

Africa in the Dynamic World of Science and Technology

Ayoade MJ. Oduola

University of Ibadan Research Foundation

University of Ibadan

This Session

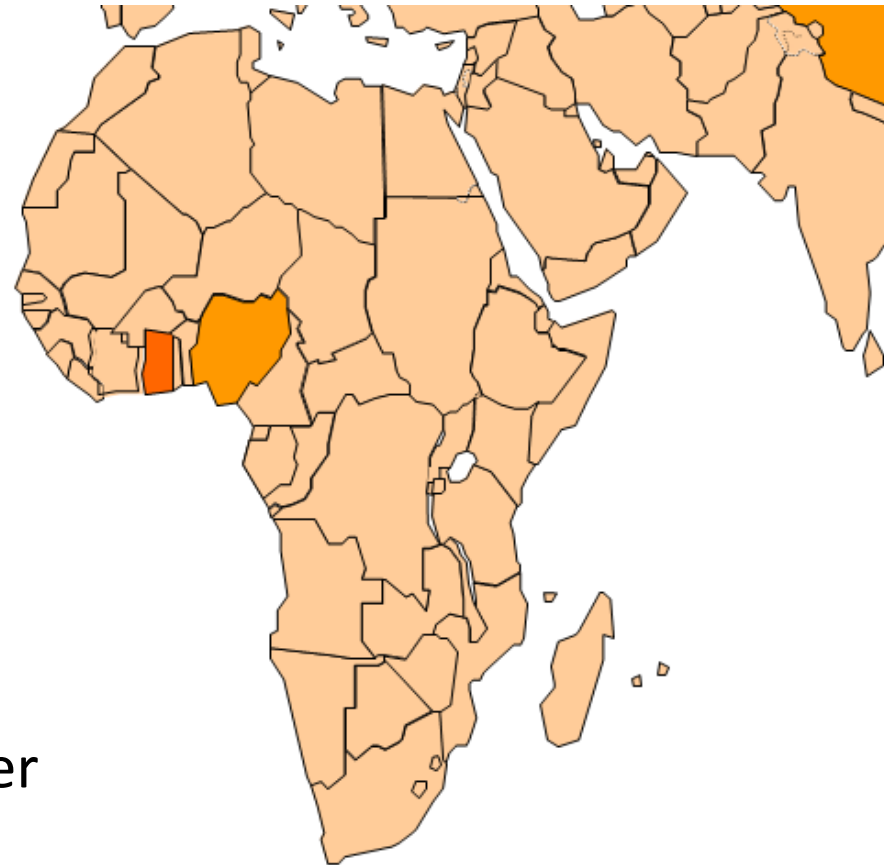
- Presentation 20 minutes
- Discussions 20 minutes
- Suggestions on way forward

Outline of presentation

- Africa -Economic Statistics
- Why Science and Technology –Context of sustainable development
- Dividends of Science and Technology
- Human Genome Sequencing (a landmark in S&T)
- Surrogate Markers of advances in Science and Technology
- Africa of My Dreams

Africa

- Population 1.1 Billion
(15% World Population)
- GDP US\$ 2,390 Trillion (2013)
- GDP Growth 5.16% (2004-2006)*
- GDP Per Capital US\$ 2,320
- Millionaires 100,000 (1%)
- People living in poverty <US\$1 per day 36.2%



Low population Density but growing at an alarming rate. 65 people per square mile

Global Economic Ranking

Rank	Country (Rank)	GDP(Millions US \$) IMF 2013	GDP(Millions US \$) World Bank 2013
1	US	16,799,700	16,800,000
2	China	9,181,377 ⁽ⁿ⁻²⁾	9,240,270 ⁽ⁿ⁻²⁾
3	Japan	4,901,532	4,901,530
4	Germany	3,635,959	3,634,823
7	Brazil	2,242,854	2,245,673
10	India	1,870,651	1,876,797
29	Thailand	387,156	387,252
33	South Africa	350,779	350,630
38/23	Nigeria	286,470 (38)	522,638 (23)

Global Economic Ranking

Rank	Country (Rank)	GDP(Millions US \$) IMF 2013	GDP(Millions US \$) World Bank 2013
1	US	16,799,700	16,800,000
2	China	9,181,377 ⁽ⁿ⁻²⁾	9,240,270 ⁽ⁿ⁻²⁾
3	Japan	4,901,532	4,901,530
4	Germany	3,635,959	3,634,823
7	Brazil	2,242,854	2,245,673
10	India	1,870,651	1,876,797
29	Thailand	387,156	387,252
33	South Africa	350,779	350,630
38/23	Nigeria	286,470 (38)	522,638 (23)

The World @ Night



Dividends of Science and Technology

- **Life style and Life Expectancy**
- Food
- Health
- Energy
- Robotics
- Modified Organisms
- Innovation in Products
- Space Exploration
- **Human Genome Sequencing (a landmark in S&T)**

Africa: Early Technology Leader

- 1st Domesticated plants for agricultural purposes in Africa occurred in the Sahel region c. 5000 BCE,
- **Sorghum and african rice (*Oryza glaberrima*)** began to be cultivated.
- 1st Domesticated food animal, the small **Guinea fowl**.
- Other African domesticated plants :
 - **oil palm, raffia palm, black-eyed peas, groundnuts, and kola nuts.**

Science

16 February 2001

Vol. 291 No. 5507
Pages 1145-1434 \$9

THE HUMAN GENOME

 AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Malaysia: Research and Oil Palm Industry

- Earning from Palm oil Export
 - 2000 **\$ 6.5 Billion**
 - 2001 **\$ 7.5 Billion**
- Palm Oil Research Institute of Malaysia (PORIM) established **1988**
- Research Target
 - **use of methyl ester of palm oil as diesel substitute**

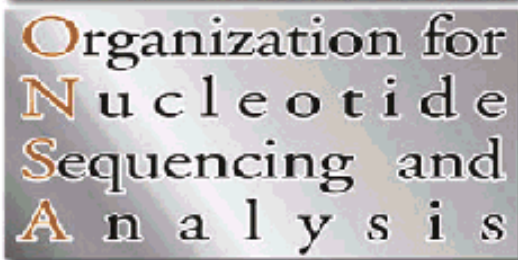



Thailand: World Leader in Rice and Shrimp Export

- Agricultural Export **\$ 20 billion a year**
- Shrimp export 2009 **\$ 2.64 billion**

- **Research Target**
- Specific Pathogen Free (SPF) shrimp
- Production of Broad SPF stock

- Pacific white shrimp **\$6 to \$7 per kilo**
- Black Tiger shrimp **\$12 - \$18 per kilo**

Brazil: Leadership in Genomics and Biotechnology in Developing World



The Virtual Genomics Institute

- Xylella fastidiosa
- SugarCane
- Human Cancer
- Xanthomonas citri
- Agronomical & Environmental
- Schistosoma mansoni
- Functional Genomics
- Proposta Novos Genomas
- ONSA in the Press

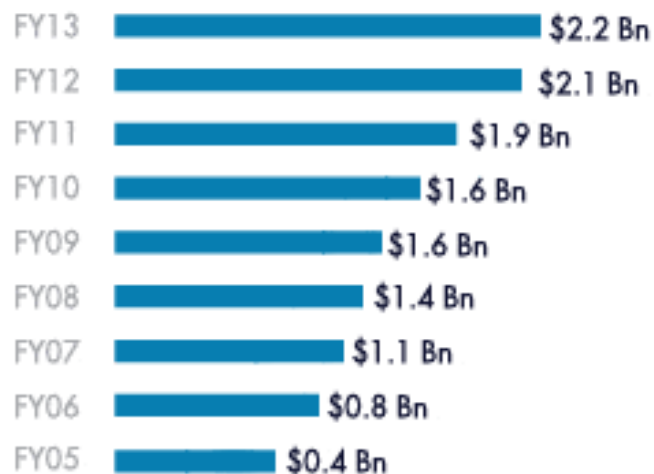
onsa@trieste.fapesp.br

Indian Biotechnology Industry Analysis

Latest update: April, 2014

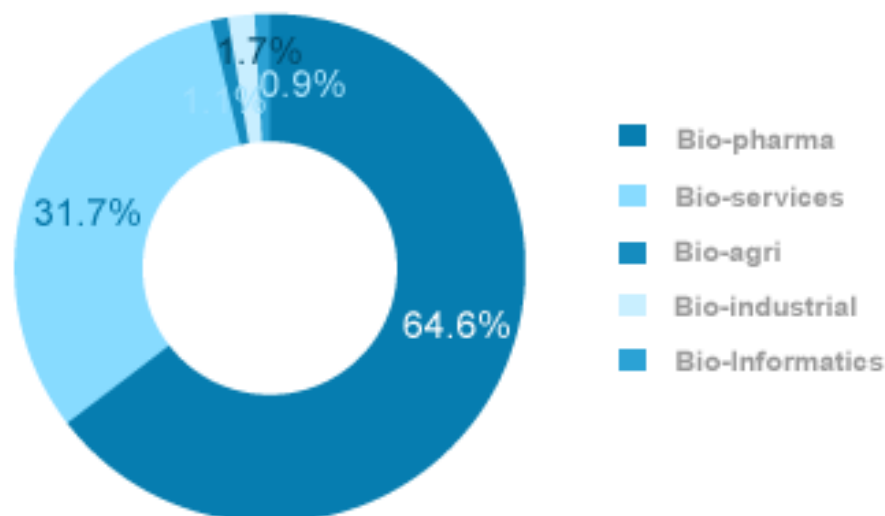
Export Revenue

Revenue from biotech exports reached US\$ 2.2 billion in FY13.



Export Share

Revenue from bio-pharma exports contributes more than 64.6 per cent to total export revenues in the biotech industry.

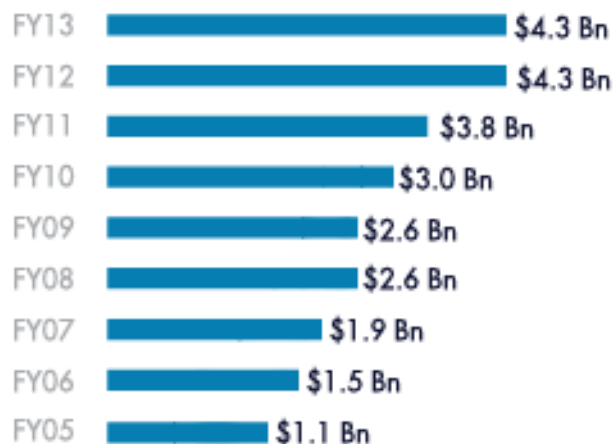


Indian Biotechnology Industry Analysis

Latest update: April, 2014

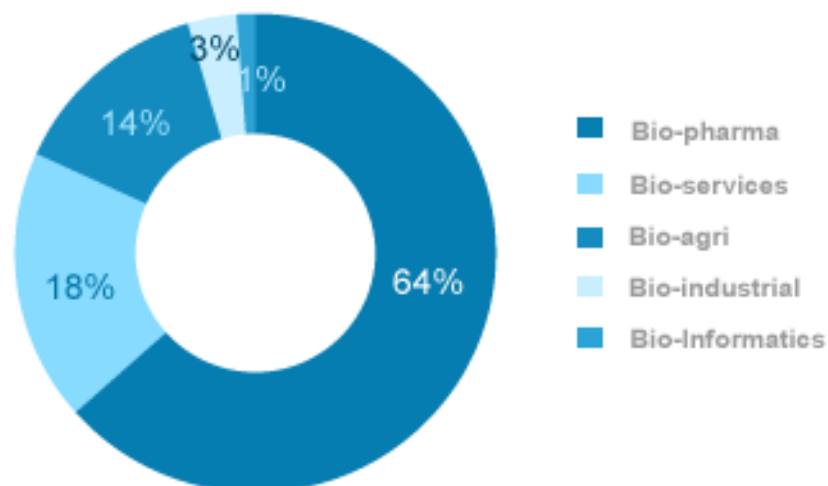
Market Size

The total industry size was US\$ 4.3 billion at the end of the FY13.



Market Segment

The bio-pharmaceutical segment accounted for the largest share of the biotech industry, with 64 per cent of total revenues in FY13.



BRICS

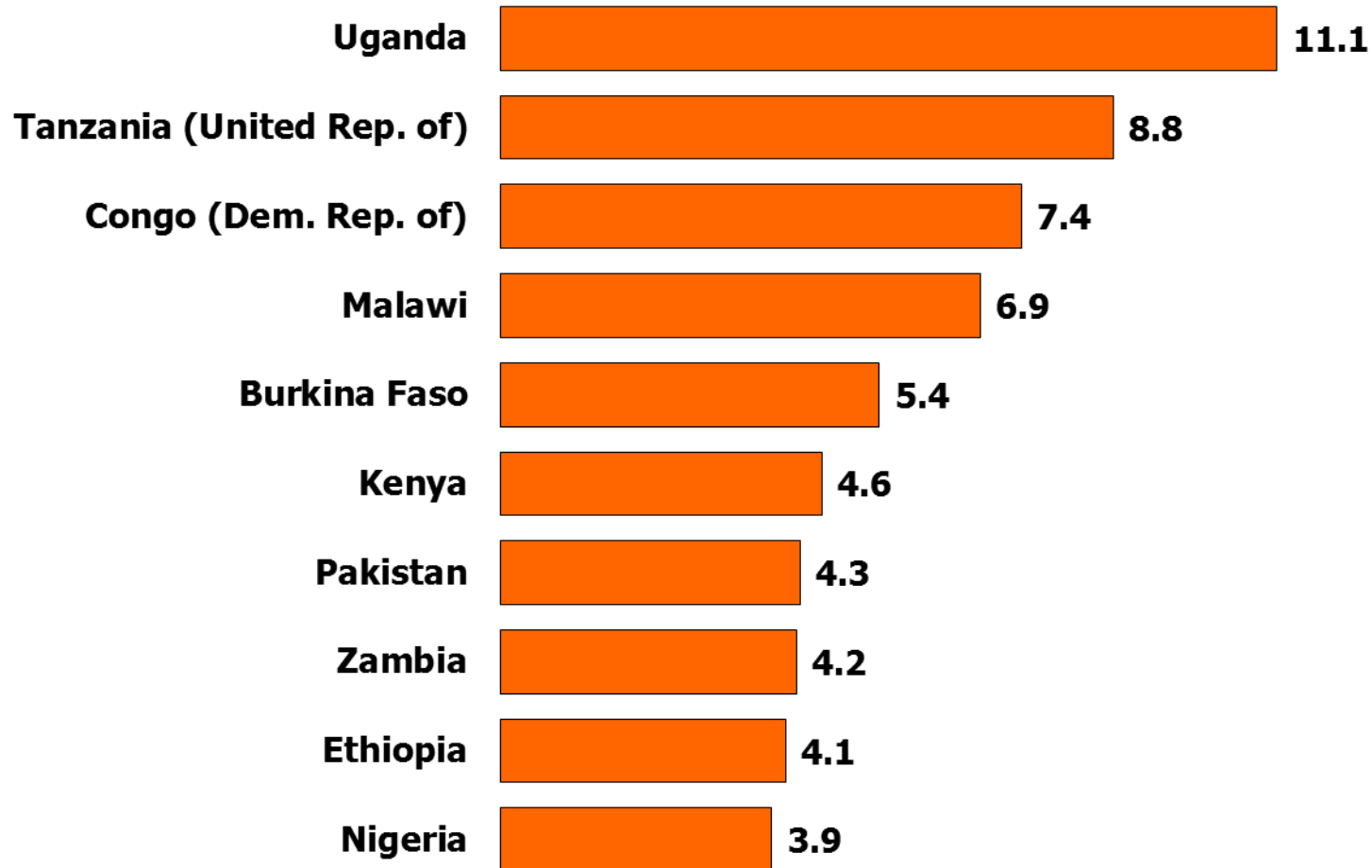
Country	Population	<u>GDP</u> (nominal)	<u>Literacy</u> rate	<u>Life</u> <u>expectancy</u> (years, avg.)
<u>South Africa</u>	51,770,560	\$350.8 bn	93% ^[38]	51.2
<u>Russia</u>	143,451,702	\$2,118.0 bn	99.6%	70.7
<u>Brazil</u>	201,046,886	\$2,242.8 bn	93.5%	74.6
<u>India</u>	1,210,193,422	\$1,870.6 bn	74.04%	64.2
<u>China</u>	1,354,040,000	\$9,181.4 bn	95.1% ^[37]	72.7

BRICS

Country	<u>GDP per capita (PPP)</u>	<u>Government spending</u>	<u>Exports</u>	<u>Imports</u>
<u>South Africa</u>	\$11,375	\$95.27 bn	\$101.2 bn	\$106.8 bn
<u>Russia</u>	\$17,708	\$414.0 bn	\$542.5 bn	\$358.1 bn
<u>Brazil</u>	\$13,623	\$846.6 bn	\$256.0 bn	\$238.8 bn
<u>India</u>	\$3,829	\$281.0 bn	\$309.1 bn	\$500.3 bn
<u>China</u>	\$9,161	\$2,031.0 bn	\$2,021.0 bn	\$1,780.0 bn

Top 10 Countries, Reported Confirmed Malaria Cases, 2010

In Millions



Global Malaria Cases, 2010 = 91.3 Million

NOTES: Data are estimates.

SOURCE: Kaiser Family Foundation, <http://globalhealth.kff.org/globalhealthfacts>, based on WHO, *World Malaria Report 2011*; December 2011.

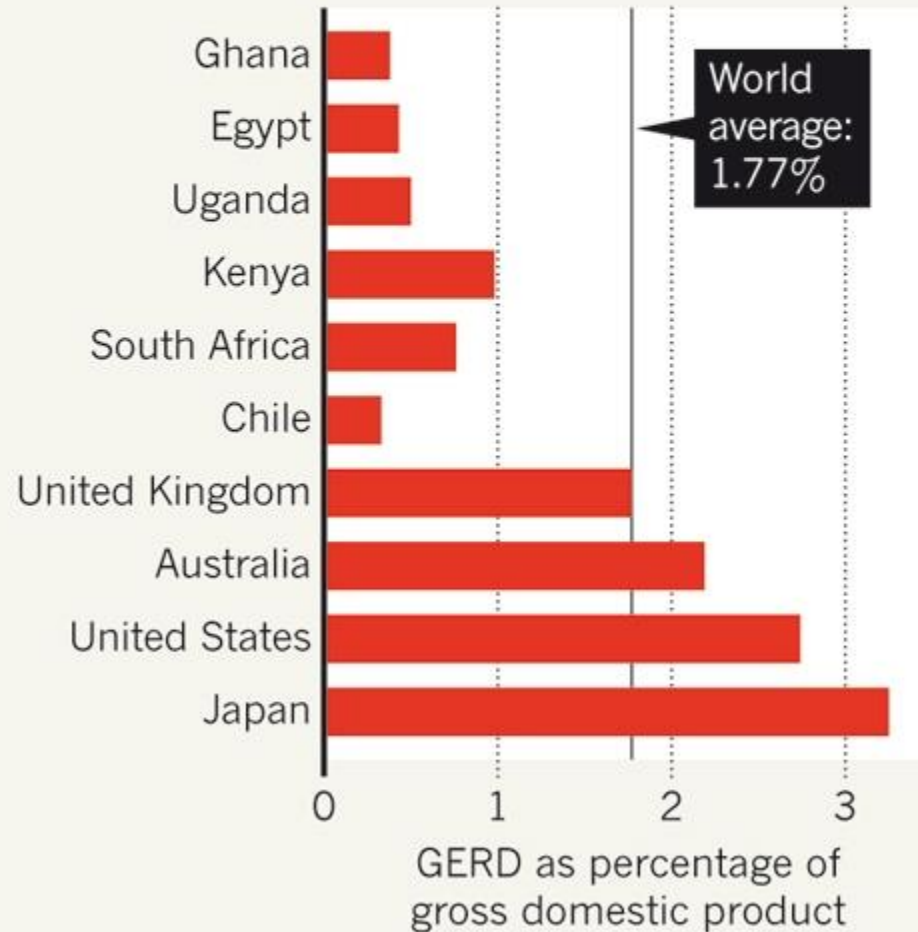
SURROGATE MARKERS OF S&T

Spending on Science & Technology

- **AU in 2007 –recommended 1 per cent of GDP to research and development by 2020**
- **Sub-Saharan African countries spent on average 0.3%**
- **North African countries spend a comparative 0.4%**
- **South Africa spends 0.87% of GDP on science and technology research.**

CONTINENTAL DIVIDE

A sample of leading African science spenders shows that they lagged behind many major economies in gross domestic expenditure on research and development (GERD) in 2010.



Source: AFRICAN INNOVATION OUTLOOK II/OECD

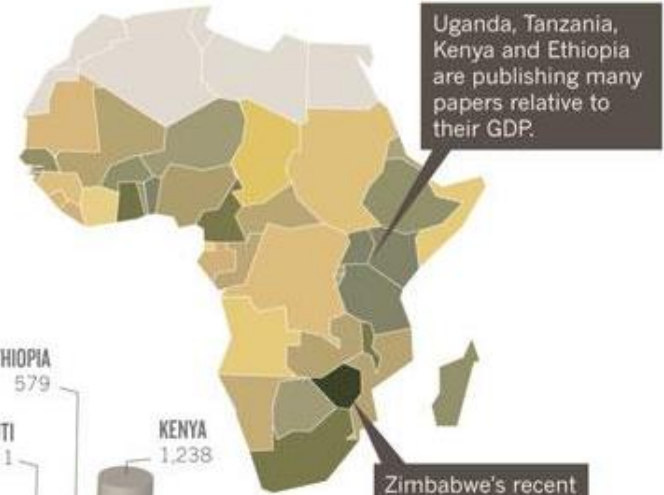
Researchers to Population Ratio

Region	Researchers per Million
Africa	100
Latin America	300
North Africa	700
Central and Eastern Europe	1600

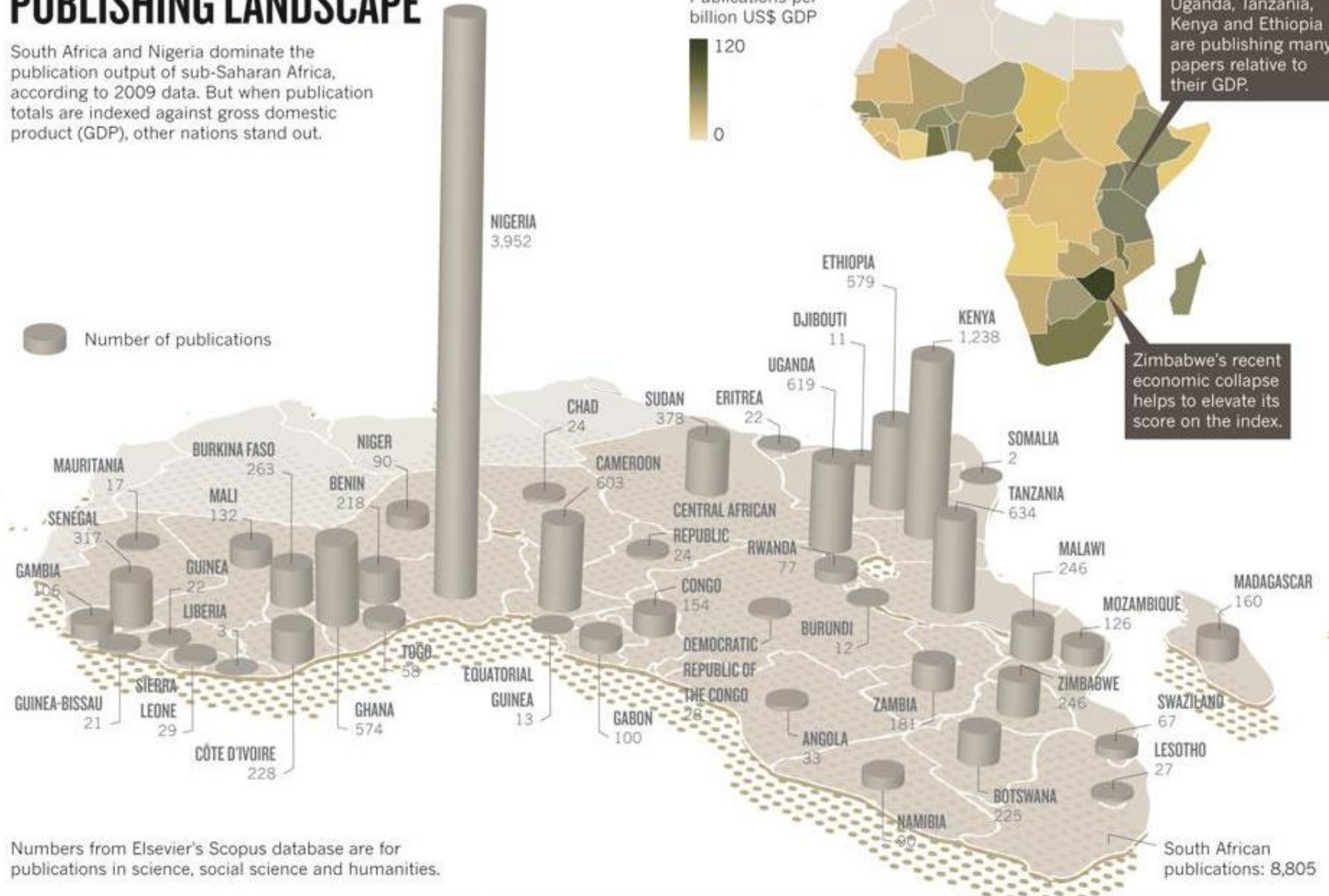
PUBLISHING LANDSCAPE

South Africa and Nigeria dominate the publication output of sub-Saharan Africa, according to 2009 data. But when publication totals are indexed against gross domestic product (GDP), other nations stand out.

Publications per billion US\$ GDP



Number of publications



Numbers from Elsevier's Scopus database are for publications in science, social science and humanities.

Translating Research into Innovation

Country	Number of Publications	Number of International Patents
Taiwan	10,841	36,538
Thailand	1,249	59

ALL innovation including SOCIAL INNOVATION

Only 0.07% of Global Patent Applications from Africa

2008 World competitiveness Yearbook

YEARS	Foreign Patents		Local Patents		Total Application Filed
	No. of Applications Filed	No. of Applications Granted	No. of Applications Filed	No. of Applications Granted	
1998	411	185	39	2	450
1999	439	312	5	2	444
2000	473	351	49	42	522
2001	476	142	34	13	510
2002	466	62	36	3	502
2003	450	179	55	15	505
2004	425	421	88	40	513
2005	297	316	81	64	378
2006	255	212	95	87	350
2007	565	218	84	33	649
TOTAL	4,257	2,398	566	318	4,823

Number of Patent Applications Filed and Granted in Nigeria between 1998 and 2007

THAILAND SCIENCE PARK

by Weena Yoswangjai



Thailand: Investment in Biotechnology with Results

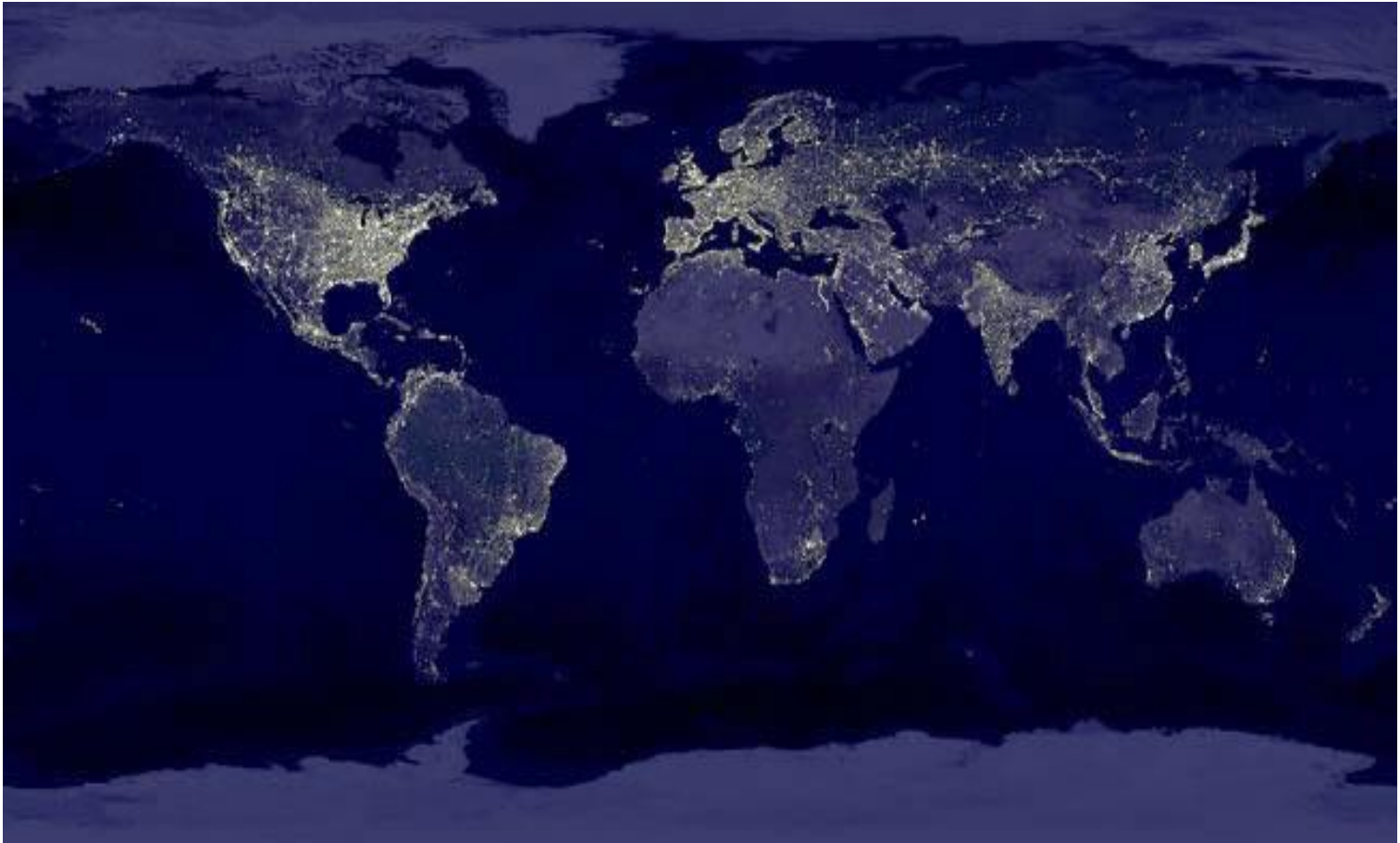
- 1985 Science & Technology Dev. Board launched
 - » With \$50 million loan from USAID
 - » to provide grants for Biotechnology research and other leading edge science.
- 2002 Rice genome sequence completed
 - Drug target (DHFR) for malaria discovered
- 2003 Cloning of a cow
- 2009 Transfection Technology established

Science and Technology Parks in Africa

- Morocco
- Egypt
- Senegal,
- Madagascar
- Tunisia
- South Africa

Six countries have made technology park construction an integral piece of their development goals.

The World @ Night



A measure of technology Advances?

Africa of My Dream

***TO KNOW IS NOT ENOUGH, WE MUST
APPLY***

***WILLING IS NOT ENOUGH, WE MUST
DO.***

W. H. Murray in The Scottish Himalaya Expedition, 1951

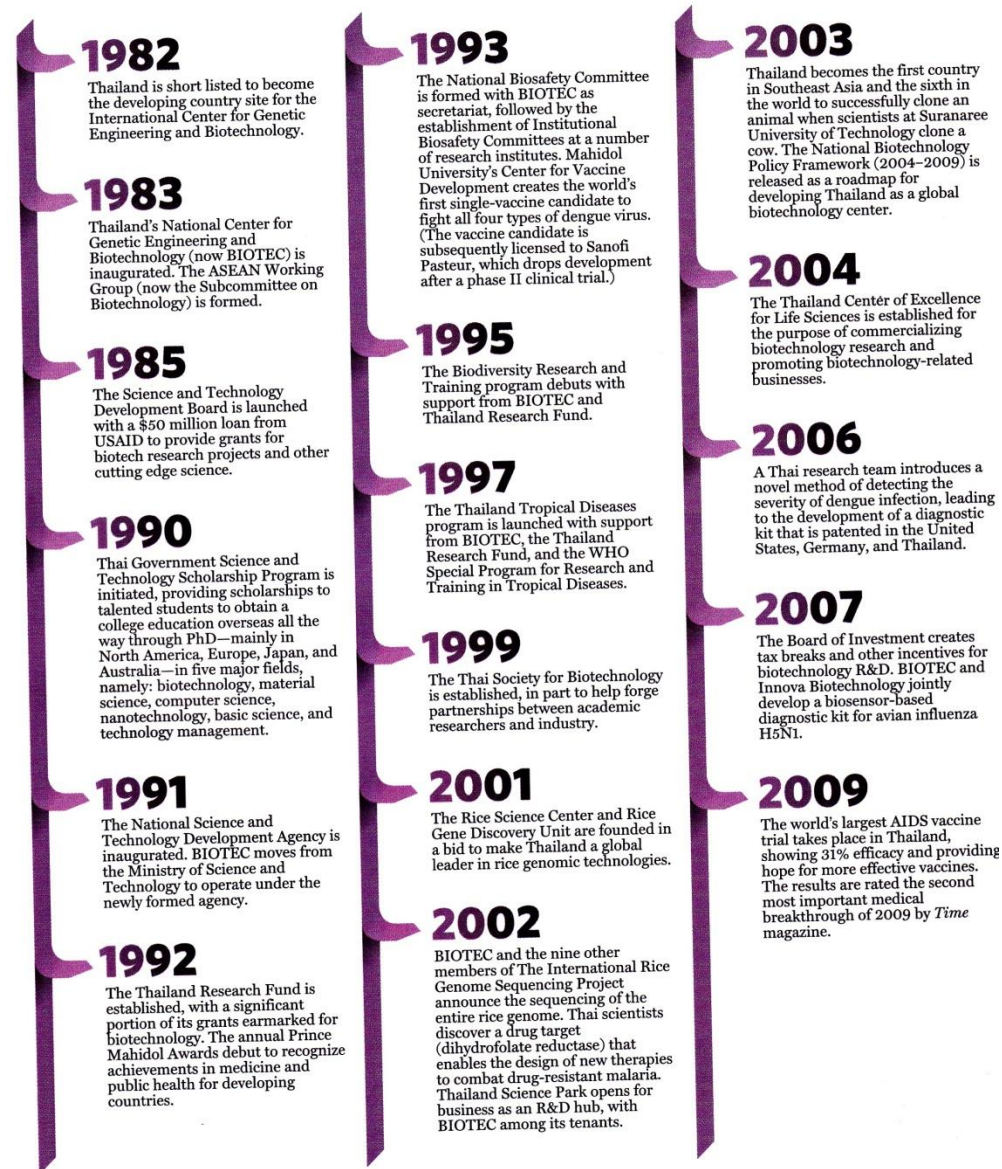
Johann Wolfgang von Goethe

**What Can WE do to
Improve
Africa's Fortune
with
Science and Technology**

Thank you

The text 'Thank you' is rendered in a bold, sans-serif font. Each letter is filled with a different color from a rainbow spectrum: 'T' is magenta, 'h' is red, 'a' is orange, 'n' is yellow, 'k' is light green, 'y' is dark blue, and 'u' is purple. The letters are positioned on a white surface, casting a soft, grey shadow to the left and slightly forward, giving the text a three-dimensional appearance.

A HUB IS BORN: TIMELINE OF KEY EVENTS IN THAILAND'S DEVELOPMENT AS A GLOBAL BIOTECH CENTER



Thailand: Biotechnology Initiative

Competing in World Economy

To be successful on the global stage, particularly as the world struggles with its worst economic situation in decades,

countries have to combine open markets and investment incentives with a flexible labor market and **a well-educated workforce.**

World Competitiveness Yearbook 2010

- The World Competitiveness Yearbook measures 58 countries on the basis of 327 criteria. The [International Institute for Management Development](#) reports that Singapore, Hong Kong and the US come out on top in the World Competitiveness Rankings, while [South Africa](#) improved its position to 44th place.

Benefits associated with local bioenergy production [1]

Dimension	Benefit
Social aspects	<ul style="list-style-type: none">● Increased standard of living.<ul style="list-style-type: none">○ Environment.○ Health.○ Education.● Social cohesion and stability.<ul style="list-style-type: none">○ Migration effects (mitigating rural depopulation).○ Regional development.○ Rural diversification.
Macro level	<ul style="list-style-type: none">● Security of supply/risk diversification.● Regional growth.● Reduced regional trade balance.● Export potential.
Supply side	<ul style="list-style-type: none">● Increased productivity.● Enhanced competitiveness.● Labour and population mobility (induced effects).● Improved infrastructure.
Demand side	<ul style="list-style-type: none">● Employment.● Income and wealth creation.● Induced investment.● Support of related industries.

Why Invest in Energy Research?