EDUCATING AND TRAINING SCIENTISTS FROM DEVELOPING COUNTRIES AT ICTP

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ICTP is a centre of scientific excellence, open to scientists and students from all countries, with the main objective of strengthening research capacity in physics, mathematics and other sciences in developing countries. The strategy of ICTP in training human resources from the developing world is based on the concept that more benefits will accrue if scientists and students will continue and expand their work in their home countries.

The main mode of operation of ICTP is *scientist-to-scientist*, a mode that can effectively target 'research-needy' individuals independently of the adequacy of their home institutions. Its functions and appeal for scientists from developing countries scientists are based on the existence of a strong in-house research leadership.

In fact, well-established research groups exist in ICTP in diverse fields, including Condensed Matter and Statistical Physics, High Energy and Astroparticle Physics, Pure and Applied Mathematics and Earth System Physics. Activities are also carried out in areas such as fluid dynamics, optics and lasers, alternative energies, ecological and environmental economy, plasma physics, astrobiology, medical physics, applications of synchrotron radiation, geophysics and soil physics. ICTP organises schools, workshops and training activities based on its research programmes, providing also practical training in its radiopropagation, microprocessor and optics laboratories.

Scientists from developing countries also benefit from links of ICTP with neighbouring research institutions, including the International School for Advanced Studies, the University of Trieste, the International Centre for Genetic Engineering and Biotechnology, the International Centre for Science and High Technology and the AREA Science Park (all part of a loosely defined 'Trieste System').

A diverse range of mechanisms facilitates the involvement of individuals and institutions from developing countries: the programme of Training and Research in Italian Laboratories, Associates and Federation Schemes and the Diploma programme. Thanks to these schemes, there have been about 100,000 visits of individuals (about 50% from developing countries) from 170 nations during the last 40 years of ICTP's existence. In particular, IAEA and ICTP run jointly the so-called Sandwich Training Educational Programme, which offers fellowship opportunities to Ph.D. candidates from developing countries in fields covered by the IAEA Technical Cooperation Programmes and falling within the scientific competence of the ICTP and its associated institutions. In addition, the office of External Activities connects ICTP with groups and institutions in developing countries, sponsoring Affiliated Centres and Networks, regional training schools and scientific meetings.

In spite of the impact ICTP has had on a relatively large number of individual scientists from developing countries, it is clear that much work needs to be done—especially at the institutional level. To enhance the impact, new approaches are being devised constantly. One example is the programme developed recently by ICTP's Physics of Weather and Climate Section, under the name Targeted Training Activities (TTA).

TTA has the objective of involving teams of scientists who can work together on a specific goal in institutions from developing countries. A small number of institutions are engaged, with a group of scientists from each institution. In the specific case of the TTA recently kicked off at the ICTP, such goals include: (i) building an academic, educational team with

expertise in climate sciences; (ii) developing expertise on the use of numerical weather forecasting; and (iii) implementing specific projects on the application of climate prediction to the management of hydrological or agricultural resources.

The above approach might be extended to other research areas and include the integration and co-ordination of different mechanisms. An important outcome would be the development of recognised centres of excellence in developing countries in specific areas of research. These new centres would increase the influence of the local scientific community and act as catalysers of scientific cooperation among developing countries (South-South cooperation).

Considering the specific theme of this international conference, namely, the nuclear knowledge management, ICTP is involved, mainly in co-operation with IAEA, in a range of activities aimed to update and disseminate the global knowledge of nuclear instruments and methods, including access to relevant nuclear data. This knowledge is critical for applications in a broad range of areas of high significance in sustainable development, such as energy, agriculture, nutrition, human health, water resources, climate change, protection of the environment, new materials and industrial applications.

Nuclear science applications are often based on facilities that can produce high quality ion, neutron and synchrotron radiation beams. In co-operation with IAEA, ICTP helps scientists from developing countries to access advanced accelerators such as the ELETTRA Synchrotron Light Source in Trieste and other facilities, including nuclear and isotope laboratories. It also supports the development of regional facilities such as the Synchrotron Light for Experimental Science and Applications in the Middle-East (SESAME), the UNESCO-sponsored centre to be established in Jordan.

Technological advances in developing countries depend increasingly on access to information available via internet, particularly electronic journals and databases. Hence, it is necessary to bridge the existing digital divide between advanced and developing countries (e.g. internet access is 1000 times slower, on the average, in Africa than in United States), mainly created by the high costs of telecommunication and through monopolies. ICTP is planning specific projects, under the aegis of UNESCO and in co-operation with the International Telecommunication Union, to strengthen cyber-connectivity in Africa and Asia.