INTERNATIONAL COOPERATION IN SCIENCE AND TECHNOLOGY
An Overview of African Protocols and Approaches

Introduction

International cooperation in science and technology is increasing in intensity and complexity. Recent studies show that cooperation in scientific and technological activities has increased among developed countries and between some developed and developing countries.[1] The growth in cooperation in science and technology is stimulated by a variety of factors, including globalization and increasing recognition of benefits of such cooperation. Most recent international and regional economic, trade, security and environmental agreements or treaties contain provisions on cooperation in science and technology.

At the international level such treaties as the Montreal Protocol (1987), the Vienna Convention for the Protection of the Ozone Layer (1985), the Convention on Biological Diversity (1992), the United Nations Framework on Climate Change (1992), the United Nations Convention to Combat Drought and Desertification (1994), the Trade Related Intellectual Property Rights (TRIPS) agreement of the World Trade Organization (1994), the Kyoto Protocol (1997) and the Cartagena Protocol on Biosafety (2001) put emphasis on cooperation in science and technology. They create obligations for their contracting parties to invest in joint science and technology programmes and engage in cooperation through exchange of expertise and information as well as sharing of research facilities.

Agenda 21—the United Nations programme on sustainable development—adopted at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 devotes a lot of attention to the need for international cooperation in science and technology. For example, its chapter 31 (on scientific and technological community) and chapter 34 (on transfer of environmentally sound technology, cooperation and capacity building) are largely dedicated to measures that promote science and technology cooperation.

At the regional level in Africa there are also agreements and declaratory statements stressing the importance of countries cooperating or collaborating in science and technology. For example, Articles 103, 104 and 127 of the Treaty establishing the Common Market for Eastern and Southern Africa (COMESA) are dedicated to issues of cooperation in the development of science and technology. Article 21 of the Southern Africa Development Community (SADC) Treaty recognises the importance of cooperation in areas of science and technology. SADC has also adopted a protocol with provisions aimed at promoting science and technology cooperation. The East African Community (EAC) Treaty devotes its Article 103 to issues of cooperation in science and technology. Similar provisions are

[1] See for example Advisory Council on Science and Technology (2000) *Reaching Out: Canada, International Science and Technology, and the Knowledge-Based Economy*. Report of the Expert Panel on Canada's Role in International Science and Technology, also see Wagner, C. *et. al*. 2000. *International Cooperation in Research and Development: An Update to an Inventory of U.S. Government Spending*. RAND, Santa Monica, CA.

found the treaty of the Economic Commission of West African States (ECOWAS) and the Constitution of the African Union (AU).

The greatest challenge facing African countries now is how best to translate the provisions on cooperation in science and technology into concrete activities, programmes and processes. Meeting this challenge requires policy guidance and the support of high-level political institutions.

This paper suggests the New Partnership for Africa's Development (NEPAD) as an appropriate regional framework for cooperation in science and technology. It is a framework that should be used to establish the necessary conditions for science and technology cooperation among African countries and between Africa and the rest of the world. The paper gives a general overview of the benefits of and challenges in scientific and technological cooperation, and discusses how well African countries are forging cooperative arrangements among themselves and with the rest of the world. It notes that most African countries lack appropriate institutional arrangements to invoke provisions of international and regional agreements to establish and benefit from scientific and technological cooperation.

The paper recommends that through NEPAD African countries should consider:

(a) review and share their experiences in scientific and technological cooperation;
(b) formulate guidelines for regional and international scientific and technological cooperation;[2]
(c) designate a regional agency to facilitate, and where necessary coordinate and monitor, negotiation and implementation of bilateral, regional and international science and technology cooperation; and
(d) identify and develop concrete regional science and technology projects on which they will collectively devote their resources.

1. IMPORTANCE OF COOPERATION IN SCIENCE AND TECHNOLOGY

International cooperation in various fields of science and technology is increasing and gaining importance as the forces of globalization open up national and regional research and development (R&D) systems. New information and communications technologies are making it relatively easy and in some cases cheaper for scientific and technological information to be exchanged across the globe. These technologies have radically changed ways by which scientists and scientific institutions create knowledge and search as well as exchange information. The frequency and ease of information exchange have improved considerably, at least in the past decade or so. This has led to new forms of organizations. Witness the emergence and spread of 'e-laboratories', 'e-libraries', and 'virtual universities'. Scientists in one continent can now conduct research and share their results with their counterparts in another continent in real time.

[2] Such guidelines would address issues that emerge from individual countries' desire to build and sustain their national competitiveness as well as to safeguard their intellectual property.

In addition to these developments, increasing international recognition that such environmental challenges as climate change, loss of biological diversity and pollution of water are global in nature and require global action has stimulated more attention to the role of cooperation in science and technology. Many of the recent environmental agreements or conventions contain provisions explicitly call for and/or promoting cooperation in science and technology. For example, in Article 4© of the United Nations Framework Convention on Climate Change (UNFCCC) contracting States commit themselves to "promote and cooperate in the development, application and diffusion, including transfer of technologies, practices and processes that control, reduce or prevent anthropogenic emissions greenhouse gases …in all relevant sectors including the energy, transport, industry, agriculture, forestry and waste management sectors." Article 4(g) of the Convention requires Parties to "cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data."

The Convention on Biological Diversity contains similar provisions on cooperation in science and technology. Its Article 18 is devoted to international cooperation in science and technology. Article 18(2) states: "Each Contracting Party shall promote technical and scientific cooperation with other Contracting Parties, in particular developing countries, in implementing this Convention, inter alia, through the development and implementation of national policies. In promoting such cooperation, special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building" while Article 18(5) requires Contracting Parties to "promote the establishment of joint research programmes and joint ventures for the development of technologies".

The Plan of Implementation of Agenda 21 adopted by governments at the World Summit on Sustainable Development (WSSD) is largely about the role of science and technology in meeting sustainable development goals. Many of its recommendations are about mobilizing and directing science and technology to solve problems associated with energy deficiency, food insecurity, environmental degradation, diseases, water insecurity and many other sustainable development challenges. The Plan calls on the international community to [p]romote technology development, transfer and diffusion to Africa and further develop technology and knowledge available in African centres of excellence; and [s]upport African countries to develop effective science and technology institutions and research activities capable of developing and adapting to world class technologies".

The G8 Action Plan on Science and Technology for Sustainable Development at adopted at the last meeting in Evian, France is largely about international cooperation in science and technology. In it G8 countries recognize that "[c]o-operative scientific research on transformational technologies offers potential to improve public health by cutting pollution and reduce greenhouse emissions to address the challenge of global climate change. Our countries must optimise the use of natural resources including through recycling." Their leaders recognize that to "meet the objectives of the WSSD, developing countries and countries with economies in transition need to build and strengthen their capacity to assimilate and generate knowledge for sustainable development." They reaffirm their commitment to assist developing countries and

those with economies in transition to enhance their research capacities through international co-operation.

On the whole, there is increasing recognition and articulation of the role of cooperation in fostering the application of science and technology for sustainable development. Scientific and technological development is a learning process that is largely achieved by countries through cooperative or collaborative efforts of sharing experiences, information, infrastructure and such other resources as human and financial. Today no country can secure scientific advances and technological progress without interacting with its peers and neighbours. The ability of countries and firms to innovate, both in technical and managerial ways, is largely determined by strategic alliances the forge both within their industrial landscape and across sectors. Furthermore, for industrial firms to become successful in generating new innovations they often have to create partnership with public R&D institutions. This is clearly manifest in such fields as biotechnology: relatively strong and strategic partnerships between university R&D activities and operations of companies.

Cooperation in science and technology can take various forms, including joint science projects, sharing of information, conferences, building and sharing joint laboratories, setting common standards for R&D, and exchange of expertise. Its advantages for developing countries, particularly those of Africa include:

(a) access to new knowledge, foreign skills and training opportunities that may not be available at the national level;
(b) access to large and often expensive research facilities, including laboratories and libraries
(c) avoiding the costs of duplication of research;
(d) enrichment of political and social relations between countries;
(e) opportunities to establish multidisciplinary research activities and teams
(f) favourable basis for international funding; and
(g) building or strengthening domestic R&D institutions.

There are numerous initiatives on international cooperation in science and technology. These include programmes such as the Human Genome Project (HGP), the Intergovernmental Panel on Climate Change (IPCC), the Global Taxonomy Initiative (GTI), and Consultative Group for International Agricultural Research (CGIAR).

The United States of America and many EU countries invest considerably in science and technology cooperation. This is manifested in the growing number of joint laboratories, EU common projects, growing numbers of co-authored scientific publications, transatlantic movement of scientists, and intensity of science and technology policy activities in the OECD. The USA spends about 6 percent of US$ 80 billion science and technology budget on international collaboration.[3] The emergence of the European Research Area is a clear demonstration of the importance of S&T cooperation among EU countries.

[3] Wagner, C. et. al. 2002. *Linking Effectively: Learning Lessons from Successful Collaboration in Science and Technology*. Report Prepared for the White House Office of Science and Technology Policy. RAND DB-345-OSTP.

A large share of European collaborative research budget is invested in large facilities, such as accelerators for particle physics, astronomy and space studies, whose costs exceed the capabilities of even larger countries. The benefits of collaboration are thus reaped by both small and large European countries. In addition, science and technology cooperation has over the years created permanent research networks outliving projects. The leverage of collaboration is large, for instance Finland pays about 1.5 % of the EU research programs but is part of about 10 % of research projects. Statistics show that Finland obtains some six times more knowledge from EU collaborative initiative than by working alone.

2. REGIONAL SCIENCE AND TECHNOLOGY COOPERATION IN AFRICA

Africa has a wide range of regional instruments—policies, programmes, protocols and treaties—that articulate the importance of science and technology cooperation. Most regional and sub-regional economic, political and trade treaties make explicit reference to the need to strengthen cooperation in various science and technology fields. Article 13 of the Constitutive Act of the African Union (AU) gives authority to the Executive Committee of the AU to formulate policies that promote science and technology cooperation.

The Declaration and Treaty establishing the Southern Africa Development Community (SADC) aims at promoting the development, transfer and mastery of technology. Article 21 (Areas of Cooperation) of this instrument makes explicit reference to SADC member countries cooperating in science and technology. SADC's Protocol on Education and Training ratified by at least eight countries aims at promoting the development of a common science and technology policy, establishment of joint research facilities and regional centres of excellence, and facilitating moving of scientists in SADC.

The Treaty Establishing the East African Community (EAC) contains several provisions on science and technology. Article 5 (Objectives of the Community), Article 80, and Article 103 are very explicit on the role of cooperation in fostering the sub-region's scientific and technological development. Article 80(e) provides that the EAC shall "promote industrial research and development and the transfer, acquisition, adaptation and development of modern technology, training, management and consultancy services through the establishment of joint industrial institutions and other infrastructural facilities" In Article 103, member states of the EAC commit themselves to "promote co-operation in the development of science and technology within the Community through: (a) the joint establishment and support of scientific and technological research and of institutions in the various disciplines of science and technology; (b) the creation of a conducive environment for the promotion of science and technology within the Community;…; and (i) the harmonisation of policies on commercialisation of technologies and promotion and protection of intellectual property rights."

Similar provisions are found in the Common Market for Eastern and Southern African (COMESA). Article 100(d) of COMESA's treaty calls on member countries to cooperate to promote "industrial research and development, the transfer, adaptation and development of technology, training, management and consultancy services

through the establishment of joint industrial support institutions and other infrastructural facilities".

The need to promote and strengthen cooperation in science and technology is also recognized in the Economic Community of West African States (ECOWAS). **(Add specific reference to provisions in ECOWAS treaty) .**

African countries have signed and ratified a wide range of other multilateral agreements that contain provisions on international scientific and technological cooperation. At least 45 African countries are Contracting Parties to the Convention on Biological Diversity, the UNFCC and the Montreal Protocol. Many are also members of the World Trade Organization (WTO) where issues of technical cooperation and technology transfer preoccupy most of the negotiations.

In addition to provisions in multilateral instruments, the importance of cooperation in science and technology is articulated in declaratory statements and national policies. Many African countries have entered into bilateral science and technology cooperation agreements. For example, by 2002 Egypt had entered into at least 18 agreements, South Africa at least 27, Nigeria at least 9 and Kenya at least 5. South Africa's agreement with Nigeria signed in early 2001 aims at enhancing the two countries' cooperation in biotechnology, environmental observation systems, materials science, space science and other fields. It provides for exchange of scientists around joint projects

South Africa alone has entered into bilateral cooperation agreements with at least 7 African countries, the European Union, Poland, the USA, France, Germany, United Kingdom, Belgium, Hungary, Italy, Norway, India and several other countries.

To implement its agreement with the EU, South Africa established a special fund and designated national institutions to be responsible for specific activities. This Fund was established to enhance existing international cooperation in the fields of biotechnology, new materials, information and communication technology, environmental management, rural development, and urban renewal. During the first round (1999 – 2001), the Lead Programmes Fund successfully leveraged international R&D support and established viable consortia between South African Science Councils and CIRAD (France), ALCOA (USA), Rolls Royce (United Kingdom), and IVL (Sweden), among others. The National Research Foundation (NRF) services the implementation of the agreements. Between January 2000 and March 2003 more than US$ 1.2 million was spent to service over 27 bilateral and multilateral agreements.

On whole there is significant recognition amongst most, if not all, African countries that international cooperation in science and technology matter. However, with exception of a few countries, there is no evidence that many have instituted specific programmes and institutional arrangements to implement provisions of the agreements. Some of the reasons given for lack of implementation of the agreements are:

(a) inadequate financial resources to be devoted to international and regional activities,

(b) lack of explicit linkages between science and technology policies and foreign policies of most African countries,
(c) weak capacity to effectively negotiate and monitor implementation of cooperation agreements, and generally
(d) weak national science and technology systems.

3. EMERGING POLICY AND INSTITUTIONAL ISSUES

The ability of African countries to achieve high levels of scientific and technological development and thereby reap benefits in economic growth, poverty reduction, environmental sustainability, improved health, and other areas, requires that they place increased emphasis on pursuing science and technology in an international context. Isolated national approaches de-linked from regional and international programmes will deny these countries opportunities to benefit from the globalization of science and related technological innovations.

African countries can benefit scientifically through increased international and regional cooperation because many scientific and technological advances are made in other regions of the world. A large portion of all scientific articles and patents are generated outside Africa. Most African countries do not have the necessary research facilities in such areas as genomics since these tend to be relatively expensive. International and regional collaboration is necessary in order to enable Africa to access such facilities.

However, in order for Africa to be able to utilize and benefit from scientific discoveries made and facilities located elsewhere, it needs world-class researchers who maintain constant communication and work frequently in collaboration with the best scientists around the world. The challenge therefore is for the continent to invest in creating a cadre of scientists that will be able to peer with developed country scientists on specific international projects.

International cooperation in science and technology should focus on addressing sustainable development challenges, particularly those of poverty reduction and environmental sustainability. In a global economy, knowledge of and experience with other countries are critical to developing markets, partnerships, and learning about technological developments elsewhere. African countries will need to establish deliberate or strategic measures to benefit from cooperation.

The vast and growing majority of intellectual property is in the private domain. Most African countries do not have companies that generate such property or have ability to engage in R&D in new science fields. In addition to establishing cooperation around public-funded research, it is crucial that the design ways to promote domestic private sector's participation in international private R&D.

4. A NEW ROLE FOR NEPAD

There is recognition by African policy-makers and scientists of the importance of regional cooperation in science and technology. This is explicit from provisions in regional and sub-regional treaties, in decisions of regional meetings and from various statements. As stated above, most of the regional treaties have provisions on science and technology cooperation.

However, not much has been done to translate the provisions of the treaties into concrete processes and activities on S&T cooperation. Many African countries continue to work with isolated R&D systems often with limited scientific and technical expertise and financial resources. The continent, as a whole, has spread its limited resources too thinly across science and technology fields. In many cases existing science infrastructure of the relatively well-to-do countries of the region is not accessible to others that desperately require it.

NEPAD's science and technology should support African countries to intensify and improve the quality of their cooperation in science and technology. In this regarding its specific activities may include:

(a) Providing a synthesis review of how international and regional processes have addressed the importance of cooperation in science and technology. Emphasis shall be placed on such international instruments as Agenda 21, WTO agreements, declarations of the United Nations, environmental treaties from the UNCED and WSSD processes as well regional economic and trade treaties. One of the aims of the review is to provide a succinct illustration of commitments made by countries and the different institutional arrangements they have established to implement science and technology provisions of the agreements.

(b) Identifying bilateral science and technology agreements and studying, through case approaches, how these have been translated into concrete actions in terms of joint projects and programmes. Emphasis will be on the nature and intensity of learning by each of the countries involved. The study will be organized in such a way as to cover arrangements signed among African countries and those between African countries and their counterparts from other regions of the world. A methodological framework for studying the implementation of bilateral and multilateral science and technology agreements will be developed.

(c) Identifying and promoting best practices in science and technology cooperation. This activity will largely focus on drawing lesions from science and technology cooperation arrangements in the European Union, Asian and the OECD groups. A review of the historical evolution and content of science and technology cooperation in the EU, Asian and OECD groups will be prepared, and some specific case studies documented drawing from sources at EU, OECD and such other agencies as the U.S. Research and Development (RAND) Corporation's Science and Technology Institute.

(d) Formulating and adopting a body of guidelines and/or a protocol on science and technology cooperation. On the basis of the results of the above activities a-c, a body of guidelines on negotiating and implementing bilateral science and technology cooperation agreements will be developed. Emphasis of the guidelines will focus on the nature of the process of agreement negotiation, priority setting, institutional actors, implementation modalities and financial mechanisms.