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Bridging the North-South divide

Forum: November 2000

Physics plays a key role in enabling developing countries to build strong economies. Gallieno Denardo explains how the physics community can help scientists in the "third world".

From the pure beauty of general relativity to modern high technology, physics is a fascinating and worthwhile subject, leading to both vast new industries and far-reaching speculations about the world in which we live. However, physics does not necessarily need advanced equipment or the latest supercomputers for worthwhile research to be carried out. In some cases it is possible to carry out satisfactory experimental physics even in fairly simple laboratories.

Suitably thought-out programmes can even lead to results that are good enough to be published. What is particularly important for developing countries is that such programmes can help to create groups of experts who are familiar with modern technology. These people can then help their countries to industrialize, and provide their governments with sound scientific advice. Supporting physics in developing nations is, in short, both possible and important.

Physics goes international

It was this need to support physics in the developing world that drove Abdus Salam, the Nobel-prize winning Pakistani physicist, to found the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, in 1964. The centre, which is now named after him, is mainly supported by the Italian government and is currently directed by the respected theoretical physicist Miguel Angel Virasoro from Argentina. No physics department in the "third world" can afford to ignore the existence of the ICTP, which organizes international collaborations of physicists and mathematicians for the benefit of researchers in developing countries.

It is important to remember that the level of training and research in physics varies remarkably around the world. The most advanced nations can produce several thousand times as many physics PhDs as the least developed countries. Indeed, some nations, including many in central Africa, do not run postgraduate courses and do not produce any PhDs at all.

There has been some progress in recent decades. Several countries on the United Nations' official list of developing nations have set up educational systems that allow physics to be studied to PhD level and for scientists to carry out original research in their own land, rather than having to go abroad, possibly never to return. Countries such as India, China, Brazil, Argentina and Chile - as well as Korea, Malaysia, Singapore, Thailand and others on the "Confucian Rim" - now all have their own groups of university physicists, many doing excellent work.

However, other developing countries have been unable to make such progress and have actually seen their science base shrink. For them the gap is widening. These countries will soon feel the

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dramatic consequences of scientific regress. For example, the average age of university physics professors in some African countries, such as Ghana and Uganda, is now more than 50. If no action is taken immediately, there will be no-one to replace these staff when they retire in 10 years' time. We need to start training young physicists right now.

However, this will not be achieved through programmes that merely offer grants for students to carry out the whole of a PhD course abroad. What we need are "sandwich fellowships", in which students study with an "external" university in a developed nation for part of the time, but have their degrees awarded by their home country. This will help to stem the brain drain of scientific talent to industrialized nations, which already produce more than enough science graduates of their own. The need for developing countries to train PhD students locally is so urgent that it must be a priority for those organizations, such as the International Union of Pure and Applied Physics (IUPAP), that are trying to stimulate scientific progress in the third world.

Fortunately, some universities in the developing world - such as the University Cheikh Anta Diop in Dakar, Senegal - do produce their own PhD students, and these institutions will be able to replace staff who are due to retire over the next few years. However, even these universities do not fully benefit from their scientific potential because there are so few academic positions on offer. Young scientists feel discouraged from embarking on academic careers because the chances of getting a research post are so slim. It is therefore important that international organizations, such as IUPAP, should stimulate the scientific awareness of governments in developing nations. Hopefully, this will enhance the role of science in those countries, and encourage them to strengthen university science facilities and appoint more young scientists as researchers and university teachers.

The role of IUPAP

IUPAP, which was founded in 1924, plays a key role in helping third-world science. It encourages international co-operation in physics, helps scientists to move freely about the world and promotes all forms of physics research and education. IUPAP operates through 24 scientific commissions, each of which specializes in a particular aspect of physics. One commission - C13 - focuses on "physics for development". As well as finding ways of improving the conditions for physics and physicists in developing countries, C13 promotes and supports initiatives that show how physics can help industry. It also collects and distributes information on opportunities for the development of physics. It is therefore natural that C13 should mainly focus on developing countries, where physicists often work in isolation or in modest research conditions.

While most developed nations are members of IUPAP and participate in its programmes, a remarkable number of developing countries (more than 50%) are not. These countries are unable to benefit from being part of an international forum, which enhances their isolation still further. C13 is therefore doing all that it can to encourage such countries to join IUPAP. Indeed, following contacts with the highest governmental and university authorities, IUPAP has recently encouraged both Ghana and Senegal to became members. Ethiopia and Cameroon are also deciding whether to join. However, many countries - especially in Africa - remain to be convinced of the benefits of joining IUPAP.

In practical terms, C13 offers scientific advice and financial support to scientists wishing to organize international conferences, with the emphasis on those meetings that strengthen regional co-operation and encourage links between scientists from the least advanced nations. It has particularly close links with the IUPAP commission for education (C14) and it has also begun to form contacts with the International Commission for Optics.

Education and information technology

With physics playing such a key role in technology, C13 has also started a series of international conferences to debate how physicists can contribute to the growth of high-tech industry in

developing nations. Successful case studies were examined to find the best approaches. By looking at the progress of countries such as India, China, Brazil, Argentina and Japan - the classic example of a nation that has transformed itself into a high-tech economy - it identified guidelines to show how even the poorest countries can develop their economies through science. The commission also analysed scientific subjects, such as semiconductor physics and lasers, that are relevant to technological development. From these studies it became clear that developing nations must have a good-quality science-education system in place if they want to grow industrially.

However, another factor has recently entered the equation: information technology. While the growth of the Internet has provided scientists with increased opportunities for global collaboration, it also leaves those who are not part of these new networks at a huge disadvantage. Of course, third-world nations need to find the money to invest in information technology, but it is often more than just a question of funding. Many developing countries - particularly those in sub-Saharan Africa, South East Asia and some parts of South America - have failed to invest in IT because they lack any scientific culture whatsoever.

This imbalance will only widen the educational and technological gap between developing and industrialized countries still further. Also, when a nation lacks trained physicists, it lacks people who can become experts in many sectors of high technology. Third-world governments end up relying on foreign experts to help them with major national projects such as new telecommunications networks.

C13 has promoted conferences on these issues and been directly involved in the series "Physics and Industrial Development: Bridging the Gap". Each meeting in the series has focused on problems in a particular region. The first took place in New Delhi, India, in 1994, the second in Belo Horizonte, Brazil, in 1996 and the latest in Durban, South Africa, in September. At the most recent conference, special emphasis was placed on education and the need to train scientists and technicians.

C13 also maintains contacts with organizations that run programmes to support physicists in developing countries, such as the ICTP in Trieste and the International Programme in the Physical Sciences at Uppsala University in Sweden. Although these programmes all have their own approaches, IUPAP - through C13 - acts as a "clearing house", helping to coordinate the efforts of different institutions that are trying to support physics in the third world.

The way forward

So what can physicists in the North do to help their colleagues in the South? I believe that they must do all that they can to collaborate with scientists from developing nations, but that these collaborations must be driven by science alone. They should not be viewed as an act of mercy from a powerful world towards a poorer one. It is the duty of international organizations to support such collaborations, so that universities in the third world can one day become as good as those in the North.

The North also has a moral duty to support the most promising universities in the third world. Of course, this will not be enough to transform science in those countries overnight. Scientific progress cannot be "donated" or transferred from one mind to another, but we must start somewhere. Meanwhile, physicists in the developing world must resist the temptation to go abroad and make the effort to carry on working in their home countries. These scientists who sacrifice their lives for research require our full support.

* This article is based on a report in the IUPAP book entitled Physics 2000.

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