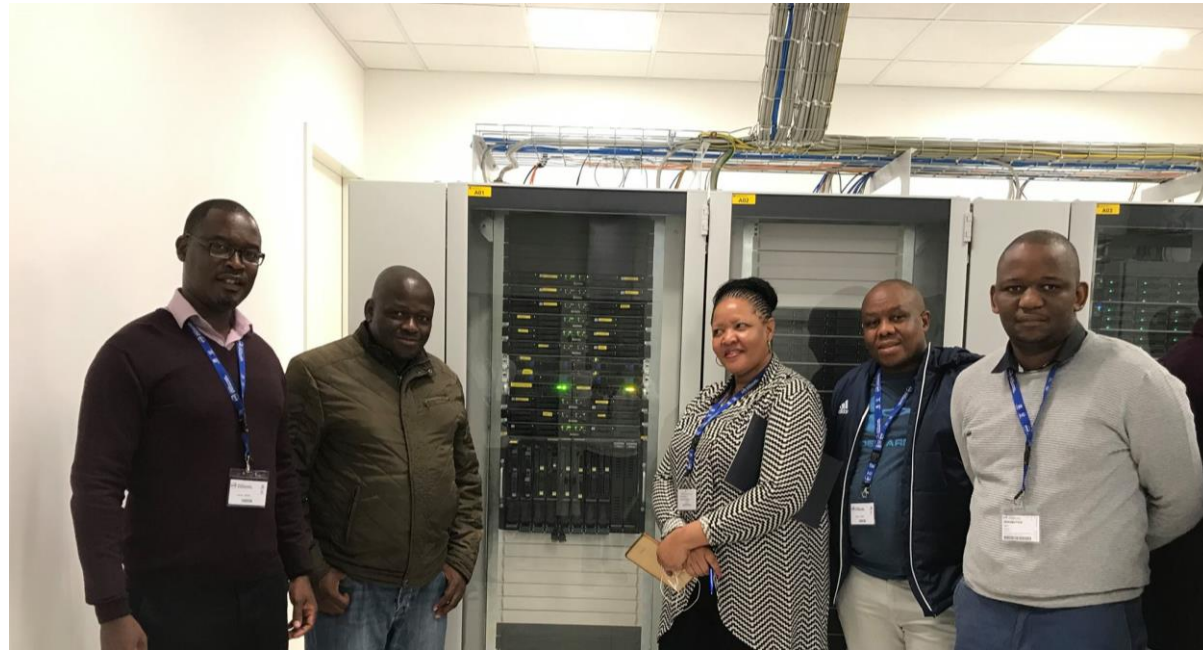


Four UB Computer Science Dept Staff Members



**Hands-on Workshop on
Design, Installation and Management of HPC Data Centers for Academic Institutions**
8 - 16 April 2019, Miramare - Trieste, Italy

Hands On Workshop on Design , Installation and Management of HPC Data Centers



The CODATA-RDA Research Data Science Summer School

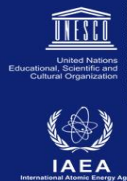
5 - 16 August 2019, Miramare - Trieste, Italy



Two University of Botswana Msc Computer Science Dept students and staff member represented



The Abdus Salam
**International Centre
for Theoretical Physics**





The Abdus Salam
**International Centre
for Theoretical Physics**



One PhD Student and Two Staff Members (Computer Science Dept & Physics Dept) represented



**The CODATA-RDA Research Data Science Advanced Workshops on
Bio-informatics, Climate Data Sciences, Extreme Sources of Data and Internet of Things(IoT)/Big-Data Analytics**

19 - 23 August 2019, Miramare - Trieste, Italy

Weather and Climate Implementation Project*

Climate Research for Development (CR4D**) Fellowship Improving weather and climate early warnings in Southern Africa

*SADC Cyber-Infrastructure(CI) Framework & SADC STI response to Climate Change
Framework

*African Academy of Sciences (The AAS),
UK Department for International Development (DFID) Weather and
Climate information SERVICES for Africa (WISER) programme Africa Climate Policy Centre (ACPC)
of the United Nations Economic Commission for Africa

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Reading: A Regional Project in Support of the SADC Cyber-Infrastructure Framework Implementation: Wea...

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Practice Papers

A Regional Project in Support of the SADC Cyber-Infrastructure Framework Implementation:
Weather and Climate

Authors: [Mary-Jane Morongwa Bopape](#) [✉](#), [Happy Marumo Sithole](#),
[Tshiamo Motshegwa](#), [Edward Rakate](#), [Francois Engelbrecht](#), [Emma Archer](#),
[Anneline Morgan](#), [Lwando Ndimeni](#), [Joel Botai](#)

Abstract



SADC Atmospheric Processes Workshop, South African Weather Services, South Africa, 26th – 28th August, Pretoria – Meteorologists and HPC Experts - 3 Computer Science Dept Staff Represented



Two BIUST Students at Thai National Observatory for 6 months internship September – January 2019 – National Astronomical Research Institute Of Thailand



GCRF Big Data and Technologies Workshop,
Chiang Mai, Thailand, 16th – 20th September



2019/9/16 14:37

UB Computer Science Dept staff represented – Invited Talk



International Training Centre in Astronomy under the auspices of UNESCO

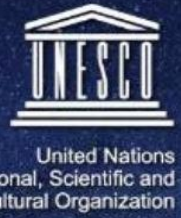
The 3rd ITCA Colloquium 2019 :

Big Data

for Southeast Asian Development

23-24 September 2019

Pullman Bangkok Hotel G
Bangkok, Thailand



International Training Centre in Astronomy under the auspices of UNESCO





Dell CTO presenting on Scaling AI

PEARC19: presenting at the AI4Good session
<https://twitter.com/SciNode/status/1155852540006817792>



Mr Badisa Mosesane – UB
 Computer Science Student
 @ National Center for
 Supercomputing
 Applications, Illinois, USA –
 Cyberinfrastructure 3
 months internship

Working on Large Synoptic Survey Telesc

With a little background on Astrophysics & my hands dirty on the Large Synoptic Survey camera to photograph a giant swath of the than 20 Terabytes of data, capturing every astronomical stop-motion movie.

Skills and Knowledge Acquired

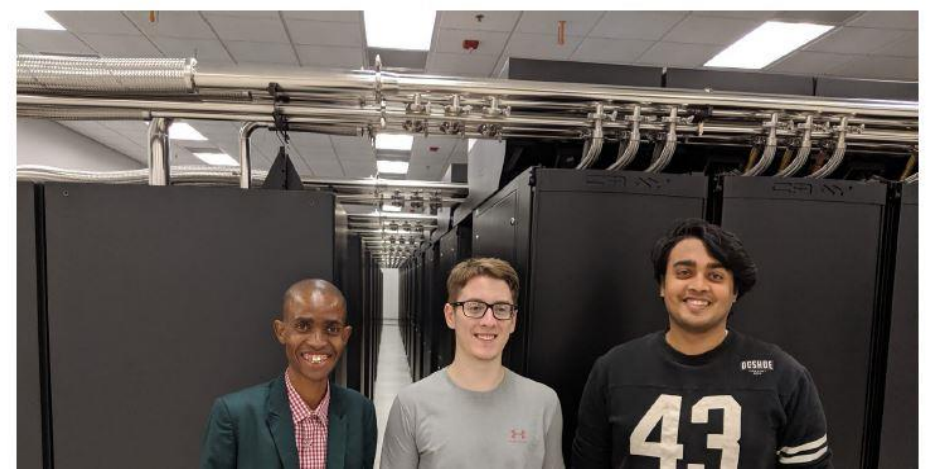
Working on BlueWaters Supercomputer

- For 2 weeks I worked on the Bluewaters system which is NCSA's first Petascale system with over 27,000 nodes capable of doing sustained science calculations in excess of 1 PetaFlops/s. The primary users are scientists with a demonstrated need for large scale calculations. It's peak speed is almost 3 million times faster than an average laptop.
- I spent most of the time investigating on this supercomputers' machine architecture, how it balances processing speed with data storage, memory and communication within itself and to the outside world and the kinds of Scientific projects it supports.
- I also had a chance to look at BW-jenkins - a continuous integration tool for source code repositories using pipelines and automating other routine development tasks. Jenkins runs multiple tests on BlueWaters like power fluctuation checks, check if some machines

My Experience as a CyberInfrastructure Professional Intern at the National Center for Supercomputing Applications - Badisa Mosesane

The National Center for Supercomputing Applications (NCSA) hosted the third cohort of the CyberInfrastructure Professional Intern program (CIP) which I was truly honored to participate in from May 20 to August 16, 2019.

The CIP program is NCSA's internship program for those interested in pursuing a career in Cyberinfrastructure (CI) and is designed to address the shortage of a workforce with the specialized skills needed to support advanced CI operations. During the program, I worked directly with engineers to gain hands-on experience in the Cyberinfrastructure operations of a major leading supercomputing center.



CODATA-Helsinki 2019 FAIR RDM Workshop

Submit proposals for presentations and posters: <https://conference.codata.org/Helsinki-CODATA-2019/submit/>

Register Now for CODATA-Helsinki 2019 Workshop on FAIR RDM in Institutions: <https://www.eventbrite.com/e/codata-helsinki-2019-workshop-on-fair-rdm-in-institutions-registration-66997233529>

The CODATA-Helsinki Workshop on FAIR RDM in Institutions will take place at the National Archives of Finland on 20-21 October 2019. It is a collocated event before the 14th RDA Plenary Meeting, Helsinki, Finland.

The organisers and programme committee invites presentations and posters for this workshop. The



Tweets by @CODATANews

CODATA @CODATANews
@CODATANews and @DDIAlliance Workshop on Interoperability of Metadata Standards in Cross-Domain Applications 2019 - Schloss Dagstuhl, 7-11 October di- alliance.atlassian.net/wiki/spaces/DD...



Oct 8, 2019



O&A Members 58
Active Organisational & Affiliate members

MEMBERSHIP Members: 9143
Becoming a member of RDA is simple and open to both individuals and organizations
[Register now](#)

RDA Groups WG & IGS: 87
Discover what RDA Working and Interest Groups and all other Groups are up to and find out how to join them. [Explore Groups](#)

1 PhD, 1 Msc, 1 Bsc UB Computer Science Dept Students to represent – and get training

RDA's 14th Plenary - Helsinki, Finland

Home » Plenaries » RDA's 14th Plenary - Helsinki, Finland

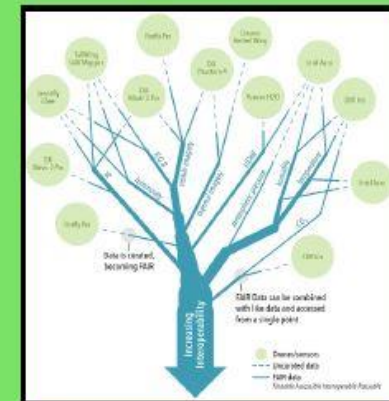


- RDA 14th Plenary - Programme
- RDA 14th Plenary - Co-located Events
- RDA Plenary 14 - Pathways
- RDA 14th Plenary - Registration
- RDA 14th Plenary - Participants List
- 14th Plenary - Poster Session



Linked And Networked DRones Hackathon2

- **When:** 21-22 October (pre-workshop to RDA P14)
- **Where:** University of Helsinki
- **What:**
 - Ontology building
 - Open API building
 - Application building



Continuing work started at Hack1:

<https://github.com/opengeospatial/LANDRS>

- **How:**
 - Register
 - Apply for up to USD1500 travel support

<https://forms.gle/vjWaa6QmxEowSVyt8>

Also: Internships

We are also seeking applications for paid remote interns interested in working ~8hrs/wk over Nov 2019 - Feb 2020 on all of the above topics. Dates and hrs are negotiable, compensation offered will be commensurate with applicants expertise and proposed scope of work. All interested graduate students are encouraged to apply to attend the hackathon and to separately submit a 1-2pg CV to: <https://forms.gle/WaXc1XtnN1JavBgM9>

Recent Update Presentation:

<https://tinyurl.com/y39s6uur>

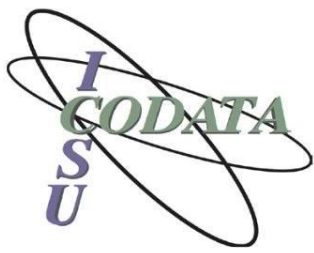
Slack:

<https://tinyurl.com/yy748ug3>



Alfred P. Sloan

Conferences



INTERNATIONAL DATA WEEK – IDW 2018



Time: 8:30am

Date: 05th to 08th November 2018

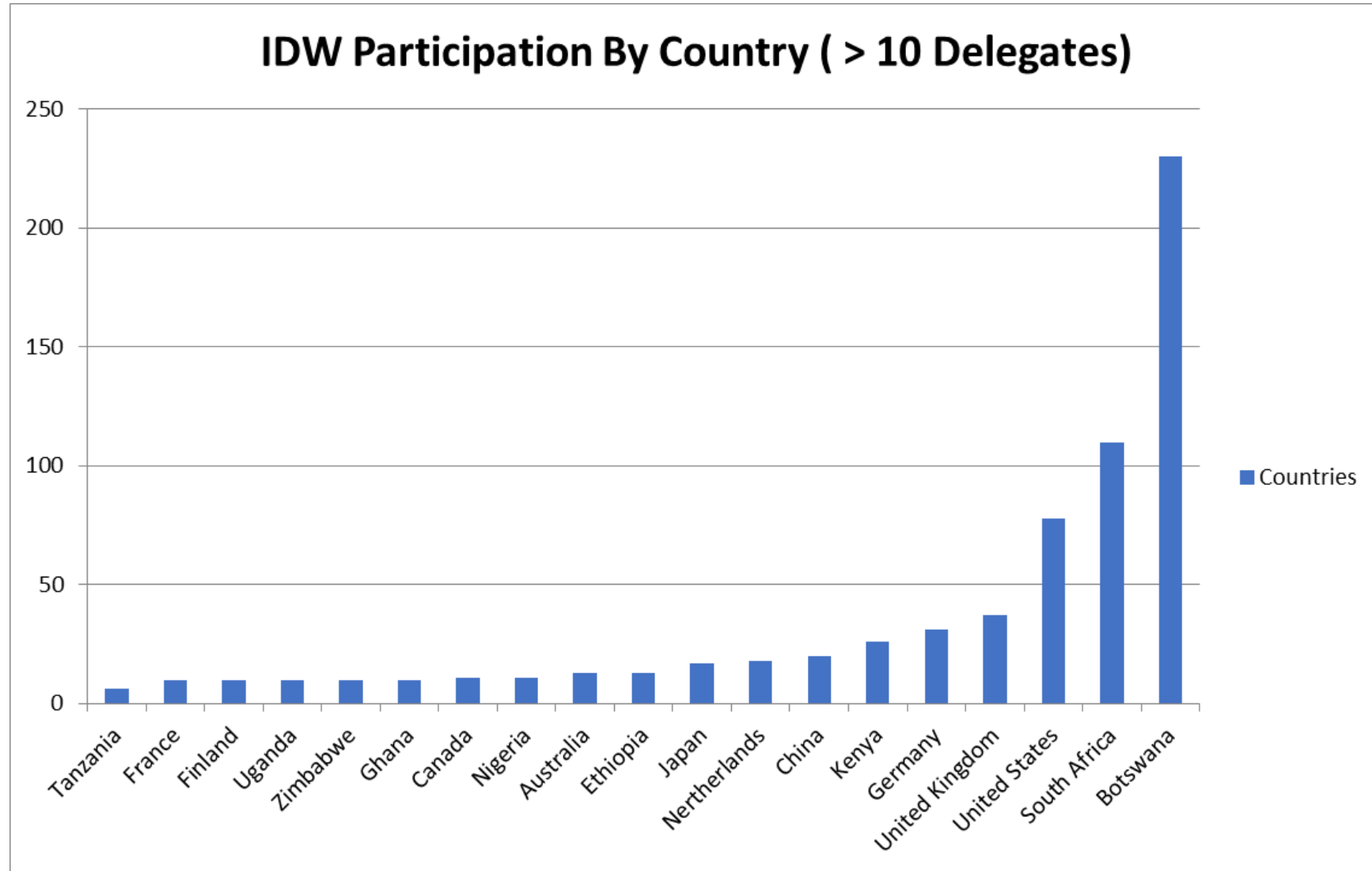
Venue: Gaborone International Conference Centre (GICC)

KEYNOTE ADDRESS AND OFFICIAL OPENING by His Excellency, the President of the Republic of Botswana, Dr. Mokgweetsi Eric Keabetswe Masisi.

THEME: "DIGITAL FRONTIERS OF GLOBAL SCIENCE"

- > 800 participants from 64 countries and 6 continents
- ~200 Sessions – collocated conferences – ScidataCon, ICICIS 2019
- Preconference workshops and training
- High Level Ministerial session
- Gaborone Statement

IDW In Numbers



Digital Frontiers of Global Science

The background image shows a large audience seated in a conference hall, facing a stage. The stage features several large projection screens displaying the text 'INTERNATIONAL DATA WEEK 2018'. A speaker is visible on the stage, and the audience is diverse in age and ethnicity. The overall atmosphere is professional and academic.

Frontier issues for research in a global and digital age.

Applications, progress and challenges of data intensive research.

Data infrastructure and enabling practices for international and collaborative research.

Data, development and innovation: data as an interface between research, industry, government, society and development.

- <http://internationaldataweek.org/>
- <https://www.scidatacon.org/IDW2018/>



Themes: research and data; data science and data analysis; data stewardship; policy and practice of data in research; education and data; data, society, ethics and politics; open data, innovation and development; data and cybersecurity





170+ Submitted , 65 Accepted, ~45% Developing Countries Relevant Themes

Approved Sessions

The sessions listed below are approved. However, please note that these will form part of the final programme only if a sufficient number of high quality abstracts are received. You can submit Abstracts for Papers and Posters here: <https://www.scidatacon.org/IDW2018/submit/>

ID	Session Title	Owner	Description
124	Skills-development in an increasingly data-driven science environment: an African perspective	Ina Smith	View details
125	Metadata for 2020 and Beyond: Collaborative approaches to advancing metadata	Clare Dean	View details
127	Designing inclusive capacity development for those engaging with Agriculture and Nutrition data	Alan Stanley	View details
129	Issues and best practices for data stewardship: recommendations for African countries and institutions	Kgomotso Moahi	View details
131	Open data, open science in Agriculture and Nutrition a Case for Developing Countries	Irene Wambui Kimani	View details
133	Frameworks for Agricultural Data Production and Education in Africa - The Role of the Data Revolution	Kiringai Kamau	View details
135	Agriculture Data and Citizens in the African Open Research Data Space	Boniface Okelo Akuku	View details
136	The Role of the Marginalised in Open Data Driven Innovation.	Obwaya Mogire	View details
137	Visualization and Pattern Recognition Techniques for Understanding Data	Wafula Muliaro	View details
139	Data for Effective Humanitarian Decision-Making: Challenges and Opportunities	Tefera Darge Delhiso	View details

National, Regional and Continental Leadership



Diverse Global Audience



Local, Regional, Continental, Global renown speakers and experts



Workshops and Interest Group Sessions



Preconference Training and Stakeholder Engagements



Call for Participation

Register Now!

Indigenous & Data knowledge systems

Pre-Conference in the framework of SciDataCor/International Data Week 2018

Sa., 3 November 2018,

UB Library Auditorium, 8.00am



With

- Prof. S.A. Materchera
Director, Indigenous Knowledge Centre
North-West University (Mafikeng),
South-Africa
- Ms. Roselyn Molotsi
Bakgatla-Ba-Kgafela Moruleng,
South-Africa
- Mr. G. Leaka &
Mr. K. Mogodu,
San Khwedom Council, Botswana
- Mr. B.G. Setlo,
Traditional Healers Umbrella
Association, Botswana
- Mrs. Mmankudu Glickman
Bahurutshe Cultural Cooperative,
Mmankgodji Botswana

This unique conference seeks to:

- give indigenous knowledge holders a forum for dialogue
- learn from successful collaborations between researchers and indigenous knowledgeholders
- discuss adequate forms of documentation of IKS
- outline how data on IKS can contribute to innovation and entrepreneurship

and many more...

Organized by
CesriKi



To register for free
send e-mail to:
cesriki@mopipi.ub.bw
or phone 355 4379/2552



Domesticating Conversations to Local Contexts






Merging of Cultures



IDW Gaborone Statement about Data : Co-edited



DRAFT FOR THE INTERNATIONAL DATA WEEK GABORONE STATEMENT

International Data Week explores the digital frontiers of global science and how governments, science systems, research institutions and researchers engage with developments that are transforming the world.

The world is being transformed by digital technologies and by the data revolution.

The ability to gather, manage, analyze, and reuse data is central to implementing, monitoring and to achieving the United Nations Sustainable Development Goals (SDGs).

International Data Week provided examples of ~~The conference explored~~ how data can transform agriculture, education, health, and the response to health crises; among other things. Data can also contribute to social inclusion; and preservation of global heritage, the environment and biodiversity. Participants # examined the policy dimensions of Open Science and the technical implementation that enables data to be findable, accessible, interoperable and reusable (FAIR). Furthermore, Participants # ~~drafted~~ developed open Indigenous data governance principles ~~CARE~~, collective benefit, authority and control, responsibility and

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Comment [1]: Suggest to change "developments" to "digital technology and the data revolution" and delete following sentence ("The world is being transformed...").

Comment [2]: Or "Attendees (or Participants) of IDW..."

Comment [3]: R and A the wrong way around?

Comment [4]: ng. looks right, and aligned with the draft document.

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1st - 2nd November 2018, University of Botswana Conference Centre, Gaborone, Botswana

As a pre-conference event of International Data Week 2018, Gaborone, Botswana

ICICIS 2018

[Home](#)

[Proceedings](#)

[Conference Programme](#)

[VISA and travel information](#)

[Register Now](#)

[Call for Papers](#)

[Submission](#)

[Schedule](#)

CALL FOR PAPERS

IMPORTANT DATES

- Paper submission: Opens 20 August, 2018 – 10 September, 2018
 - Extended till 27th September 2018
- Acceptance Notification: 30 September, 2018
 - New submission notification: 9th October 2018
- Camera-ready due: 15 October, 2018
- 1-2 November 2018: Conference

OVERVIEW

The Third International Conference on the Internet, Cyber Security and Information Systems (ICICIS), University of Botswana Conference Centre Gaborone, Botswana, November 1-2, 2018.

ICICIS 2018 will this year address progress and new trends in internet use in relation to cyber security. The conference builds on the previous ICICIS2016 and ICICIS2017.



VIZAFRICA

SYMPOSIUM

The Data, Information and Scientific Visualization Symposium – 18-19th November 2019 (Summer School 11th – 15th November 2019), University of Botswana Conference Center, Gaborone

Welcome to VizAfrica Botswana 2019



The **VizAfrica 2019 Data Visualization Symposium** will take place from **18th -19th November 2019** at the University of Botswana Gaborone, Botswana. The symposium also includes a two weeks **Summer School** training from **11th -15th November 2019** on Data Science/Visualization.

The symposium is part of the University's mission of improving economic and social conditions for Botswana while advancing itself as a distinctively African University with a regional and international outlook. In fulfilling its mandate in reaching out to and interacting with international community, the general public, entrepreneurs, scientists and policy makers on advances in technological innovations for social economic development and industrialization. 300 participants drawn from government ministries, universities, research organizations, corporate, small and medium scale industries (SMEs), policy makers in key sectors of the economy and from international organizations are expected to attend.

The theme of the symposium is **"Application of Data, Information and Scientific Visualization for Resource Management and Sustainability."**

Conference

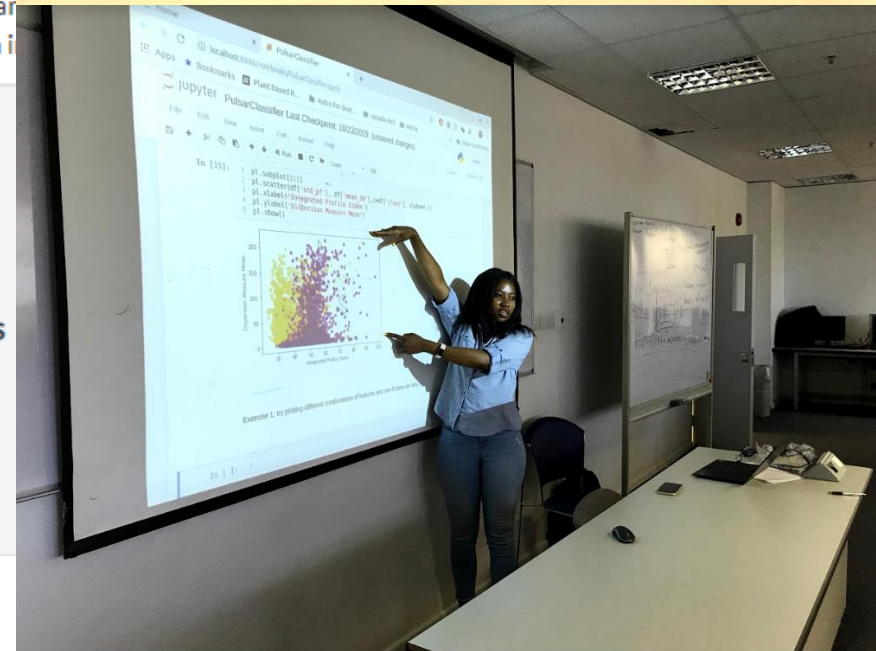


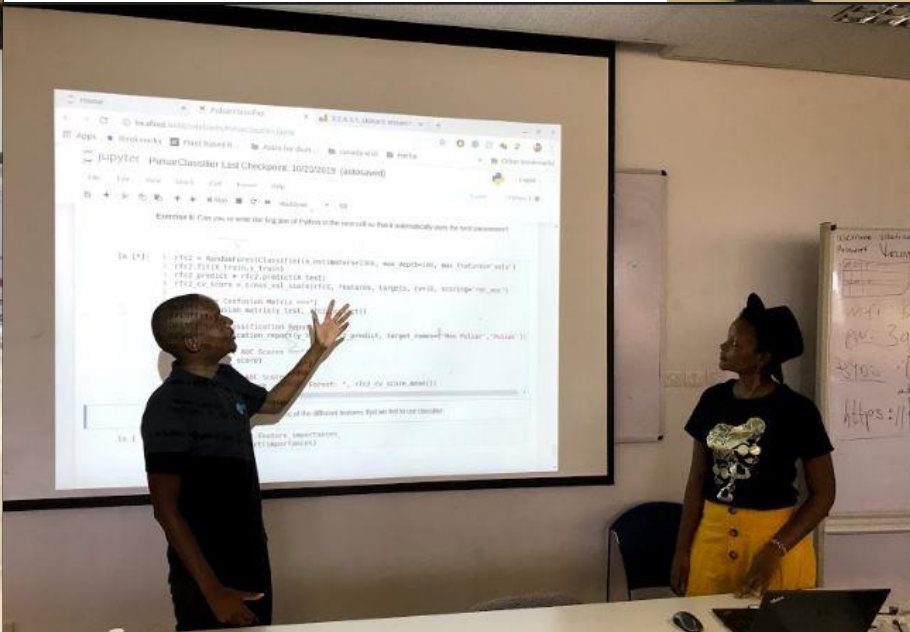
To submit session proposals and logistics and accommodation information

Session proposals

Conference abstracts

Conference poster





Health, Data, Technologies,
Sustainable Development Goal
HELINA 2019 20th – 22nd
November 2019 , University of
Botswana Conference Center,
Gaborone



The poster features a dark blue background with a grid pattern and a large white cross on the left. At the top, the HELINA logo is displayed in a green box, with the text 'HEALTH INFORMATICS IN AFRICA' and 'THE PAN AFRICAN HEALTH INFORMATICS ASSOCIATION' below it. The main title 'HELINA'19 CONFERENCE' is in large white letters, with the dates 'November 20-22, 2019' in orange script. A quote in white text reads: "From Evidence to Practice: Implementation of Digital Health Interventions in Africa for achievement of Universal Health Coverage". Below this, a paragraph in white text states: "Digital health is an enabler for equitable health care access, from clinical care to public health. This conference provides a platform to showcase digital health interventions that have not only shown benefits, but are also sustainable." To the right, the location 'Gaborone, Botswana' and 'University of Botswana Conference Center' are listed in white and orange. A white box contains the text: "Featuring local, regional and International experts in Digital Health from across Academia, NGO's, Private and Public Sector." Below this is a photograph of the University of Botswana Conference Center at night. A light blue banner reads: "Conference Participation and Presentation with CPD points". A large orange rounded rectangle contains the 'CONFERENCE PACKAGES' section. To the right, a white box contains the registration information, including the URL 'https://is.gd/helina2019' and contact details for the Chair of the Conference (Dr. Tom Oluoch) and the Chair of the Scientific Committee (Prof. Nicky Mostert).

HELINA HEALTH INFORMATICS IN AFRICA
THE PAN AFRICAN HEALTH INFORMATICS ASSOCIATION

HELINA'19 CONFERENCE

November 20-22, 2019

"From Evidence to Practice: Implementation of Digital Health Interventions in Africa for achievement of Universal Health Coverage"

Digital health is an enabler for equitable health care access, from clinical care to public health. This conference provides a platform to showcase digital health interventions that have not only shown benefits, but are also sustainable.

Gaborone, Botswana
University of Botswana
Conference Center

Featuring local, regional and International experts in Digital Health from across Academia, NGO's, Private and Public Sector.



"Conference Participation and Presentation with CPD points"

CONFERENCE PACKAGES
Early Bird - \$150 : Until 30th September 2019
Regular - \$200 : 1st Oct- 31st October 2019
Late registration - \$250 : 1st -19th November 2019
Student Fee - \$50 - Until 19th November 2019
Exhibition Stall - \$100 - Until 19th November 2019

Register here:
<https://is.gd/helina2019>

For more information, please contact: Chair of the Conference: Dr. Tom Oluoch, hcs@helina-online.org
Chair of the local organizing committee: Kagiso Ndlovu, hcs@helina-online.org
Chair of the Scientific Committee: Prof. Nicky Mostert, spc@helina-online.org



Outreach & STEM



Universities-Industry-Government
Co-Creation Platform



OUTREACH AND AWARENESS ACTIVITIES

- University-Industry-Government Co-Creation platform – Innovation Ecosystem Strengthening
 - Future Skills Programme through Software Innovation & Skills Academy/“Coding School”
 - Partnerships
 - Innovation projects (including Data Innovations)
 - Intellectual Property Framework
- **STEM Education through Astronomy & Robotics**
- Science Communication for Public and Policy Engagement
- Research Data Skills and Training for Researchers

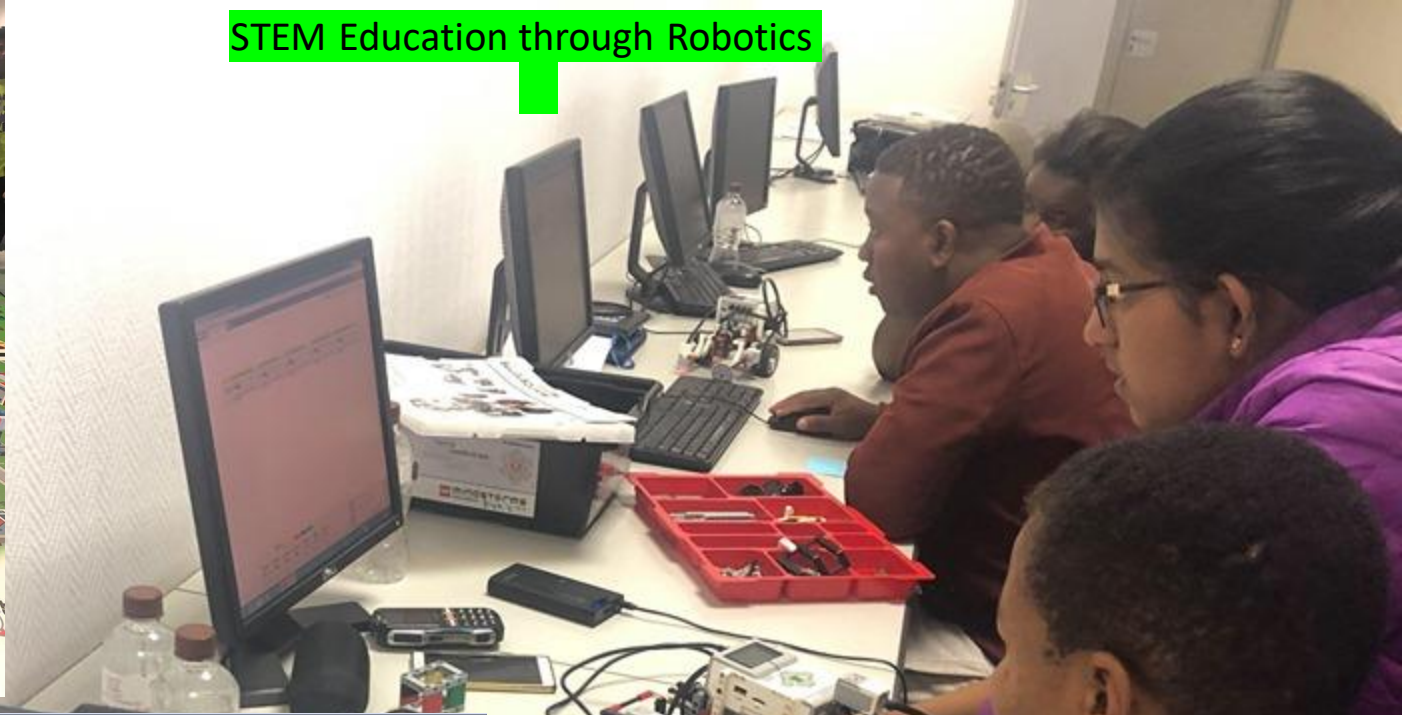


Project Outputs

- Coding school
- Innovation lab
- Robust IPR framework
- Multidomain Flagship projects
- Skills database

Universities-Industry-Government

STEM Education through Robotics



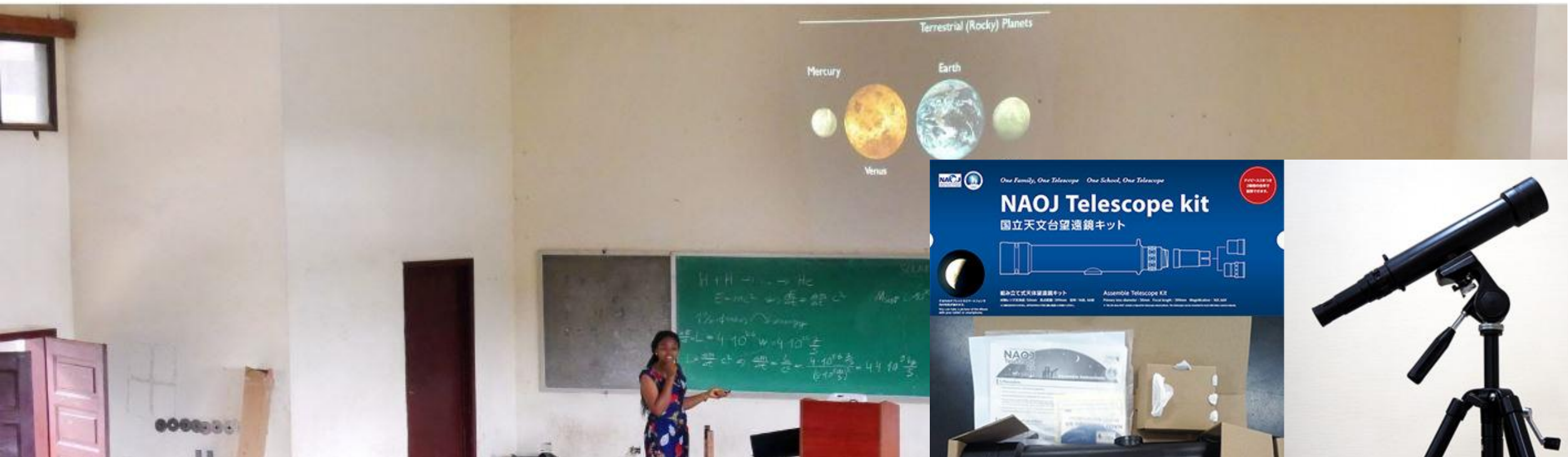
FIRST® LEGO® League Robotics Training

A STEM initiative in Gaborone
(Science Technology Engineering & Maths)

WHEN: 22 - 26 July, 2019
9am - 4pm daily

WHERE: University of Botswana, Gaborone





Address [elementary themes and/or concepts of astronomy.](#)

Universities-Industry-Government Co-Creation Platform

About project

The project aims to develop a universities-centric co-creation platform with its associated activities, government & industry partnerships, mentorship and processes centred on industry and government or stakeholder defined challenges solved by students through well-defined mentored flagstone capstone projects. The projects will be executed within a well-defined, mutually agreed Intellectual Property Rights Framework favourable to student advancement. For up-skilling and preparedness, there will be practical training delivered through modules conducted between SABC regional partner institutions and by capacity support partners to plug the skills gap in students in the university innovation ecosystems. Each institution will host a coding school to deliver these modules, provide interaction spaces and well-equipped ICT innovation laboratories. This project will define formal interfaces between industry, government and the national innovation ecosystem to provide sustainability beyond the project phase and adoption of solutions by proponents. The interplay with government and industry will facilitate access to data for data innovations and data for development.



Key Objectives



To create an operational co-creation platform network in partner countries



To link co-creation platforms for cross border and global interplay



To upskill students on technology development



To build interfaces between industry Government for sustainability of the platform through stakeholder propose driven flagship projects

Outcomes and Impact

- Enhanced capacity building: Ecosystem especially software engineering and development skills
- Simulated local software development industry
- Enhanced cross-border collaboration and co-creation
- Enhanced cross-border trade
- Enhanced global connectivity and co-creation

Outputs



Coding School



Open Data Repository



Robust IPR Framework



Project & Problem Set Repository



Practical Training Modules



Multidisciplinary Flagship Projects



Skills Database

GET IN TOUCH

sais-ulg-cocreation@ub.ac.bw

facebook.com/groups/490708974783882/

PROJECT PARTNERS



SUPPORT PARTNERS



COMMUNITY PARTNERS



SPONSORS



Research Data Skills Training for Researchers



UB Software Carpentry Workshop

Who: The course is aimed at graduate students and other researchers.

You don't need to have any previous knowledge of the tools that will be presented at the workshop.

Date: 16-19 September 2019

Time: 09:00-16:30

Venue: University of Botswana Block 247 Room 292

<https://tshotshegwa.github.io/University-of-Botswana-SAIS-UIG/>

Requirements: Bring your own laptop with Git, Python and a text editor of your choice



Project Outcomes

- **Enhanced capacity building especially Software engineering and development**
- **Stimulated software development industry**
- **Enhanced cross border collaboration and co-creation**
- **Enhanced cross border trade**
- **Enhanced global connectivity and co-creation**



African Open Science platform

<http://africanopenscience.org.za/>

About AOSP

- Outcome of ISC “Open Data in a Big Data World”
- NRF/ASSAf agreement signed on 9 Feb. 2017
- October 2016 – October 2019 (3 years)
- Fully funded by the National Research Foundation (NRF) (SA Dept. of Science and Technology)
- Directed by CODATA (ISC)
- Managed by Academy of Science of South Africa (ASSAf)
 - Through ASSAf hosting ISC Regional Office for Africa (ISC ROA)





7 Pilot Deliverables

- Established an African Open Data Forum
 - Launched AOSP during SFSA 2016
 - Framework for open data policies
 - Framework for incentives for sharing research data
 - Framework for capacity building in research data
 - Framework & roadmap for e-Infrastructure
- Landscape report on Open Data in Africa

Research Data Initiatives (66+)



E.g. CIRAD, FAOSTAT, KAiNeT, RCMRD, CSIRSpace



E.g. AfReMaS, IODE, ODINAFRICA, SAIAB



E.g. H3Africa, AHRI, APHRC, GHDx, MalariaGEN



E.g. GBIF, ReBioMa, ICRAF, CERSGIS, CGIAR, GLOSS, MASDAP, SERVIR, AMMA-CATCH, SASSCAL



E.g. CGKP, SAEON, RESILIENCE ATLAS, WASCAL



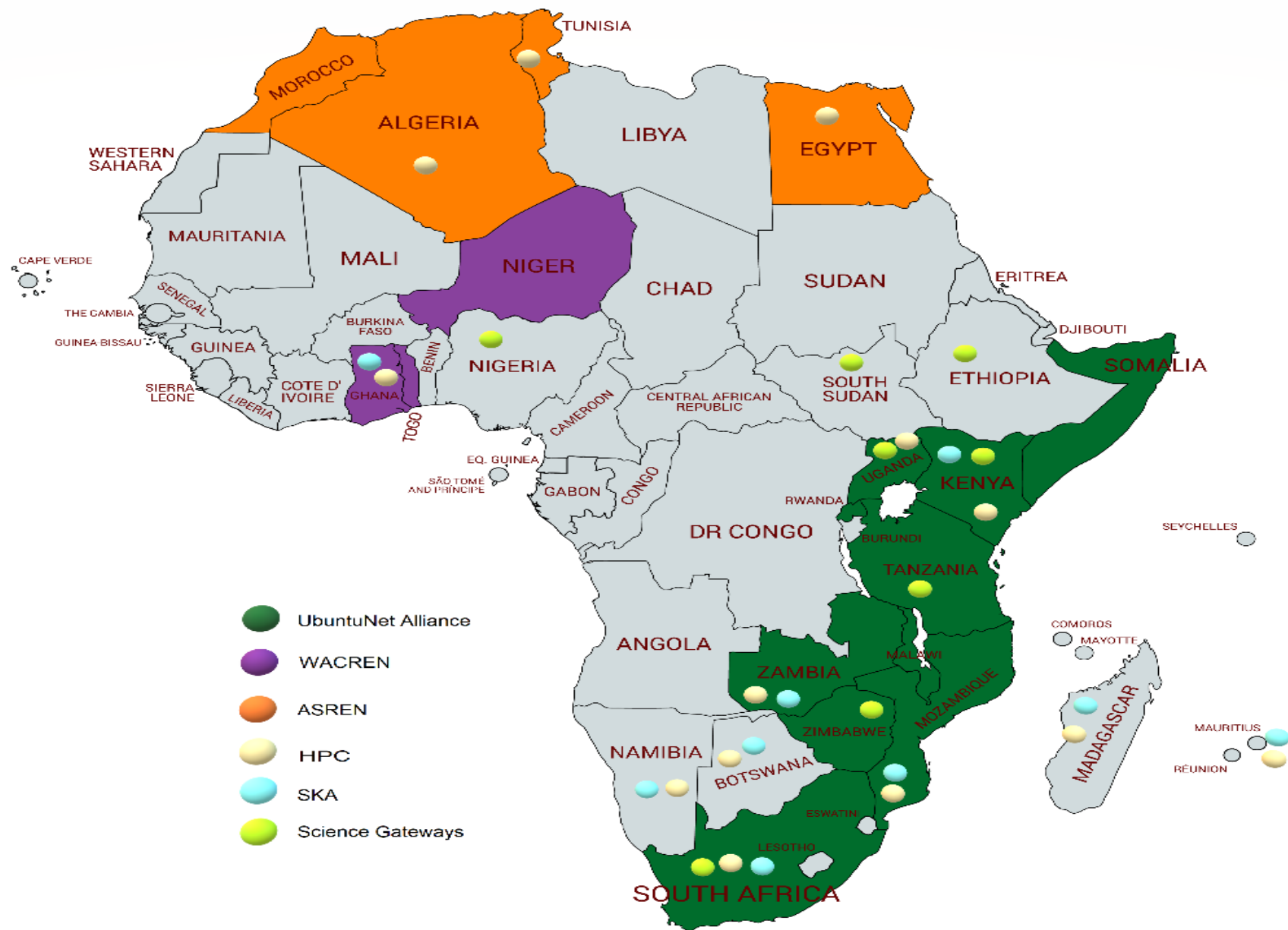
E.g. OHADA, DICAMES

African Investment in Science, ICT



- Low levels of organisation and funding of many science systems in Africa - UNECA 2018 Sustainable Development Report
- Kenya & SA closest to AUs target of investing 1% of annual GDP in R&D (Kenya & SA invest 0.8%)
- R&D expenditure of 24 African countries unknown

African ICT Landscape



e-Infrastructure Challenges



Connectivity & Bandwidth

- Selected governments have low awareness of value of NREN – Foley (2016)
- Many NRENs not operational, low/no budgets
- Commercial public ISPs a threat to NRENs, while NRENs do far more than just being an ISP
- Private ISPs with monopolies (Central, West Africa) close down access to cable landing stations – not allowing other competitors into market, keeping costs high



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- Power outages on continent interrupting Internet service delivery, interrupting science
 - Cloud services require high-speed Internet access/broadband - very expensive
 - Medium-scale server infrastructures only; not trusted; **infrastructure not funded** (H3ABioNet)
 - Small number of computer workstations, outdated/software outdated

e-Infrastructure Status & Challenge



Data Management (Curation)

- Only one trusted registered data repository on continent (CoreTrustSeal)
- Lack of centralised, secure data storage
- Data repositories not registered with Registry of Research Data Repositories (re3data.org)
- Data management plans not the norm, due to lack of policies/funder requirements



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- Few repositories use proper data repository software or science gateways, tailor-made for purpose, adhering to international best practise regarding persistent identifiers, metadata, licensing, IPR, data citation, archiving, and back-up of data
 - Some instances - low awareness of free and open source software (FOSS) to collaborate and share data

Research Cultures Impacting on Data Sharing



- Institutional metric & funding systems rely heavily on publishing in high impact factor publications
- Data sharing not acknowledged for promotional purposes/performance appraisal – lack of incentives
- Researchers want to exhaust publication possibilities before sharing data
- Trust – ‘parachute’ research prevent sharing – in past African researchers were often excluded and not acknowledged for contributions to international research

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- Lack of proper infrastructure makes collaboration and data sharing impossible
 - Already lack of support for publishing research papers (African researchers fund own publication costs – even more so for data sharing)

Key to Future AOSP



- **Collaboration** among countries, institutions, projects, researchers – sharing resources; free flow of data, research, knowledge
- **Trust** relationships, openness, transparency – trusting others for having your best interest at heart, and not because of the profits they can make from your research
- **Researcher driven** – needs addressed & bring infrastructure to data
- Keep momentum, strong leadership, build on knowledge (also tacit) collected through project

Summary

- African Continental aspirations, vision and integration can be supported by RSTI
- Development of African Cyberinfrastructure can facilitated collaboration and RSTI
- Open Science and Open Data provides opportunity for Africa and increased participation in the Global science enterprise
- There is need for trickle down effect to education and STEM to develop a pipeline for RSTI