Science in a time of global transformation

Over the past 30 years, tremendous changes have swept across the international science landscape: developing countries have increased their investments in research and science education.

Since the beginning of the 21st century, they have more than doubled their expenditure on R&D[1]. The investments have paid off in growing numbers of researchers and publications, and in surging development and economic growth, especially in such countries as Brazil, India, and my own country, China. Other nations have seen this success and are following a similar path. Today, thanks to a great and continuing effort, the powers of innovation are being distributed across the globe. International scientific collaboration is flourishing.

TWAS can rightly claim some credit for this ongoing transformation. From the time of its birth in 1983, founder Abdus Salam, the 42 Founding Fellows and other Academy leaders advanced a central idea: through science, engineering and technology, developing nations can empower themselves to solve problems and build prosperity. In schools, laboratories and political capitals throughout the world, TWAS has built important programmes and networks. Just as important, it has helped to convey a sense of scientific confidence where confidence often had been absent.

This autumn, TWAS convenes its 24th General Meeting in the beautiful and dynamic city of Buenos Aires, Argentina. It is our 30th anniversary, and we are celebrating all of the important partners and friends who have shared our work and helped TWAS to grow. It is, as well, a celebration of science in Argentina and throughout Latin America.

Latin America has always been important to TWAS. Among the Founding Fellows, 10 were from the region. Brazilian chemist José I. Vargas, TWAS's president from 1996-2000, guided TWAS through a very important period after Salam's death. And my predecessor, Brazilian mathematician Jacob Palis, led TWAS to significant growth across a range of important programmes from 2006-2012.

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ICTP Campus, Strada Costiera 11
34151 Trieste, Italy
tel: +39 040 2240327
fax: +39 040 224559
e-mail: info@twas.org
website: www.twas.org

EDITOR
Edward W. Lempinen

MANAGING EDITOR
Gisela Isten

ASSISTANT EDITORS
Cristina Serra
Sean Treacy

DESIGN & ART DIRECTION
Rado Jagodic
www.studio-link.it

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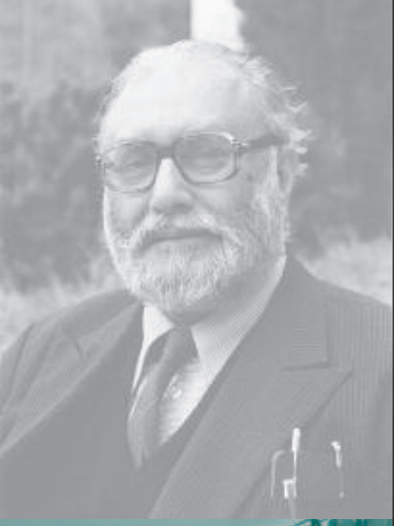


Argentina, with three Nobel science laureates, has long been admired by developing nations. In recent years, under the government of Argentinian president Cristina Fernández de Kirchner, Argentina has been working intently to leverage science and technology for economic strength. INVAP, a spin-off of the renowned Instituto Balseiro, provides satellites to NASA in the United States and to other nations; its nuclear research and energy facilities are in demand worldwide. Earlier this year, Argentina issued a plan that could increase R&D investment to 1.65% of GDP – more than double the current rate – by 2020.

Other nations in Latin America are following a course of similar ambition. According to SciDev.net, Brazil's science budget in 2002 was about USD575 million; for 2013, the investment has grown to USD5.6 billion, the nation's highest level ever. One estimate puts its 2013 R&D investment at 1.3% of GDP. Recognizing Brazil's skilled science workforce, a number of major international companies are creating research centres there. Mexico, meanwhile, is working to push investment up to 1% of GDP, and it is helping to educate and train science students from throughout the developing world through TWAS PhD and postdoctoral fellowship programmes. Chile is becoming the international capital of telescope astronomy.

Of course, Latin America's advances in science and engineering are happening in a global context. India's R&D investments amount to 10% of the total for all of Asia. Its science and engineering universities are among the continent's best, and its publications have been rising steadily. China is spending nearly 2% of its GDP on research and development. Its workforce of scientists and engineers was less than 800,000 at the turn of the century; by 2008 it was 1.6 million, and by the end of 2012 it had risen another 50% to 2.9 million. In materials science, it has emerged as the world leader in research publications.

You can look at other nations and see similar trends: South Africa and Rwanda, for example, or Malaysia and Bangladesh. In many nations of the Arab world, science enrollment in universities is surging. But the progress is uneven, and TWAS and others share a concern that many developing nations risk being left behind.

This creates a high priority for networking and cooperation among nations of the developing world. Again, we can point to many positive examples: universities and research centres across Latin America collaborating on physics, astronomy and social sciences, for example, or the nations of East Africa joining to increase internet bandwidth and access to information through a shared optical fibre network.

Over the past 30 years, helping to build science-based networks has been one of TWAS's most impor-

Top to bottom: TWAS founder Abdus Salam; construction of satellite at Argentina's leading technology company, INVAP; researchers on the Auger Project, based in Argentina, which is stydying ultra-high-energy cosmic rays; Argentinian president Cristina Fernández de Kirchner.

tant roles, and one of its greatest successes. Our PhD and postdoctoral research fellowships, to cite a key example, are based on the idea of building science in the developing world through South-South cooperation. We are now able to offer more than 500 fellowships per year, and we are aiming for at least 1,000 in years to come.

In China, the age of 30 is auspicious. In the Analects*, Confucius says: "At 30, I stood firm." This well describes TWAS as we celebrate our 30th anniversary. We are established and well-known; we have broad credibility in the world of science, both South and North. Still, TWAS faces a central challenge: Both our programmes and our vision must evolve to keep pace with a constantly changing global scientific landscape.*

Certainly it will be important for TWAS, in the years ahead, to focus energy on the least developed countries, and on programmes to support their scientific and technological development. TWAS also should seek to elect excellent scientists from countries where we currently have no members; a good goal is to expand our membership from the current 91 countries to 100 in coming years.

We may find one model in the five CAS-TWAS Centres of Excellence. The centres are focused on areas of critical importance and value for the developing world: water, biotechnology, green technology, climate and environment sciences, and space technology for disaster mitigation. The new investment of the Chinese Academy of Sciences (CAS) is focused on PhD programmes, joint research projects, workshops, training, and strategic study reports at CAS and the China-based centres.

The programmes will bring in top scholars from both the developed and the developing world. The programmes will be open to students from the developing world, and many will include support for women scientists. We envision the five TWAS regional offices playing an important role in supporting and advancing the centres of excellence.

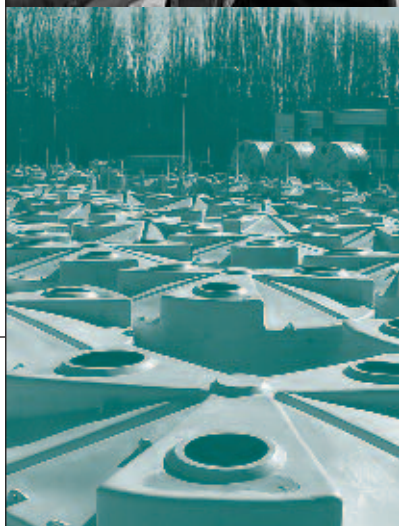
With this systematic approach, the centres will function as a powerful arm of TWAS in achieving some of its most important strategic missions, while fully employing its resources and building its networks.

TWAS attaches great importance to the nurturing of young scientific talents in developing countries. Bearing this in mind, TWAS and CAS initiated a new President's Fellowship Programme early this year; up to 140 students annually will be sponsored to travel to China for up to four years of PhD study and research. With this and many more other efforts, TWAS looks forward to the spreading of scientific awareness and strengthening of science capacity building in the developing countries.

The celebration of our 30th anniversary is an important time for us to acknowledge the hard work and transformative contributions of TWAS's founders and past leaders. As we reflect on their accomplishments in building the Academy, we must also commit ourselves to matching their ambition, their energy and their many years of innovation. ■

Bai Chunli *took office as TWAS president in January 2013. He also is president of the Chinese Academy of Sciences.*

[1] Based on the standard United Nations Statistics Division classification (composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings). *–Knowledge, Networks and Nations: Global scientific collaboration in the 21st century.* 28 March, 2011. -Royal Academy of Sciences



From top:
A radio telescope with the Atacama Large Millimeter Array project in the Atacama Desert in Chile (Photo: ESO).
Argentinian physicist José Antonio Balseiro, founder of the Balseiro Institute in Bariloche (Photo: Balseiro Institute).
A student in the KeV accelerator lab at the Balseiro Institute (Photo: Balseiro Institute).
Surface detector tanks staged for preparation at the Pierre Auger Observatory in Malargüe, Argentina (Photo: Pierre Auger Observatory).

At right:
"At 30, I stood firm."
***– Confucius,* Analects**
Calligraphy by TWAS president Bai Chunli offering the Academy good wishes for its 30th anniversary.