

Science, Migration and Development

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It is estimated that about 2 percent of the world's population is presently in the process of migrating to a new country---some of it legally, some of it otherwise. The large numbers involved create enormous strain on civil society as we know it, in both the donor and host countries. Within the population that is seeking to migrate, scientists are but a miniscule fraction. Perhaps about 50,000 of the million or so yearly immigrants to the US have some technical expertise. An even smaller number of them can be labeled as scientists.

Despite the small size of the scientific community, its migration has wide impact on education, scientific culture, technological development, and national morale. To emphasize my point, allow me to recall the following facts:

The migration of scientists from Europe to the U.S. during and immediately after the Nazi era shifted the center of

gravity of science from Europe to the US. The process involved relatively few people, but the impact on science and on university education has been immense for both Europe and the US. The technical superiority that the US acquired during these years continues even now---one might say, because of its sustained policy (with occasional deviations) of embracing immigrant scientists. For example, three of the four US Nobel Prize winners in 1999 were first-generation immigrants.

Conversely, after the '70s a large number of scientists from developing countries moved, and are still moving, to the US and Europe. This migration is regarded as "brain drain" on the whole, constantly eroding the scientific capacity of the developing world.

After the '90s, a rapid migration of scientists occurred from the former Soviet Union to Europe and to the US. It is estimated that some 200,000 scientists have moved away, essentially decimating the once-thriving centers of excellence in USSR, causing an estimated annual loss of 50 billion dollars.

It is perhaps appropriate to recall the remark attributed to the 17th century French scientist, Blaise Pascal (1623-1662), that

France would become an idiot nation if some 300 of its scientists left the country.

Altogether, therefore, the issue of migration of scientists deserves special attention. This is what I propose to discuss here.

I should immediately note that my discussion will lean heavily on the experience acquired through the lens of my own institution, the International Centre for Theoretical Physics in Trieste---or ICTP, as it is generally known. Thus, to make sense of much of what I shall say, it is useful to recall schematically the history of the Centre and the way it functions. Please bear with me.

Abdus Salam, born in British India, graduated with a physics Ph.D. from Cambridge University and returned to his new country, Pakistan, as a professor. In the couple of years that he spent there, he felt miserable because he could do no competitive physics: there were no peers with whom to discuss, no library facilities from which to learn, and the teaching load was heavy. He went back to Cambridge, and later to the Imperial College of London.

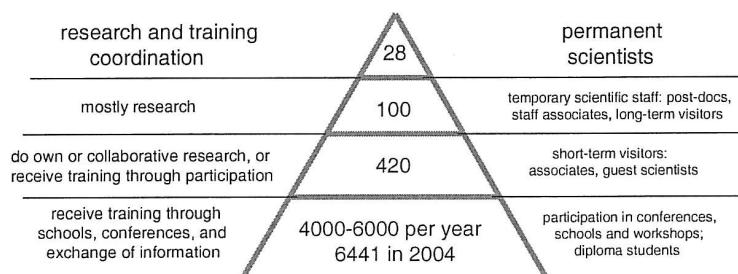
But Salam felt deeply that, had he been given the opportunity to be part of a center of excellence where he could interact with the best scientists from all over the world, a center which would provide him a

periodical haven for doing front-ranking research, he would probably have stayed in Pakistan and built the scientific capacity of that country more directly. He went about creating a center of just that sort.

Salam advocated for an international center, focused on physical and mathematical sciences, sometime early in the 1960's. It was the time when the world was divided into two cold war camps separated by the iron curtain. The city of Trieste, which lies at the threshold between eastern and western blocks of yesteryears, had been returned to Italy only a few years before. Salam's idea caught the attention of some Trieste physicists, mainly Paolo Budinich, who were devoted to the idea of making Trieste a center for a continual exchange of scientific ideas between the East and the West. These two interests merged and ICTP came into being. Salam became ICTP's first director; he was eventually to earn the 1979 Nobel Prize for Physics.

Let me now show you a few slides to describe ICTP and then formulate some general conclusions.

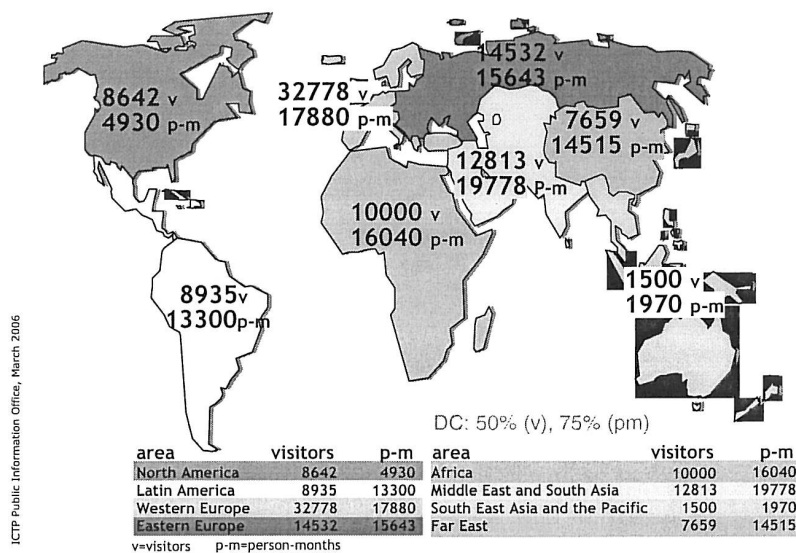
ICTP is an institution run by a few scientists for the benefit of many



ICTP Scientists, Visitors and their Functions

+ about 125 general staff

ICTP VISITORS STATISTICS, 1970-2005



Among ICTP's Associates are

- 1 President of a Republic
- 11 Ministers or Deputy Ministers
- 2 Members of Parliament
- 7 Advisors to Presidents or Prime Ministers
- 18 University Presidents or Vice Chancellors
- 22 Deans of Faculty
- About 150 Heads of Laboratory or Departments

ICTP's impact on the world of science

ICTP has had a longstanding impact on the science in Iran... the most important one is the concept of excellence...and I dare say ICTP has been the most influential institution in the world to bring that into existence. [It also has had] direct impact [on the] establishment of the various institutions; many graduate students in Iran have been exposed to international scientific community through different activities of ICTP.

Professor Reza Mansouri
Deputy Minister for Research, Iran

ICTP was very useful to me personally ...[and] it opened up a new world to me. Almost all of my colleagues at the Centre for Theoretical Physics in Hanoi get the same help from the ICTP. In addition, we also get book donations, computers, etc. For young physicists, the ICTP Diploma program is very attractive.

Professor Hoang Ngoc Long
Head of Particle Physics division, Vietnam

One particular international institution that has played an important role in providing resources and opportunities for physicists [in Africa] is the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy. ...ICTP's affiliated centers and visiting scholars programs are well known in African universities; nearly every PhD physicist in ... Africa has had an association with ICTP.

Professor Edmund Zingu
Physics Today, January 2004

Italian leadership in computational condensed matter physics ...would not have happened without ICTP.

Professor Erio Tosatti
SISSA, Trieste

This Center can make an effective contribution to the solution of the central problem of humanity, namely that of peace.

G. Andreotti
Minister of Foreign Affairs in Italy in 1984

Allow me now to restate the philosophy of the Centre before making some general conclusions. The Centre has always felt that it was important for poor countries to keep their scientists engaged in research and education in their own countries. It has further felt that this can be achieved only by providing scientists from those countries a certain level of mobility which allows them to periodically meet good scientists from other countries, exchange ideas, and create new ones by learning from each other. Every program that the Centre has invented over time has been in this spirit; every euro it has spent has been to fulfill this promise.

In recent years, the Centre has had to adapt itself to three major world events. The first is the fall of the Soviet empire. This event reduced the importance of the Center as a principal contact point between the two cold-war blocks. ICTP adapted itself by treating Russia like any other scientifically developed country (including hiring some Russian scientists on its staff), and by treating most former countries of USSR from Central Asia and the Caucasus as developing countries in need of support. It developed further ties with East European countries like Slovenia, Ukraine and Belarus. The collapse of the former Soviet Union increased the Center's responsibility in another way. Scientists

from former client states such as Cuba ended up having no place to go but ICTP.

Then came globalization. I shall take the word to mean free trade, free flow of capital and free access to ideas. Globalization is a controversial notion because even those who espouse the virtues of free migration of goods and capital do not necessarily support the free migration of people. This view, which is not to be interpreted as anti-immigrant but rather as anti-immigration, is motivated by concerns that free migration of people leaves in its wake far more intense problems than does the free flow of goods and capital. The scientific scene at ICTP has followed the trends of globalization in some respects.

To understand this last statement better and to see how our Centre has adapted itself, we should make a bit of digression.

The Centre has always encouraged the mobility of scientists and their free movement for purposes of building connections and common projects, but has discouraged the permanent dislocation of scientists from developing countries to the richer ones. Permanent migration was thought to result in a one-sided loss to poor countries. But thoughtful people now agree that depriving scientific capacity for any part of the world may result in a loss to all its parts, as poor decisions made in one

part of the world inevitably affect every other part. This situation is truer now than before, for two reasons: first, the world is connected more than ever, and, second, our planet is under such pressures where poor decisions may lead to irreversible exhaustion of its resources. Such prospects include climate changes, the depletion of fisheries, minerals and water resources.

The prospect of development in a sustainable context will only underline the need to enhance scientific capacity in all parts of the world, and reinforce the importance of the Centre's functions. In the long run, large-scale depletion of scientific capacity in any part of the world is detrimental to all its parts. In this sense, ICTP's vision has been both pioneering and far-reaching.

It thus appears natural to conclude the following: whatever the merits or demerits of wholesale transfer of goods and capital, it is not beneficial, as a rule, for wholesale immigration of scientific communities to occur from poor countries to rich ones. It is important, however, to have a free mobility of scientists for short periods of time, crossing national boundaries periodically and developing international communities within which free exchange of ideas is rendered possible. This is precisely what ICTP does.

[illegible]

■ ICTP visitors from 1995-2005
(including associates, TRIL fellows, course participants and researchers)

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scientists to the U.S. in the 80's and early 90's, many returned to China and drastically altered the scientific and technical landscape of their country, and started creating new wealth. This kind of mobility makes the concept of "brain drain" less meaningful. Regretfully, however, the situation is less sanguine for some other countries, especially in the sub-Saharan Africa. For those countries, the mobility of scientists has made the risk of losing the best and the brightest even more real. For a variety of reasons, globalization has made some countries winners but tougher for others. Recall that in the cold war days a large number of students from developing countries studied in the USSR and returned home. Indeed, in several African Universities, there are many scientists even today who were educated in the USSR. This kind of opportunity has diminished overall in recent years, as we shall see below.

The third world-event of some significance for the mobility of scientists is the terrorist attack on Twin Towers on September 11, 2001. Its policy aftermaths are too well known for us to discuss here. The repercussions are felt even at ICTP. These effects have hindered the very core reason for the success of ICTP, namely the mobility of scientists. This mobility is hindered because the vigilance required to keep terrorists at bay is often extended to scientists as well. This is, of course, the

easy thing to do. Italy has very good about balancing the two conflicting requirements, but it has become a constant struggle to get scientists to come to ICTP on time to attend a program. In particular, it has been difficult to get visas for scientists from certain countries in the Middle East and South Asia.

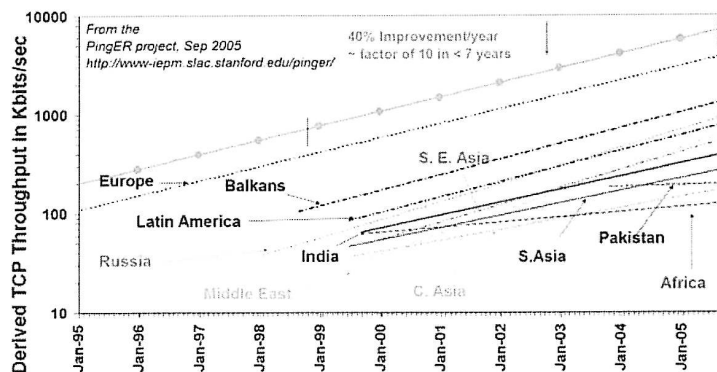
I have argued above that building certain level of scientific capacity in all parts of the world favors our common good. Alas, it has become increasingly acceptable to think that some countries misuse their scientific knowledge and must therefore be shut out. ICTP builds scientific capacity with the expectation that it will feed into proficient public policies benefiting all of society, and is not in the business of technology transfer. Building scientific capacity everywhere is a positive thing to do. That said, we must acknowledge that a tyrant might indeed get hold of a potentially destructive technology and abuse it. Part of the solution is that, even as we advocate scientific development, we must also promote ethical values, civil society and respect for human rights and dignity.

I do not like to make dramatic statements, and it is dramatic to say that the world today is divided today along religious lines more than at any time in recent memory. Nevertheless, there is some truth to it. At ICTP, we have been doing our best to support

good scientists from all parts of the world, independent of their ethnicity, culture or religion. We look for scientific competence within the broad mandate of encouraging diversity. To do justice to both diversity and excellence is demandingly difficult, but that has been the mandate of the Centre, and one which is worth working for. The following few slides illustrate my point.

There is fourth and final point I wish to make. The world has witnessed a true revolution in ITC, or information and telecommunication technologies, and it is only natural that we should use ITC more and more effectively to supplement the physical mobility of scientists. But the promise of these technologies has been limited in developing countries for what is known as the "digital divide". The figure shows the speed of internet connectivity in different parts of the world.

TCP Throughput Measured From N. America to World Regions



Even if the speed of the internet in developing countries can be enhanced, there is almost nothing that can supplant personal meetings when it comes to matters of science. What is required is a judicious combination of the mobility of scientists, the use of ITC to hasten the building of scientific capacity all over the world, keeping matters of sustainable development on the front burner. This is our task as I see it. It is a task that requires enlightened policies of governments, infusion of significant capital and a certain level of commitment.

ICTP has been in existence for 42 years. Over these years, Italy has been its steadfast sponsor. I believe that this has

been possible because Italian governments of all shades have generally understood the importance of the ideals represented by ICTP, and have informally concurred that the mobility of scientists, not their permanent migration, is the key to building scientific capacity. Many governments and institutions have acknowledged the importance of the Center's work. Immigration is an incidental issue to our Centre but I hope that the lessons learned are of broader value. I have tried to outline some of these aspects. On the whole, the Centre and its mission are worthy for consideration and I hope some of you will find interest in visiting us and, perhaps, also in finding support for our functions.

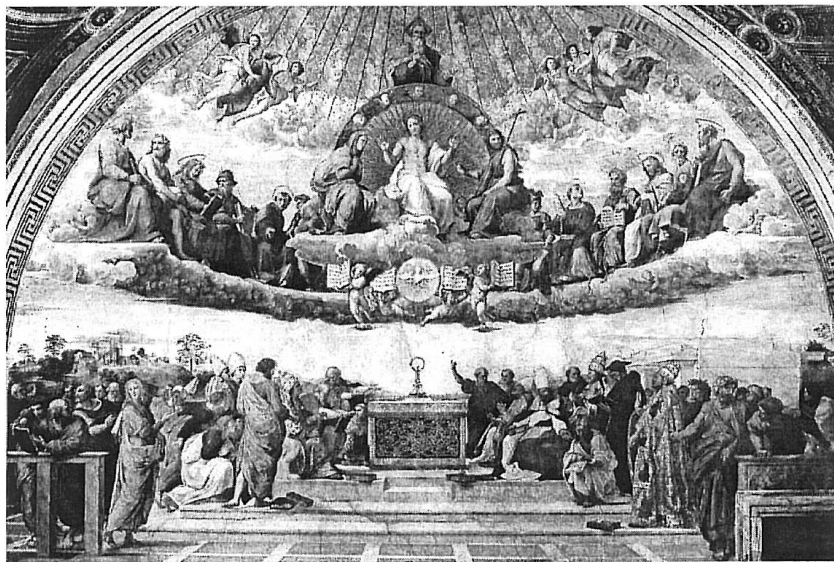
Let me close with a world view according to The School of Athens, probably the best of Raphael's creation, which can be found in Stanza della Segnatura in the Vatican. The most appealing part of The School of Athens is a complex allegory of philosophy, showing Plato and Aristotle surrounded by other philosophers, past and present, in a lovely setting. Here Raphael fills the space with figures in a rich variety of poses and gestures, which he controls in such a way as to make one group of figures lead to the next in an interweaving and interlocking pattern. Each group is working within itself, yet curiously aware of the rest, with beautiful continuity of space and time. This is how the world ought to work, in my

opinion. A distinctly different model is that of Disputa, also Rafael's creation, in which one sees a select group that is strangely content with itself for having known the celestial truth, sitting atop the more militant crowd, which, for not having been a party to that truth, is in a strange state of anxiety and agitation. This is the way of revealed truth, not of science derived from empirical experience, whose rhythm is the continuity in space and time.

Thank you.



The School of Athens



Disputa