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**Globalization: Challenges and Opportunities for Science and Technology**

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# Scientific and Technical Cooperation

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## Globalization by whom, for whom

Globalization is a powerful change mechanism without clear definition, explicit objectives or an agreed operational framework. Yet while complex and disorderly, it is increasingly clear that nothing about globalization is arbitrary because the changes it produces are the results of commercial, political and economic drives. It is also difficult to predict the future course of globalization, however some trends seem apparent: the pace of globalization is clearly accelerating with a continuous 'free' flow of information, investment capital, ideas, products and services between countries.

A fundamental challenge posed by global markets is that they are inherently disequalizing,[1] which means that they make rising inequality more likely rather than less. And yet accessing and participating in the global economy has become one major factor influencing the development process of individual countries. Therefore, considering globalization just as a threat or a problem has particularly negative consequences for developing countries. The big challenge for these countries is not to be swallowed up by the globalization process but to seize the opportunities it may open for the benefit of their own development and avoid as much as possible its risks.

One of the forces that push globalization is technological development. Science-based technological advance has also been a long-term driving force for modern economic growth[2]. Traditionally, in the high-income countries technological development has been enabled by the national setting: institutions, investment, regulations, academics, social/cultural priorities. Increasingly, however, such development is driven by factors beyond the national setting – the 'global economy'.

Yet the technological opportunities offered by the global market cannot be equally seized by developing countries. Technological innovations are increasingly created in response to market pressures and not the needs of the poor populations in those countries, where more than four billion people live on less than three dollars a day and face basic subsistence problems. The global marketplace is driven by the investments and consumption patterns of the affluent societies and therefore technologies are more often than not created to make life ever more comfortable and convenient for those who are not worrying about their next meal or wondering how to get medical care; this stock of technologies is not geared to provide the best solutions to development constraints.

Technical cooperation for development

Increasingly, scientific and technological cooperation have become pieces of the global machinery and have come to play an important role in bridging between the different parts of this still fragmented world. Here we have at hand powerful tools to support national development strategies and link them with global development goals.

For a number of decades, the conventional approach to cooperation for development had been to adapt technologies, often driven by the convenience of their owners or their promoters, to specific needs in developing countries. However, it is now recognized that this transfer of technology has not been effective for overcoming critical ecological barriers to development such as Malaria, Chagas and Trypanosomosis,[2] nor, say, for developing a sustainable and efficient use of the natural resources, with which many of these countries are generously endowed. Simple access to technology does not automatically mean that sustainable and desirable solutions can be adopted and adapted to local conditions or that they will lead to expanded technological capability.

Therefore, developing countries need to adopt comprehensive technology development strategies in their national development processes, including the respective policy, process and legal frameworks. The analysis underpinning such strategies should identify which technologies are critical for the immediate and longer-term future, what technologies are most likely to become obsolete or be replaced and what trends in technological innovation may influence technology development.

The primary function of such strategies is to help meet the requirements of national goals and priorities as identified by the countries themselves, furthering endogenous technological innovation and production; but they should at the same time strengthen the capacity of these countries to fully participate in the definition of global development policies and strategies in order for the latter to be of truly global benefit.

These decades of experience have brought about important changes in the approach to cooperation for development. Interestingly, there is a trend in the development community towards increased national focus, taking into account specific country conditions.

A major indicator in this regard is the Paris Declaration on Aid Effectiveness[3] which reflects a new consensus on international development that calls for strengthened partnerships with developing countries based upon defined national development strategies reflecting the specific needs, interests and priorities of each partner country. This consensus is reflected as well in the new EU Strategy for Africa,[4] which proposes the establishment of an EU-African Partnership for Infrastructure to support and initiate programmes, and trans-African networks that facilitate interconnectivity at the continental level for the promotion of regional integration. Strong national scientific and technological institutions in the regions are expected to play a decisive role in achieving the EU goal of helping to build an environmentally sustainable future for Africa.

Ownership is being adopted as a fundamental principle for international cooperation because it is widely understood that development policies and strategies cannot be imposed from the outside. For example, the vision of good governance, respect for human rights, gender equality and empowerment of civil society, embraced by the African Union and NEPAD, are now at the center of EU commitment to Africa and will likely guide cooperation with other regions. However, the consensus on ownership does not yet incorporate a robust understanding that sustainable solutions to development problems and opportunities must be

owned by the countries facing the challenges. It is not sufficient for developing countries to state their needs and formulate their requests; they must have the capabilities and infrastructure to advocate, analyze, postulate, test, validate, and adapt solutions to meet their unique and specific circumstances.

The new cornerstone strategies for international development must recognize that unique and differentiated circumstances determine the choices available to developing countries for advancement and participation in the globalized marketplace. They must also recognize the critical importance of institutional capacity development, including national scientific and technical capacities that enable developing countries to utilize the resources and participate in the benefits of economic integration. Given these new initiatives and the opportunities for more effective cooperation, it is of course imperative that developing countries, in their turn, recognize the importance of sound and sustainable national scientific and technological institutions and of the civil and administrative reforms that ensure advantageous and stable environments for sustained and successful efforts by their own scientific-technological communities.

The UN system and scientific cooperation

The UN has an important role to play in helping developing countries meet the challenges of science-based technological development in the era of globalization. The Secretary General's Council of Development Advisors reported in March 2005, that the UN risks being relegated to the sidelines, in part because most UN agencies and programs are not set up to systematically receive scientific advice or use research as a key component of effective programming. The Panel[5] speculated that it is not the size or complexity of the UN that is the overriding challenge; its weakness lies in how it uses scientific and technical knowledge. Thus, its influence and effectiveness will increasingly depend on the extent to which the UN System can mobilize scientific and technical expertise to face 21st century challenges, such as infectious diseases, environmental degradation, exhaustion of natural resources, and other problems that in the past would have been the concern of individual nations, but have now grown to international importance, such as those embodied in the Millennium Development Goals.

The Panel considers that the UN's capacity to deal with these questions must grow. It also recommends that the UN system should increasingly engage the growing community of science and technology advisors. National bodies that provide scientific advice do not have an effective focal point in the UN system, neither do international organizations that catalyze research cooperation and technological innovation to address global development problems. The UN's ability to convene states and civil society should place international scientific cooperation at the forefront to provide fora for global consensus building based on scientific knowledge. As we have learned from the experience with the Kyoto Protocol and other specific cases, the UN system must also increase its capacity to engage the international community in the implementation of the recommendations arising from such fora.

International scientific cooperation has in fact a long history, longer than the UN system itself. Globalization as meaning 'disappearance of borders' and increased interaction between countries is an old phenomenon in science, first in the European and increasingly in the broader domain. Steps to bring together the international scientific community under a single organization date back to the late 19th century, and culminated with the establishment of the

International Council for Science (ICSU) in 1931. It is ICSU's goal to ensure that science is integrated into policy development at the international and national levels and that relevant policies take into account both scientific knowledge and the needs of science. Through its membership of 29 international scientific unions and over a hundred national scientific organizations, ICSU brings together a unique pool of intellectual resources, backed by institutions all over the world. Some major interdisciplinary programmes created by ICSU are cosponsored by UN agencies and nongovernmental partners, such as the International Geophysical Year in 1957-58, the World Climate Research Programme, the Global Earth Observation System and, more recently, the International Polar Year 2007-08.

Recent trends, including accelerated globalization but also importantly regionalization (as occurring diversely in Europe and in Africa) have urged ICSU to review its policies and procedures, and one significant move in this respect has been the creation of regional offices in the major areas of the developing world. This recognizes that science cannot be international without the active involvement of scientists from all parts of the world in the scientific endeavour and in setting the research agendas, and also that international cooperation plays a key role in support of the national efforts of countries to build and put to good use their scientific capacity.

For similar reasons, other nongovernmental science-based organizations have been created more recently, such as global and regional networks of national academies of science, which play complementary roles and altogether provide a strong basis of support to the UN system on science-policy matters.

Globalization has meant also increased mobility of students, researchers and the scientific-technological labour force, with a concomitant loss of stability in the workplace and job security. The job market for scientists has become highly competitive, even more so as public research loses ground vis-à-vis R&D funded by the (borderless) private sector. This makes it more difficult for developing country institutions to retain their best scientists and develop strong national S&T infrastructures.

The Millennium Project Report compares high-income countries that make public investments in higher education and in scientific and technological capacities, with poor countries that have largely been spectators, or at best users of the technological advances produced in the high-income world. Those countries often lack even medium size scientific communities, and their scientists are chronically underfunded and nationally unmotivated, with the best and brightest often moving abroad to find colleagues and support for scientific research.

The incapacity of many developing countries to retain scientific and technical expertise has indeed become critical. The UN Economic Commission for Africa and the International Organization for Migration (IOM) estimate that 27,000 Africans left the continent for industrialized countries between 1960 and 1975. During the period 1975 to 1984, the figure rose to 40,000. It is estimated that since 1990 at least 20,000 people leave the continent annually, leaving sub-Saharan Africa with only 18 scientists and engineers per million population, compared with 69 in South Asia, 76 in the Middle East, 273 in Latin America, and 903 in East Asia (World Bank 2004). Africa as a whole counts only 20,000 scientists (3.6 % percent of the world total) and its share in the world's scientific output has fallen from 0.5% to 0.3% as it continues to suffer the brain drain of scientists, engineers and technologists.

International and regional cooperation strategies and mechanisms are needed to counteract this negative influence of globalization and effectively support national R&D infrastructures. NEPAD has called for the establishment of a reliable continental database to determine the magnitude of the problem of brain drain and promote collaboration between Africans abroad and those at home. Recognizing the urgent need to develop Africa's human resource base, African leaders explicitly call for the creation of the "necessary political, social and economic conditions that would serve as incentives to curb the brain drain…"

Other regions of the developing world could also benefit highly from increased regional integration and cooperation in the scientific domain, not just to curb the brain drain but to address common problems and find joint solutions. Support by the international community and the UN system to specific regional cooperation mechanisms such as large experimental facilities, databases of centres of reference, joint educational programmes, or regional S&T observatories, would be a timely contribution to complement national efforts for the development of autonomous S&T systems.

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