

## PROMOTING SOUTH-SOUTH AND NORTH-SOUTH COOPERATION IN EDUCATION AND RESEARCH: A QUESTION OF RESPONSIBILITY

MOHAMED H.A. HASSAN

I would first like to thank the Pontifical Academy of Sciences for once again inviting me to participate in one of its very stimulating workshops, and for giving me yet another opportunity to speak before such a distinguished group of intellectuals. I was here three years ago for a workshop examining the cultural values of science. The inspiring presentations – and equally inspiring discussions that followed – made it one of the most memorable workshops in which I have participated.

This year's workshop promises to be equally rewarding – if not more so. I am particularly encouraged by the presence of the Pontifical Academy of Social Sciences. That makes it even more likely that we will be exploring compelling issues that lie at the increasingly busy intersection between science and society.

My talk today will focus on strategies for promoting South-South and South-North cooperation in scientific research and education. Strategies that promote scientific cooperation are key to promoting sustainable economic and social development, particularly in developing countries. If anything, the global economy and global information and communication networks have only heightened the degree of international cooperation over the past two decades. Science has always been an international enterprise, and cooperation has always been a critical driver for how science – at least how excellence in science – gets done.

I might also add that the rising level of scientific excellence in the developing world – most notably, in countries such as Brazil, China and India – have made international cooperation in science not only more likely, but more global and more fruitful. It's a trend that benefits not just the developing world, but the entire world.

A decade ago, policy analysts and policy-makers spoke about a North-South divide in science. That divide has by no means disappeared. Yet, as it narrows for some developing countries, it widens for others – mainly those nations in sub-Saharan Africa and the Islamic world.

That has led to what some observers now call a South-South divide between science-and-technology (S&T) lagging countries and the rest of the world. A recent survey conducted by TWAS listed 77 S&T-lagging countries – a new group of 77 that includes all of the least developed countries (LDCs), as defined by the UN, and most of the low-income countries, as defined by the World Bank.

The good news is that an increasing number of nations seem to be following suit. Over the past few years, a number of African countries – including Nigeria, South Africa, Tanzania, and Uganda – have all embarked on unprecedented science capacity building programmes in education and research that have helped advance their agendas for sustainable development. The results have been encouraging. Here are a few snapshots of the progress that has been made:

Nigeria has increased its budget for science three-fold over the past five years and launched its first remote sensing satellite in 2003. It now plans to launch a communications satellite next year in collaboration with China.

South Africa, with Africa's strongest scientific capacity and infrastructure, just last week inaugurated the Southern African Large Telescope (SALT), the largest single optical telescope in the southern hemisphere. The telescope, costing US\$36 million, is open to the entire international scientific community and, most notably, scientists from developing countries. It can see distant stars and galaxies that are a billion times too faint to spot with the naked eye.

Tanzania doubled its budget for science and technology last year. In June, the president, at the launch of the Tanzanian Academy of Sciences, announced that his country would increase its investment in science and technology to 1 percent of the nation's gross domestic product by 2015.

Uganda has embarked on an ambitious programme for building centres of excellence in science, technology and innovation, and has taken a US\$20 million loan from the World Bank to support its plans.

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Good news on the science-capacity building front for these developing nations is good news for all nations. That's because the strong foundation

for science now being built by the 'larger' and 'richer' developing countries – Brazil, China, India and a growing list of others – creates unprecedented opportunities for both South-South and North-South cooperation.

Too often, in the past, the cutting-edge science taking place in developed countries was too advanced and too remote to be of value in solving real-life problems in developing countries. As a result, developing countries too often viewed science as a luxury that only wealthier countries in the developed world could afford. And as scientific research advanced at an ever-faster pace in the developed world, the gap between the scientific 'haves' and 'have nots' only grew.

One statistic sheds revealing light on the consequences of such trends: The World Health Organization (WHO) has estimated that more than 90 percent of the annual US\$65 billion global investment in health research is devoted to diseases that afflict rich people in rich countries: cancer, heart ailments, hypertension, obesity. That leaves the health of poor people in poor countries short-changed, rendering such disease as malaria, schistosomiasis and tuberculosis as neglected orphans in well-healed research and development programmes financed by international pharmaceutical companies. Think of this: of the 1200 new drugs developed between 1971 and 1996, only three were antimalarial. This despite the fact that malaria is the fourth leading cause of death among children in the developing world and more than 40 percent of the world's population lives in areas where malaria is transmitted.

By the same token, why did initial investments in biotechnology in the 1980s and early 1990s often focus on making strawberries less resistant to frost and not on making cassava less resistant to disease? And why have substantial amounts of funds for nanotechnology gone into strengthening the outer coating of tennis balls and developing stain-resistant fabrics for pants and skirts, and not on developing nano-filters for water purification?

The answer is that the vast majority of scientific research – both basic and applied – has been conducted by scientists living and working in developed countries, or by scientists from developing countries who had no choice but to pursue their careers in developed countries. The developed world's 'research monopoly' created a skewed research agenda that tilted heavily towards challenges of particular importance and interest to the North, but of little consequence to the South.

Today we are, at least potentially, at the dawn of a new era in global science – an era in which scientific capacities are reaching beyond the United States and Europe to Asia, Latin America and even Africa. The global sci-

entific community, as a result, finds itself able and willing to explore a full range of issues of importance to both rich and poor nations.

We should all welcome the opportunities presented by the growing promise of science – and science-based development – in the developing world. But there are challenges as well.

First, there is the challenge of e-learning. The internet provides an excellent tool for students and educators worldwide to interact, exchange experiences and learn from each other. Advanced courses and lectures developed by world-class universities can be made available free of charge to anyone, anywhere and at any time. Educators can also adapt the material to their own needs, including translating it into their local languages. Currently, the leading courseware provider is the Massachusetts Institute of Technology (MIT) in Boston, MA, USA, which provides open courseware in over 900 subject areas. As the MIT website points out: ‘History has proved that education and discovery are best advanced when knowledge is shared openly’. Will other leading universities in the world (both in the North and in the South) follow the example set by MIT? Will students and teachers in the S&T-lagging countries have affordable and reliable high-speed internet connections to make full use of the open courseware system?

Second, there is the challenge of advancing South-South cooperation in scientific research and education. China is now a world leader in nanoscience and nanotechnology. A survey conducted last year showed that Chinese scientists published more articles on nanoscience and nanotechnology in international peer-reviewed journals than any other country, including the United States. India has become a world leader in information technologies and in the development of computer software. And Brazil has become a leading country in space science and technology. These three – as well as other – developing countries that are displaying a growing proficiency in science and technology, undoubtedly have a primary obligation to the economic and social well-being of their own citizens. Yet, will they use a portion of their newly created scientific and technical capabilities to help their less fortunate brethren in other parts of the developing world, especially in the least developed countries? Will South-South cooperation in education and research thrive as science begins to thrive in segments of the South?

Third, there is the challenge of democracy and good governance. S&T-proficient countries may have moral – and indeed strategic – reasons for helping others in the developing world in building their research and education capacities. But such help will only prove fruitful if recipient countries are prepared to make effective use of the assistance. That’s why one

of the best ways for building a strong foundation for successful initiatives in South-South and South-North cooperation in education and research is through the enactment of political reforms based on openness, transparency and accountability – three fundamental principles of both good governance and good science. It should not be surprising, then, that the countries in sub-Saharan Africa that have shown the most promising advances in political reform – Ghana, Nigeria, Senegal, South Africa, Tanzania and Uganda – have also shown the most promising growth in education and research capacity. Will such interrelated progress in politics and science continue in the countries where it has taken place? Will it spread to other countries?

Fourth, there is the challenge of engaging – and convincing – the public. Emerging democracies in Africa, for example, are creating opportunities for scientific organizations, such as science academies, to interact strongly with decision-makers – including members of parliament and ministers of science and technology. This is both a challenge and an opportunity for scientific communities in Africa. Will scientists be able to acquire the diplomatic and communications skills that are so crucial for success in the political arena? Will political leaders be receptive to their ideas?

Fifth, there is the challenge of regional cooperation. It is regional cooperation – that is, cooperation among neighbours who share common problems and common capabilities – that may hold the most promise for advancing science in the developing world. That is why we should all applaud the recent decisions by The New Partnership for Africa's Development (NEPAD) and the African Union (AU) to support capacity building efforts in education and research across Africa through the creation of scientific centres and networks of excellence, and the upgrading of both research and teaching at universities. Will sufficient funding follow on the heels of this promising rhetoric? Will such funding be sustained over the long term?

Sixth, there is the challenge of transforming the brain drain into a brain gain. For too long, developing countries have bemoaned the loss of home-grown scientists to developed countries, where career opportunities, working conditions and pay are so much better. But complaints are no substitute for policy and usually accomplish little unless a positive plan of action, designed to address the complaints, follows. Today, some countries – notably, China, India and South Korea – have sought to make the best of this situation by developing scientific exchange and visiting professorship programmes that involve members of their scientific diaspora. The results so far have been encouraging, and there is no reason to preclude the possi-

bility that some scientists who have left will some day return home if working conditions and job opportunities improve in the native countries.

And seventh, there is the challenge of devising effective aid programmes to help African nations build and sustain their *institutions* of higher education and research. Aid remains critical for improving the state of universities in many poor nations, especially in Africa and the least developed countries.

In the last two decades, the state of higher education in most African countries has deteriorated substantially. Severe cuts in government spending have pushed universities and research institutions into steep decline. Universities that once served as beacons of hope – including the universities of Ibadan in Nigeria, Dakar in Senegal, Dar-es-Salaam in Tanzania, Khartoum in Sudan and Makerere in Uganda – have been turned into empty shells. Buildings are poorly maintained; modern laboratory equipment is rarely available; and faculty and staff go underappreciated and sometimes unpaid. External funding and joint initiatives with other countries have also declined.

That is why we should all be encouraged by the recommendations of the recent report of the ‘Commission for Africa’, established by the UK Prime Minister Tony Blair last year, which called on the world’s richest countries to contribute US\$5 billion over the next decade to re-build universities and an another US\$3 billion to help build centres of excellence in sub-Saharan Africa. Both of these broadly based initiatives, which were subsequently partially embraced by the Group of 8 richest nations at their summer meeting in Scotland, are based on strategies developed by Africans themselves.

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Mr. Chairman,

If current trends continue, this may prove to be the most promising time for advancing scientific research and education in the developing world in the past three decades. Yet for the promise of today to be fulfilled, the world’s scientific communities must also shoulder new responsibilities and adopt a new set of principles.

First, the scientific community in the developing world has a responsibility to devote at least a portion of its knowledge and expertise to addressing real-life problems and to educate a new generation of problem-solving scientists. It can no longer simply pursue science driven by its own curiosity or only seek to answer cutting-edge questions posed by the international scientific community. At the same time, the scientific community in the

developing world must open its doors to the practitioners of traditional knowledge and devise cooperative strategies for harmonizing indigenous knowledge with modern science. Progress in such fields as public health, the conservation and sustainable use of indigenous and medicinal plants, and the protection of biodiversity depend, to a large extent, on strengthening the ties between these two knowledge systems, based on a sense of mutual admiration and respect.

Second, the scientific community in the developing world must actively convince both decision-makers and the public at large that science plays a vital role in a society's well-being. Researchers in the developing world (the same can be said of the developed world too) can no longer assume that science is inherently valuable and that such value should be self-evident to the public. That means scientists have an obligation to explain their work to governmental officials and the public in easily understood language.

Third, leading scientists, as represented by those elected into merit-based national science academies, should advise their governments on critical policy issues related to scientific research and education. In the developing world, these issues now extend beyond questions of increasing crop yields and improving access to safe drinking water to encompassing such cutting-edge scientific fields as cloning, genetically modified organisms, nanotechnology and global warming – all of which are likely to impact every nation's future economic and social well-being.

And fourth, scientific communities in the developed and developing world should be encouraged both by their governments and international aid agencies to devote part of the research and education agenda to critical problems facing the South and, particularly, the S&T-lagging countries. The Canadian government, for example, recently proposed to allocate 5 percent of its national research and development budget to science-based issues of importance to the developing world. There is no doubt that the implementation of this proposal will encourage an increasing number of scientists and educators in the country to pursue research initiatives relevant to the developing world and to devise strategies to work closely with their colleagues in the South. The European Union also has dedicated a portion of its research budget to science-based problems in the developing world and on fostering collaboration between European and developing world scientists to address these issues. Such measures, I hope, will become the cornerstone of South-North scientific cooperation in the future.

So, how do we get from here to there: from plans of action to real action; from knowledge of what works to putting our knowledge to work? It takes not only commitment by the scientific community and good scientific capacity to succeed but also commitment by decision-makers and their ability to develop effective scientific policies – on the national, regional and international fronts.

On the national front, this means that governments must provide a sustained commitment to education and research and that scientists, in turn, must focus on real-life issues – all as part of a new social contract between science and society.

On the regional front, this means that intergovernmental organizations in S&T-lagging areas – such as NEPAD in Africa and COMSTECH in the Islamic world – must serve as both public advocates and strategic policy centres for the advancement of scientific research and education.

On the international front, this means a sustained commitment from both donor nations and international financial institutions to ensure that all nations participate in the world of science and that all nations enjoy the benefits of science-based development. Most significantly, this means uplifting the scientific capabilities of the 77 countries that are lagging in science and technology.

To achieve this goal, it is necessary to establish and support a number of regional and/or international centres of excellence in these countries. Such centres will act as a magnet and attract talented students and researchers, and therefore facilitate fruitful regional and international cooperation in research areas relevant to poor countries. Let us not forget the role of such international centres as those operating within the Consultative Group of International Agricultural Research (CGIAR), several of which are located in S&T-lagging countries, or the International Centre for Insect Physiology and Ecology (ICIPE) in Nairobi, Kenya – noble institutions that have helped to build and sustain scientific excellence and to mobilize the global scientific community to address critical issues in 'left-behind' regions of the world.

To uplift the scientific capabilities in these regions, it will also be necessary to provide more support for UN organizations such as UNESCO, FAO and WHO that have focused on issues of education, poverty alleviation, public health and sustainable development. These organizations have made a difference, but have yet to reach their potential; and the only way that potential can be reached is with additional funds. UNESCO's annual budget, for instance, is substantially less than the average budget of an elite university in the United States.



And that brings me to my own organization – TWAS. As many of you know, TWAS has been an advocate of South-South cooperation in scientific research and education for the past two decades.

When TWAS was launched in the mid-1980s, South-South cooperation was very weak. There was simply not a sufficient number of institutions of excellence for a dynamic and sustained exchange of ideas to take place. There was also lack of information about the research activities of the small number of existing competent institutions, and few opportunities for students and young researchers to visit these institutions.

Today, South-South cooperation has emerged as a powerful force for change in the developing world thanks largely to the growing scientific capabilities of research centres and universities in such S&T-advanced developing countries as Brazil, China and India. These nations now have universities and research centres of increasing excellence capable of meeting the requirements of not only their own scientists, but of scientists from other developing countries who can visit these institutions to pursue both research and education.

TWAS has played a key role in the development of South-South cooperation through its sponsorship of such initiatives as the TWAS South-South fellowship programme. In the last three years, the programme received a considerable boost when Brazil, China, India and Mexico each agreed to fund 50 fellowships a year for young scientists in S&T-lagging countries. Specifically, the fellowships will allow students to pursue doctorate and post doctorate studies at institutions in sponsoring countries.

The bottom line of South-South cooperation is this: South-South cooperation in education and research is now flourishing and promises to become an even greater force for building a new generation of talented scholars in the years ahead.

When the Academy started its activities in the mid-1980s, North-South cooperation was not only limited in scope but flowed in only one direction – from the North to the South. In other words, virtually all scientific knowledge and innovation originated in the North and then was transferred, selectively, to the South. This amounted to a ‘lopsided’ partnership in which developing world scientists played a subservient role to their Northern counterparts.

Today, science in the North continues to dominate the global scientific agenda – 80 percent of all active scientists live and work in the North, which is home to less than 20 percent of the world’s population. Yet the nature of that relationship is slowly evolving due to several factors.

First, as noted above, the South's universities and research centres have gained a level of competence that now allows them to participate as true partners in international science initiatives. Indeed, in certain fields (for example, software development in India, nanotechnology in China and plant biotechnology in Brazil) the level of scientific inquiry now equals or exceeds the level of scientific inquiry in many countries in the North.

Second, there is growing recognition that efforts to solve today's critical challenges – ranging from global climate change to the need to meet the Millennium Development Goals (MDGs) – require international cooperation.

And third, indigenous knowledge is increasingly viewed not as a separate source of knowledge but as an important contribution to our understanding of the natural world and the ways in which human beings interact with it. With its deeply rooted indigenous systems of knowledge, the South is the primary source of expertise in this critical area of ideas and insights.

Together with its partner organizations, TWAS has played an important role in North-South cooperation. For example, TWAS's Visiting Scientist Scheme, which is co-sponsored by the International Council for Science (ICSU), UNESCO and the United Nations University's Institute for Advanced Studies (IAS), enables scientists from the North to visit institutions in the South for teaching and research collaboration.

The InterAcademy Panel on International Issues (IAP), which is a network of all merit-based academies in the world operating under the administrative wing of TWAS, has provided a forum for merit-based science academies from both the North and South to exchange ideas and learn from one another, as part of a larger effort designed to improve the ability of science academies to influence both public opinion and public policies within their countries and regions. IAP's efforts have led to the creation of regional science academy networks in Africa, Asia and the Americas.

In addition, IAP members have pursued cooperative programmes focusing on such global issues as science education and open access to scientific information.

The IAP science education programme seeks to reform science education on a global scale by encouraging hands-on enquiry-based learning, especially in primary and secondary schools. An interactive electronic portal has been created in cooperation with the International Council for Science (ICSU) highlighting national curricula in science education. The objective is to mobilize the world's science academies to improve science education in collaboration with scientists, teachers and educational authorities.

The bottom line of North-South cooperation is this: As scientific expertise in developing countries continues to grow and as critical economic, environmental and social problems become more global in scope, it is likely that North-South scientific cooperation will intensify in the years ahead – with positive impacts on science and education throughout the world.

In conclusion:

Science in the developing world will continue to evolve from its modest beginnings, where the focus was on building basic scientific capacity, to its current quest for full and equal partnership in the global scientific community – a journey that will ultimately confer upon the developing world's scientific community both the tangible rewards and ethical responsibilities that such a crucial voyage demands.

Reaching the destination, which we all seek, will require everyone to contribute to the voyage's success. This is a shared challenge and a shared responsibility in which both South-South and North-South cooperation in education and research may prove to be the best way to ensure success. This is one adventure where global cooperation will help ensure that since no one loses, everyone wins. It is indeed a matter of education, research and responsibility – broadly cast and broadly shared.

Thank you.