Strengthening African Universities for Science-Based Sustainable Development

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Changing Roles of Higher Education in the Globalized World
UNU/UNESCO International Conference, Tokyo, Japan, 29-30 August 2007
Strengthening African Universities for Science-Based Sustainable Development

- Challenges
- Opportunities
- Strengthening African Universities
- Conclusions
SIZE OF THE AFRICAN CONTINENT COMPARED TO OTHER LAND MASSES

<table>
<thead>
<tr>
<th></th>
<th>SQUARE MILES</th>
<th>SQUARE KILOMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZIL</td>
<td>3,300,161</td>
<td>8,547,378</td>
</tr>
<tr>
<td>JAPAN</td>
<td>377,727</td>
<td>978,308</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>2,966,189</td>
<td>7,682,394</td>
</tr>
<tr>
<td>EUROPE</td>
<td>1,905,731</td>
<td>4,935,820</td>
</tr>
<tr>
<td>U.S.A. (Continental)</td>
<td>3,120,066</td>
<td>8,080,934</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11,669,874</td>
<td>30,224,835</td>
</tr>
</tbody>
</table>

AFRICA (including MADAGASCAR) | 11,715,721 | 30,343,578

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Challenges

1. Addressing sustainability problems
2. Improving quality and quantity of research output
3. Reducing brain drain
Sustainability problems

- Africa is the poorest region in the world.
- Half of the population live on less than one dollar a day.
- Around a sixth of the entire population of sub-Saharan Africa – more than 100 million people – are chronically poor.

Source: Our Common Interest: Report of the Commission for Africa
166 million Africans live in slums

Source: Our Common Interest: Report of the Commission for Africa
42% of Africans have no access to safe drinking water

Source: Our Common Interest: Report of the Commission for Africa
73% of Africans have no access to electricity

“In countries for which data are available around 27 percent of the population has access to electricity.”
Source: African Development Indicators 2006. World Bank
Malaria kills 900,000 Africans each year

“Each year, it kills more than 1 million people around the world — 90 percent of them in Africa.”
Source: *African Development Indicators 2006. World Bank*
25 million Africans carry HIV

Source: *African Development Indicators 2006*. World Bank
Africa and climate change

- Africa is most vulnerable to climate change because of its fragile ecosystems
- Weak resilience and adaptation capacity
African ‘exports’

50 million tons of dust transported every year — including top soil rich in nutrients
Challenge 1

- How can STI capacity be built and sustained in Africa to assist in solving critical sustainability problems and in achieving the Millennium Development Goals?
Challenges

1. Addressing sustainability problems
2. Improving quality and quantity of research output
3. Reducing brain drain
North-South Disparities

World's top 25 countries, ranked by their share of world's papers in science, medicine and engineering

<table>
<thead>
<tr>
<th>Country/Territory</th>
<th>Share of papers %</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>28.32%</td>
</tr>
<tr>
<td>China</td>
<td>6.60%</td>
</tr>
<tr>
<td>Japan</td>
<td>6.23%</td>
</tr>
<tr>
<td>Germany</td>
<td>6.15%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>5.80%</td>
</tr>
<tr>
<td>France</td>
<td>4.45%</td>
</tr>
<tr>
<td>Italy</td>
<td>3.38%</td>
</tr>
<tr>
<td>Canada</td>
<td>3.38%</td>
</tr>
<tr>
<td>Spain</td>
<td>2.59%</td>
</tr>
<tr>
<td>South Korea</td>
<td>2.36%</td>
</tr>
<tr>
<td>India</td>
<td>2.23%</td>
</tr>
<tr>
<td>Australia</td>
<td>2.11%</td>
</tr>
<tr>
<td>Russia</td>
<td>1.98%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.86%</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.50%</td>
</tr>
<tr>
<td>Taiwan, China</td>
<td>1.44%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.39%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1.39%</td>
</tr>
<tr>
<td>Turkey</td>
<td>1.24%</td>
</tr>
<tr>
<td>Poland</td>
<td>1.22%</td>
</tr>
<tr>
<td>Belgium</td>
<td>1.05%</td>
</tr>
<tr>
<td>Israel</td>
<td>0.84%</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.74%</td>
</tr>
<tr>
<td>Austria</td>
<td>0.72%</td>
</tr>
<tr>
<td>Finland</td>
<td>0.70%</td>
</tr>
</tbody>
</table>

Source: SCI, January 2007
Africa’s world share of ISI-listed SME papers

**Average 2005-2006**

- Rest of the World: 78.28%
- Rest of Developing World: 20.36%
- North Africa (5 countries): 0.54%
- Sub-Saharan Africa (48 countries): 0.82%

Source: SCI, January 2007
South-South Disparities

Top 12 of the South: World publication shares

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent of World</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>6.6</td>
</tr>
<tr>
<td>South Korea</td>
<td>2.4</td>
</tr>
<tr>
<td>India</td>
<td>2.2</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.5</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1.4</td>
</tr>
<tr>
<td>Turkey</td>
<td>1.2</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.6</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.5</td>
</tr>
<tr>
<td>Iran</td>
<td>0.5</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.4</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.4</td>
</tr>
<tr>
<td>Egypt</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Source: SCI, January 2007
Disparities in STI

<table>
<thead>
<tr>
<th>AFRICA</th>
<th>Share of World</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 South Africa</td>
<td>0.37%</td>
</tr>
<tr>
<td>2 Egypt</td>
<td>0.26%</td>
</tr>
<tr>
<td>3 Tunisia</td>
<td>0.11%</td>
</tr>
<tr>
<td>4 Morocco</td>
<td>0.09%</td>
</tr>
<tr>
<td>5 Nigeria</td>
<td>0.08%</td>
</tr>
<tr>
<td>6 Algeria</td>
<td>0.08%</td>
</tr>
<tr>
<td>7 Kenya</td>
<td>0.05%</td>
</tr>
<tr>
<td>8 Cameroon</td>
<td>0.03%</td>
</tr>
<tr>
<td>9 Tanzania</td>
<td>0.03%</td>
</tr>
<tr>
<td>10 Ethiopia</td>
<td>0.03%</td>
</tr>
<tr>
<td>11 Uganda</td>
<td>0.02%</td>
</tr>
<tr>
<td>12 Ghana</td>
<td>0.02%</td>
</tr>
<tr>
<td>13 Senegal</td>
<td>0.02%</td>
</tr>
<tr>
<td>14 Zimbabwe</td>
<td>0.02%</td>
</tr>
<tr>
<td>Rest of Africa (39 c.)</td>
<td>0.16%</td>
</tr>
<tr>
<td>Total Africa</td>
<td>1.37%</td>
</tr>
</tbody>
</table>

Source: SCI, January 2007

African countries contributing ≥ 0.02% of world share of ISI-listed S&E papers

Average 2005-2006
Challenge 2

- How to improve quality of scientific research and education and create a culture of scientific excellence to reduce disparities between Africa and the rest of the world?
Challenges

1. Addressing sustainability problems
2. Improving quality and quantity of research output
3. Reducing brain drain
Brain Drain

- Serious problem for African countries
- International market for scientific talent becoming more competitive
- Globalization of higher education growing competition among best universities for best and brightest students
Brain Drain

- USA and EU still greatest market place for talent from Africa
- Providing adequate research facilities and attractive work conditions to talented African scientists is the only way to reduce brain drain
Rajiv Gandhi:

“Better brain drain than brain in the drain”
Challenge 3

◆ How to convert brain drain into brain gain and brain circulation?

Source: The Economist, 2005
Strengthening African Universities for Science-Based Sustainable Development

- Challenges
- **Opportunities**
- Strengthening African Universities
- Conclusions
Opportunities for STI Development in Africa

1. Cutting-edge technologies
2. Natural resources
3. Renewed political commitment in Africa
4. Greater commitment by G8 countries
5. Renewed South-South cooperation
6. New commitment by African academies
Opportunity 1: Cutting-edge Technologies

- Opportunities to contribute to sustainable well-being
  - Wireless information and communication technologies (ICTs)
    - Instant access to scientific and technical information from anywhere in the world
  - Biotechnologies
    - Substantial improvement in agriculture and health
  - Space science and technology
    - Monitoring environmental change and natural resources
  - Nanotechnologies
    - New generation of nanomaterials with broad-ranging applications to critical problems (e.g., water purification, clean energy)
Opportunities for STI Development in Africa

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Opportunity 2: Natural Resources

- Africa is rich in biodiversity and natural resources
- Centuries-long traditional knowledge
- Conservation and rational utilization of these resources require regional and international cooperation
Opportunity 2: Clean energy from African deserts

- Solar power plants in the Sahara desert can supply Europe with vast quantities of energy.
- Each square kilometre of African desert every year receives solar energy equivalent to 1.5 million barrels of oil.
- Solar energy received by deserts worldwide is nearly 1,000 times the world’s entire annual energy consumption.
Opportunities for STI Development in Africa

1. Cutting-edge technologies
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6. New commitment by African academies
Opportunity 3: Renewed Political Commitment by African Leaders

- Decisions of African Union Summit
  - Regional strategies to promote S&T in Africa: NEPAD Networks of Excellence
  - 2007: Year of Science and Innovation
  - S&T Expenditure at least 1% of GDP
Opportunity 3: Renewed Political Commitment by African Leaders

- Several **Sub-Saharan African** countries have substantially increased investment in S&T
  - Ghana
  - Kenya
  - Mozambique
  - Nigeria
  - Rwanda
  - Senegal
  - South Africa
  - Tanzania
  - Uganda
  - Zambia
Opportunity 3: Renewed Political Commitment in Africa

- Africa is beginning to witness emergence of new champions of S&T in several countries
- These countries deserve more support by international and regional financial institutions
Opportunities for STI Development in Africa

1. Cutting-edge technologies
2. Natural resources
3. Renewed political commitment in Africa
4. Greater commitment by G8 countries
5. Renewed South-South cooperation
6. New commitment by African academies
Opportunity 4: Greater commitment by G8 countries

  - US$ 5 billion to rebuild universities
  - US$ 3 billion to establish centres of excellence in Africa
Opportunity 4: Greater commitment by G8 countries

- Support to NEPAD Action Plan
  - US$ 160 million support for networks of centres of excellence (water, biotech, lasers, mathematics)
Opportunities for STI Development in Africa

1. Cutting-edge technologies
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3. Renewed political commitment in Africa
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Opportunity 5: Renewed South-South Cooperation

China
- Development Fund for Africa
- US$ 5 billion over the next 3 years for infrastructure, institution building and technical training
Opportunity 5: Renewed South-South Cooperation

- Brazil's pro-Africa programmes
  - Support S&T capacity building in Sub-Saharan Africa
- Brazil, India and Senegal
  - Biofuels project in Senegal
- India, Brazil and South Africa
  - Support for joint problem-solving projects
Opportunity 5: Renewed South-South Cooperation

- TWAS agreement with Brazil, China, India, Mexico and Pakistan
  - Postgraduate/postdoctoral fellowships to researchers from other developing countries

Dr. H.M.I. Ahmed from Egypt at the Universidade Federal de Viçosa in Brazil *(TWAS-CNPq Fellowship for Postdoctoral Research)*
Opportunity 5: Renewed South-South Cooperation

- Consortium on Science, Technology and Innovation for the South (COSTIS)
  - Ministries of S&T
  - National research councils
  - Science academies in the developing world
Opportunity 5: Renewed South-South Cooperation

- COSTIS
  - Established by the Ministers of S&T and endorsed by the Foreign Ministers of the Group of 77 (2006)
Opportunity 5: Renewed South-South Cooperation

- UNESCO and Malaysia
  - Establishment of an International Centre for South-South Cooperation in Science, Technology and Innovation in Kuala Lumpur, Malaysia
Opportunities for STI Development in Africa

1. Cutting-edge technologies
2. Natural resources
3. Renewed political commitment in Africa
4. Renewed South-South cooperation
5. Greater commitment by G8 countries
6. New commitment by African academies
Opportunity 6:
New commitment by African academies

- With IAP support, science academies in Africa are transforming themselves into dynamic boundary organizations able to provide critical services to governments, scientific communities and general public.
African countries with merit-based science academies

<table>
<thead>
<tr>
<th>Green: Existing academies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameroon</td>
<td>Senegal</td>
</tr>
<tr>
<td>Egypt</td>
<td>Sudan</td>
</tr>
<tr>
<td>Ghana</td>
<td>South Africa</td>
</tr>
<tr>
<td>Kenya</td>
<td>Tanzania</td>
</tr>
<tr>
<td>Madagascar</td>
<td>Uganda</td>
</tr>
<tr>
<td>Morocco</td>
<td>Zambia</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Zimbabwe</td>
</tr>
<tr>
<td>AAS (regional academy)</td>
<td></td>
</tr>
<tr>
<td><strong>Red: Being founded</strong></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>Rwanda</td>
</tr>
<tr>
<td>Mauritius</td>
<td>Tunisia</td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
</tr>
</tbody>
</table>
Network of African Science Academies (NASAC)

Founded in Nairobi in 2001 as independent forum for African science academies to:

- provide (individually or jointly) independent evidence-based advice to African governments on scientific issues of critical importance to development
- prepare and issue common statements on major issues relevant to Africa
Network of African Science Academies (NASAC)

Statements

♦ Joint statement by academies of G8 countries and NASAC to G8 summit in Scotland in June 2005

♦ NASAC statement to AU summit in Addis Ababa, Ethiopia, in January 2007

♦ NASAC statement to G8 summit in Germany in June 2007
Strengthening African Universities for Science-Based Sustainable Development

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- Opportunities
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Strengthening African Universities

◆ Quality education and research
  ▪ Revitalize and reform key universities and upgrade to world-class research universities
    ■ Promote culture of excellence in education
    ■ Provide fast track training to best students
    ■ Reduce brain drain
  ▪ Establish research units and centres of excellence within university departments and faculties to reinforce links between education and research
Strengthening African Universities

- Training new generations of scientists
  - Curriculum reforms and ICT-based innovative teaching methods to produce problem-solving scientists, technologists and innovators
  - South-South postgraduate fellowships (TWAS/TWOWS)
Strengthening African Universities

- Funds for research and innovation
  - Secure adequate and sustained funding mechanism to support quality education, research and innovation and to attract, train and retain best and brightest young researchers
  - Establish autonomous, self-governing national and regional research foundations (South Africa, Nigeria)
Strengthening African Universities

- Problem-solving research
  - Collaboration between competent research teams within universities to address critical regional problems
  - Links between universities and research institutions / para-statals within government ministries
  - Partnership between faculties of agriculture and national and international agricultural research centres (CGIAR)
  - Links between university research units and NEPAD’s networks of excellence
Strengthening African Universities

- Partnership with academies of science
  - 15 merit-based academies of science in Africa (NASAC). Majority of members are professors at African universities
  - Academies can provide universities with scientific leadership and advice on curriculum development and quality education and research
  - Universities can help accelerate reforms of academies, transforming them into more dynamic organizations by linking them to young researchers
Strengthening African Universities for Science-Based Sustainable Development

- Challenges
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Conclusions

1. Africa needs a new generation of home-grown, problem-solving, world-class scientists to lead science-based development in the continent. This can only be achieved through establishing an effective STI system of world-class research universities.
Conclusions

2. Success stories highlighting achievements of universities in contributing to economic growth need to be identified, published and widely distributed.
Conclusions

3. Increased financial allocations for higher education and STI development in Africa should first and foremost come from African governments. External support from G8 countries, large developing countries (Brazil, China, India) and foundations is critical in developing excellence and relevance in STI.
Conclusions

4. African leaders are increasingly recognizing that science, technology and innovation are essential to lead and implement strategies to achieve the UN Millennium Goals. The world's rich nations (G8) expressed strong support for strengthening universities and for building STI capacities in Africa.
Conclusions

5. 2007 has been a year of high hopes and political will to save Africa through increased investment in quality education and STI. Let 2008 be the year of explicit commitment, implementation and action.
6. World-class research universities alone will not accelerate economic growth in Africa. But without a sustainable system of world-class research universities Africa's economic growth cannot be accelerated.
Thank you for your attention

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• President, African Academy of Sciences

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