



Economic Commission for Africa



African Union



Science with Africa

Conference Report

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UNECA and AUC are indebted to Mr. Omar Bakhet for his excellent technical guidance throughout the conference. Conference participants appreciated the well-coordinated conference services provided by UNECA and AUC conference staff and the contribution of the Rapporteur-General (Mr. Sospeter Muhongo). CD-ROMs containing all oral presentations and a draft report were provided to the conference participants on the final day of the conference.



I Background

The Constitutive Act establishing the African Union identified the promotion of research and development (R&D) in all fields of science and technology (S&T) as one of the means to promote development in Africa. In November 2003, the first conference of African Ministers for S&T recommended that the S&T programmes of the African Union Commission (AUC) and the New Partnership for Africa's Development (NEPAD) should be integrated, in order to create a well-coordinated policy and programme framework to accelerate Africa's socio-economic development through science, technology and innovation (STI).

The United Nations Economic Commission for Africa (UNECA) promotes and facilitates the implementation of the 2005 AUC/NEPAD Consolidated Plan of Action, which calls for the utilization of STI for the sustainable socio-economic development of the African continent, and promotes the vision and priorities of the African Union (AU) on regional integration.

The main theme of the 8th African Union Summit (22-30 January 2007, Addis Ababa, Ethiopia) was science, technology and scientific research for development and the importance of STI as a driver of economic growth and poverty reduction in Africa. The Summit decided that new efforts to build constituencies and champions for STI in Africa would be launched in 2007. It also decided to establish the Pan-African Intellectual Property Organization (PAIPO), and reiterated its Khartoum Decision of 2006 that urges AU member States to allocate at least 1 per cent of their national gross domestic product to R&D. The Summit also emphasized the importance of South-South and North-South cooperation in STI.

It is against this background that UNECA, in collaboration with AUC and other United Nations agencies and partners, organized the well-attended and highly successful conference on **Science with Africa** which was held at the United Nations Conference Centre in Addis Ababa (Ethiopia) on 3-7 March 2008. The main objective of the conference was to provide a platform for an in-depth exploration of ways in which science, technology and innovation (STI) can be used to benefit Africa's population. The other objectives of this conference were: (a) to promote South-South and North-South cooperation in STI through increased synergies between African scientific organizations and their counterparts elsewhere around the world; (b) to explore ways of improving the interface between scientific research, policy development and business enterprises; and (c) to provide a framework for utilizing STI for accelerated economic growth in Africa.

The high-level conference panel, which included ministers and the speakers of national parliaments of several African countries, emphasized the importance of STI as a tool for socio-economic development in their respective countries. They argued that current low levels of investment in STI activities in Africa are mostly due to modest economic growth on the continent. Hence, they urged African countries to seek greater regional and international cooperation in STI for sustainable development of the continent.

II Themes

The Science with Africa conference covered the following topics/issues in relation to Africa's socio-economic development:

- a. science, technology and innovation (STI) policies;
- b. energy, water, transport and infrastructure;
- c. agriculture, health and life sciences, including guidelines for health research in Africa;
- d. climate change,
- e. intellectual property rights (IPR), patents and technology transfer;
- f. information and communications technologies (ICTs);
- g. STI capacity-building, including international programmes for STI capacity-building in Africa; and
- h. generation and selection of R&D projects, including the R&D Idea Factory and Science with Africa Marketplace initiatives.

A number of other cross-cutting issues, e.g. STI capacity-building and climate change in Africa, also formed part of the lively discussions.



III Attendance

The conference was attended by about 800 participants representing African governments (including the Speakers of African parliaments, Ministers and Permanent Secretaries), academia, the business community, the media, civil society organizations, student bodies, the development partner community and S&T international organizations and business enterprises.

A. Participants from Africa

Two Speakers of Parliament from Rwanda and Togo, six Ministers from Algeria, the Congo, Ethiopia, Guinea, Swaziland and the United Republic of Tanzania, as well as 13 Members of Parliament from Burkina Faso, Ghana (2), Namibia, Nigeria (3), the Niger, Rwanda (2), Togo and Tunisia (2) attended the conference.

The Conference was also attended by scientists, policymakers, private sector and civil society organizations from 43 African countries: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Chad, the Congo, the Comoros, Côte d'Ivoire, Djibouti, the Democratic Republic of the Congo, Ethiopia, Gabon, the Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Namibia, the Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, the Sudan, Swaziland, the United Republic of Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe.

B. Participants from Europe, the Americas and the Asia-Pacific region

Twenty-three participants came from countries outside Africa, namely: Austria, Bangladesh, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, Republic of Korea, Malaysia, Netherlands, Norway, Slovakia, Spain, Switzerland, Thailand, the United Kingdom and the United States.

C. Regional and international organizations and United Nations agencies

The following organizations and agencies sent delegates to the conference: Academy of Sciences for the Developing World (TWAS); African Union Commission (AUC); African Development Bank (AfDB); African Academy of Sciences (AAS); African Centre of Meteorological Applications for Development (ACMAD); African Clinical Research Organization (ACRO); African Regional Intellectual Property Organization (ARIPO); African Society of Scientific Research and Technology (ASSRT); Association of Commonwealth Universities (ACU); Bellanet Africa; BrainStore; the British Council; Innovation and Community (CLK); Chain of Hope; Common Market for Eastern and Southern Africa (COMESA); European Commission (EC); European Parliament; European Science Foundation (ESF); Food and Agriculture Organization of the United Nations (FAO); Forum for Agricultural Research in Africa (FARA); GCP Alliance – Europe; Global Education Communication; Global Knowledge Partnership (GKP); Global Water Partnership; German Agency for Technical Cooperation (GTZ); Imperial College – London; Institut de recherche pour le développement (IRD); International Centre of Insect Physiology and Ecology (ICIPE); International Council for Science (ICSU); International Food Policy Research Institute (IFPRI); International Institute for Tropical Agriculture (IITA); International Livestock Research Institute (ILRI); International Research Institute for Climate and Society; Inter-University Council for East Africa (IUCEA); Japan Science and Technology Agency; Korean Science and Technology Policy Institute; Médecins du Monde; Nile

Basin Initiative; Nokia; Nokia Siemens Networks; Organization for Social Science Research in Eastern and Southern Africa (OSSREA); Pan-African Institute for Technology and Development (PAITD); Pangaea Global AIDS Foundation; Pasteur Institute; Pfizer External Medical Affairs; Port Management Association of Eastern and Southern Africa (PMAESA); Royal Netherlands Academy of Arts and Sciences (KNAW); Schoolnet Africa; Swiss Agency for Development Cooperation (SDC); Thai Rural-Net Lab; TRN Institute; U.S. Office of Naval Research; UNDP; UNECA; UNEP; UNESCO; UNIDO; United Nations Convention to Combat Desertification (UNCCD); United Nations High Commissioner for Human Rights; WFP; and WHO.

D. Partners

The main partners of the Science with Africa conference included UNECA; AUC; the Swiss Agency for Development and Cooperation (SDC); the Canadian e-Policy Resource Centre (CePRC); UNESCO; the Global Knowledge Partnership (GKP); BrainStore; Ethiopian Airlines; Microsoft; and Nokia Siemens Networks. About 200 people attended a pre-conference workshop organized by GKP on 3 March 2008.

E. Exhibition

Approximately 26 local and international enterprises and organizations mounted panel exhibitions on STI facilities, scientific research products and the promotional material of institutions and business enterprises dealing with the development of STI on the continent.





IV High-level panel opening ceremony

Mr. Abdoulie Janneh, Under-Secretary-General and Executive Secretary of the United Nations Economic Commission for Africa, and Professor Nagia M. Essayed, Commissioner for Human Resources, Science and Technology of the African Union Commission, opened the conference. The Minister for Education of Ethiopia, H.E. Dr. Sintayehu Wolde-Michael, gave the welcoming speech. Other dignitaries and partners at the opening ceremony included H.E. Dušan Caplovic, Deputy Prime Minister of Slovakia; Dr. Beate Elsa Wilhelm, Assistant Director-General, Swiss Agency for Development and Cooperation (SDC); Mr. N. Satti, representative of the Director-General of UNESCO; and Professor Sir Magdi Yacoub, Imperial College London.

The high-level panel discussions addressed a number of issues, including Africa's inability to use STI to drive its socio-economic devel-

opment, despite having many national development visions that built around STI. The panel also spelled out the main STI challenges facing the continent, including: low investment in R&D; poor STI infrastructure; low human capital in STI; small scientific contribution to global knowledge; weak participation in the global economy and world markets; weak STI regulatory regimes; gender inequality and the effects of the brain drain. Consequently, the high-level panel emphasized the importance of STI for accelerated economic growth and poverty reduction as a prerequisite for the attainment of the Millennium Development Goals (MDGs) in Africa. It also emphasized the importance of STI in protecting the environment. The panel called for a sound and dynamic partnership to be formed for the implementation of the 2005 AU/NEPAD Consolidated Plan of Action (CPA), a continent-wide blueprint for accelerating economic growth through the deployment of STI. The abundance of mineral, agricultural and energy resources and productive human capital on the African continent should be soundly and strategically utilized to enable Africa to occupy its rightful place in the world economy and global markets.

The conference also received a very inspiring goodwill message (below) from H.E. Mrs. Ellen Johnson-Sirleaf, President of Liberia:

“No country on Earth has developed without deploying, harnessing and utilizing science and technology, whether through technology transfer or home-grown solutions. This continent needs to think seriously about stepping up its efforts in using S&T for decision support and for making a difference in the lives of ordinary people. By harnessing S&T, African countries have a stronger chance for sustained economic growth, for addressing poverty, disease and environmental destruction. Therefore, building national S&T capacities are critical indicators of the future well-being of a country’s citizens and how well a country can compete in the global market. This is why the Science with Africa conference, organized by the UNECA and the AU and partners is a welcome attempt at putting R&D firmly on the development agenda of African policymakers, scientists and the international community”.

Mrs. Ellen Johnson Sirleaf, President, Republic of Liberia

A. Keynote address

The keynote address was delivered by Professor Mohamed H.A. Hassan, President of the African Academy of Sciences (AAS) and Executive Director of the Academy of Sciences for the Developing World (TWAS). In his presentation, Professor Hassan addressed the steps that African countries and their partners could take to sustain the fragile advances in STI that have begun to take hold in Africa. Professor Hassan argued that African countries should: (a) institute educational reforms that make science more interesting and attractive to women and youth; (b) establish and sustain programmes aimed at increasing scientific literacy in communities; (c) provide quality education at all levels; (d) promote and facilitate

quality research among local scientists and support merit-based science academies, foundations and innovation centres; (e) develop and sustain STI human capital; (f) transform brains drains into brain gains; and (g) share success stories/experiences in the use of S&T to address critical social and economic needs among developing countries. It was also important to take into account the size of the African continent (figure 1) and to take stock of its enormous under-utilized natural wealth and biodiversity when planning to address economic development on a continent characterized by diverse populations confronted with a range of cultural and social challenges.

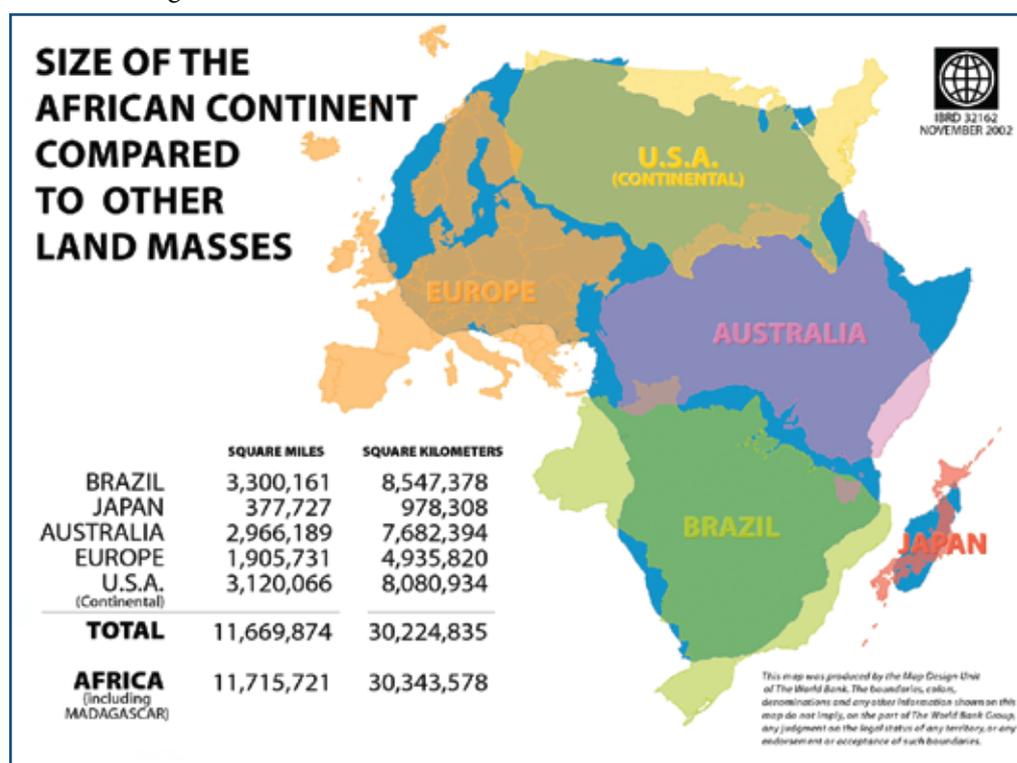


Figure 1

Professor Hassan further argued that in the light of the current challenges facing the continent, the implementation of the AU/NEPAD Consolidated Plan of Action (CPA) needs to be accelerated. African governments also need to scale up investment in STI and to strengthen the linkages between STI policy, research products and enterprises.

B. Synopsis of the high-level panel discussions

The main speakers in this session were: H.E. Dušan Caplovic, the Deputy Prime Minister of Slovakia; Mr. Abdoulie Janneh, Under-Secretary-General and Executive Secretary of UNECA; Professor Nagia Essayed, AU Commissioner of Human Resources, Science and Technology; and H.E. Dr. Sintayehu Wolde-Michael, Minister of Education of Ethiopia. Other speakers included H.E. Alfred Mukezambura, Speaker of the Parliament of Rwanda; Dr. Shukuru Kawambwa, Minister of Communication, Science

and Technology of the United Republic of Tanzania; H.E. Mr. Matson Mampouya, Minister of Scientific Research and Innovation of the Congo; H.E. Mrs. Souad Bendjaballah, Minister of High-Level Education and Scientific Research of Algeria; H.E. Mr. El H. Ousmane Souare, Minister of National Education and Scientific Research of Guinea; and Mr. N. Satti, the representative of the Director-General of UNESCO, Professor Lidia Brito (Mozambique); Engineer Irene Nafuna-Muloni (Uganda); Professor Edward Ayensu (Ghana).

These speakers emphasized the importance of STI as a tool for socio-economic development in their respective countries. They also argued that the attainment of the MDGs will be heavily dependent on the appropriate application of S&T. However, they acknowledged that investment in STI activities will continue to be modest in Africa due to competing national developmental challenges, weak national industrial sectors and small annual economic growth rates. They also called for greater regional and international cooperation in STI in order to achieve sustainable development in Africa.

Suggested actions

- a. AUC and UNECA, in partnership with United Nations agencies dealing with S&T for development in Africa (i.e. UNESCO, UNICEF, UNIDO, UNEP, UNCTAD, WHO and FAO) and other development partners, should establish a strong functioning institutional framework to support a harmonized implementation of the AU/NEPAD Consolidated Plan of Action;
- b. AU, with the support of its partners, needs to foster the development of an African STI policy framework;
- c. African countries need to prioritize innovation as part of their S&T strategy for job creation, market competitiveness and wealth creation. Hence, they should develop national innovation systems that have well-defined development indicators, and establish a clear interface between education, research, STI policy and business enterprises;
- d. African governments should strengthen their determination and commitment to ensure sustainable funding for STI activities in their respective countries, and mobilize public and private sector funds for R&D.



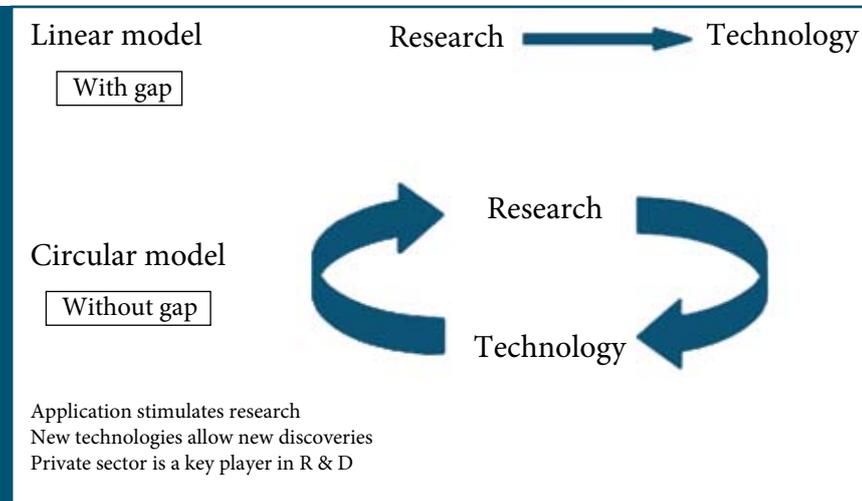
V Outcomes

A. Theme I: Science, technology and innovation policies in Africa

Africa is the only region in the world that has not yet fully exploited the great potential of using STI as an engine for economic growth, poverty reduction and socio-economic development. Almost all African countries have R&D systems that operate on linear R&D models (figure 2). This type of model is not appropriate, as there are gaps between science education, research, technology, innovation and commercialization. A more appropriate model is the circular one (figure 2), in which scientific research produces technological discoveries that may be innovatively developed and deployed in productive sectors of the economy. The key player in this type of model is the private sector, because it usefully complements the public sector by providing sustainable financial resources and research infrastructure for successful R&D programmes. Howev-

er, the African private sector is not very developed and does not rely on knowledge-based operations, and public-private partnership is weak in most African countries.

Figure 2:
SRTI-Conceptual change



Source: ICSU ROA, 2006

R&D investment levels in Africa are still very dismal and are among the lowest in the world, as shown in (figure 3). However, the situation is evolving and the decision made by African Heads of State and Government at the 2006 AU Summit in Khartoum, the Sudan that African countries should spend at least 1 per cent of their national gross domestic product (GDP) on R&D is a positive development. A few African countries have dramatically boosted their S&T expenditures, including Rwanda which spends about 1.6 per cent of its GDP, and South Africa which earmarks about 1 per cent of its GDP for R&D. However, R&D expenditures are much higher in the Asia-Pacific region. For instance, the R&D budget of the Republic of Korea has been growing at a rate of about 9.7 per cent annually for the past six years, reaching about 3 per cent of GDP in 2006. Brazil has 1,700 research groups dedicated to biotechnology and private and public investment in the country's biotechnology industry will reach US\$ 4.8 billion over the next 10 years. In 2007, S&T accounted for 40 per cent of China's economy and there are plans to expand its knowledge-based economy and to ensure that S&T accounts for 75 per cent of China's economic growth by 2050. World Bank data show that annual R&D spending in OECD countries is more than the total value of economic output of 61 of the world's poorest countries. In 2006, the United States spent \$340 billion on R&D, with 18 per cent of the amount going to basic research, 22 per cent to applied research and 60 per cent to development.

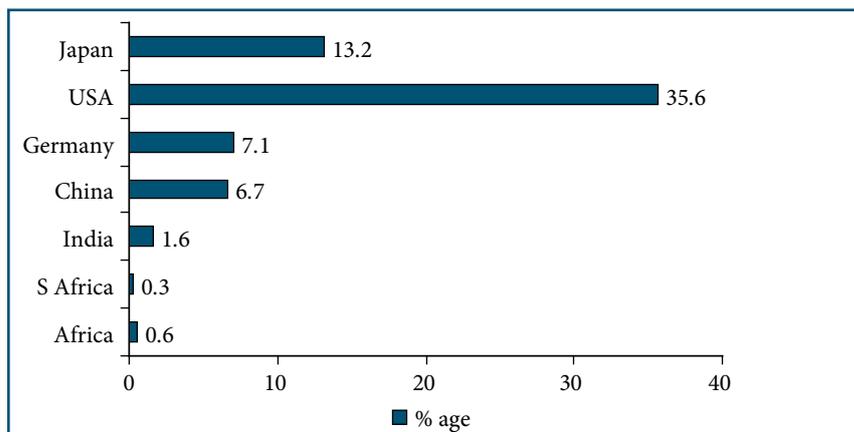


Figure 3:
Shares of world (global gross expenditure on research and development)

Source: UNESCO, 2002

The consequences of low investment in science education and R&D in Africa are also reflected in the distribution of researchers around the world (figure 4). Africa has fewer than one scientist or engineer per 10,000 inhabitants, whereas the Asia-Pacific region has between two and five scientists or engineers per 10,000 inhabitants. Another indicator of this low level of investment is Africa's publication record in learned journals (figure 5), especially sub-Saharan Africa, which has seen a drastic decline in its share of internationally publishable quality data and knowledge.

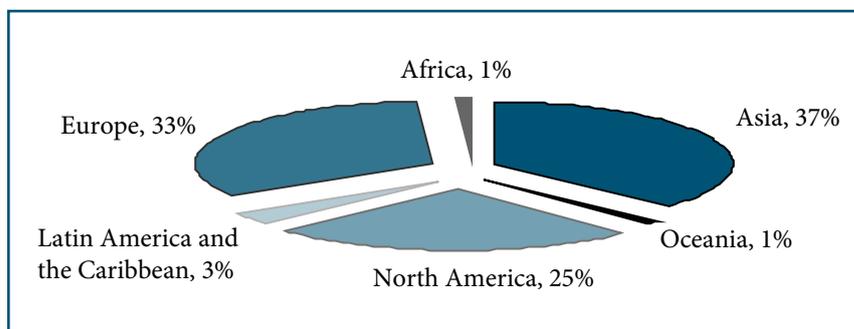


Figure 4:
Shares of world researchers by region, 2002

Source: UNESCO

The high-level panel and conference participants agreed that in order for Africa to occupy a favourable position in today's global knowledge-driven economy and address its priority needs, it has to put current scientific knowledge and skills to better use. The continent needs to engage in new and emerging fields of science and cutting-edge technologies that impact strongly on its sustainable socio-economic development. These include health and life sciences, nanotechnology and biotechnology, ICTs, agricultural technologies and industries, space and earth sciences, energy technologies and the science of climate change and adaptation. Furthermore, the 21st century offers the promise of even greater and accelerated progress as digital technologies drive down the costs of creation, reproduction, distribution and consumption of knowledge and skills.

Region and country	1988	1990	1995	2000	2003	Percent change
Other Asia (excl China, S. Korea, Singap, Taiw.)	2.17	2.08	1.96	1.94	2.26	+4.12%
Near East/North Africa	1.69	1.62	1.66	1.76	1.93	+13.83%
Central/South America	1.21	1.35	1.64	2.33	2.71	+124.4%
Sub-Saharan Africa	0.97	0.86	0.72	0.63	0.60	-0.382%

Source: Science and Engineering indicators, 2006: derived from Thompson ISI, Social Science Index and Science Indexes

Figure 5:

International Published Output (percentage)

Africa has to recognize that innovation systems offer practical solutions that can help to bridge the gap between S&T and productive economic sectors in a systematic and sustainable manner. Hence, the continent requires STI policies which will address its most urgent needs, especially that of poverty reduction through sustainable economic growth. The formulation of such problem-solving policies should be based on development indicators and existing STI infrastructure, and on the human and financial capacities of individual countries. Such policies should incorporate elements of South-South and North-South STI cooperation (e.g. technology transfer and domestication), but should avoid heavy dependence on external funding. Few African countries currently have an environment that is conducive to the use of S&T for socio-economic development and hence their local, regional and global market competitiveness is weak. In response, the AU and the EU recently adopted a joint strategy that focuses on climate change and R&D in Africa, and a number of development cooperation partners have expressed their willingness to support collaborative R&D activities taking place on the continent.

Suggested actions

- a. African governments should establish enabling environments to encourage their local STI experts, and work towards the development of a critical mass of STI experts and knowledge communities in their respective countries;
- b. African governments should develop mechanisms to address the brain drain and encourage brain gain and brain circulation through South-South and North-South scientific cooperation;
- c. African countries should incorporate climate change issues into their S&T priorities, particularly in their partnership projects with the European Union, the G8 and other development partners, including emerging economies such as Brazil, China, India, Malaysia and the Republic of Korea;
- d. AU, in collaboration with UNECA, UNESCO and UNIDO, should encourage African countries and their regional economic communities to prepare or review and harmonize national and

regional STI policies, which should incorporate adequate STI development indicators.

B. Theme 2: Energy, water, transport and infrastructure

About 75 per cent of sub-Saharan Africa's population does not have access to electricity (figure 6). This impacts negatively on the attainment of the MDGs, particularly with regard to poverty alleviation. However, records show that Africa has abundant primary energy resources in the form of water for hydropower generation, oil, natural gas, coal, etc. A conservative estimate shows that Africa has proven coal reserves of about 50 billion tons, enough for more than 300 years at the current rate of electricity consumption. In addition, Africa has enormous amounts of renewable energy sources, e.g. solar, wind, waves and tides, geothermal and biofuels. One square kilometre of an African desert receives annual solar energy levels equivalent to 1.5 million barrels of crude oil. Research and development work has yet to focus on the energy sector in Africa, particularly with regard to energy resource assessment conversion technologies, low-cost transport and distribution technologies, and energy efficiency. Similarly, little emphasis has to date been placed on the nexus between energy production and utilization and environmental protection in the context of the African continent.

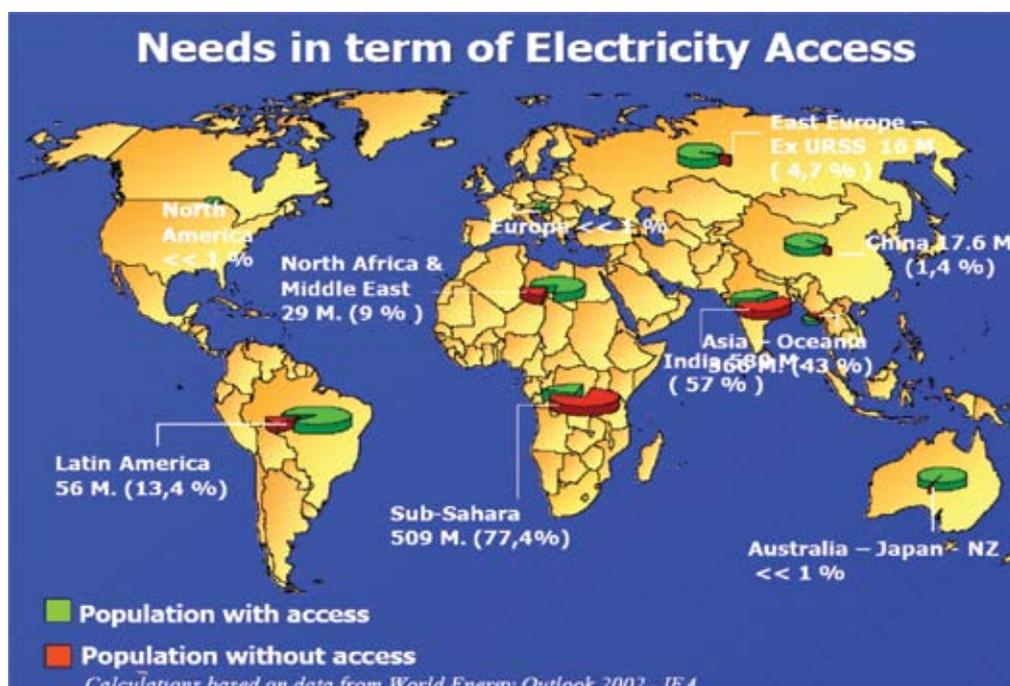


Figure 6

On average, the proportion of Africans with access to clean and safe water is 60-80 per cent in urban areas and 30-50 per cent in rural areas. It has also been reported that sanitation levels in urban and rural areas are

about 55 and 25 per cent, respectively. Such living conditions promote the spread of water-borne diseases on the continent. The main concerns in the water sector in Africa include variable precipitation due to climate change, water scarcity, irrigation needs, the uneven geographical distribution of water resources, water governance, transboundary aquifers, unavailability of reliable data, lack of adequately trained human resources, and shortage of functioning research infrastructure.

The main challenges in the transport sector in Africa include poorly functioning transport systems resulting from weak infrastructure and maintenance schemes, discrepancy between demand and supply of transport services in many African countries, and poor management of population growth, land use and transport networks. Furthermore, the transport industry in Africa does not sufficiently utilize existing ICT tools, such as geographical information systems and global positioning systems.

Suggested actions

- a. African institutions operating in the energy, water, transport and infrastructure sectors should establish professional networks for sharing information, knowledge, skills and experiences in these sectors;
- b. African countries should harness their enormous energy resources for socio-economic development and pay particular attention to the use of renewable energies in rural areas;
- c. UNECA should continue to work with African energy institutions, such as the African Energy Commission (AFREC), the AU/NEPAD energy initiative and energy projects carried out by regional economic communities.

C. Theme 3: Agriculture, health and life sciences

Agriculture provides livelihood opportunities to about 40 per cent of the world's population, and about 70 per cent of the poor in developing countries who live in rural areas depend on agriculture for their livelihood.

Furthermore, 70 per cent of Africa's workforce is employed in the agricultural sector, the majority of whom are small-holder farmers and traditional pastoralists, while 40 per cent of the GDP of African countries is derived from agricultural products. African biodiversity is very important, particularly as about 80 per cent of Africans resort to traditional medicine for their medical needs. However, despite the importance of the agricultural sector, investment in agricultural research has fallen in recent years, leading to low capacities to address agricultural productivity issues. Fast-emerging large-scale farming systems in Africa, which are capital-intensive, mono-cropping and export-oriented, are affecting the livelihoods

and occupational prosperity of traditional and small-scale farmers on the continent.

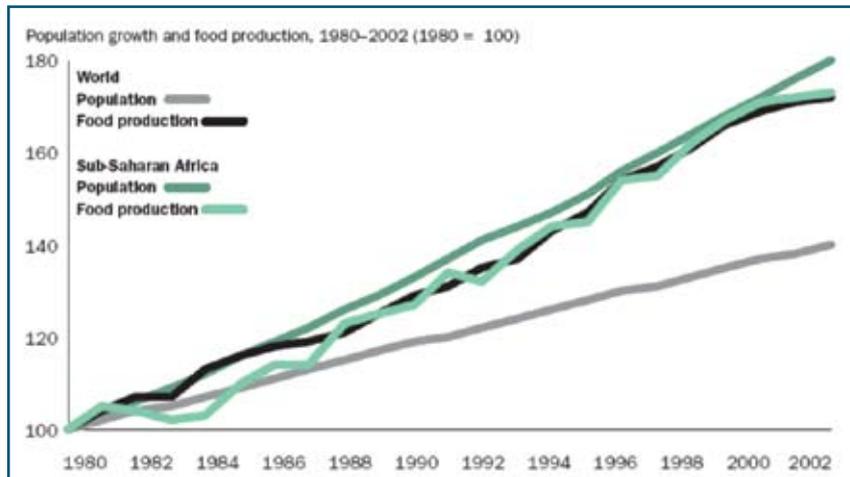


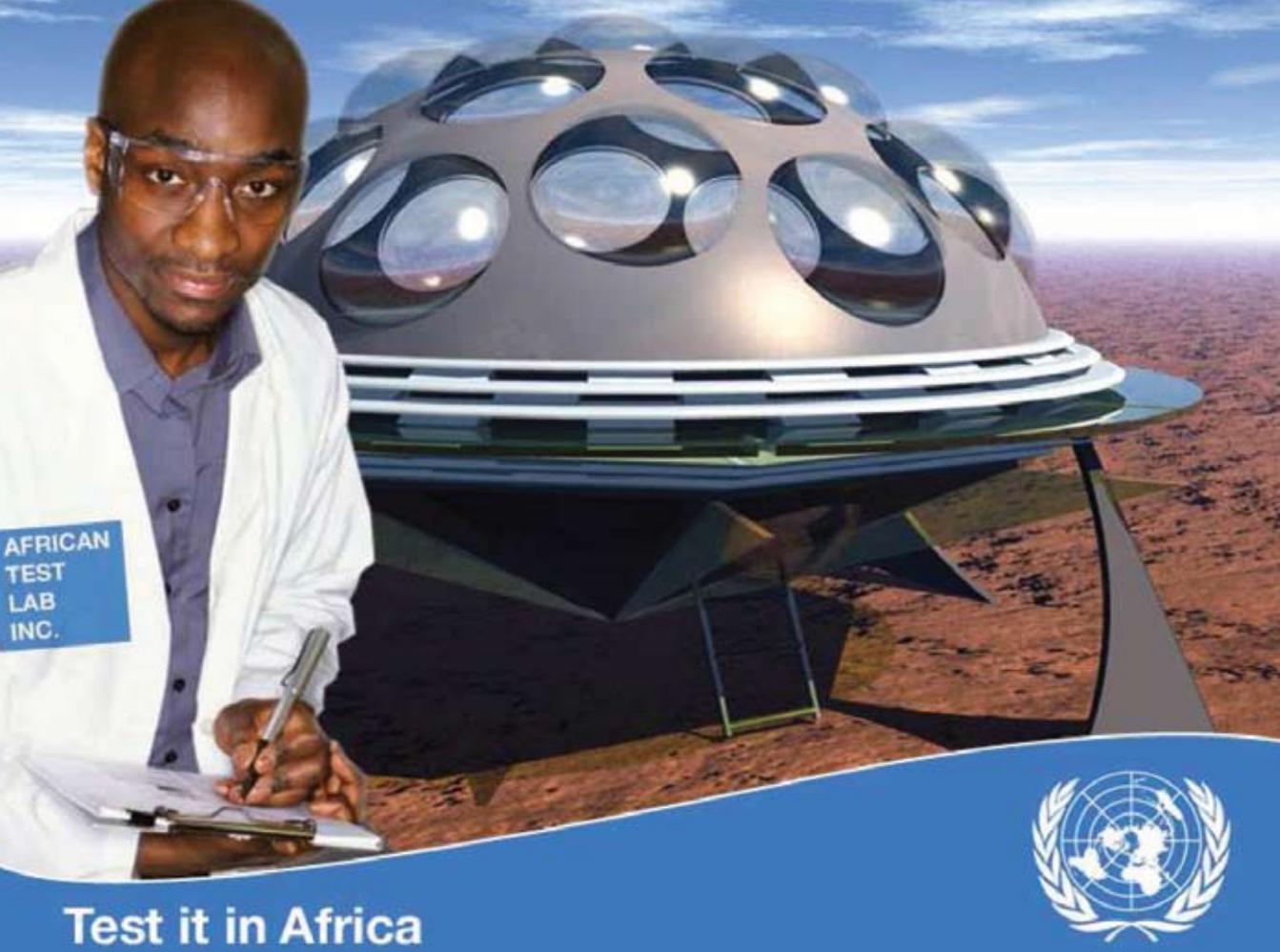
Figure 7:
Limited land and more demand for food

Source: World Bank, 2004

Agriculture in Africa is heavily dependent on rainfall, but climate change has created erratic rainfall patterns. The migration of the productive workforce (i.e. youths) to urban centres, ageing rural populations, malaria and the HIV/AIDS pandemic have weakened the human capacity of rural populations to farm and harvest their crops. Consequently, famine remains a major problem in many countries on the continent. As can be seen in figure 7, the food production curve in sub-Saharan Africa is below that of its annual population growth.

Gender equality in the agricultural sector in Africa is a source of concern, as African women produce 70 per cent of the continent's food, but own only 10 per cent of its wealth. Consequently, women's activities in Africa's agricultural sector remain undervalued, and women continue to be treated as unpaid family labour or receive low wages as seasonal labourers. Conference participants argued that women and men, who have different responsibilities in the agricultural sector, should all benefit from existing agricultural knowledge, science, technology and innovation and have equal land ownership rights, as well as access to the financial resources required to enhance and develop agriculture in Africa.

Africa is not currently benefiting fully from recent advances in biotechnology, despite their potential to contribute to the achievement of the MDGs. This is partly due to the perceived risks of biotech products and genetic modification, and to concerns about the impact of such products on biodiversity and human health (e.g. allergenicity), and the possible dominance of transnational corporations in the supply of biotech products. Nevertheless, a number of strategies exist to contain, confine and mitigate these perceived risks, including genetic manipulation strategies.



The population of Africa now stands at 922 million, with 41.4 per cent (382 million) under the age of 14. On average, life expectancy currently stands at 45 and the infant mortality rate is 103 per 1,000 live births.

About 26.5 million people are living with HIV in Africa, and every year 2.5 million of them die of AIDS. It is estimated that about 1 million people die of malaria in Africa every year. In addition to HIV/AIDS, malaria and water-borne diseases, experts consider that rheumatic heart disease (RHD) has been neglected and overlooked in the MDGs documents and is predicted to become the number one killer on a global scale by 2011. Hence, health and life sciences in Africa should specifically address the issue of cardiovascular diseases. It was also argued that biotechnology and nanotechnology in health services have the potential of treating diseases such as HIV/AIDS, malaria and TB.

Suggested actions

- a. African governments should support R&D programmes aimed at modernizing the agricultural sector, in order to increase productivity, industrialization and commercialization. At the same time, indigenous and simple technologies should be harnessed so that they can contribute to poverty reduction. Gender equality in the agricultural sector also needs to be addressed;
- b. African governments should establish adequate policy frameworks to support the modernization and commercialization of traditional medicine products;

- c. African countries should focus on identifying more viable seed storage systems for indigenous African plants, roll out a more user-friendly biosafety legislative framework, and improve support and service conditions for African scientists. South-South and North-South collaboration should support African programmes on biotechnology and nanotechnology in the agricultural and health sectors.

Developing guidelines for health research in Africa

Health research policy and guidelines in Africa should be developed in keeping with African needs, and in accordance with prevailing legal frameworks and ethics.

Strong political will is required from African leaders, supported by health experts and other stakeholders in this sector, in order to develop and implement relevant legal, regulatory and practical guidance to promote and support health research. Africa, in collaboration with the international community, needs to establish harmonized Pan-African guidelines and legal frameworks for health research and practice. Health research in Africa is a key driver of health policy and health care across the continent, and AUC and UNECA have a key role to play in this regard.

Lastly, Africa should develop its own guidelines for ethics, good clinical practice (GCP), investments and other key areas for the development of its health sector. AUC and the Pan-African Parliament, as well as national parliaments and governments should work on bioethics norms and practices when developing regional and national health research policies. Professional bodies active in this field, such as the newly established Cameroon Bioethics Society (CBS) and the Good Clinical Practice Alliance (GCPA) of Europe, should support this initiative.

Suggested actions

- a. AUC and UNECA, in collaboration with partners such as WHO and other United Nations agencies, should support the implementation of an African health strategy and establish strong linkages between health research, health policy and health care based on African needs and common health standards;
- b. AUC and UNECA, in collaboration with partners such as the European Union, WHO and other United Nations agencies, should continue working together in order to share the benefits of medical research and improve health systems in African countries;
- c. African governments should develop integrated frameworks on ethics in their respective countries, and should establish Pan-African focal points for the promotion of South-South and North-South partnerships in the health sector.

D. Theme 4: Climate change in Africa

African nations have developed greater awareness of the impacts of climate change on the continent and increased high-level attention is now being paid to climate security and stability. Conference participants recognized that global environmental change is multi-sectoral in nature and thus requires the participation of various stakeholders, including the general public. A report on global environmental climate research (GECR) activities and capacity in Africa published by NEPAD in 2006 (Scholes R. J. Olago D. and Sigha-Nkamdjou L. (2006a), *Global Change and the New Partnership for African Development* NEPAD, Pretoria. 73 pp) shows that there are 740 known GECR scientists working in virtually every country in Africa, but over half of them are concentrated in only five countries: Côte d'Ivoire, Ghana, Kenya, Nigeria and South Africa.

Human activities have, since the pre-Industrial Era (~1750), resulted in the release of large quantities of greenhouse gases (GHG) into the atmosphere in the following proportions: CO₂ by 30 per cent, CH₄ by over 100 per cent and N₂O by 15 per cent. Agriculture currently contributes 58 and 47 per cent of the global anthropogenic emissions of CH₄ and N₂O, respectively. Global warming is a major challenge, as the global temperature has risen by 0.6 °C since 1860. Africa experienced an atmospheric temperature rise of 0.7 °C in the 20th century and the last two decades of the century were the hottest on record. These climatic changes have increased the frequency of floods and droughts in Africa, and altered the dynamics of disease agents and vectors and ecosystems, especially in relation to species composition, food production and food security.

Ninety per cent of all natural hazards and disasters are linked to climate variability; the economic losses suffered by countries which have experienced such events can be as high as 85 per cent. Marine, coastal and freshwater ecosystems have been drastically altered over the past 50 years, reducing their productivity, resilience to stress, and potential to contribute to future food security. Furthermore, climate change has a detrimental impact on rainfall, food security, health, water and energy resources (e.g. hydropower). Hence, there is an urgent need for key stakeholders within Africa to work in close collaboration and to focus on both immediate and long-term action on adaptation to climate change at all levels.



Suggested actions

- a. African countries need to improve their observation systems, data collection and prediction and mitigation capacity with regard to natural hazards and disasters. African institutions dealing with natural hazards and disasters should collaborate among themselves and with the international community in order to provide services to decision makers and end-users;
- b. A real-time Internet-based data collection infrastructure should be developed to assist African researchers to better study climate change and its impacts, and to formulate mitigation strategies. This will alleviate the problem of lack of adequate data collection infrastructure, which hampers the development of high-quality scientific research on issues relating to the environment and climate change in Africa.

E. Theme 5: Intellectual property rights, patents and technology transfer

Africa's low levels of investment in quality science education, lack of quality R&D infrastructure and poor innovation systems have resulted in low scientific research output and few international patent applications from the region. In 2007, for example, the Republic of Korea and China submitted 7,061 and 5,456 applications for international patents, respectively. In contrast, the highest number of applications submitted by African countries were from South Africa (390 applications) and Egypt (41 applications).

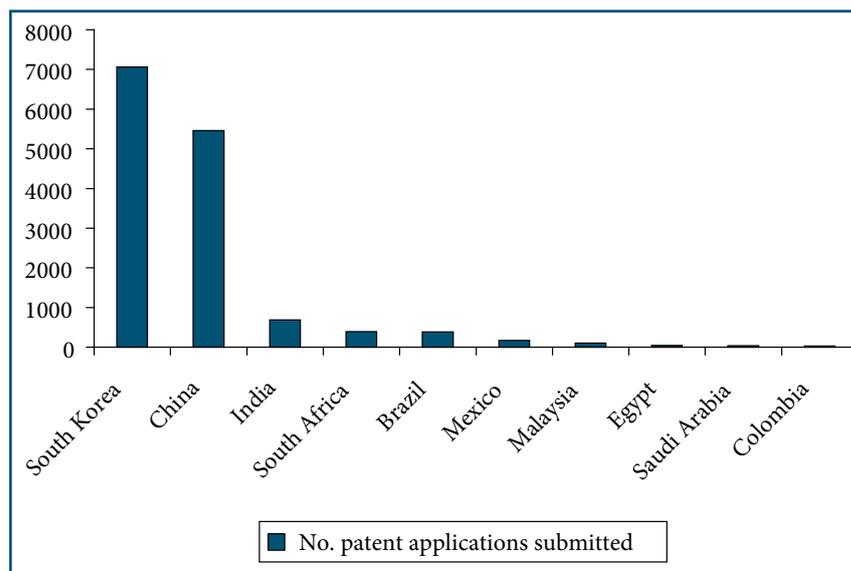


Figure 8:
International patent applications to the
WIPO from developing countries in 2007

Source: WIPO



The conference discussed how Africa could benefit from the IPR systems that were being proposed in international organizations such as the World Trade Organization (WTO). However, there was a need to raise awareness of IPRs in order to benefit fully from existing IPR systems and protocols. It was also argued that for Africa to enjoy the benefits of IPR systems, African countries should ensure that IPR institutions are adequately funded and operate efficiently, and that the costs of obtaining, maintaining and enforcing intellectual property rights remain low. The countries should also combat counterfeiting and piracy.

The conference was informed that Africa has two institutional patent registration organizations: l'Organisation Africaine pour la protection intellectuelle (OAPI) for Francophone Africa and the African Regional Intellectual Property Organization (ARIPO) for Anglophone Africa. The African Union has recently decided to establish a continent-wide body – the Pan-African Intellectual Property Organization (PAIPO) – to provide policy harmonization and political leadership on IPR issues. In addition, each African country has its own established registration body dealing with IPR and licensing of patents.

African countries face many challenges in relation to the establishment of functioning IPR systems, capacity-building in the area of IPRs, and the adoption of common positions in the context of international IPR platforms. Some of the existing IPR protocols have weak protection regimes, leading to revenues losses as a result of piracy and counterfeiting, especially for artists and traditional healers. Africa is continuing to lose its indigenous knowledge and traditional artefacts due to inadequate IPR regimes. The few available patents cannot be commercialized due to lack of financial resources, technology and access to markets.

Suggested actions

- a. PAIPO, ARIPO, OAPI and national IPR bodies should embark upon intensive capacity-building and awareness-raising campaigns on IPR and patent issues. Collaboration with WIPO and WTO should be strengthened, especially on training of policy and decision-makers on IPR issues;
- b. African countries and their respective institutions should act more like custodians and enhance their governance systems for African indigenous knowledge and traditional artefacts by developing their IPR regimes to better protect traditional knowledge;
- c. African countries should also develop effective strategies and policies for technology transfer, adaptation and domestication.

F. Theme 6: Information and communications technologies

ICTs constitute a solid foundation for harnessing STI for development as they support research activities aimed at data capture, storage and dissemination. Consequently, the availability of ICTs and Internet connectivity facilitates access to knowledge and promotes the creation of networks of informed communities and business enterprises. However, the main ICT challenge faced by African countries is the current low level of ICT penetration on the continent – particularly among widely dispersed rural communities and disenfranchised groups – coupled with poor national and subregional innovation systems. The conference also observed that the lack of technological innovation to support small and medium-size enterprises limited their contribution to the growth of national economies.

Suggested actions

- a. UNECA and AUC, in collaboration with their development partners, should continue supporting African governments and regional economic communities to develop and implement harmonized ICT policies on a national and subregional level. Greater emphasis should be put on reinforcing implementation mechanisms and on meeting the needs of rural communities, women and youth;
- b. African countries should develop national ICT and innovation policies and strategies;
- c. African countries should establish an enabling environment for partnerships to foster knowledge sharing and networking;
- d. UNECA and AUC, in collaboration with their partners, should foster the implementation of the African Regional Action Plan on the Knowledge Economy (ARAPKE) and its flagship projects.



G. Theme 7: STI capacity-building

An innovation system approach offers solutions to bridging the gap between S&T and the productive sector and to building STI capacity. There is a need to improve the quality of science education at all levels, to adopt on strategies to produce and sustain human capital in S&T in Africa, and to address the issue of gender equality in science education. The education budget allocated to S&T has to be substantially increased in order to match that of the post-independence era, which represented 20-30 per cent of the total national budget. Enrollment of primary and secondary school students has to increase by 50-150 per cent, and enrollment of students in tertiary institutions has to increase by 50-200 per cent. The quality and quantity of education and research facilities need to be scaled up across all education sectors to match the number of students, teachers and academic staff. It is also necessary to increase the quality and quantity of human resources (e.g. technicians, teachers, lecturers, professors), and most importantly, to boost remuneration levels and the number of African women training to become scientists, engineers and technologists. The working conditions of employees in all education and S&T sectors should be drastically improved, and African universities and other institutions of higher learning should establish strong research and innovation partnerships with industry.

Political commitment and a willingness to prioritize these issues are needed to build knowledge communities and productive STI networks on the continent. Furthermore, they are important prerequisites in any effort to lay a solid foundation for S&T capacity and to establish a functioning infrastructure in any progressive nation wishing to have a prosperous knowledge-driven economy. The private sector also has a role to play by providing additional financial capital and research facilities. Furthermore, African experts in the Diaspora should be deployed in capacity-building programmes, as well as in the utilization of S&T for the socio-economic development of their home countries, thereby transforming the brain drain into a brain gain.

Suggested actions

- a. UNECA and AUC and other international organizations should promote and facilitate the establishment of knowledge communities, and the production of a critical mass of STI experts on the continent, and support African countries to establish functioning STI infrastructure;
- b. African countries should establish a sustainable enabling environment for their STI human resources and drastically increase the number of African women working as scientists, engineers and technologists;
- c. African countries should develop mechanisms to profitably address the brain drain and encourage brain gain and brain circulation through South-South and North-South cooperation;
- d. African countries should develop clear national and regional policy frameworks to build their capacity in science education, research, technology and innovation, and to link S&T to all productive economic sectors. UNECA and AUC should assist African countries and regional economic communities to prepare, review and harmonize national and regional STI policies incorporating adequate STI development indicators;
- e. African countries should increase their spending on education and R&D, and introduce incentives to attract private sector investment in science education and R&D activities;
- f. African countries should incorporate climate change issues into their S&T priorities, particularly in their partnership projects with the European Union, the G8 and other development partners, including emerging economies such as Brazil, China, India, Malaysia and Republic of Korea.

H. International programmes for STI capacity-building in Africa

- a. The conference welcomed the funds provided by the European Union to support R&D activities in Africa. African countries renewed their commitment and support to the 2008-2013 Strategic Plan of UNESCO, which emphasizes its support to African STI initiatives, including the AU/NEPAD Consolidated Plan of Action (CPA);
- b. African countries also welcomed the pledges made by NOKIA systems and the Global Knowledge Partnership (GKP) to support STI activities across the continent;



- c. The existing UNECA-AUC/NEPAD partnership and STI arrangements among regional and international organizations such as UNESCO; UNIDO; the International Council for Science (ICSU); the Network of African Science Academies (NASAC); the Association of African Universities (AAU); and other active African-based STI organizations, should be strengthened through collaborative STI programmes and projects.



VI Generation and selection of R&D projects

A. R & D Idea Factory

The Idea Factory is an innovative method for generating ideas, selecting and implementing innovative projects. Industrial Idea Production is BrainStore's unique process of stimulating innovative and lateral thinking in a systematic – industrial – process. Conference participants were invited to take part in a quick mental exercise to generate ideas for projects that could be undertaken. The exercise developed by Idea Production sought to stimulate the creative resources and expertise of conference participants and to develop their research ideas in only three days. Thus, the Idea Factory exercise provided an opportunity to select research ideas which will be jointly implemented by GKP, UNECA and

African scientists, engineers and technologists. The practical ideas developed by conference participants were based on the following criteria:

- a. Reflect current challenges facing the continent and build the foundation for strengthening and expanding its R&D capacities;
- b. Increase the visibility of African R&D capabilities on an international level and lay the groundwork for sustainable partnerships;
- c. Increase the usability, practicability and commercial appeal of products generated by researchers.

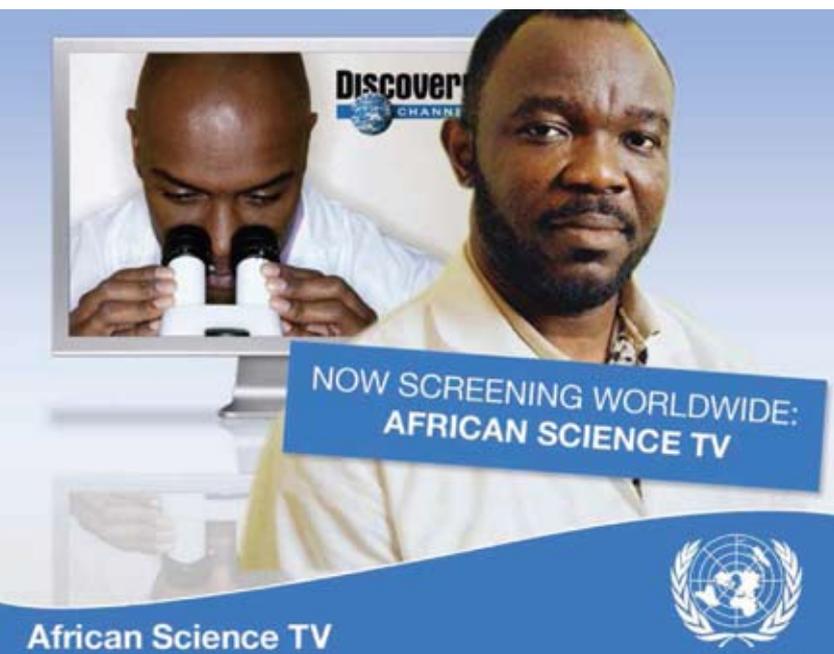
In the context of the **Science with Africa** conference and BrainStore's initiative, the Global Knowledge Partnership (GKP) offered an opportunity to African experts to collaborate with their counterparts in other parts of the world, with the financial support of the Swiss Agency for Development and Cooperation (SDC). GKP is the world's first international multi-stakeholder network and will assist African countries to establish concrete measures to boost R&D on the continent.

The selected project came from the 5,000 proposed ideas collected in the creative workshop held during the conference. The ideas were summarized in 450 proposals, 144 of which were

examined by a panel of experts. Twenty of these ideas were placed on a short list and presented to conference participants and a vote was taken to select innovative ideas which should be developed into project proposals. UNECA, SDC and BrainStore intend to organize a post-conference workshop on the implementation of the outcomes of the Idea Factory in Africa.

Suggested action

UNECA, AUC and the United Nations family, in collaboration with other implementing partners, should work with African-based S&T entities to implement ideas aimed at boosting R&D in Africa.



B. Science with Africa marketplace

Prior to the **Science with Africa** conference, a call was made for papers on the major conference themes: energy; transport and infrastructure; health and life sciences; agriculture; climate change; and ICTs. A good response was received and some of the accepted abstracts were featured in a marketplace, where participants would defend their ideas in a peer-to-peer environment. The session's paradigm was that research activities in Africa should focus on a few niche areas based on comparative advantage and implemented with the objective of promoting industrialization and commercialization. It was also argued that competitive research called for investment in cutting-edge science as well as professional cooperation.

Africa does not have enough human and social scientists specialized in S&T disciplines, such as technology development, acquisition, adaptation and commercialization. The absence of such scientists makes it difficult to address social and cultural factors which can either promote or stand in the way of scientific and technological progress in Africa. Research in the areas of human and social sciences is being carried out in Africa, but the results of this research are not applied because of cultural constraints. The experiences and lessons from Asian countries (e.g. India) may be useful to African S&T policy- and decision-makers. Furthermore, in the area of scientific outputs, the number of scientific articles authored by African scientists that are published in international journals is decreasing in many countries, with the exception of South Africa and Egypt. Similarly, international publications and bibliographic databases do not adequately acknowledge the scientific contributions coming from Africa.



Suggested actions

- a. African countries should promote and facilitate the free movement of scientists, engineers and technologists within Africa so that they can share their competencies and invigorate STI, thereby promoting the socio-economic development of the continent;
- b. African scientists have to consolidate available capacities and opportunities through networking in order to compete with the rest of the world;
- c. The issue of gender equality should be given prime attention by all African countries and be integrated into all STI policies and implementation plans.



VII Way forward

The Conference recommended that UNECA and AUC, in collaboration with the United Nations S&T cluster and other international partners (e.g. the European Union), should establish an African cluster for S&T to foster the coordinated implementation of the AU/NEPAD Consolidated Plan of Action (CPA). This cluster should seek to harmonize and monitor the implementation of S&T initiatives on the continent in order to avoid duplication, and serve as a permanent forum for interaction between Africa-based scientists, engineers and technologists and their international partners.

RoadMap «AfricanExpress»

«Boosting African R&D – growing stronger, going global»

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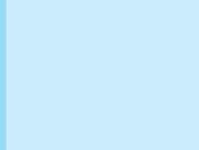
2012

2011

2010

2009

2008



Funding

African Innovation

Building Human Capital

Business Development

Outreach & advocacy



ECA

