Submission No 8

Review of Australia's Relationship with the Countries of Africa

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SUBMISSION TO THE
JOINT STANDING COMMITTEE ON FOREIGN AFFAIRS, DEFENCE AND TRADE

INQUIRY INTO AUSTRALIA'S RELATIONSHIP WITH THE COUNTRIES OF AFRICA

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TERMS OF REFERENCE

The Joint Standing Committee on Foreign Affairs, Defence and Trade shall inquire into and report on Australia's relationship with Africa, with special emphasis on:

- *Bilateral relations at the parliamentary and government levels;*
- *Economic issues, including trade and investment;*
- *Cultural, scientific and educational relations and exchanges;*
- *Development assistance cooperation and capacity building;*
- *Defence co-operation, regional security and strategic issues; and*
- *Migration and human rights issues.*

The Committee will consider both the current situation and opportunities for the future

The purpose of this submission is to provide factual material to the Committee in relation to the Terms of Reference.

The Department of Innovation has a number of activities in relation to the inquiry. These are outlined in the following pages.

SCOPE OF SUBMISSION

The Department of Innovation, Industry, Science and Research (the Department of Innovation) has a number of areas of involvement in Africa-Australia relations.

The Department of Innovation's portfolio interests in Africa are predominantly in science and research collaboration where both the Department itself and a number of portfolio agencies have interactions. Information on these matters is provided in the submission with detail on the relationship with South Africa, the country with which the Department of Innovation has the highest level of interaction.

Portfolio science and research agency CSIRO also has significant interaction with African countries but is not included here as the organisation will make its own submission to the inquiry.

In addition, science and research engagement in Africa intersects with other government activities such as Official Development Assistance (ODA). This submission does not comment on ODA, as AusAID and ACIAR, the major providers of Australia's ODA programs, will provide submissions to this inquiry.

Other portfolio agencies such as IP Australia also have relationships with South Africa and their input is included in this submission.

Industry matters associated with Africa are largely trade related and fall within the purview of the Department of Foreign Affairs and Trade. Consequently this submission does not include any commentary or general descriptive material on the trade and investment relationship with Africa.

Outline of submission

Within the scope describes above, the submission outlines Australia's science and research relationship with Africa, with particular emphasis on South Africa.

SCIENCE AND RESEARCH RELATIONSHIP

Australia's International Science and Research Collaboration Strategy

All developed, and the most dynamic developing countries, recognise the importance of international science and research (S&R) engagement to national prosperity. The ever-increasing complexity and cost of scientific discovery and technological development, coupled with the acceleration of globalised commerce, trade, finance and information flows, means that participation in global science and technology is seen as essential to the maintenance of living standards and a nation's global competitiveness.

Australia, like most countries, with the notable exception of the USA, is a net importer of technology and, in global terms, produces only a very small proportion (3% as measured by publication rates) of new knowledge. Therefore successive governments have recognised the importance of international collaboration and established specific programs to enable Australia to engage bilaterally and multilaterally.

International S&R engagement contributes directly to the achievement of the goals articulated in *Powering Ideas: An innovation agenda for the 21st century*. Through its international science engagement function, the Department of Innovation plays a unique role within the Australian Government, as it is responsible for managing intergovernmental S&R relationships across the whole spectrum of S&R. While other departments pursue bilateral and multilateral agreements in specific thematic areas for which they have portfolio responsibility, only the Department of Innovation pursues international S&R engagement on a broad front. This work enables Australian researchers and research agencies to establish productive partnerships with leading international researchers and institutions and contributes to the Government's National Innovation and National Research Priorities.

The Department of Innovation fosters international S&R engagement in a strategic, targeted manner by:

- initiating and managing productive formal government to government relationships with key countries and international organisations;
- managing funding programs that provide the platform for supporting the activities that give substance to the commitments made under various science and technology treaties and MOUs;
- developing high-level visits to and from a wide range of countries; and
- maintaining dedicated science and technology staff at key overseas posts.

The choice of countries with which Australia manages an active S&R relationship is based on:

- the anticipated scientific, economic and social benefits from S&R cooperation with the other country (including consideration of the timeframe within which these benefits can be expected);
- the extent to which a formal S&R arrangement will deliver benefits to Australia which would not otherwise be realised;
- broader strategic, whole-of-government considerations.

Recognition of potential mutual benefits from S&R collaboration is based on identification of countries which:

- provide a consistent, significant investment in research and development (known as Gross Expenditure in Research and Development, GERD); and/or
- achieve above world average impact in particular science fields in scientific publications (as measured by ISI citations); and/or
- are leaders in niche areas of science.

Some of the specific programs with which the Department of Innovation fosters international collaboration include:

- International collaboration is specified as an objective in the funding rules for the Australian Research Council (ARC) managed *Discovery Projects*, *Australian Laureate Fellowships* and *ARC Centres of Excellence* schemes, and there is also a significant level of international collaboration across projects funded under the *Linkage Projects* and *Future Fellowships* schemes and other initiatives.
- The Cooperative Research Centre (CRC) Program Guidelines encourage CRCs to engage with international organisations. In 2007-2008, CRCs engaged in international collaborations with more than 49 nations.
- The International Science Linkages program managed by the Department of Innovation from 2001 and due to expire in 2011 provides funding to support international research collaboration, and to support relationship-building events that lay the essential groundwork for future collaboration.

Australia's Science and Research collaboration with Africa

Australian science and research (S&R) collaboration with Africa has been limited, due to the developing nature of most African S&R programs and their relatively modest contribution to global research output. Most current S&R collaboration is a result of Official Development Assistance and capacity building activities, much of it supported through the Australian Agency for International Development (AusAID) and the Australian Centre for International Agricultural Research (ACIAR). AusAID and ACIAR will be providing submissions to this inquiry.

Africa's contribution to global S&R is very modest, totalling 0.9% of global investment in research and development, and about 1.5% of scientific publications annually. In comparison, Australia accounts for 1.4% of investment and 3% of publications[1].

According to all standard measures, South Africa has significantly greater S&R investment and scientific output than any other African country, accounting for almost half of Africa's investment and nearly one third of Africa's publications. South Africa's publications achieve higher citation impact than those of other African countries, indicating higher research quality. For this reason, Australia's international S&R collaboration efforts with Africa have focussed primarily on South Africa, and this is likely to remain the case for many years. Consequently, collaboration with South Africa constitutes a separate section of this submission.

Australian Research Council (ARC)

Across all ARC funding schemes applicants are asked to indicate in their proposals if their research will involve international collaboration and, if so, to identify the country or countries involved. Collaboration between ARC-funded researchers and researchers in countries of Africa comprises a small proportion of all intended international collaboration on research projects supported by the ARC. The majority of this collaboration is with researchers in South Africa.

There are 85 new and ongoing ARC-supported research projects with funding allocations in 2009 that involve collaboration with countries of Africa.[2] These projects comprise 1.8% of all new and ongoing projects funded by the ARC in 2009. Across these 85 projects there are 103 intended instances of collaboration with 25 countries. The majority (58%) of the instances of collaboration are with researchers in South Africa. Other countries involved include Egypt, Kenya, Ethiopia and Ghana. Total ARC commitment to these projects is $67.7 million over the duration of the projects.[3] The research fields with the most collaboration between Australian and African researchers are Historical Studies (10 projects), Ecology and Evolution (eight projects) and Geology (seven projects).

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[1] The USA accounts for 32.4% of investment and over 30% of publications, the EU for 22.9% of investment and over 30% of publications, Japan 13.0% of investment and about 8% of publications, and China 9.2% of investment and over 8% of publications. See Appendix for further S&R statistics.

[2] Intended collaboration as indicated in funding proposals.

[3] Note that the total includes $27 million in funding for two ARC Centres of Excellence, but excludes additional funding for these centres that will commence in 2010.

In October 2009 new National Competitive Grants Program (NCGP) funding was announced for research projects commencing in 2010. Among the 925 projects approved for funding commencing in 2010 under the *Discovery Projects* scheme there are 15 projects involving 18 instances of collaboration with eight countries of Africa. Of these instances of collaboration, 11 are with researchers in South Africa. Selection outcomes for funding commencing in 2010 have not been finalised for most other schemes.

Australian Nuclear Science and Technology Organisation (ANSTO)
Under a memorandum of understanding with the International Atomic Energy Agency (IAEA), ANSTO coordinates and facilitates the placement of all IAEA fellowships and scientific visits in Australia. The program enables personnel from developing countries to receive specialised training at appropriate institutes around the world, contributing to the development of atomic energy applications for peaceful purposes in their home countries.

In 2009, ANSTO coordinated the placement of fellows and scientific visitors from a number of countries in Africa, including Sudan, Zambia, South Africa and Madagascar. The visitors received training at various laboratories, hospitals, universities and institutes around Australia, including ANSTO.

The Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) is the mechanism by which the IAEA undertakes technical cooperation in the Asia Pacific region. Development assistance projects initially implemented in our region under the aegis of the RCA have subsequently been exported to other regions, including Africa. For example, the Australian-developed RCA Applied Sciences of Oncology (ASO) Distance Learning Program is an innovative project designed to bring distance learning to radiation oncologist trainees, with an emphasis on those working in developing countries. This distance learning course is now being applied around the world, including in 13 African nations. Australia's participation in the RCA is facilitated through ANSTO.

In addition to substantial ANSTO cooperation with South Africa, ANSTO Minerals is assisting Australian companies in Namibia and several other countries to ensure sustainable resource management and best practices for management of naturally occurring radioactive materials during minerals extraction.

Cooperative Research Centre (CRC) Program
Through the Cooperative Research Centre Program researchers are linked with industry to focus R&D efforts on deployment and commercialisation. The close interaction between researchers and the end users is a key feature of the Program. Another feature is industry contribution to CRC education programs, which produces industry-ready graduates. There are 48 CRCs operating in six sectors: environment (10), agriculture and rural-based manufacturing (14), information and communication technology (5), mining and energy (4), medical science and technology (8) and manufacturing technology (7).

Since 1998 there have been 43 education and training, commercialisation or research collaborations between CRCs and African organisations in Kenya, Namibia and South Africa. In those countries, 11 CRCs currently have 38 collaborative links across the agriculture and rural based manufacturing, environment, manufacturing and technology, medical science and technology, and mining and energy sectors. The majority of the collaborations are with South Africa through the CRC for Sustainable Resource Processing.

International Postgraduate Research Scholarship (IPRS) Program
The IPRS program enables international students to undertake a postgraduate research qualification in Australia and gain experience with leading Australian researchers. The scholarship covers tuition fees and health cover costs for scholarship holders, and health cover costs of their dependants. The main objectives of the IPRS program are to attract top quality international postgraduate students to areas of research strength in Australian Higher Education Providers and support Australia's research effort.

Scholarships are open to international students of all countries (except New Zealand) and are available for a period of two years for a Masters by research degree or three years for a Doctorate by research degree. In 2008 there were 34 IPRS recipients from African countries.

National Science and Technology Centre: Questacon
As Australia's National Science and Technology Centre, Questacon engages internationally through participation in several international science centre networks, international exhibition tours and hosting international cultural institution and government delegations. Questacon's most recent activities with Africa include:

- In early 2009 Questacon worked with the Centre for the Public Awareness of Science (CPAS) at the Australian National University to bring eight science communication professionals from South Africa and Lesotho. The delegates participated in a training and development program facilitated by Questacon staff. The program was funded by AusAID and coordinated by the Australian National University. The aim of the program is to help to build science centre capability in Africa.
- The 6th Science Centre World Congress is being hosted in Cape Town, South Africa, 4 – 8 September 2011 by the MTN Sciencentre, the Southern African Association of Science and Technology Education Centres, and the North Africa and Middle East Science Centers network. Questacon is involved in the organisation of this event and will be represented at the congress. The theme for the Science Centre World Congress is "Science Across Cultures".

Commonwealth Scientific and Industrial Research Organisation (CSIRO)
The CSIRO, which has significant collaboration with African countries, is providing a separate submission to this inquiry.

South Africa

As previously noted, the Republic of South Africa is Africa's dominant S&R investor and producer. This makes it Australia's most significant S&R partner in Africa.

Overview of South Africa's S&R capacity

South Africa's Gross Expenditure on Research and Development (GERD) more than doubled (a factor of 2.3) to PPP$3.7 billion between 1997 and 2005. Australia's GERD increased by almost the same factor (2.2) from 1996 to 2006 and was four times South Africa's.

The business sector is the major financer of S&R in South Africa. In 2004, the business sector funded 48.6% of total S&R and the government 38.2%. In October 2006, South African legislation was amended to provide for a 150% tax deduction for spending on research and development by private organisations.

Most South African S&R is performed in the engineering sciences (20.9% of the total), followed by the natural sciences (20.3%) and the medical and health sciences (15.1%).

South Africa produced a total of 21,958 (or 0.50%) of the world's scientific publications in the period 2001-5, achieving the highest volume and citation impact of any African nation. In some fields, the impact of papers was observed to be as high as or higher impact than other key S&R countries. Highest relative impacts (80% or above of world relative impact average) for South Africa were achieved in Agricultural Science, Clinical Medicine, Computer Science, Ecology/Environment, Geosciences, Immunology, Mathematics, Microbiology, Social Sciences and Space Science.

Current relationship with South Africa

The treaty-level *Agreement on Scientific and Technological Cooperation between the Government of the Republic of South Africa and the Government of Australia* was signed in 2006 and the underpinning *Program of Cooperation* was signed at the inaugural Australia-South Africa Joint Science and Technology Committee (JSTC) meeting on 24 February 2009.

In 2008, South Africa was Australia's 18th ranked international collaboration partner and Australia was South Africa's 4th ranked international collaboration partner (behind the USA, the UK and Germany).

The Australia-South Africa Joint Science and Technology Committee

The first meeting of the Australia-South Africa Joint Science and Technology Committee (JSTC) was held 24th February 2009 in Cape Town, South Africa. The purpose of these meetings is to promote bilateral S&R relationships at the government to government level by exchanging information and agreeing joint priorities and programs. The inaugural Australia-South Africa JSTC was held in conjunction with the International Square Kilometre Array Forum in Cape Town, in order to reinforce the friendly nature of the bilateral S&R relationship with South Africa and Australia's commitment to its further development.

The 2009 Australia-South Africa JSTC was led by the Australian Department of Innovation, Industry, Science and Research and the South African Department of Science and Technology (DST), with participants from CSIRO, the Australian Academy of Technological Sciences and Engineering, the Australian Academy of Science and Universities Australia. At the meeting, Australia and South Africa signed a science and technology *Program of Cooperation*, with four bilateral workshops to be delivered over two years. Australia will provide $200,000 over 2009-11 through the Department of Innovation's International Science Linkages program to support these activities.

In addition to initiatives such as the workshops, the Australian Government will continue to foster broader systemic links between Australian and South African researchers and research institutions, particularly in areas of strong mutual benefit and mutual scientific strength, such as dryland agriculture, astronomy and geosciences.

Australian Research Council (ARC)

Overall, South Africa ranked 19th in 2009 in Australian Research Council (ARC) support for international research collaboration. As of November 2009 there are 60 active ARC funded projects with a total value of A$6.5 million that involve collaboration with South Africa, or 1% of all ARC supported international collaborations, compared with (for example) the USA with 24%, the UK 14%, Germany 8%, Japan 4%, China 4%, New Zealand 3% and India 1%.

The top fields of ARC funded collaboration with South Africa in 2009 were Ecology & Evolution (16%); Historical Studies (13%); Public Health & Health Services (11%); Genetics (8%); Geology (8%); and Geochemistry (8%).

The Square Kilometre Array (SKA) radio telescope project

Australia and NZ are competing with a group of eight African countries, led by South Africa, to be selected as the site for the planned Square Kilometre Array (SKA) radio telescopes – a project which will cost around $2.5 billion to build, $200 million per year to operate, and which promises to be among the iconic science facilities of the 21st century.

There is a shared interest between Australia-NZ and South Africa and its bid partners in helping demonstrate to the world the technical feasibility of the SKA and its deep scientific value, so that funding is provided to proceed with the SKA.

Both Australia, with the Australian SKA Pathfinder (ASKAP) telescope, and South Africa, with the MeerKAT telescope, are currently building SKA demonstrator (or pathfinder) telescopes. In February 2009, Minister Carr and his South African counterpart agreed to establish a collaborative pathfinder science program between the two SKA pathfinder telescopes, ASKAP and MeerKAT, to exploit their differing but complementary strengths. ASKAP will be a fast survey instrument, capable of detecting vast numbers of astronomical objects at unprecedented speed. MeerKAT will have the capacity to 'zero in' on particular objects of interest and detect detail at immense distances. There has been close, ongoing contact between Australian and South African astronomers over much of 2009 to develop specific collaborative science programs utilising ASKAP and MeerKAT.

There are two broad future opportunities for Australia-Africa collaboration in the SKA context. The first opportunity lies with working more closely together at the governmental and senior official levels to build momentum and support for the SKA project around the

world. The second, and perhaps more important future opportunity, relates to the scope for developing mutually beneficial programs of science and research collaboration based upon the framework developed for SKA cooperation.

National Measurement Institute (NMI)

Australia has a strong level of engagement with South Africa in metrology, and the South African metrology system has similarities with Australia's system. Australians, including senior NMI staff, were actively involved in the 2001 review of South Africa's standards, quality, accreditation and metrology (SQAM) infrastructure that was undertaken in recognition of the potential of an improved infrastructure to contribute to South Africa's technical, economic and social development.

The South African government adopted key recommendations of the SQAM review, including transferring all responsibilities for the maintenance, traceability and dissemination of national measurement standards to a new National Metrology Institute of South Africa (NMISA), effective 1 May 2007. Similarly, South Africa's legal metrology body, the National Regulator for Compulsory Specifications (NCRS), was established as a new statutory institution within the Department of Trade and Industry (DTI), effective 1 September 2008. For comparison, Australia's National Measurement Institute, which is Australia's peak measurement body with legal, physical, chemical and biological measurement responsibilities, was formed from 1 July 2004.

NMI staff engage with NCRS and NMISA staff through the global metrology bodies – the International Organization of Legal Metrology Organisation (OIML) and the activities of the International Committee for Weights and Measures (CIPM) established under the Metre Convention - and also through the linkages formed via the Asia-Pacific and African regional bodies. South Africa and Australia each play an important leadership role in enhancing metrology in their respective regions through the regional metrology bodies.

Experts from NMI, have been invited by NMISA to participate in international peer reviews and NMISA experts have also been invited to undertake peer reviews of NMI's measurement activities – these peer reviews form part of an international system of mutual recognition whereby national metrology institutes underpin their comparability and credibility of their measurement capabilities.

Australian Nuclear Science and Technology Organisation (ANSTO)

ANSTO's main research cooperation arrangements in Africa are with NECSA (the Nuclear Energy Corporation of South Africa), South Africa's national nuclear laboratory and counterpart to ANSTO. ANSTO and NECSA entered into a collaborative agreement, together with the NRG (Netherlands), in 2007 for a five year period. The agreement seeks to take advantage of the similarities between the research reactors in each country to increase their safety and reliability through cooperation and exchange of experience.

Other linkages with NECSA include the provision by ANSTO of two data-acquisition systems for neutron-scattering instruments at their SAFARI reactor, along with training of South African staff at ANSTO; NECSA's interest in, and potential use of, ANSTO's SYNROC technology for use in South Africa for long-term management of molybdenum-99 wastes; and the reciprocal use of facilities and instrumentation for scientific research.

During periods of shortage, ANSTO imports molybdenum-99 in bulk from NECSA's SAFARI reactor and processes it into generators at its Lucas Heights plant for use by Australian medical practitioners. Technetium-99m, a decay product of molybdenum-99, is the most widely used isotope in nuclear medicine, and is used in the diagnosis of a range of cancers, heart disease and skeletal injuries. The world is currently facing a supply crisis for radioisotopes, particularly molybdenum-99, due to the aging of major reactors and their associated processing facilities. ANSTO has recently commenced production of molybdenum-99, but continues to rely on the importation of molybdenum-99 from South Africa when the OPAL reactor is in a scheduled maintenance shut down period. The combination of indigenous production of molybdenum-99 and back-up by importation from South Africa is ensuring that Australia remains in the sound position of its full requirements for molybdenum-99 being met, in spite of the global shortage.

IP Australia

IP Australia has informal bilateral relations with the Companies and Intellectual Property Registration Office of the Republic of South Africa (CIPRO). A bilateral meeting was held on 17 March 2008 with the objective of exchanging information with CIPRO, in particular to share Australia's experience in acceding to the Madrid Protocol (at the request of CIPRO) and general Trade Mark issues. During 2009 a number of contacts have been made regarding possible future cooperation between the offices, including further fact finding visits to IP Australia, however no arrangements have been formally pursued at this point.

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

The CSIRO, which has significant collaboration with South Africa, is providing a separate submission to this inquiry.

APPENDIX: STATISTICAL INDICATORS

UNESCO's Institute for Statistics (September 2009) estimates that Africa accounts for 0.9% of the world's Gross Expenditure on Research and Development (GERD), compared to Australia's 1.4%. South Africa alone accounts for 0.4%, Arab Africa 0.3%, and other African countries collectively 0.2%.

In terms of proportional investment or "research intensity", Australia's GERD equals just over 2% of GDP, South Africa's GERD averages nearly 1% of GDP, whilst the overall average research intensity for Africa is 0.4% of GDP, Arab Africa 0.3% and the rest of Africa 0.3%. There are several individual African countries which invest far more than these averages. The highest research intensity in Africa is Tunisia's, which more than doubled in the period 1996-2007 to over 1%, and the Tunisian Government plans to increase GERD to 1.25% of GDP by 2009.[4] On a global scale, however, Tunisia's S&R investment and output will remain modest.

Australia produces about 3% of the world's scientific publications, nearly 40,000 in 2008. South Africa leads Africa's publications with over 7,000 in 2008, over 0.5% of world publications. Only five other African countries produced more than 1,000 scientific publications in 2008. In total, African countries produced fewer than 23,000 publications in 2008, compared with global leaders like the USA (over 407,000), China (over 116,000) and Japan (nearly 92,000).

Many publications involve authors from more than one country[5], and evidence suggests that these internationally collaborative papers have on average a higher citation impact than single country papers. Australia's major publication partner in Africa is South Africa[6], by a wide margin ahead of Kenya and Nigeria.

Table 1 provides a comparison of S&T indicator data for many of the countries of Africa, plus Australia, the USA, Japan and China for comparison purposes. GERD figures, where available, are from Organisation for Economic Cooperation and Development (OECD) or United Nations Educational Scientific and Cultural Organization (UNESCO) data.[7] Publications figures are from Thompson ISI Web of Knowledge. 2008 population was taken from the CIA World Factbook.

[4] President Zine-El-Abidine Ben Ali, *For Tomorrow's Tunisia* program (2004-2009).

[5] In 2008, 43% of publications with an Australian author also included at least one non-Australian author. The USA was Australia's top ranked publication partner, followed by the UK and China.

[6] 0.9% of publications in 2008 with at least one Australian author also included at least one South African author.

[7] Unfortunately no OECD or UNESCO investment data was available for several major African economies, but as these countries, particularly Nigeria, will have a dominant effect on the "Other Africa" average, studies estimating a research intensity for Nigeria of about 0.3% are likely to be reasonably close.

Table 1: S&T Indicator data for African countries (for which UNESCO or OECD data is available)

Country (year of GERD data)	Gross Expenditure on Research and Development (GERD) (most recent available year)		Number of Joint publications with Australia in 2008	Total number of publications in 2008	Publications per million capita
	PPP$	% of GDP			
Australia (2006)*	15 billion	2.01%	--	39,669	1,888
South Africa (2005)*	3.7 billion	0.92%	347	7,026	144
Egypt (2000)	0.47 billion	0.19%	16	4,709	58
Tunisia (2005)	0.66 billion	1.03%	8	2,512	242
Morocco (2003)	0.62 billion	0.66%	8	1,549	45
Algeria (2005)	0.13 billion	0.07%	4	1,492	44
Kenya	n/a	n/a	57	1,021	27
Cameroon	n/a	n/a	9	557	30
Tanzania	n/a	n/a	14	535	13
Nigeria†	n/a	n/a	20	500	3
Uganda (2006)	0.051 billion	0.19%	11	489	16
Ethiopia (2005)	0.085 billion	0.20%	5	451	5
Ghana	n/a	n/a	11	375	16
Senegal (2005)	0.016 billion	0.009%	5	288	22
Malawi	n/a	n/a	18	252	18
Burkina Faso (2005)	0.025 billion	0.17%	5	227	15
Sudan (2005)	0.18 billion	0.28%	2	209	5
Madagascar (2005)	0.025 billion	0.16%	4	195	10
Zambia (2005)	0.0038 billion	0.03%	1	167	14
Mozambique (2002)	0.052 billion	0.50%	1	108	5
Namibia	n/a	n/a	14	69	33
Democratic Republic of the Congo (formerly Zaire; 2005)	0.075 billion	0.48%	1	55	1
Mauritius (2005)	0.047 billion	0.38%	6	51	16
Seychelles (2005)	0.0046 billion	0.38%	1	31	377
Lesotho (2004)	0.0016 billion	0.06%	0	14	7
USA (2007)*	368 billion	2.68%	5,694	407,200	1,340
Japan (2007)*	148 billion	3.44%	885	91,767	721
China (2007)*	102 billion	1.49%	1,976	116,656	88

* Denotes GERD data from the Organization for Economic Co-operation and Development (OECD) *Main S&T Indicators 2009-1* (published June 2009). All other GERD data from UNESCO *S&T Indicators* (published June 2008).

† Some studies for UNESCO (not included in the *S&T Indicators*) suggest that Nigeria's GERD is approximately 0.3% of GDP, which would equal a GERD of roughly PPP$1 billion (2008).