

# TEACH SCIENCE, CHANGE THE WORLD

HOW WILL SCIENCE BUILD THE STRENGTH TO ADDRESS HUNGER, DISEASE AND OTHER GLOBAL-SCALE CHALLENGES? ONE STUDENT AT A TIME, SAYS MOHAMED H.A. HASSAN, TWAS'S FORMER EXECUTIVE DIRECTOR.

Thirty years ago, the idea that developing nations could invest in science and technology (S&T) to drive economic growth and human prosperity had few adherents, even in developing nations. But as nations as large as China and as small as Rwanda demonstrated that science and technology could transform economies and people's lives, the idea moved into the mainstream.

TWAS was in the vanguard of that movement, with Mohamed H.A. Hassan serving as the executive director. Today, Hassan says, TWAS and its global partners face critical challenges in areas such as climate change, food production, and public health. And to address the challenges, they must set ambitious new goals: support young scientists; identify and nurture talented women researchers; and, above all, advocate broader and more effective science and engineering education at every



level and in every developing nation. Whether the student is in elementary school or a post-doctoral researcher, Hassan says, education is essential to create a new generation of problem-solvers.

In a presentation at the TWAS General Meeting in Tianjin, China, last September Hassan urged global science-policy leaders and research agencies to do more to build high-impact networks that can press ahead with progress. And TWAS, he said, must take steps to remain a strong leader in the field.

"TWAS aspires to be the world's leading global merit-based science academy dedicated to building S&T capabilities and promoting scientific excellence in the developing world", he said.

At the meeting in Tianjin, Hassan was honoured for his career achievements with the Abdus Salam Medal

named after the Pakistani Nobel laureate in physics who was TWAS's founding president.

While all nations have a responsibility for addressing global challenges and challenges in the developing world, Hassan said at the award ceremony, TWAS and its five regional offices, along with their many partners, have the perspective and experience to help guide the effort. Programmes to boost the number of advanced degrees in science and engineering fields, improved science education and more scientific exchanges can, over time, create powerful new scientific capacity even in less developed nations.

**KNOWLEDGE GAP: SLOWLY DIMINISHING**

Working with Salam from TWAS's first days, Hassan helped guide its evolution from an ambitious idea with an uncertain future into an academy of over 1,000 members, recognized globally today as an authoritative voice for science in developing world. In 2011, he stepped down as executive director, but he remains TWAS's treasurer; in addition, he serves as co-chair of IAP, the global network of science academies hosted by TWAS in Trieste, Italy.

In an address at the award ceremony, the Sudanese mathematician took the audience on an excursion through the history of TWAS, describing high points in its history and growth.

The number of TWAS research grants has grown from a little over 200 in 1986 to more than 8,500 as of 2010. The number of fellowships for PhD candidates and other students has grown, too. TWAS has held meetings throughout the developing world, and it has opened regional offices in Latin America, the Arab region, Africa, Central and South Asia.

Such initiatives have helped support a transformation in national and regional development strategies. While there remain big disparities in fundamental knowledge between North and South, Hassan said, "the gap is slowly narrowing."

For example, China and India each rank in top 10 of world papers on science, engineering and medicine, with Brazil, Taiwan and Turkey in top 20. But they are

only five nations among the top 20. None of them is African. And on the African continent, contributions are dominated by just a handful of countries such as South Africa, Egypt, Tunisia and Nigeria, but even they lag well behind the top 20.

**THE MOST SERIOUS GLOBAL PROBLEM**

In his address at Tianjin, Hassan focused on significant challenges that have long defined TWAS's purpose:

- **Water:** Over 1 billion people on Earth lack access to clean water; 80% of diseases in developing countries are caused by contaminated water.
- **Energy:** 1.5 billion people in developing countries have no access to electricity; 2.5 billion people rely on traditional biomass for fuel.
- **Health:** HIV affects 36 million people worldwide. Some 1 million people die of malaria every year, half of them children.
- **Biodiversity:** 60% of global ecosystem services have been degraded over past 50 years. Nearly one-third of all species could be extinct by 2050.
- **Poverty:** 1.2 billion people live on less than USD1 a day, and 3 billion on less than USD2 a day. And 300 million children go to bed hungry each night.
- **Climate change:** Water, health, agriculture and biodiversity all could suffer negative impacts caused by disruptions related to a warming climate. It is "the most serious global problem", Hassan said. "Poor countries are most vulnerable because of their fragile ecosystems and weak adaptation capacity."

*Science centres and museums are important hubs for informal science education. But in Africa's 54 nations, there are only four countries with such centres.*



The question, then, is stark: What can TWAS do to have a significant impact on these global challenges?

While the Academy has helped to change the world, Hassan said, its mission remains unchanged: ensure that all developing countries have sufficient scientific and technological capacity and excellent scientific leadership; help developing countries to apply science, technology and innovation to address global sustainability challenges; and support their efforts to engage in international scientific initiatives as full and equal partners.

“A minimum S&T capacity in each country is essential to generate local solutions and to enable effective participation in global efforts”, he told the Tianjin audience.

### THE POWER OF EDUCATION

To achieve those goals, and ultimately to address the greatest challenges of our time, Hassan said the focus must be on two main challenges. First, improve the quality of education and problem-solving research, especially in science- and technology-lagging countries. And second, TWAS and its allies and partners must take the initiative in driving science-related solutions to global sustainability problems.

Some of the responses require growth and evolution within TWAS. In Hassan’s vision, TWAS’s structure would be more decentralized and regional offices would take a greater role. Collaborations with key partners would grow stronger and more ambitious. TWAS

would engage more women and other talented young scientists in its work and activities. And TWAS’s Future Action Committee would play a vital role.

In addition, Hassan detailed a strong role for IAP which is comprised of 106 science academies worldwide. And he urged that TWAS and its partners revive the Consortium for Science, Technology and Innovation for the South (COSTIS), established in 2006 as a forum for top policymakers and agencies – science ministers, national science foundations and research councils, national science academies and related private-sector institutions.

But Hassan counselled that TWAS and its partners must also look for the most effective ways to build science-based knowledge and innovation in the developing world – and then help to get the job done.

Science education is particularly important, and many dimensions must be considered.

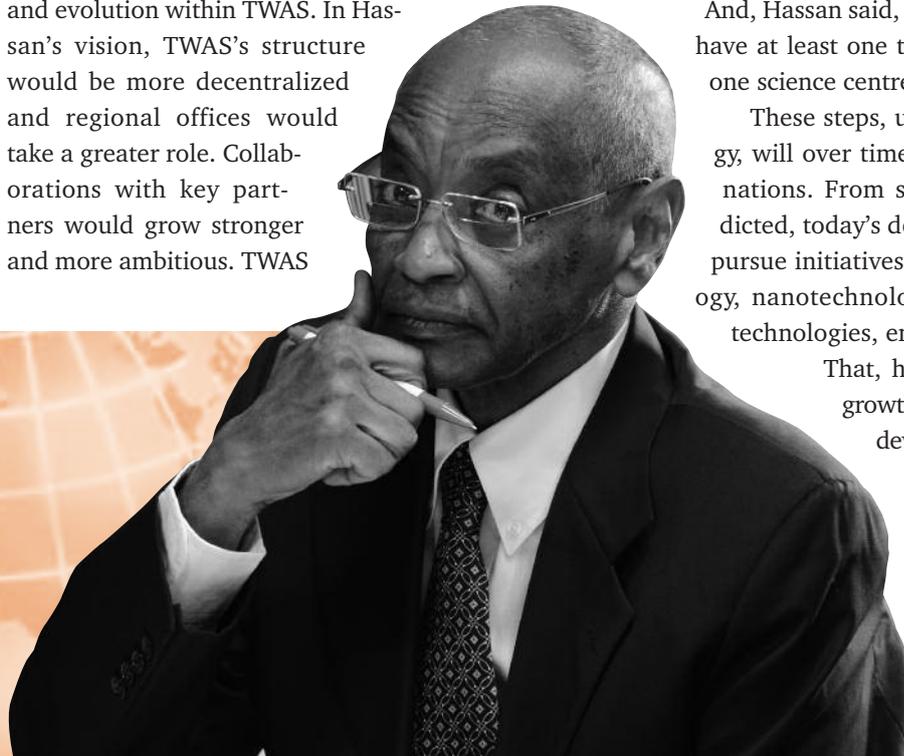
Inquiry-based education – in which students work on real research, and learn to think and work like scientists – must be advanced. That will require new training to make science teachers as effective as possible in motivating and guiding students.

Science centres and museums are important hubs for informal science education. And yet, in Africa’s 54 nations, there are only four countries with such centres.

And, Hassan said, every nation in the South should have at least one top-class research university and one science centre.

These steps, undertaken with focus and energy, will over time expand capacity in developing nations. From such a foundation, Hassan predicted, today’s developing nations will be able to pursue initiatives and partnerships in biotechnology, nanotechnology, space and communication technologies, energy and green technologies.

That, he said, is the road to economic growth and better lives for people in the developing world. ■



*From left: Abdus Salam; Mohamed H.A. Hassan shaking hands with Chinese President Hu Jintao at TWAS’s Tianjin meeting in September; a recent portrait of Hassan*