Scientific Capacity for the Developing World

Phillip A. Griffiths
Director
Institute for Advanced Study

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I want to begin by thanking this organization for the very great honor of inducting me into the Third World Academy of Sciences and inviting me to speak at this meeting. My thanks to you have been delayed because of the events of last September 11, and the postponement of last year's meeting, but in the aftermath of that terrible month, our work of research, education and cooperation has become more important than ever.

I think I can speak for all of us, in saying that one important responsibility of TWAS is to help our member countries build more prosperous and stable societies through stronger indigenous capacity in science and technology. Later, I will describe a relatively small program called the Millennium Science Initiative that attempts to do just that. Let me begin by commenting on one economist's perspective on the challenge of helping nations to nourish their human resources and to escape the grip of poverty.

The tradition of aid

Countries in the North, as some call the more developed world, have established a tradition over the past half-century of attempting to help others by giving various forms of aid. The Marshall Plan was an early and successful effort to help the battered European continent recover from wartime.

Unfortunately, other aid policies haven't been so effective. William Easterly, an experienced and respected economist who worked for many years for the World Bank, has published a controversial yet careful review of major aid strategies since World War II, and although he found some limited successes, he concluded that traditional assistance has not increased the wealth and welfare of poorer nations as had been hoped. Since World War II, the total resources given by the developed world have approached some $1 trillion, and at least from one perspective, we don't have much to show for it. The incidence of global poverty has increased in both absolute and relative terms.

Why has traditional aid failed to bring substantial change?

Easterly demonstrates by data that each primary aid strategy rests on a single assumption, and that none of these assumptions has justified the huge investments that have been made. I'll summarize the four major ones:

- The earliest aid strategy was based on the assumption that large amounts of money and building dams and power plants would stimulate economies and raise standards of living – but this kind of capital aid has not been associated with long-term growth.
  Another popular assumption has been that the control of population growth will increase wealth by freeing parents to give better care to fewer children. Again, economists have not found an association between falling population growth and higher income.
- We have also initiated aid programs by making large loans that are contingent on desirable government reforms, but this strategy has not yet brought meaningful changes or long-term growth.
- Finally, we have assumed that wider access to basic education would lead to stronger and wealthier societies. It was surprising and disappointing for me that Easterly concludes that for a variety of reasons, higher education rates have not been associated with wealth building, although Amartya Sen and other respected thinkers continue to argue that easy access to primary and secondary education is critical to economic and social development.

Easterly's analysis may be a case of seeing a cup half empty rather than half full; however, he has raised fundamental issues – backed up by data – that need to be addressed. Singling out capacity building in S&T as one strategy that has worked is one issue that we in the scientific community need to be cognizant of.

One key: Building science and technology capacity

Given the mostly unsuccessful history of traditional aid, is there a better way to help? A new model for aid includes science and technology as an integral strategic component. I refer again to Easterly, who describes S&T capacity as the only reliable means to increase the wealth of nations. He writes: "Technological progress has the strongest empirical association with sustained economic development and offers the brightest hope for poor countries." What is so interesting to me is that Easterly turns around the usual challenge posed by economists to scientists to justify their request for support by demonstrating that such support leads to a good return on the investment. Easterly in effect says that the fact that the economists are not able to devise good models for calculating that return on the investment does not mean that investing in S&T is not worthwhile. In fact from his book, one sees that Easterly makes a case, based on data, that investing in building S&T capacity is the only reliable means to increase wealth.

At UNESCO's World Conference of Science two years ago in Budapest, this concept was also discussed at length by the representatives of some 150 nations, which issued the following proclamation: "Promoting fundamental and problem-oriented research is essential for achieving endogenous development and progress... Today, more than ever, science and its applications are indispensable for development."

Another key: Helping countries help themselves

Most of us will agree with that. But how can it be done? We have already tried to export the benefits of science and technology, and indeed, this may help. For example, the Green Revolution brought new strains of disease-resistant rice and wheat to many countries, forestalling predictions of widespread starvation.

Despite the benefits of exported science, however, it seldom takes root in ways that build capacity. One African biologist has called it "parachute science": scientists drop into a developing country, do some work, including extracting samples, and return home.

A better goal is to help countries help themselves. Jeffrey Sachs of Columbia University points out that the goal of aid is not to dictate policy from the North, but to help the developing world build its own infrastructure and produce what it needs at home. "We can't presume that our technologies will bail out poor people [elsewhere]," said Dr. Sachs.

Nations of the South are of course realizing and proclaiming the importance of local responsibility. The president of one African country wrote recently in The New York Times: "A great moment is at hand to break the cycle of African underdevelopment through investments for mutual benefit." He went on to say that if programs in manufacturing, agriculture, education and health are to succeed, "Africans in their millions must take an active part. It is Africans who have done and will continue to do the planning."

Heretofore, policies for strengthening S&T in developing countries have come primarily from the scientific community, and from ministers of science and technology. But policies have fallen short of hopes when S&T was not seen by other sectors of government, such as the ministry of finance and even the president, as an essential component of its development strategy.

The Millennium Science Initiative: An example of implementation

For the last four years, a group of us have been involved in an effort to reach out to governments and the scientific communities who would like to put such a policy into action. This effort is called the Millennium Science Initiative, or MSI. It grew out of discussions I had with Jim Wolfensohn, who as well as being President of the World Bank is Chairman of the Board of Trustees of the Institute for Advanced Study, where I am Director. Mr. Wolfensohn wished to establish building science and technology capacity as part of the Comprehensive Development Framework of the Bank. Guidance for the MSI is provided by an independent board called the Science Institutes Group, or SIG, also established at the suggestion of Mr. Wolfensohn and representing research institutions in Brazil, India, Korea, and the US. Professors Rao and Palis, as well as myself, are among the scientists on the board, and our board also has expertise in development and the productive sector.

Of course the MSI is not a new idea. Many groups have considered and implemented programs and centers of excellence to build capacity in the developing world, most notably those sponsored by TWAS. The MSI's particular framework grew out of

extensive discussions with many groups, including an early meeting of the TWAS Council in Trieste, Italy. One of the core beliefs expressed at that meeting is that a country can best strengthen its science and technology by supporting its own strong local base of scientists and engineers. This approach is very different from traditional aid, because it shifts the agenda from outside donors to those inside the country who are best positioned to put it into action.

When local S&T leaders have the adequate and sustained support they need, they can perform three essential functions:

- First, they can integrate modern research with education and training.
- Second, they can use the best of modern science to address issues of importance to their home countries.
- Third, they can form linkages with the productive sector, the educational system, and the international scientific community. These linkages help to maximize the value of their research and transfer its uses directly to society.

While the framework for the MSI rests on a tradition of capacity building, several emphases are new. One is information and communications technology. You are all familiar with the isolation in which many scientists work in developing countries – isolation from colleagues as much as from current publications. As ICT costs come down, and governments begin to loosen control over telecommunications, more scientists will have a chance to download journals from the Web and to work online with colleagues around the world.

Of course you are also aware that there has been a great deal of discussion recently about making available to developing countries, free or at very low cost, various kinds of materials: journals, on-line courses, etc.; in fact TWAS recently held a workshop in Trieste on this topic. But access to content is not the only issue. There are technical questions to be addressed involving hardware, software, and support; decisions to be made about archiving, especially of e-journals; copyright laws to be considered; and financing to be developed to pay for essential information and communications technology and support. With each new MSI that is put in place, we are learning more about both the central need for ICT infrastructure and the best ways to build it. We are working with the Mellon Foundation to make capacity in ICT an integral part of the MSI.

The MSI is very much a work in progress, but an encouraging one, in which we are learning by experience. We hope that the process for establishing each new initiative will be an improvement on those that have gone before.

As I suggested, SIG is action-oriented. It has already helped catalyze MSI institutes in Chile, Mexico, and Brazil. Under the leadership of Mohamed Hassan, it has assisted a group of scientists from the region to design a series of linked programs in sub-Saharan Africa, and it is helping to plan an initiative in Vietnam. Let me give just three examples of MSI programs.

In Chile, the first MSI, programs were selected competitively by an independent panel, and all of them are making excellent progress. One of these, the Center for Scientific Studies in Valdivia, has not only performed frontier research and training for students in the region in biology and astrophysics, it has also initiated a new, multidisciplinary program in the ice fields of Patagonia to study long-term changes in climate and species distribution. Another, in operations research, which, with MSI support was assessed by an independent, external panel to be the equal of any such group in the world in the scientific quality of its work together with the integration of research, training and applications.

The MSI in Brazil follows a different strategy, where some of the individual programs reflect government priorities. One of them, an Integrated Research Institute, is an innovative strategy that brings together environmental and social scientists to study questions that are too complex for any single discipline. One IRI is focused on the arid Northeast of Brazil, a second one on marine ecosystems of the Atlantic coast, and a third is planned for the Amazon rain forest.

A third example is an MSI that is still in the planning stages – a biotechnology initiative for Africa. One biotech center, in Uganda, emphasizes genomic and post-genomic techniques to combat malaria; a second, in Cameroon, emphasizes bioinformatics; and a third, in Namibia, under the leadership of Professor Keto Mshigeni, who is here with us, focuses on natural products. All of the programs already function at a high level, and the goal of the MSI is to raise this level still further and link them in research and training – by supporting more training, more linkages with other institutions, and more transfer of technologies to the private sector.

While the specific form the MSI takes in different countries varies a great deal according to circumstances, all MSI Institutes have in common these four characteristics:

- local design;
- adequate and sustained funding;
- rigorous selection and evaluation;
- linkages, among different areas of science, to each other, to the productive sector, and to educational institutions including K-12;
- autonomy.

In practice, SIG's goal is to locate and bring together the people who have proven ability to create and run useful programs. These people are drawn from the local scientific community, the international scientific community, government ministries, and the World Bank. SIG's role is as convener and catalyst, bringing together local scientists and participating in their planning meetings, allowing us to become familiar with the people who can make a difference and with the challenges they face in building a program. To maintain high quality and relevance, SIG relies on independent selection and evaluation of programs by international scientists, most of them from the developing world.

There are two reasons that the World Bank is a valuable component of this process. The most obvious reason is that it can provide adequate and sustained financing at favorable terms, with continuity across governmental transitions. Through SIG's partnership with the Bank, governments and foundations, MSI programs have been able to bring some $300 million of new money into developing countries to strengthen science and technology.

Equally important, the Bank has been working for several years to place S&T in a more prominent position within its own mission of poverty alleviation. It has generally maintained good contacts with government ministries, so that it has strong leverage in pressing governments to integrate S&T into their comprehensive development frameworks. Placing science and technology in the development framework raises its visibility and signals its importance to other ministries that must support it, such as Finance and Planning. It also provides opportunities to communicate to government officials the essential role of science and technology – not just in solving technical problems, but in building human capacity, creating new products for export, stimulating economic growth, and generally building stronger societies.

Finally, one of the most important goals of the MSI concerns brain drain. As Professor Hassan has pointed out, many of a society's serious problems can be solved only by a critical mass of local scientists working together on local issues. There is early evidence that the MSI can help in this regard. For example, when the second round of MSI institutes were chosen in Chile in November 2001, the program in operations research was able to attract several of that country's best scientists to return home to participate. In the same spirit, we look forward with great optimism to the implementation phase of new programs in Africa and Southeast Asia.

Conclusion

To conclude, I believe that the support of local science is essential for developing nations, for several reasons. First, it allows countries to help themselves, rather than to rely on imported science. Second, we now understand the importance of S&T in generating economic growth. Third, programs designed locally can most effectively address local needs.

To support local science, we need good policies, and we need action – to mobilize and capitalize on the talent that is already present in every country and community. The Millennium Science Initiative is but one small, concrete effort in what must be seen – in engineering parlance – as a systems problem. The Inter-Academy Panel and the Inter-Academy Council are engaged in complementary efforts, including their study on Capacity Building and their work to strengthen and link the academies in various countries. These efforts, taken together, promise to be extremely important in bringing the scientific communities in all countries into a position to play a more prominent and active role in the affairs of their countries, regions, and beyond.

Thank you very much.