AFRICAN STRATEGY FOR FUNDAMENTAL AND APPLIED PHYSICS

Physics Education Working Group

Conveners

- **Khalid Berrada (Cadi Ayyad University, Morocco)**

- **Mouhamadou Mansour Faye (Cheikh Anta Diop University, Senegal)**

- **Noella Josiane Umuhoza Karemera (University of Rwanda, Rwanda)**

- **Sam Ramaila (University of Johannesburg, South Africa)**

- **Uli Raich (Retired Physicist at CERN)**

Presentation Outline

- **Teacher training in Africa**

- **Development of 21st century skills and competencies**

- **4IR: Coding and Robotics**

- **Attraction and retention of students in Physics**

Strengthening Teacher Training in Africa

Harnessing SAIP Teacher Development Project Model

CERTIFICATE OF
ACHIEVEMENT

THIS CERTIFICATE IS PRESENTED TO:

SOUTH AFRICAN INSTITUTE OF PHYSICS

THIS AWARD IS TO ACKNOWLEDGE EXCELLENCE IN THE CATEGORY OF

SCIENCE AND INNOVATION

FOR THE PROJECT "PHYSICAL SCIENCE TEACHER DEVELOPMENT PROJECT"

AS SUPPORTED BY THE UNITED KINGDOM'S PROSPERITY FUND, AND THE BRITISH HIGH COMMISSION
SOUTH AFRICA, 2015-2016.

DATE: *07 September 2016*

SIGNATURE:

DAME JUDITH MACGREGOR
BRITISH HIGH COMMISSIONER

Coordination of teacher education in Africa

- **Coordination of teacher professional development workshops in partnership with African universities**

- **Monitoring quality of pre-service and in-service teacher professional training**

- **Provision of accredited Short Learning Programs**

- **Peer learning initiatives**

- **Establishment of sustainable communities of practice and professional learning communities**

e-Learning

- **Creation of Open-Source Platform**

- **Broadening educational pathways to STEM education through virtual digital platforms**

- **Embracing digital transformation**

- **Learning Management System Implementation Plan**

- **Team Leaders**

- **Quality Standards**

- **Risk Management Guidelines**

- **Training Schedule**

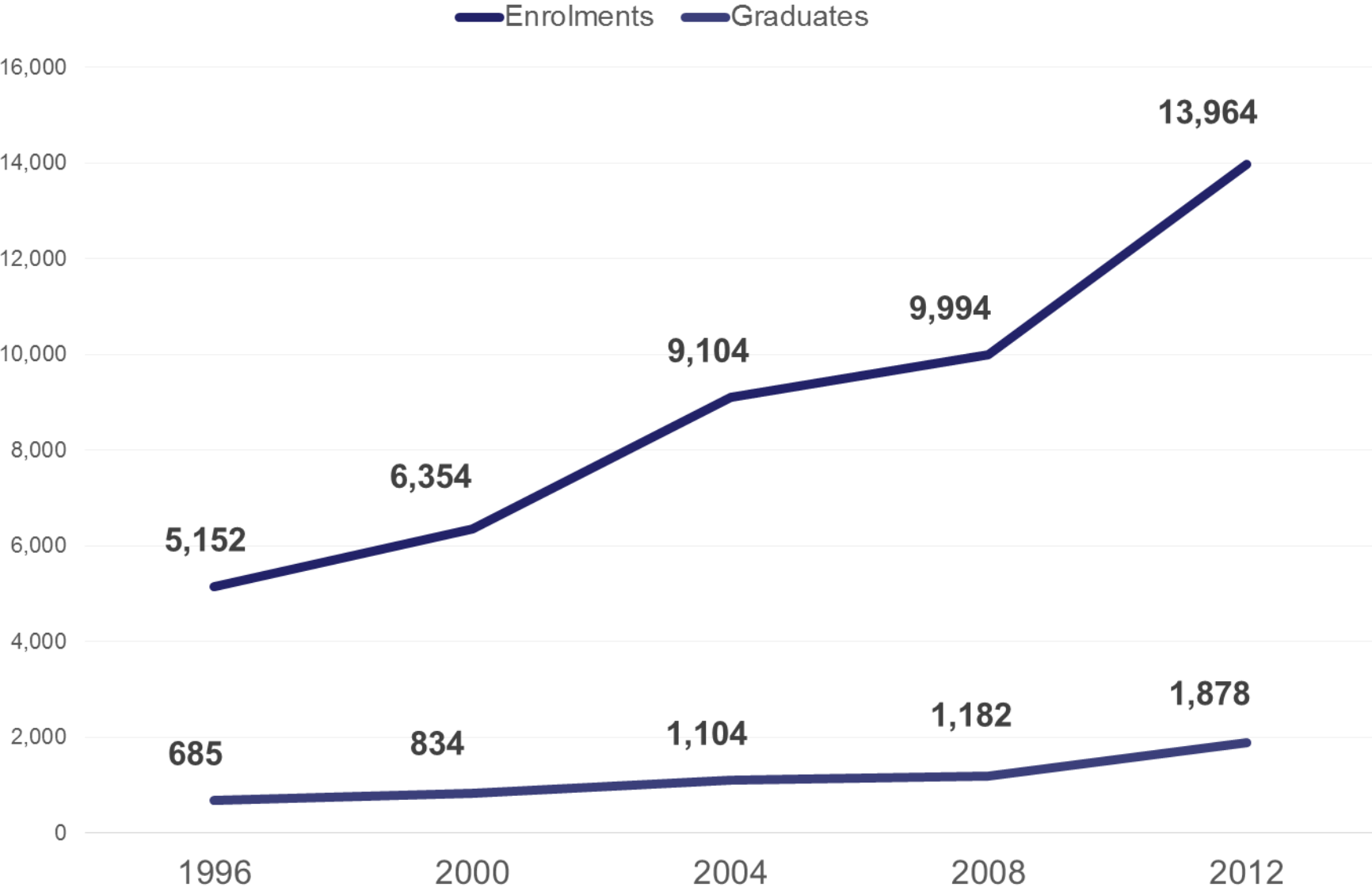- **Communication and Promotion Strategy**
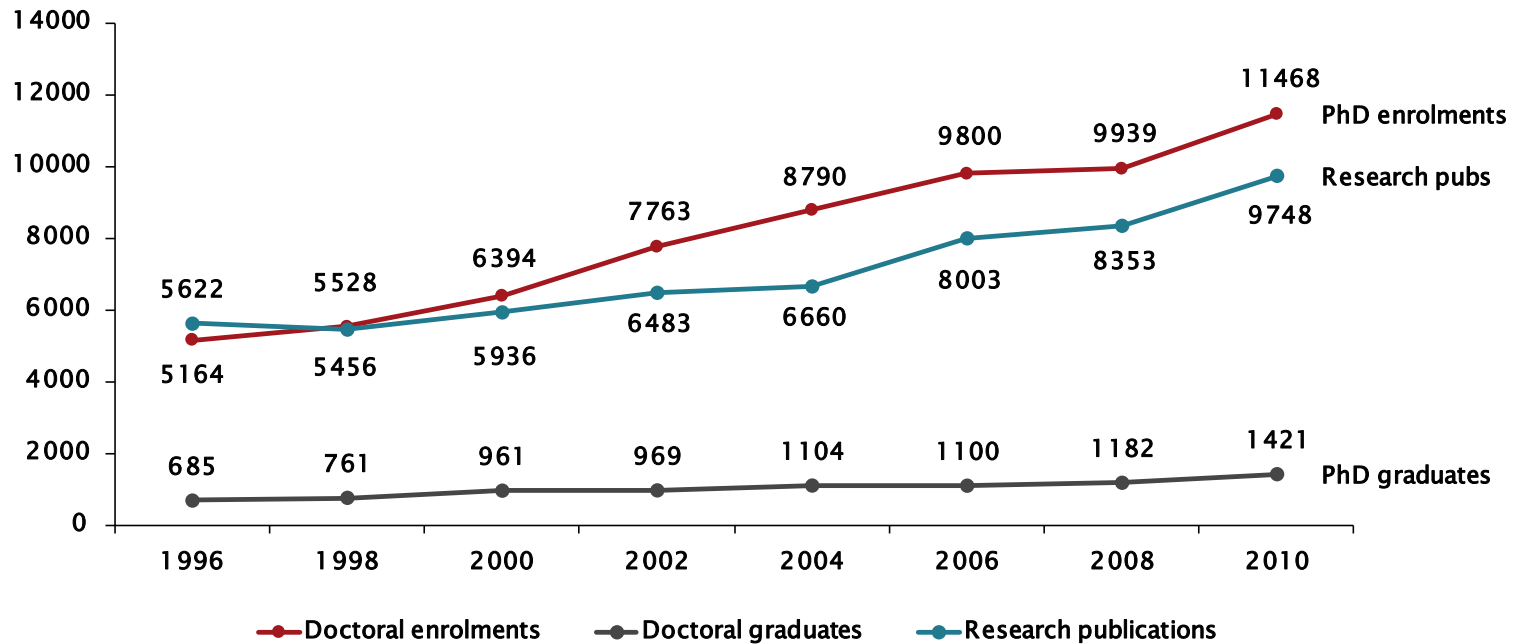
Teaching and Learning Material

- **Coherent planning and development of teaching and learning material**

- **Strategies for effective use of teaching and learning material**

- **Identifying resources for making teaching and learning material**

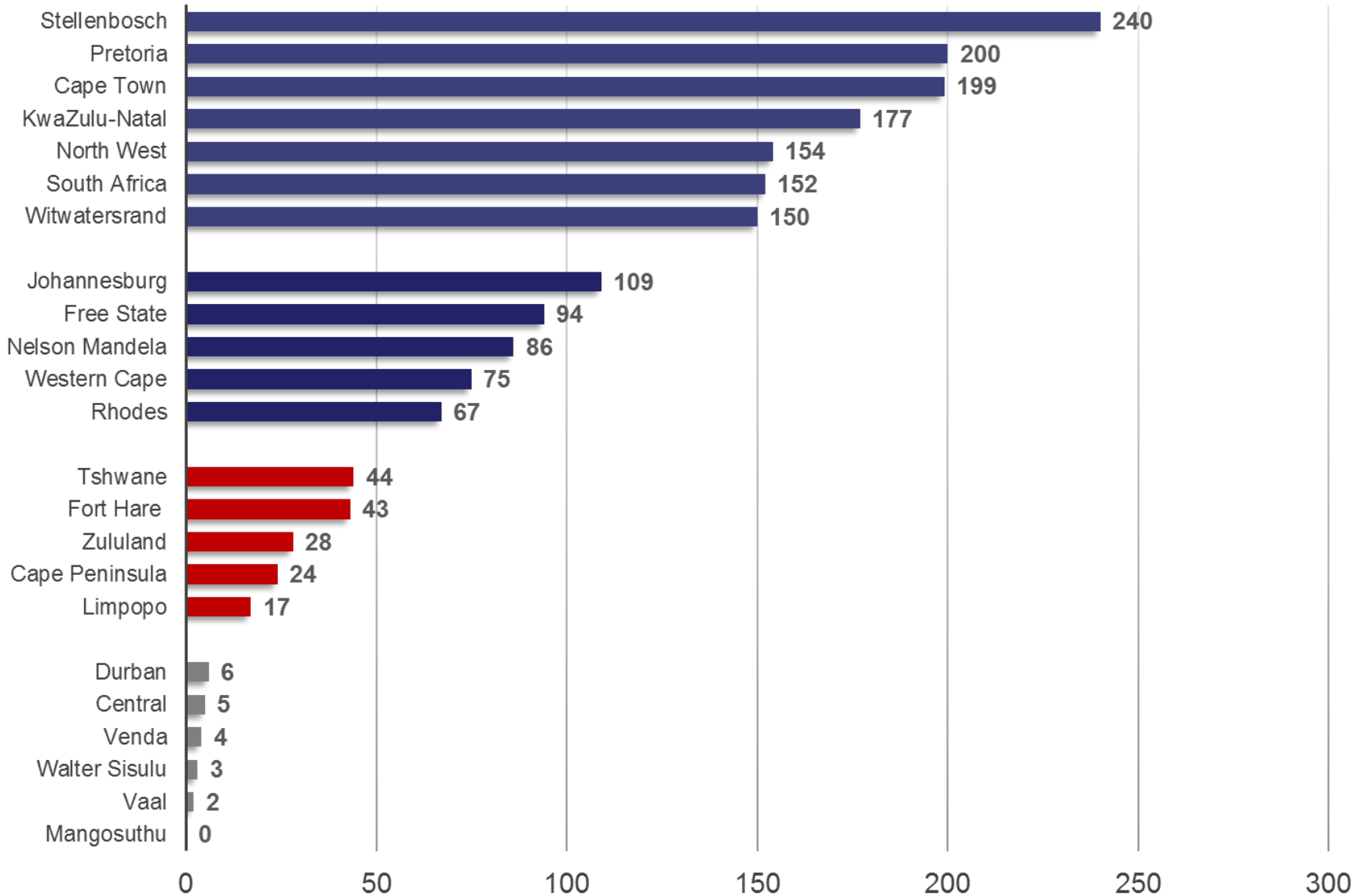- **Evaluation and revision of teaching and learning material**

PhD enrolments and graduates in SA: 1996-2012 [Source: DHET (2013)]

Doctoral enrolments, doctoral graduates and research publications in SA

Year	PhD enrolments	Research pubs	PhD graduates
1996	5164	5622	685
1998	5528	5456	761
2000	6394	5936	961
2002	7763	6483	969
2004	8790	6660	1104
2006	9800	8003	1100
2008	9939	8353	1182
2010	11468	9748	1421

Legend: Doctoral enrolments — Doctoral graduates — Research publications

Doctoral graduates produced by SA universities in 2012

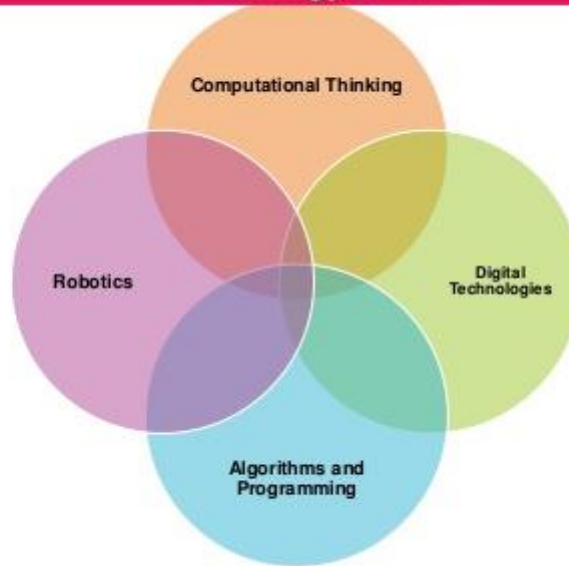| University	Graduates
Stellenbosch	240
Pretoria	200
Cape Town	199
KwaZulu-Natal	177
North West	154
South Africa	152
Witwatersrand	150
Johannesburg	109
Free State	94
Nelson Mandela	86
Western Cape	75
Rhodes	67
Tshwane	44
Fort Hare	43
Zululand	28
Cape Peninsula	24
Limpopo	17
Durban	6
Central	5
Venda	4
Walter Sisulu	3
Vaal	2
Mangosuthu	0
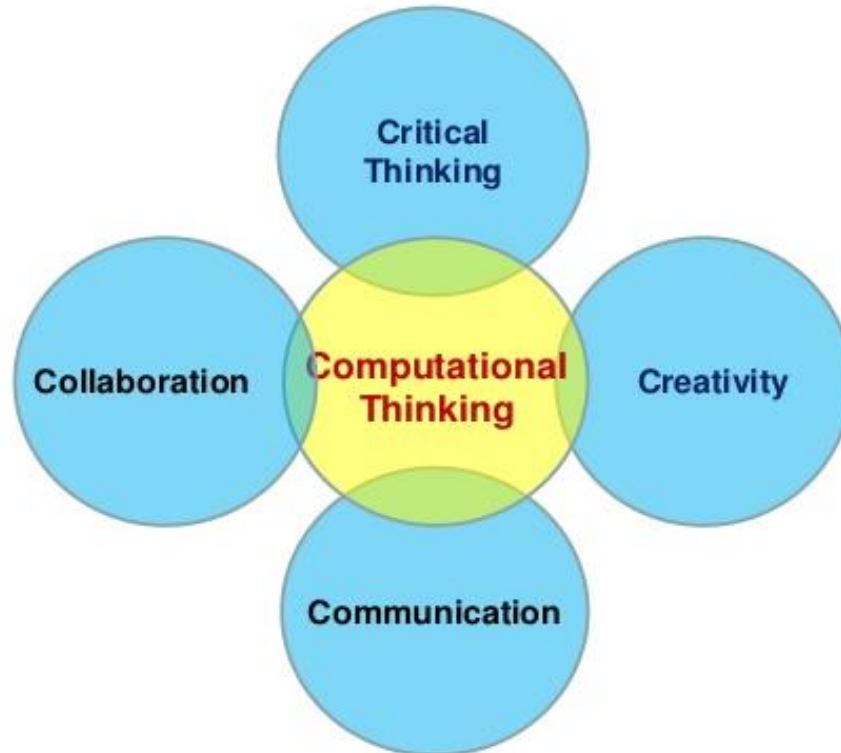
Coding and Robotics

Computational Thinking, Progamming and Robotics: A Strategy to Learn

Design targets

$f(x)$ — **Programming integrated into math lessons**

Mathematics

Computing

Visually interesting programming artifacts

Creativity

Exercises ready to be used in classroom

4
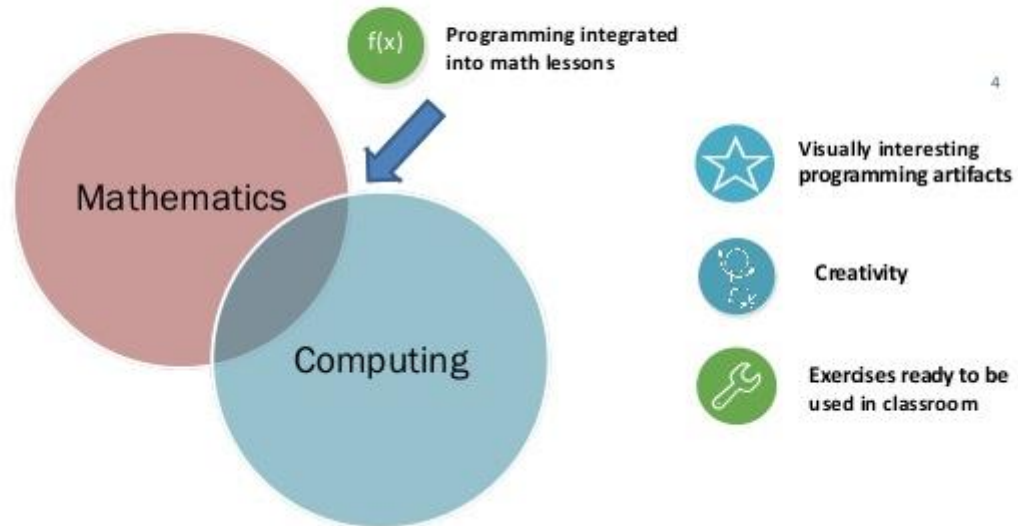
Programming   for   Physics   Experiments   and   Simulations

- **Design and implementation of Physics virtual laboratories**

- **Teaching Physics using simulations**

- **Virtual Reality and Augmented Virtual Reality**

- **Innovative use of multimedia technology in Physics teaching and learning**

- **Remote laboratory activities and experiences**

Attraction and Retention of Students in Physics

- Quality of students entering African universities

- Articulation gap between school and higher education

- The state of undergraduate physics teaching and learning

- Develop a set of standards for Physics training in Africa

- Assess levels of commonality and diversity of the physics programmes

- Assess range, scope and effectiveness of current teaching and learning practices in Physics at African universities

- Develop a set of contextually appropriate recommendations aimed at improving the effectiveness of Physics teaching at African universities

Innovating Education in Africa Initiative

- **Established in 2018 by the African Union (AU)**

- **Aimed at identifying, promoting and supporting the systemic adoption and replication of education innovations in all aspects of education and training in Africa**

- **Policy dialogues with policy makers and development stakeholders to make the case for embedding innovation in education systems in Africa**

- **Endorsing the implementation of the continental programme**

AU Agenda 2063 Goals

- **A high standard of living, quality of life and well-being for all citizens**

- **Well educated citizens and skills revolution underpinned by science, technology and innovation**

- **Healthy and well-nourished citizens**

- **Transformed economies**

Promotion of Active Learning in Africa

- **Scaffolding**

- **Contemporary innovative strategies**

- **Modelling of instruction**

- **Performance feedback**

- **Periodic reviews**

Envisaged Strategies for Promotion of Active Learning in Africa

- **Inquiry-based learning**

- **Problem-based learning**

- **Project-based learning**

- **Self-directed learning**
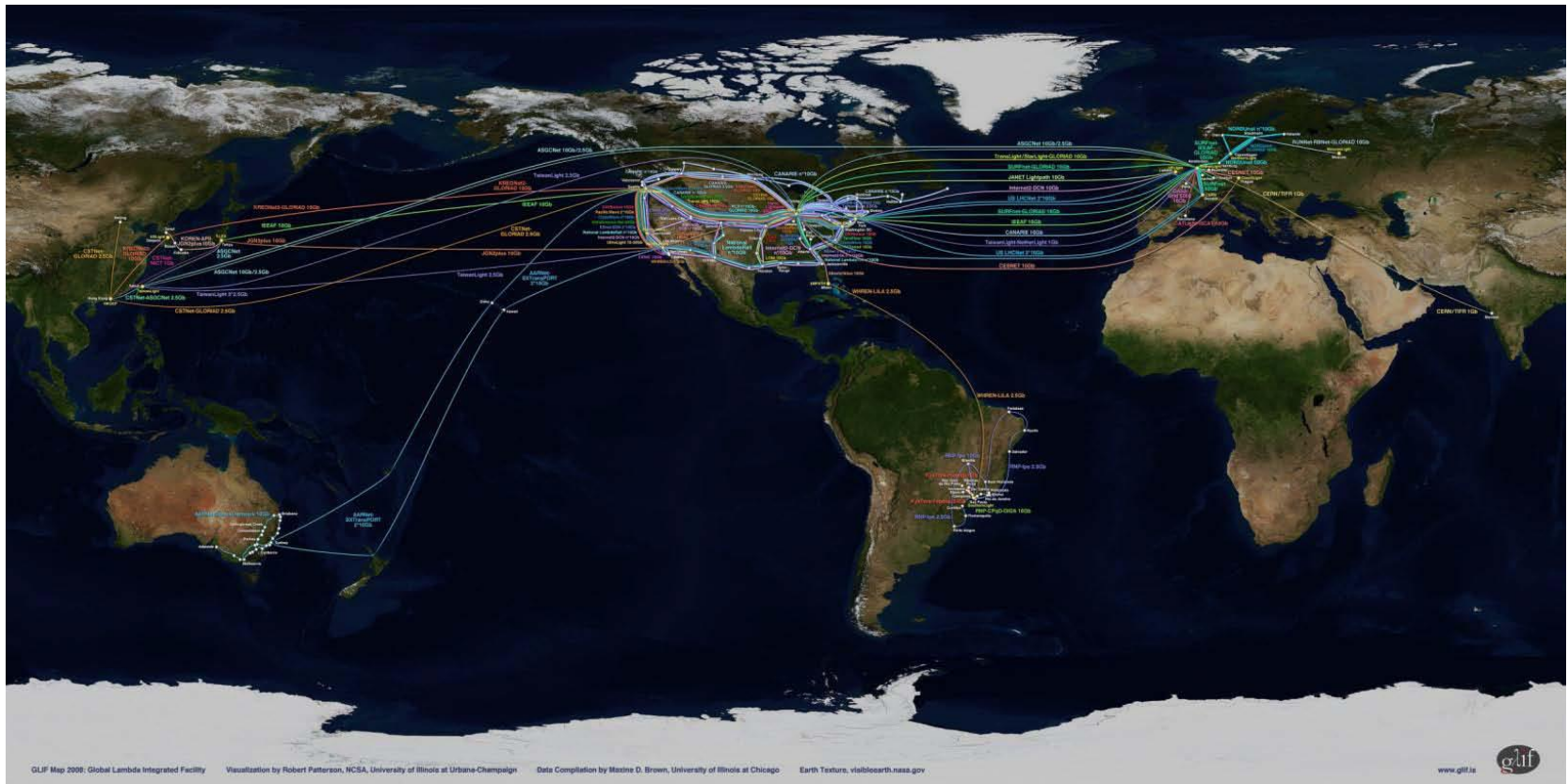
- **Technology-enhanced learning**

Mobility

- **Sharing best practices**

- **Collaboration**

- **Skills transfer**

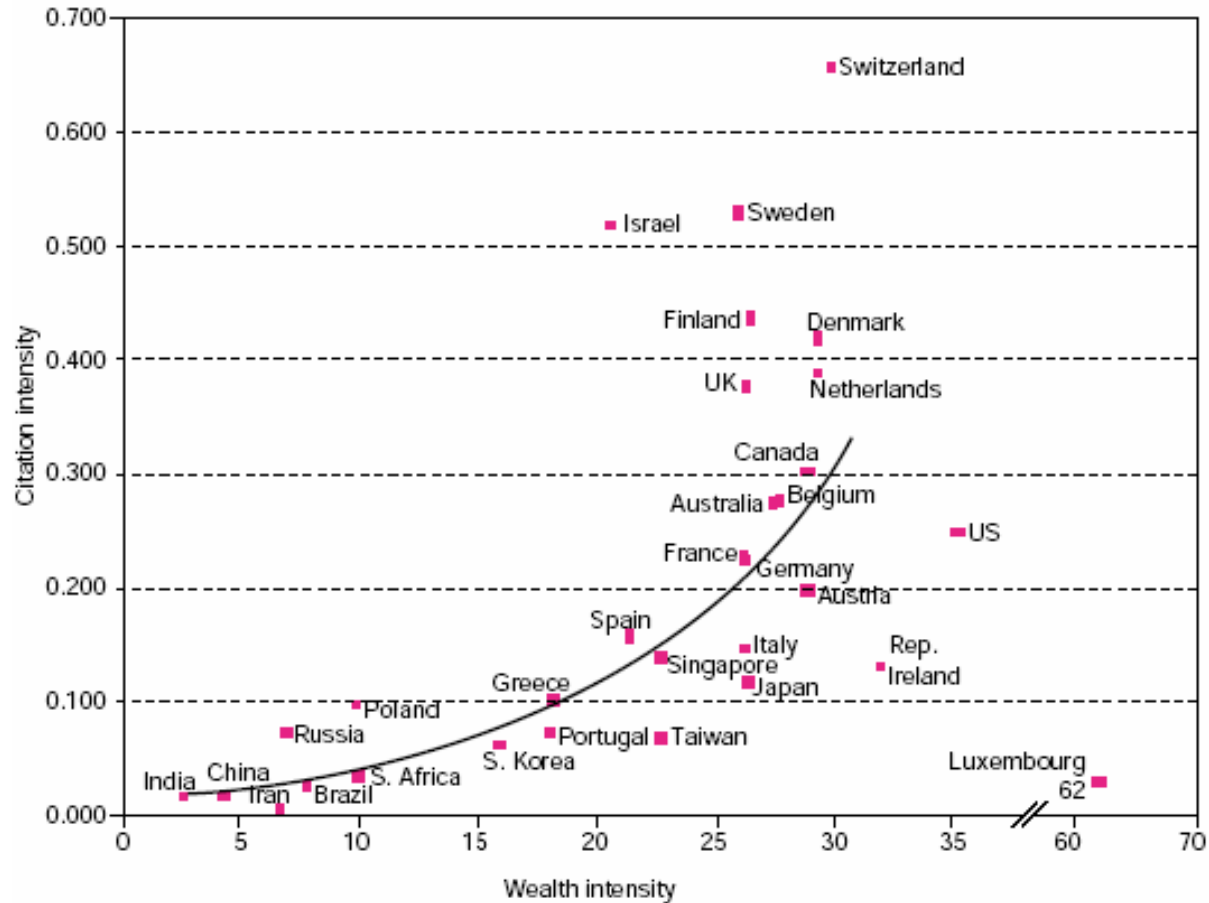- **Skills development**

- **Pedagogic innovation**

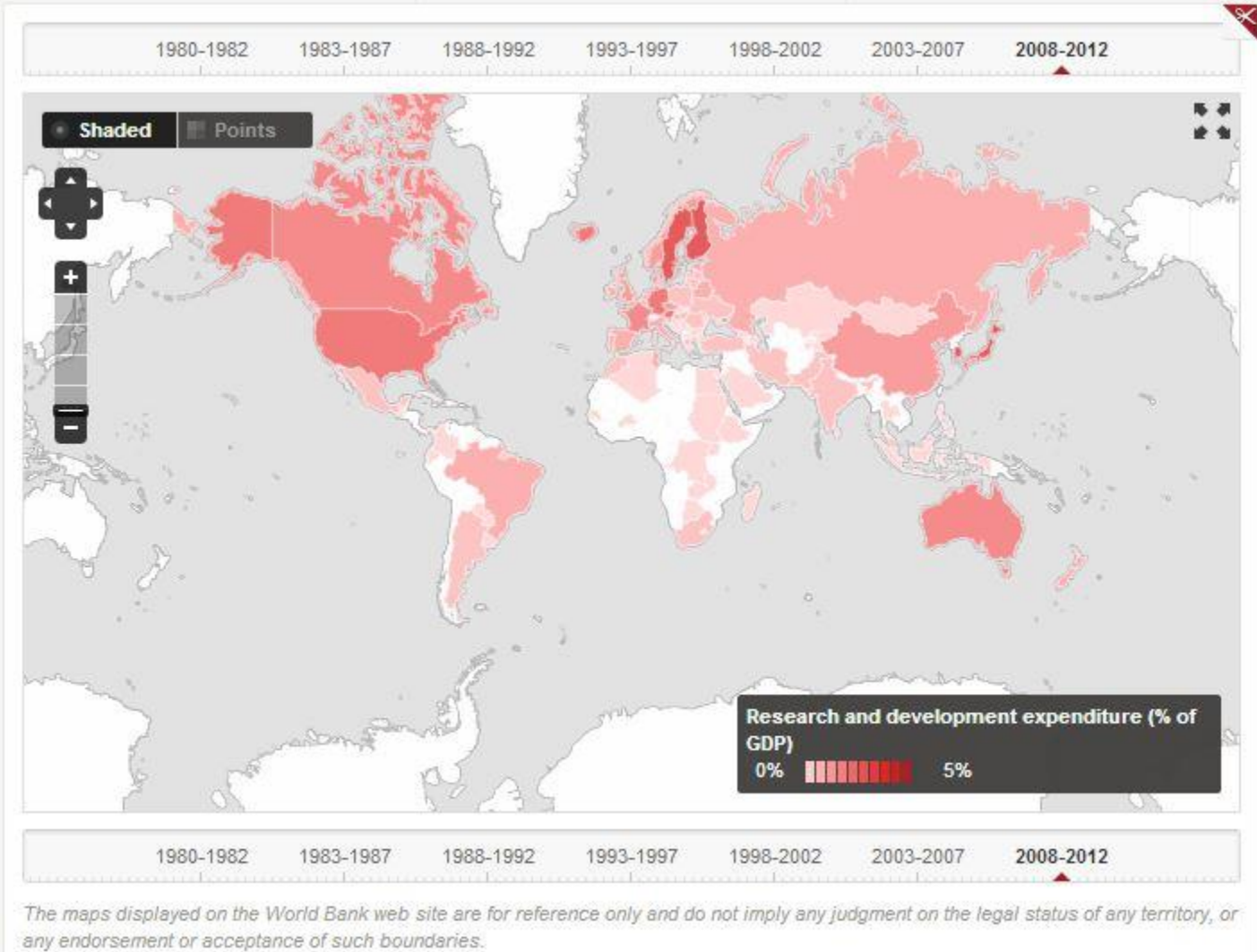# Benchmarking

High Speed Internet Without Africa

Link between citation and wealth intensities
(Sources: Thomson ISI, OECD and the World Bank)

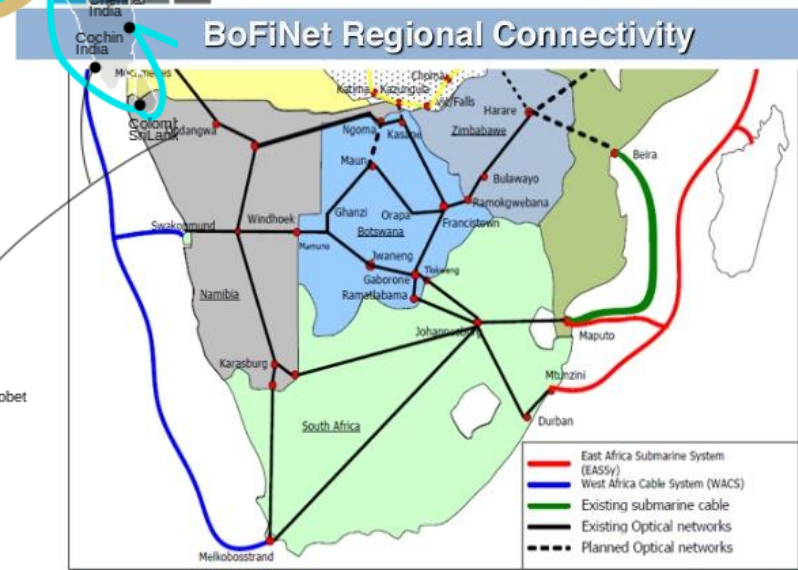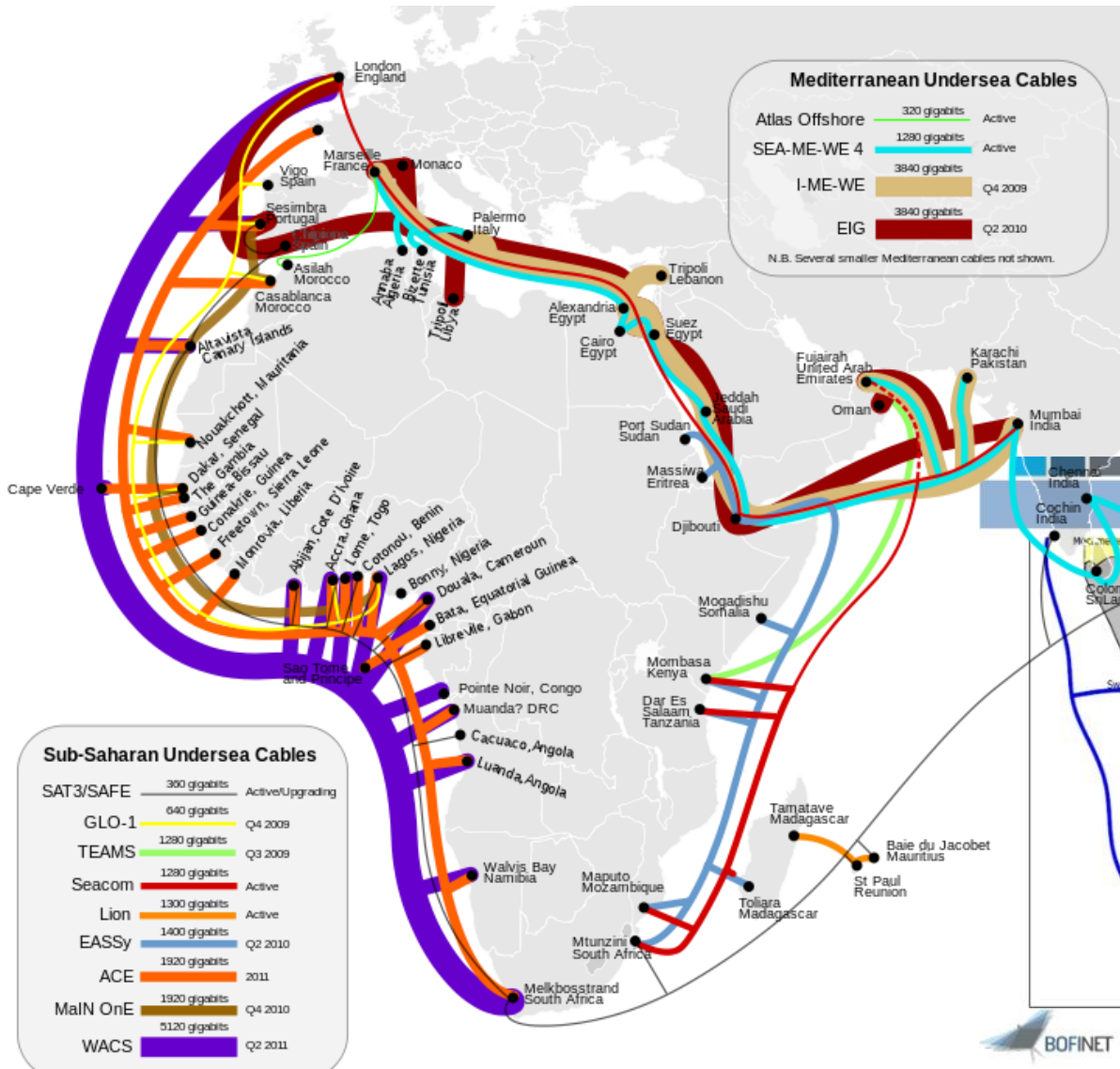# Research & Development Expenditure as % GDP [Source: World Bank]

Networking and Collaboration Between Universities

- **Facilitate sharing of resources between African universities**

- **Collaborative research projects**

- **Inbound-outbound student engagement**

- **Student exchange programs**

- **Joint Webinars**

Enhancement of Continental, Regional and National Connectivity

Mediterranean Undersea Cables

Atlas Offshore	320 gigabits	Active
SEA-ME-WE 4	1280 gigabits	Active
I-ME-WE	3840 gigabits	Q4 2009
EIG	3840 gigabits	Q2 2010

N.B. Several smaller Mediterranean cables not shown.

Sub-Saharan Undersea Cables

SAT3/SAFE	300 gigabits	Active/Upgrading
GLO-1	640 gigabits	Q4 2009
TEAMS	1280 gigabits	Q3 2009
Seacom	1280 gigabits	Active
Lion	1300 gigabits	Active
EASSy	1400 gigabits	Q2 2010
ACE	1920 gigabits	2011
MaIN OnE	1920 gigabits	Q4 2010
WACS	5120 gigabits	Q2 2011

BoFiNet Regional Connectivity

——	East Africa Submarine System (EASSy)
——	West Africa Cable System (WACS)
——	Existing submarine cable
——	Existing Optical networks
----	Planned Optical networks

BOFINET

BoFiNet 2015

- **Letters of intent**

- **Wide solicitation**

Thank You