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twas NEWSLETTER
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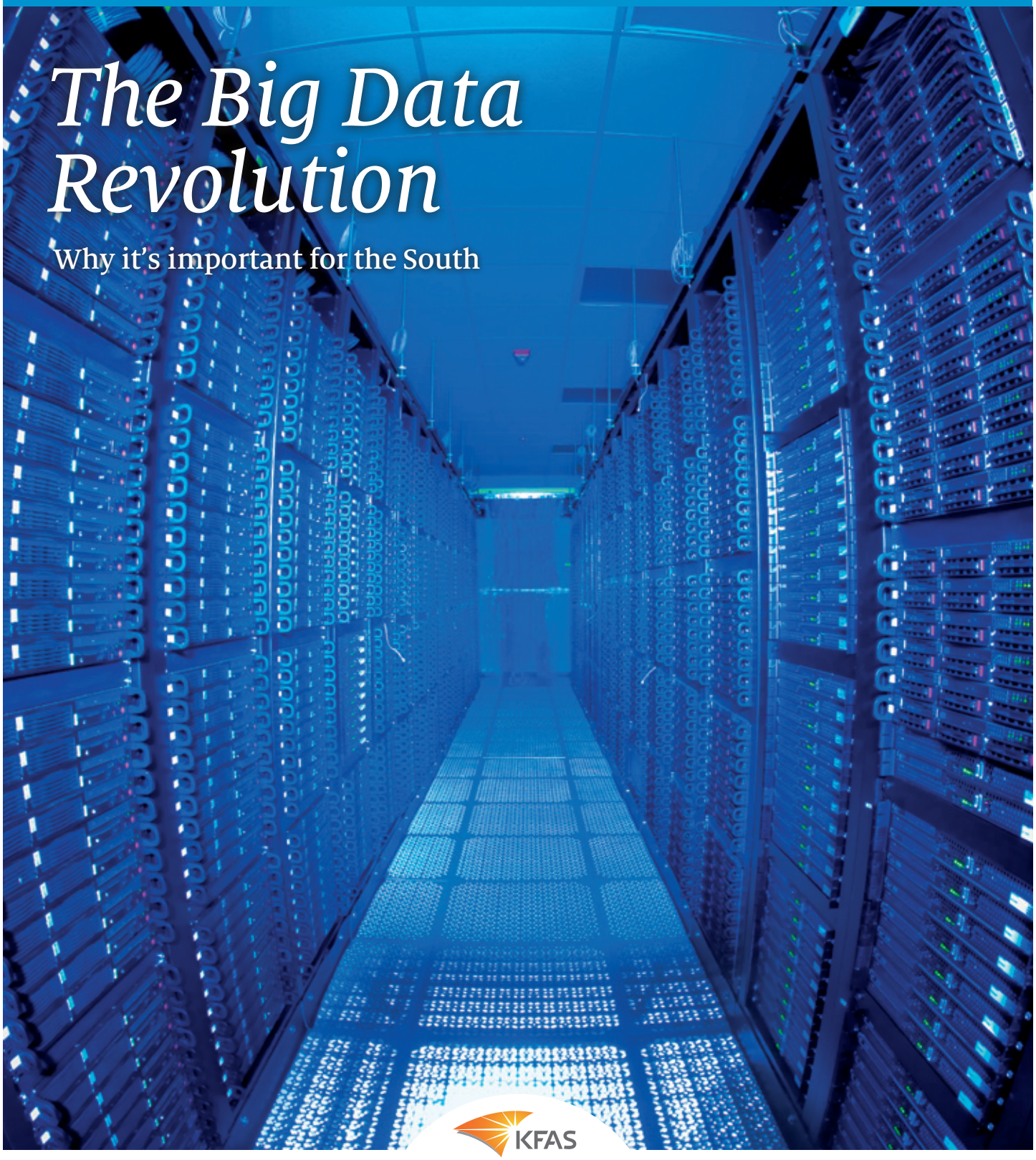
The Big Data Revolution

Why it's important for the South



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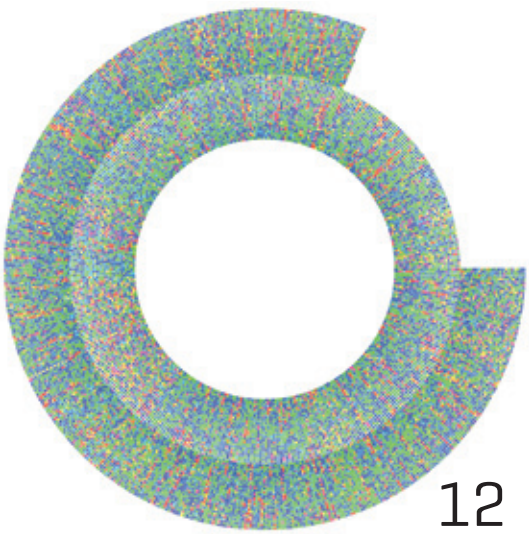

▲ Top: Students work during the CODATA-RDA School of Research Data Science in Trieste, Italy, earlier this year. (Photo: CODATA International) Bottom: A data visualisation of the genome of brewers yeast. (Image: Bill Automata/flickr)

Cover picture: The inside of the Fermilab Grid Computing Center in Warrenville, Illinois, U.S. (Photo: Fermilab)

▼ Pilgrims after crossing Dolma La Pass in the Hindu Kush Himalayas. (Photo: ICIMOD)

CONTENTS

EDITORIAL

A COMMITMENT TO BIG DATA

TWAS President Bai Chunli

For many scientists and engineers devoted to sustainable development, the challenges of hunger, clean water, public health and energy are top priorities. That is understandable – their efforts have a direct, positive impact on communities around the world. Compared to such work, big data and the emerging field of data science may seem like a luxury.

But that impression would be mistaken. Big data is a field of enormous potential power. If we can analyse galaxies of data to guide planting decisions or recognise emerging food shortages, and if the data help us to spot incipient epidemics or build better cities, then clearly we can address other priorities more efficiently and more effectively. This will be especially important as we work to achieve the Sustainable Development Goals (SDGs) by 2030.

This field emerged only in recent years; in some developing countries, researchers and policymakers have had little exposure to big data. At TWAS, we believe this is a moment to accelerate the learning. Big data and data science are essential tools *now*, and will only become more valuable in the years ahead.

Businesses and governments in the South are increasingly important sources of data. In the short span of a decade, mobile phones, social media, the Internet of Things and satellite technology have become so pervasive in the developing world that vast volumes of data can be marshalled to detail human and environmental conditions.

The SDGs, approved by the United Nations in 2015, comprise 17 goals focused on human prosperity and environmental health, plus 169 related targets. Big data can help improve our understanding of agriculture, ocean health, educational programmes and other conditions related to the SDGs. Big data also can help us measure progress toward the goals. And we should seek to make data and analysis available quickly, so that the data can provide real-time guidance to policymakers.

Building capacity in data science will require significant investment – in education and training, and in technology for data storage, analysis and sharing. But we cannot rely on the North to make these investments alone. To address global challenges effectively, we need data and analysis generated by local researchers.

TWAS is committed to advancing big data capacity, and we're helping to build South-South and South-North partnerships to support this goal.

In autumn 2015, TWAS and its partner organisation, the InterAcademy Partnership (IAP), joined the International Council for Science (ICSU) and the International Social Science Council (ISSC) to develop an accord urging that publicly funded data should be open to review and reuse by researchers, policymakers and others. Working under the banner of Science International, we have mounted a global campaign to win endorsements for the accord. (Learn more at www.science-international.org.)

In summer 2016, we joined with the Research Data Alliance (RDA); ICSU's Committee on Data for Science and Technology (CODATA); and the Abdus Salam International Centre for Theoretical Physics (ICTP) on a course in Trieste, Italy, to teach scientists from developing countries the skills to work with big data.

And in September, TWAS will hold a roundtable on big data at the annual Trieste Next science festival. Our panel will include experts from Kenya, Italy and the UK.

More such efforts are needed to build a strong foundation for big data culture in the developing world.

Bai Chunli, *president, TWAS*

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IN THE NEWS

GM mosquitoes cut dengue, company says

The first evidence of the health effects of releasing genetically modified mosquitoes into the environment suggests that they could put a dent in the number of dengue cases.
This news comes from a year's worth of disease data from Brazil, says biotech company Oxitec, which engineered the mosquitoes. Oxitec's genetically modified line of *Ae. aegypti* mosquito males sire offspring with built-in self-destruct DNA that kills the new generation off in the wild before they begin to bite.

Science News:
www.bit.ly/29QVBbP

Data gaps hide HIV

Large pockets of HIV infection are not acknowledged due to a lack of data on global HIV occurrence and prevention efforts, a study has found.
Existing data don't adequately account for adolescent girls, young women, homosexual men and transgender people in HIV/AIDS-affected countries, says a report issued in June. These gaps in data sets result from cultural, geographical and educational factors, the report says. For example, in many of the countries most afflicted by HIV/AIDS, women are less likely to be educated and more likely to live rurally, so they rarely participate in surveys.

SciDevNet:
www.bit.ly/29XeUA3

China's coal peak hailed

The global battle against climate change has passed a historic turning point as China's coal burning has finally peaked.
China is the world's biggest polluter and more than tripled its coal burning from 2000 to 2013, emitting billions of tonnes of climate-warming carbon dioxide. But its coal consumption peaked in 2014, much earlier than expected, and then began falling, a team of senior economists said in an analysis published in *Nature Geoscience*.

The Guardian:
www.bit.ly/2ae8zov

Amazon rainforest more flammable

Activities such as selective logging, hunting, altering or fragmenting the landscape, and other forms of habitat degradation are making the Amazon rainforest more flammable, according to a two-year study of the Brazilian Amazon.
The findings, published in the journal *Nature*, revealed that even protected forest is degraded by human activity. "Rainforests don't normally burn, but human activities are making them much more flammable," said lead researcher Jos Barlow from the Lancaster Environment Centre.

Down to Earth:
www.bit.ly/2bHIE4W

Running out of groundwater

In some Beijing neighbourhoods, the ground is giving way at a rate of four inches a year as water in the giant aquifer below the city is pumped.
The groundwater has been so depleted that China's capital city, home to more than 20 million people, could face serious disruptions in its rail system, roadways, and building foundations, an international team of scientists concluded. Around the world, alarms are being sounded about the depletion of underground water supplies. The United Nations predicts a global shortfall in water by 2030.

National Geographic:
www.bit.ly/29UFkbb

BIG DATA

THE NEW CULTURE OF BIG DATA

The ALMA correlator, one of the most powerful supercomputers in the world, is in a remote, high-altitude site in the Andes of northern Chile. (Photo: ESO)

The data revolution is transforming science, but taking full advantage requires resources, cooperation, education and a change to the culture of science itself. How can less-developed countries keep from being left behind?

by **Sean Treacy**

In the push to create a prosperous future for the planet, data are everything. Policymakers who want to make informed decisions rely on advice from scientists who derive knowledge from data. Well-managed data tell us where poverty is worst and how many children are undereducated. They show where more doctors are needed, and provide vital information about food and water supplies.

And now? A digital revolution has exploded the amount of data that researchers must manage and analyse, and those data move at an unprecedented speed. There are over 4.6 billion mobile-phone subscriptions worldwide. International technology company IBM estimates that roughly 90% of the world's data have been created in the last two years.

The increased volume and speed of data is known as "big data", and science will have to undergo a complex evolution to accommodate it. It will require time and money for computing power. The culture of science must become more open so that researchers make their data available to others who might also make use of it. Countries that may have different research interests and technological capacity will have to find a common ground on open access. And finally, scientists in developing countries will need to learn how to take advantage of the programmes, coding techniques and analytical methods of information-crunching computer scientists.

"Researchers are beginning to produce lots of data, but many don't have the skills, or the infrastructure and support to take advantage," said Simon Hodson, the executive director of CODATA, the International Council for Science's Committee on Data for Science and Technology. "Our challenge is to ensure we take advantage of these technologies."

The world's emerging economies are already taking advantage of the revolution. China has been making a major big data push, finishing the fastest supercomputer in the world in June, capable of making 93 quadrillion calculations per second. According to India's National Association of Software and Services Companies, the country is already one of the top ten data analytics markets in the world, with a USD2 billion data analytics sector that is projected to grow to USD16 billion by 2025.

Investments in India, China and other nations are a start. But the campaign to achieve the UN's Sustainable Development Goals by 2030 is accelerating, and that alone creates an urgency for bigger, broader investment in big data capacity.

The SDGs are the international community's most ambitious effort ever to resolve humanity's greatest challenges and set a firm course for sustainable global development. The 17 goals aim to eliminate poverty, improve health and achieve urgent improvement in the Earth's environment by 2030.

The UN also approved 169 targets within those goals. Big data and data science will be critical for measuring progress on those targets as quickly and exactly as possible. With that in mind, the UN convened its first World Data Forum in South Africa in January 2016, where data scientists with expertise in statistics, measurement and information systems, and others focused on strategies to employ data for sustainable development.

The task is more daunting for developing countries that are severely short on technological

resources and expertise – a gulf known as the global digital divide. The challenge will be most pressing in the Least Developed Countries (LDCs), which will need technical and financial support to build big data skillsets, said Amina J. Mohammed, the Minister of Environment of Nigeria and former special adviser to UN Secretary-General Ban Ki-moon on Post-2015 Development Planning. While funding will be a part of the solution, Mohammed said, building local expertise, improving policy making, and empowering citizens are all critical.

"Data literacy must be improved," she explained in a written interview, "or else we risk seeing the rise of yet another digital divide."

THE VIEW FROM AN LDC

In order for Least Developed Countries to take advantage of big data, they have to recognize that powerful computing technology and skills are a pressing need for the public good. And LDCs have a long way to progress. Consider Nepal: Over 90% of all Nepalese school children don't have access to computers, said TWAS Fellow Bishal Upreti of Nepal, who is also the TWAS Council Member representing East and Southeast Asia.

> "Data literacy must be improved, or else we risk seeing the rise of yet another digital divide." *Amina J. Mohammed*

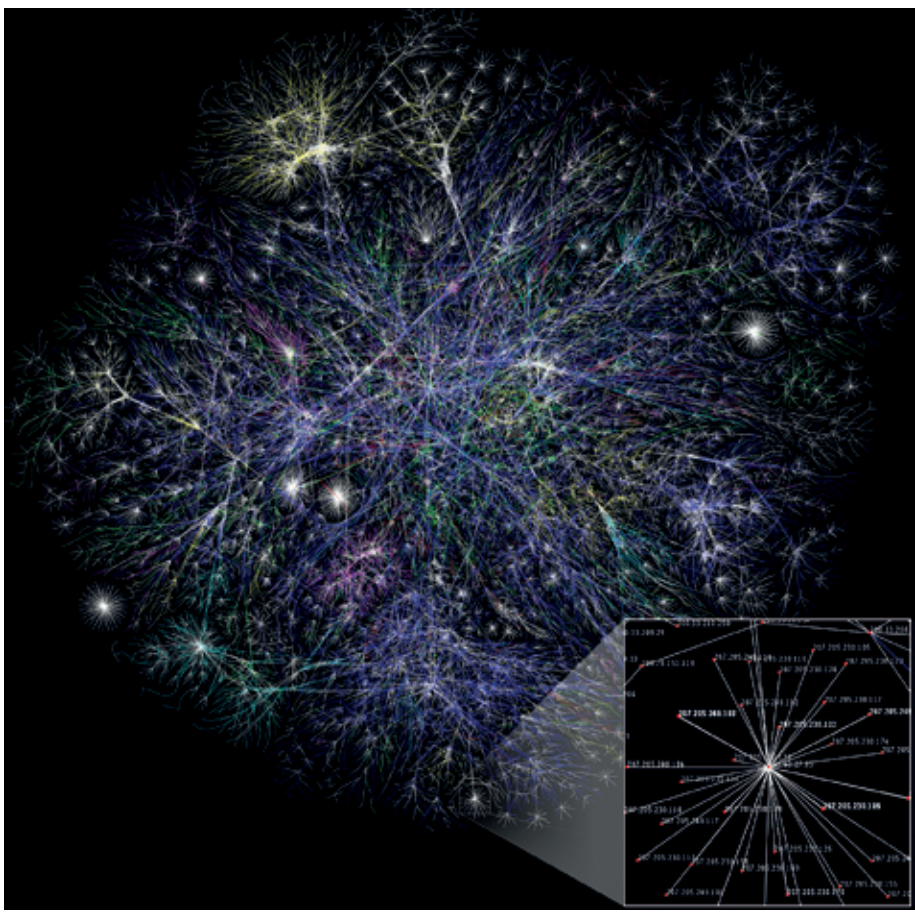
"It is a big danger that Nepal is producing a computer-illiterate generation in the future, when the contrary should be the case," he said. "The present economic condition of the country makes it hard to provide these facilities to all school-going children."

The IT-sector graduates that Nepal produces tend to go into corporate sectors, such as cell phone companies, he added, instead of public services that are short on resources. And big data is important for countries like Nepal that urgently need to provide better public services in agriculture, education and even preparedness for earthquakes. On 25 April 2015, an enormous quake struck the country, killing nearly 9,000 people, injuring many more, and destroying homes, businesses and even entire villages.

Upreti's specialty is Himalayan geology, and in the days after the quake, he provided advice and technical information on the disaster. But the earthquake also laid bare Nepal's inability to handle a large flow of data and information quickly. During the emergency, officials made decisions the old-fashioned way: getting information and relaying directions mostly through the security agencies' radios while the army and police handled search and rescue efforts. They did not have a digital database of emergency supplies for such a large a disaster, Upreti added.

When the quake happened, it was also a chance to prepare for the future – to learn what areas of Kathmandu Valley are most vulnerable and improve building codes there. But still, Nepal only had a small number of sensing stations in Kathmandu, and also didn't have

▲ From top: Simon Hodson, Amina J. Mohammed.



▲ Damage in Kathmandu, Nepal, from last year's devastating earthquake, which killed nearly 9,000 people. (Photo: Bishal Upreti)

◀ A data-derived partial map of the Internet. (Photo: The Opte Project)

the ability to analyse what data they collected. Instead, they needed to send the data to the United States for analysis.

Upreti argued that Nepal needs to upgrade its earthquake recording and data analysis abilities. At the time of the quake, he explained, Nepal had only 21 permanent seismic stations capable of automatically recording information when a quake strikes. They also only had 20 permanent GPS stations monitoring ground movements that researchers had to visit every three to six months to collect the data. After the earthquake, Nepal took steps to improve their data collection system, adding 80 temporary seismic stations and 50 new temporary and permanent GPS stations. But they still need an investment in big data management tools and skills to handle all the new data from these stations.

It's policymakers who must set the tone for solving the problem, Upreti said. Nepal and other countries need to prioritize big data management. "It's about the mind-set," he said.

▼ From left: Bishal Upreti, Ciira wa Maina, Esther Musyimi.

A NEED IN AFRICA

The issue is also pressing in Africa. Many of the continent's problems could be better addressed if scientists there made better use of data, said electrical engineer Ciira wa Maina of Dedan Kimathi University in Nyeri, Kenya.

Maina envisions a project to monitor livestock using data-collecting devices attached to animals. It would rely on smartphone-sized sensors that measure how fast the animals move, how much they move, and how steady they are. Once computers sift through all the sensor data to determine behavioural patterns, they could tell you when an animal is unwell, dealing poorly with the weather, or even in heat.

"If it sees that a set of animals aren't behaving as they normally do, you can start to ask: What's the reason?" said Maina. "One reason a cow could be agitated is because it's in heat and it can be a costly exercise to miss that cycle."

Putting such a project into practice would require powerful computers, big data software and local data scientists to quickly turn all this data into information that farmers can use. So Maina co-organized a data science workshop in Nyeri last year with about 100 students, all Kenyan.

Esther Musyimi of Dedan Kimathi University of Technology was one of the students. She said big data education is not common in Kenya, and that the workshop drove home how a telecommunications engineering student can take advantage of big data to help local development.

"Telecommunications has given people the ability to communicate with the rest of the world," she said. "You are able to access big data from any part of the world using these devices."

Maina added that underlying the need for new data is the need for a shift in attitude. Researchers and data engineers will have to climb out of their comfort zones and better understand each other's work.

BUILDING A CULTURE FROM THE GROUND UP

How does this attitude shift take place? One important thing to acknowledge is that a data scientist is a new breed of scientist, said Clement Onime of Nigeria, a systems and network

analyst for the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. Almost every scientific field needs experts who can handle large volumes of data. They also have to be more willing and able to share their data with each other.

In Onime's view, the newness of the field also presents a special opportunity for developing countries. "There is no country that is particularly ahead of the order right now," he said. "So it's an excellent opportunity for LDC countries not to play catch-up so much, but to stay abreast of what's happening."

This is one reason why Onime co-organized an open data science course this year at ICTP. Put together by The Research Data Alliance (RDA), CODATA, ICTP and TWAS, the CODATA-RDA School of Research Data Science sought to help a younger generation of scientists from developing countries learn to work with an open, common interface and make large volumes of data available to each other across disciplines.

About 75 students, including participants from over 30 developing countries, learned how to code open-source data programmes, analyse and manage data and visualize data in easy-to-understand graphics. They were then encouraged to duplicate the lessons of the course in their own countries.

One student, Bianca Peterson, is working on her genetics PhD at North-West University in Potchefstroom, South Africa. Many supervisors in her university are uncomfortable with sharing data from yet-to-be-published research. "My supervisor was worried that someone else would publish based on my data before I even get my PhD and then, suddenly, I wouldn't have a project anymore," she said.

But realistically, Peterson noted, that's unlikely to happen. She will always know her own data the best, and there are benefits to an open-data culture as well. At one point, she learned that she had been duplicating another researcher's work, so she had to retract her own paper. If scientists made their data quickly and publicly available to researchers in her field, she would have avoided lost time and resources.

Now she's planning to replicate the Trieste course in her home country. This is a hope shared by her fellow course attendee Elias Mwakilama, a computational mathematician with the University of Malawi. While data-sharing has entered the discussion among scientists in Africa, it has yet to be put into practice, he said. "We need to build the culture now, from the ground up."

▲ Students receive guidance during the CODATA-RDA School of Research Data Science in Trieste, Italy, earlier this year. (Photo: CODATA International)

COMPUTERS FOR ASTRONOMY – AND MORE

There is one enormous project taking place in Africa in particular that is building a culture for big and open data.

The Square Kilometre Array (SKA) is a massive radio telescope planned to work simultaneously in both Australia and South Africa for which construction will begin in 2018. Its astronomy work in Africa will manage massive amounts of data quickly – handling anywhere from one to 10 terabytes per second.

The presence of an enormous, first-of-its-kind data infrastructure is an opportunity for

▼ From left: Clement Onime, Bianca Peterson, Elias Mwakilama.

> The ability to extract value from data and do something useful with it is going to be really crucial to how we move forward as a species.
>
> *Jasper Horrell*

Africa to lead the way in big data education and training, and in tapping the power of supercomputers for a variety of uses. Jasper Horrell, the general manager of science computing and innovation at SKA, said plans are in the works to use this data to assist African countries, including some LDCs.

"Africa is the neglected continent in terms of technology and science," said Horrell. "This is a real opportunity to try to make a difference to a lot of people's lives in South Africa and beyond and also to open up the collaborative opportunities between South Africa and those other countries."

SKA is central to another project – the African Data Intensive Research Cloud, meant to link up Africans in partner countries: Botswana, Ghana, Kenya, Mauritius, Namibia, and three LDCs – Zambia, Mozambique and Madagascar. The goal is to connect research groups and animate new astronomy projects. But it will also help other scientific endeavours, such as green energy, environmental monitoring and health.

For example, to test drugs, scientists need to assess a huge number of people, and do so in a centralized way. Then doctors can do remote medical testing, remote diagnosis, and get the right medicine to the right places. A system geared toward data collection would make following-up easier, which is important on the ground in Africa. It could help a country be able to track contagious diseases in real time.

"The data revolution is here," said Horrell. "It's accelerating, and it's going to affect all areas of human activity. The ability to extract value from data and do something useful with it is going to be really crucial to how we move forward as a species." ◘

▲ An artist's impression of the 5km diameter central core of The Square Kilometre Array antennas. (Image: Swinburne Astronomy Productions for SKA Project Development Office)

TWAS, IAP JOIN OPEN DATA INITIATIVE

Open data is essential for 21st century science. Now TWAS and IAP are working with ICSU and ISSC on a global campaign to win endorsements for a new accord.

The emerging culture of big-data research, backed by the massive power of new digital technology, is transforming science and promising discoveries and applications that could touch every community on Earth. But disruptive technology can also disrupt the practices and values that guide global science, with particular risk for developing nations.

To address these concerns, four front-line international science groups are urging endorsement of an accord that advocates open access to publicly funded volumes of "big data". TWAS and the InterAcademy Partnership (IAP), together with the International Council for Science (ICSU) and the International Social Science Council (ISSC), developed the accord in a global consultation under the banner of Science International.

The accord is called "Open Data in a Big Data World," and it is available in several languages at www.science-international.org. Organisations can endorse the accord at that site.

"As the data revolution accelerates and the scientific potential of big data becomes clearer, it is timely that the major representative bodies of international science promote the importance of open data as a means of maximising creativity, maintaining rigour and ensuring that knowledge is a global public good rather than just a private good," said Geoffrey Boulton, president of CODATA, ICSU's Committee on Data for Science and Technology.

"Open access to data will be essential if developing countries are to join in the benefits of the big data revolution," said TWAS Executive Director Romain Murenzi (before his move to UNESCO headquarters). "If developing nations are left behind, if they are unable to make a full contribution to the global research enterprise, that will be costly not only for them and their people, but for all nations."

The four organisations represent more than 250 national and regional science academies, unions and other organisations worldwide, with individual members at the highest levels of research, policy and education.

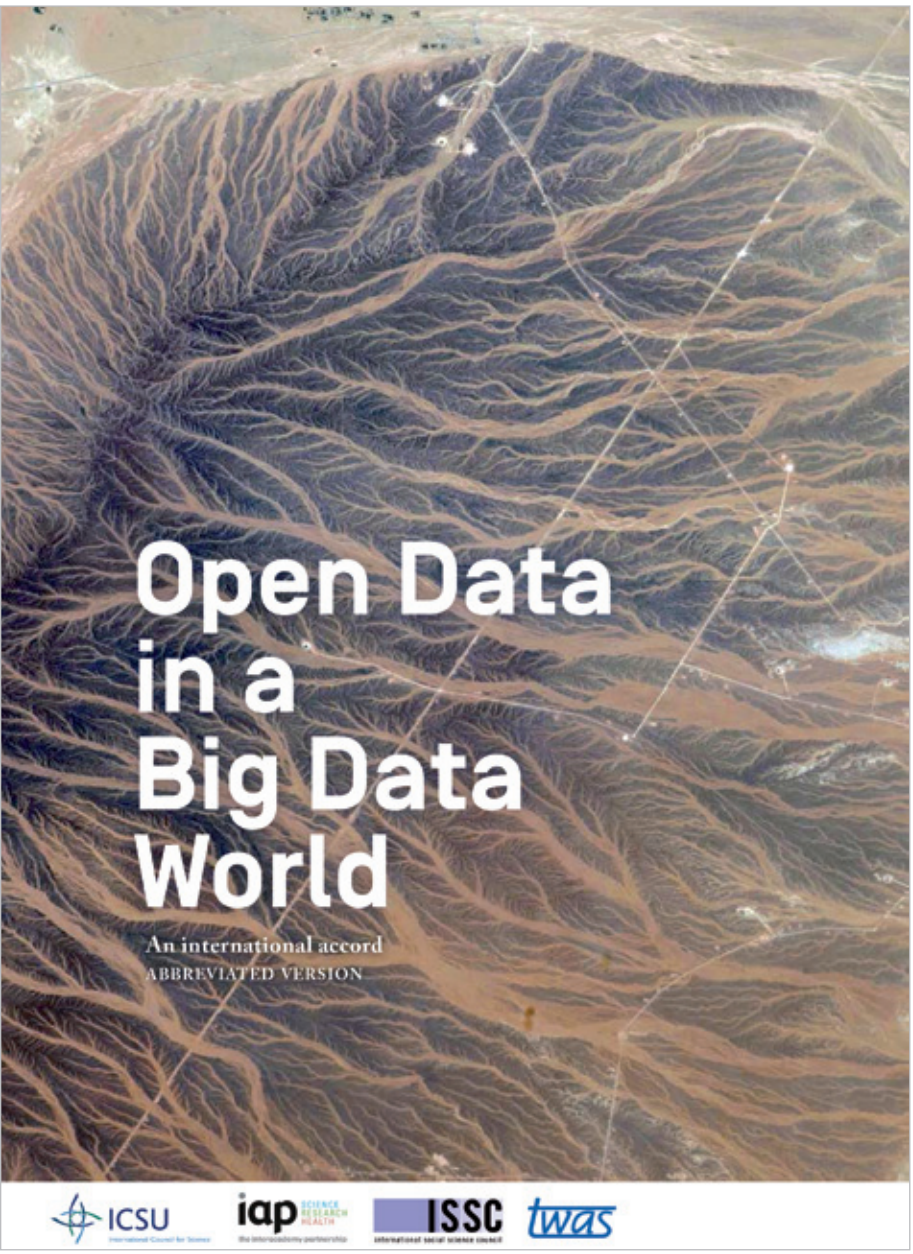
Science International is an initiative that will convene meetings periodically to focus on a high-priority science policy issue. In the second half of 2015, the four partners agreed to focus on big data and open data in a series of meetings and exchanges.

At the core of the process was an eight-member working group chaired by Boulton; members came from Asia, Africa, Latin America, North America and Europe. Each of the partner organisations assigned programme and communication staff to the effort.

DATA: "THE FABRIC OF MODERN SCIENCE"

In December, "Open Data in a Big Data World" was presented at the first Science Forum South Africa, and in high-level meetings on the sidelines at the forum. Naledi Pandor, South Africa's minister of science and technology, cited Science International in her opening remarks. And with help from her ministry and South Africa's Department of Science and Technology, a press conference generated valuable coverage in South Africa and beyond.

Science International came together at a crucial moment. The digital revolution has created unprecedented possibilities for collecting, storing and analysing data. Supercomputers and extremely large data sets, or big data, can be used to discern and analyse subtle patterns in areas ranging from security and biodiversity to climate change, genetic research and human behaviour. Such



▲ The accord, "Open Data in a Big Data World", advocates open access to publicly funded volumes of big data.

analysis has great potential value for scientists, policymakers, private enterprise and others.

"Open Data in a Big Data World" describes the opportunities and challenges of the data revolution as an overarching interest for global science policy. A central conclusion of the accord is that, unless those data sets are open, there will be risks to the global scientific enterprise.

If the data is kept private, other researchers won't be able to review and build on that knowledge – a practice that's key to a healthy science culture.

A further concern is that, without open data, developing nations in Africa and worldwide will be less able to participate in – and contribute to – technology-driven research in fields of critical importance.

"Data is the fabric of modern science," said ICSU President Gordon McBean of Canada. "The challenge for science today is to keep pace with the digital revolution, and for that we need a strong international framework setting out the principles for an open data regime that enables all nations and societies to benefit equally."

TWELVE GUIDING PRINCIPLES

The accord proposes 12 principles to guide the practice of open data, focused on the roles played by scientists, publishers, libraries, funders and other stakeholders, and on technical requirements for open data. It also assesses the "boundaries of openness".

"Open data should be the default position for publicly funded science", the accord says. "Exceptions should be limited to issues of privacy, safety, security and to commercial use in the public interest. Proposed exceptions should be justified on a case-by-case basis and not as blanket exclusions."

Leaders of the Science International partner organisations strongly encouraged their members and colleagues to consider the accord and related issues.

"Academies of science are important drivers of science policy in their countries," said IAP President Mohamed H.A. Hassan. "We hope the more than 130 national and regional IAP member academies will now support the principles set out in this accord, take them to their governments and national science systems, and collaborate on moving towards their implementation."

"Big data creates tremendous opportunities for social research," added ISSC President Alberto Martinelli. "The social sciences have long explored the ethical implications of data collection, the protection of privacy and the risks of data commercialization, and it is critically important that social scientists engage in the debates around big and open data, to ensure that rapid developments do not result in a deepening of existing knowledge divides." ◘

Q&A BIG DATA: A ROAD TO DEVELOPMENT

by **Cristina Serra**

Big data has enormous potential to benefit human communities. But two African data experts say that scientists, policymakers and the public must work together to achieve that potential.

What do traffic flow, epidemics, mobile phones and marketing campaigns have in common? They all generate huge amount of data. But to distill knowledge from the oceans of big data, it will be essential to develop skills in data collection, management and analysis.

By building that capacity, developing countries could better address local challenges, say Leonida Mutuku, CEO at Kenyan-based company Intelipro. And to encourage policy that supports capacity-building, scientists must seek partnerships with policymakers and the public, adds TWAS Fellow Tshilidzi Marwala, deputy vice chancellor at the University of Johannesburg.

> "It is difficult to solve problems that you can't quantify and the use of big data enables developing countries to determine the extent of these problems."
>
> *Leonida Mutuku*

Big data flow every day from all human activities, whether financial transactions, social media messages or climate sensors. Assembling, storing, analysing and sharing that information would make it easier for Least Developed Countries to address their own problems and to engage in regional and global research and policy decisions.

With so many other needs, can developing nations afford to make the investments in education and technology? Mutuku and Marwala, in interviews with TWAS staff writer Cristina Serra, posed a different question: Can developing nations afford to miss this opportunity?

Least Developed Countries have urgent problems to address – food and water, energy, sanitation, and primary education. They often have great difficulty responding to natural disasters. Why should they invest in big data?

Mutuku: Big data is an enabling resource to solve challenges facing LDCs. It is difficult to solve problems you can't quantify and the use of big

> The only way to build capacity in the area of big data is to educate the population.
>
> *Tshilidzi Marwala*

data enables such countries determine the extent of these problems before setting a roadmap to solve them. For instance, the availability of gender data is very critical to ensure that women and youth are not left behind in critical interventions.

Marwala: Big data, the utilization of vast data located in the Internet for decision support, can be on weather patterns which have impact on food security, energy demand or water demand. So it will be unwise for any country to ignore it, especially intelligent analytics that can assist us to plan better in fields like energy and agriculture or to anticipate natural disasters. "Ignore big data at your peril!"

Developing countries often lack the resources to compete in big projects. What kind of technology should they have? How can they build capacity with limited resources and access to technology?

Mutuku: A core requirement for big data analytics is access to affordable and fast Internet. Governments of developing countries are rolling out national fiber-optic backbones within their countries to increase access to reasonably priced broadband connectivity. This opens up opportunities for local cloud and related infrastructure that can manage big data projects with limited latency. Another investment developing countries should be making is in human capital: individuals and innovators who can work closely with governments to improve data collection methods and analysis capacity of public institutions.

Marwala: The starting point in big data regards the knowledge of mathematics, especially statistics, then computer programming and at the high-end artificial intelligence. The only way to build capacity in the area of big data is to educate the population. This can entail importing skills to come and teach in areas such as statistics, artificial intelligence and computer science, which are essential for big data. TWAS has a project that facilitates movement of experts to LDCs. I think LDCs should use this opportunity. With the recent development of massive online open courses, one is now able to learn about big data without travelling to the developed world.

For scientific and economic growth of developing countries, how essential is it that policymakers understand the importance of investment in big data?

Mutuku: National Statistics Offices (NSOs) should be at the core of the big data conversation in the context of development. NSOs, as the official sources of government data for resource planning, require increased investments and capacity to develop alternative and faster methods of collecting and analyzing demographic and economic data. Arguments for governments to embrace big data and open data have been towards the reduction and identification of corruption. This, however, is not a strong motivation for political will. Moving towards evidence-based governance is more likely to win political buy-in at the government level and in public institutions. Initiatives such as the African Data Consensus provide a roadmap for policymakers in investing in big data.

Marwala: It is essential that policymakers start to believe in big data. Policy should be evidence-based. Today the evidence is hidden in huge

PROFILES

Leonida Mutuku is a technology researcher, data scientist, entrepreneur, and investor. She is the co-founder and CEO at Intelipro, Kenya, a consultancy that builds data products and analytical tools for financial and retail organizations. She has done research on open data and big data in developing countries. She led the Research and Data Science teams at iHub Research in Keyna (2011-2015), guiding a team in groundbreaking research on the role of open data in increasing access to information, and the potential for technologies and big data to improve governance and urban resilience. Mutuku is one of the three panelists who will discuss big data at the TWAS roundtable during Trieste Next 2016, an international science festival that runs 23-27 September in Trieste, Italy.

Tshilidzi Marwala, elected to TWAS in 2010, is currently the deputy vice chancellor in research, innovation, postgraduate studies and the library at the University of Johannesburg. He was the executive dean of the faculty of engineering and the built environment at the University of Johannesburg. He is a member of the ICT Advisory Council of the South African government. Marwala was the TWAS representative in Science International working group that prepared the "Open Data in a Big Data World" accord urging global endorsement of principles and policies for open access to big data.

databases in the Internet. Without big data, such knowledge will remain hidden from policymakers and this can only limit their effectiveness. For example, power stations can only work better when machines help human beings in making better decisions, and these machines use big data. Big data enables countries to anticipate interstate conflict and help them make decisions in the presence of missing information.

What is the interest of developed countries to help developing countries acquire the capacity to use big data?

Mutuku: Developed countries are large aid donors to developing countries. Big data use in poor countries helps them move towards self-sustainability and less reliance on donor funding through proper planning and use of resources at their disposal. Secondly, with improved economic conditions for developing countries as a result of big data use, new markets or opportunities for trade partnerships open up. The concern is that developed countries are pushing developing countries to collect better data for self-serving purposes.

Marwala: New markets are essential for developed countries. Unlocking the economic activities of developing countries makes business sense for developed countries.

Is there a role for science diplomacy in helping to build global big data capacity?

Mutuku: Science diplomacy offers very useful collaborations towards not only building big data capacity but also achieving breakthroughs in solving global challenges. It should be used as an augmentation to help developing countries achieve their own priorities and not as just another opportunity to receive donor funding.

Marwala: Absolutely. Until an average person on the street knows about big data and its economic, political and social implications, then a great potential in countries will remain unrealized. Science diplomacy means we should educate the average person to understand science and technology and, in this particular case, big data.

Choose one of the 17 UN Sustainable Development Goals and explain why big data will help developing countries to achieve the goal by 2030.

Mutuku: Take for instance goal No. 2: No hunger. There is no reason why countries cannot feed their own populations, as hunger is a result of mismanagement of resources and poor planning. Big data offer opportunities that can be used to drive the achievement of the SDGs, like:

1. Commodity exchanges and pricing: Local farmers can use big data analytics to lock down great pricing of their crop at an early stage.
2. Precision agriculture: Use of big data and predictive analytics can enable farms to accurately manage and optimize resources, ensuring no wastage and high yields at optimal costs.
3. Insurance: Big data enables accurate prediction and planning for droughts and floods to reduce famine. Similarly, insurance companies are able to create packages to compensate poor farmers for reduced yields due to weather fluctuations.

Marwala: Let's take goal No. 3: good health and well being. Much of the information that people require to lead a good life lies buried in the Internet. Today, especially in Africa, there has been a growth in mobile telephone use. If these devices can be used to disseminate information on health, then life expectancies can be increased. If it can be used to give doctors in rural areas access to relevant information, then delivery of medical services will be increased. ◘

MURENZI NAMED TO KEY UNESCO POST

by **Edward W. Lempinen**

TWAS's executive director will be leaving to take a policy post in Paris. Founding Executive Director Mohamed Hassan will return temporarily to his former role.

After five years as TWAS's executive director, Romain Murenzi has been appointed by UNESCO Director General Irina Bokova as director of the Division of Science Policy and Capacity Building in UNESCO's Natural Sciences Sector. Murenzi, a physicist born in Rwanda, will be based in Paris.

Mohamed H.A. Hassan, the academy's founding executive director, will fill the TWAS post on an interim basis beginning 1 July 2016.

Murenzi led TWAS in a period of significant growth and evolution. During his tenure, core PhD and postdoctoral fellowship programmes grew significantly. TWAS built a new initiative in science diplomacy, and its communications initiatives dramatically increased the Academy's global audience. He has been a prominent voice for science policy in the developing world, speaking frequently before high-level bodies of the United Nations and other organisations.

Murenzi previoiusly served from 2001 to 2009 as a minister in the government of Rwanda, overseeing science, education and technology. He "will bring a wealth of experience and knowledge to the position," said Flavia Schlegel, UNESCO's assistant director general for the natural sciences. He "is expected to take... the programmes of the Division forward in the context of the 2030 Sustainable Development Goals."

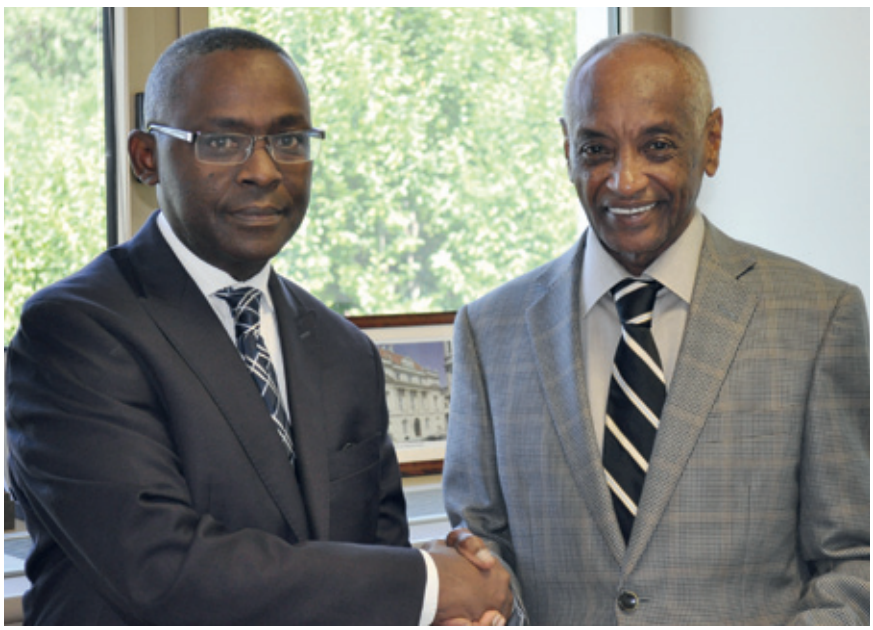
"I want to thank Romain for the excellent work done with TWAS," said Academy President Bai Chunli.

Said Murenzi: "I have been privileged to work with some remarkably committed people – the TWAS Council and staff, and our many global partners – to build science for the developing world.... I am confident that many of us will continue to work together toward the goal that we all share: using science and engineering to support sustainable development and better lives for people everywhere."

Hassan was a Sudanese mathematician when he met TWAS Founder Abdus Salam. As the Academy's first executive director, he was a close adviser to Salam and other elite scientists who sought to harness scientific innovation to advance the strength of developing nations. After Salam's death in 1996, he used his experience and diplomatic skill to help build global networks with far-reaching impact.

Hassan retired as executive director in 2011, but took the post of TWAS treasurer. He currently serves as president of the InterAcademy Partnership and of the Sudanese National Academy of Sciences.

UN Secretary-General Ban Ki-moon has named Hassan chair of the Governing Council of the new Technology Bank for Least-Developed Countries. The bank, said Hassan, is "an innovative and very promising tool for scientists, innovators and entrepreneurs, and it will have a central place in the innovation ecosystem of many developing countries." ◘



▼ TWAS Executive Director Romain Murenzi (left) met with Mohamed Hassan before his move to UNESCO headquarters in Paris.

SCIENCE ADVICE: "A MATTER OF URGENCY"

In an era of complex, high-priority challenges, scientists can provide valuable advice to policymakers. At the IAP Conference and a parallel workshop in South Africa, science leaders explored the best approach.

by **Edward W. Lempinen**

On issues ranging from Ebola and energy to climate change, natural disasters and synthetic biology, scientific expertise is essential for effective government policy. But providing that advice is not as simple as it seems. Science and policy are two different cultures, with different values and different languages. Scientists often don't know how best to communicate with policymakers, and policymakers might not understand science. Sometimes, they don't want to hear from scientists at all.

But when the issues are urgent, when lives are at stake, scientists must find a way to connect. During four days of discussion and exercises at the Conference of the InterAcademy Partnership (IAP) and a related training workshop, some of the world's leading figures in the field of scientific advice explored how to bring these cultures together.

"Science is no longer in an ivory tower," said Sir Peter Gluckman, chief science adviser to the prime minister of New Zealand. "But that raises a question about how scientists relate to society and to governments.... The way science engages with both society and the policy process, and the way these both engage with science, will shape our progress as nations and as a global society."

Throughout the two events, the lesson was clear: There's a time and place for scientists to be "issue advocates" who press for specific policies or new funding. But when policymakers ask for scientific expertise, researchers should be "honest brokers" who provide reliable information and insight. It's crucial to build trust with policymakers – and that requires a measure of humility.

▲ Sergio Pastrana, foreign secretary and executive director, Cuban Academy of Sciences, speaks during the IAP Conference. Behind him, IAP co-chairs Mohamed Hassan and Volker ter Meulen (right) listen.

Gluckman is chair of the International Network for Government Science Advice (INGSA), which organised the training workshop with the Academy of Science of South Africa (ASSAf). Support also came from South Africa's Department of Science and Technology; the New Zealand Ministry of Foreign Affairs and Trade; the Wellcome Trust; and the Royal Society.

Focused on science advice for African

Learn more:
www.twas.org/node/11681/

governments, the workshop on 26-27 February brought together some 40 participants from 12 nations for high-level presentations and high-intensity exercises. Discussions ranged beyond the conventional issues of policy advice to explore the importance of gender balance, social science and communication.

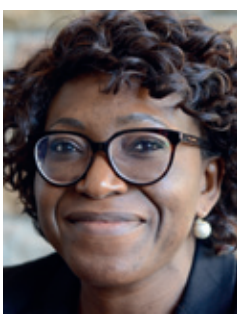
But the core focus was on science advice for Africa. Thiambi Netshiluvhi, director of policy analysis and advice at South Africa's National Advisory Council on Innovation, cited a 2013 study to explain the need for more robust advice in science, technology and innovation (STI).

"The overall findings suggest that Africa in general has inadequate capacity for STI policy analysis and formulation," Netshiluvhi wrote in a paper prepared for the workshop. "In order for our STI policies to be credible, Africa must work hard to ensure the capacity in policy analysis and formulation is obtained or enhanced as a matter of urgency."

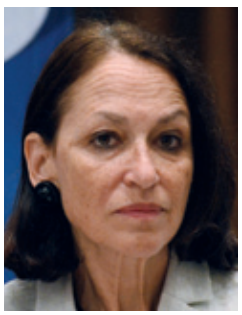
The IAP Conference on "Science Advice", held 28 February-1 March and also hosted by ASSAf, affirmed the need to strengthen scientist-policymaker links.

"Science advice is acknowledged as an area of science capacity development that has the potential to make a significant contribution to developing research and innovation in Africa," said Naledi Pandor, South Africa's minister of science and technology, in her opening remarks.

Nearly 80 academies of science and medicine were represented at the event, making it the largest-ever gathering of science academies, according to IAP co-chair Mohamed Hassan of Sudan. Among the speakers were Flavia Schlegel, UNESCO assistant director-general for natural sciences; Margaret Hamburg, former commissioner of the U.S. Food and Drug Administration; Jos van der Meer, president of the European Academies Science Advisory Council; Daya Reddy, president of ASSAf; and former or current top officials from the science academies of Australia, Benin, Germany and the Global Young Academy.



◀ From left: Jacqueline McGlade, Karine Ndjoko Ioset



▲ From top: Peter Gluckman, Flavia Schlegel, Margaret Hamburg

Discussions focused on the ecosystem for science advice and the degree to which countries are ready to incorporate science advice into policymaking; other sessions were more focused, assessing advice during natural disasters and for the emerging field of synthetic biology.

The need for effective communication to connect scientists and policymakers was a central theme – and initiatives undertaken by the United Nations Environment Programme (UNEP) are remarkable for their ambition. UNEP Chief Scientist Jacqueline McGlade described efforts to collect vast amounts of data and to make it available, using the latest technology, to policymakers. Such data will be crucial to achieve the UN Sustainable Development Goals, McGlade said.

For many participants, the INGSA workshop and the IAP Conference were important steps for building the culture of science advice. Among them was Karine Ndjoko Ioset, a professor at the University of Lubumbashi in the Democratic Republic of the Congo and general manager of the Excellence Scholarship Program BEBUC at the University of Würzburg in Germany.

> "As scientists, we have to be modest...and really also work to build trust." *Karine Ndjoko Ioset*

"As a scientist," she said, "I know we have to balance our knowledge with the challenges the politicians are facing. There is always criticism from African scientists about politics, but we are not doing politics, we are doing science. As scientists, we have to be modest...and really also work to build trust.

"We want to change things, and we can do it together." ◘

SPEAKING WITH A COMMON VOICE

A trio of global inter-academy networks join to form the InterAcademy Partnership.

Three global networks of science and medical academies with close ties to TWAS have merged to do their work under a single umbrella organisation: the InterAcademy Partnership.

The new body includes three networks that have long worked in close collaboration: IAP – the global network of science academies; the InterAcademy Medical Panel (IAMP); and the InterAcademy Council (IAC). The new IAP will permit the three inter-academy networks to speak with one voice and thus have a greater impact on global issues of common interest.

Academies are typically independent, merit-based national institutions, with members selected from among a country's leading scientific, medical and engineering minds. The InterAcademy Partnership, representing more than 130 academies, harnesses the power, authority and credibility of its member academies.

"Our three inter-academy networks – IAP, IAC and IAMP – already have an accomplished track record of building the capacity of new and young academies, especially in developing countries, of providing syntheses and reports to national and international governance structures on scientific issues, and issuing statements that highlight critical areas for action with recommendations to policymakers," says Mohamed Hassan, co-chair of IAP and one of the two presidents of the new body.

IAP and IAMP both have a long relationship with TWAS, which hosts their offices in Trieste, Italy, and cooperates with them on many initiatives. The new InterAcademy Partnership will focus on providing evidence-based advice and perspectives on global issues, building a scientifically literate global citizenry, strengthening global scientific enterprise and strengthening the global network of academies.

For the time being, each of the three participating organizations will retain its autonomy with regard to governance and projects. However, there will be greater coordination among the co-chairs of the three networks and the secretariats.

In addition, coordinated branding will ensure greater visibility and impact with target audiences such as governments and international organizations.

- IAP will become 'IAP for Science'
- IAMP will become 'IAP for Health'
- IAC will become 'IAP for Research'.

"New research and the application of science are vital if we are to achieve the United Nations' Sustainable Development Goals (SDGs) and when dealing with global challenges such as food security and climate change," says Robbert Dijkgraaf, co-chair of IAP for Research and the second InterAcademy Partnership President. "By working together more cohesively under this new umbrella organization, we are able to bring both regional and global perspectives into the discussions and ensure that the voice of the scientific community is heard loud and clear." ◘

▼ From left: Mohamed Hassan, Robbert Dijkgraaf

◀ Aziz Sancar, 2015 Nobel laureate in chemistry

AZIZ SANCAR WINS NOBEL PRIZE

by **Edward W. Lempinen**

The Turkish-born scientist, elected to TWAS in 1994, shares the 2015 Nobel Prize in chemistry for research into DNA repair.

Aziz Sancar, a Turkish-born chemist elected to TWAS in 1994, is one of three scientists named to share the 2015 Nobel Prize in chemistry "for mechanistic studies of gene repair". He is the seventh TWAS Fellow to win the world's highest honour for discoveries in chemistry.

Sancar's research has focused on how DNA can repair itself. He discovered enzymes which can recognize mutations caused by ultraviolet radiation and then cut the DNA to remove the damaged genetic code. His initial discoveries at Yale University in the United States focused on *E. coli* bacteria; more recently, at the University of North Carolina in the United States, he detailed the workings of this DNA repair in humans.

Sancar is the first native of Turkey to win a Nobel Prize in science. "I am of course honoured to get this recognition for all the work I've done over the years," he said in an interview released by the Nobel organization. "But I'm also proud for my family and for my native country and my adopted country, and especially for Turkey it's quite important."

"Aziz Sancar is a researcher of rare accomplishment and impact, and he is also a dedicated teacher who is committed to the global advance of science," said TWAS Executive Director Romain Murenzi. "We are extremely proud that he is a member of TWAS, and we offer him heartfelt congratulations."

Sharing the prize with Sancar are two other chemists who have made pioneering discoveries in gene repair: Swedish native Tomas Lindahl of the Francis Crick Institute and Clare Hall Laboratory in Hertfordshire, UK, and American Paul Modrich of the Howard Hughes Medical Institute and Duke University School of Medicine in North Carolina.

"Systematic work" by the three researchers "has made a decisive contribution to the understanding of how the living cell functions, as well as providing knowledge about the molecular causes of several hereditary diseases and about mechanisms behind both cancer development and aging," the Royal Swedish Academy of Sciences said in announcing the prizes.

Sancar, 69, was born in Savur, a small town in southeastern Turkey. He was the seventh of eight children. "My parents were both illiterate," he said in a 2005 profile published in the *Proceedings of the National Academy of Sciences* (USA), "but they valued the importance of education and did their best to ensure that all of their children would receive some education."

He received his M.D. in 1969 from the Istanbul Medical School in Turkey. At the University of Texas at Dallas, he studied molecular biology, receiving a master's degree in 1975 and a PhD in 1977.

TWAS now counts 16 Nobel laureates among its over 1,170 members. ◘

Gisela Isten and Sean Treacy contributed to this report.

Learn more: www.bit.do/SancarNobel

FIVE WOMEN NAMED ELSEVIER WINNERS

Early-career life scientists from Indonesia, Nepal, Peru, Uganda and Yemen were honoured with the 2016 Elsevier Foundation awards – supported by OWSD and TWAS – for work in health and nutrition.

by **Sean Treacy**

▲ The winners of the 2016 Elsevier Award, from left: Sri Fatmawati of Indonesia, Etheldreda Nakimuli-Mpungu of Uganda, Ghanya Al-Naqeb of Yemen, Magaly Blas of Peru, and Sushila Maharjan of Nepal. (Photo: Elsevier Foundation)

Five researchers have been named winners of the 2016 Elsevier Foundation Awards for Early Career Women Scientists in the Developing World, in recognition of research that has strong potential health and economic benefits.

The winning scholars from Indonesia, Nepal, Peru, Uganda and Yemen were honoured for their accomplishments in nutrition, psychiatry, biotechnology, women's health, bioenvironmental sciences and epidemiology. They were also celebrated for mentoring young women scientists who are pursuing careers in agriculture, biology and medicine in their respective countries.

The Elsevier Foundation awards are given in partnership with the Organization for Women in Science for the Developing World (OWSD) and TWAS. The women received their awards on 13 February at the American Association for the Advancement of Science (AAAS) Annual Meeting in Washington, D.C.

The 2016 winners are:

- **Etheldreda Nakimuli-Mpungu**, of Makerere University in Kampala, Uganda, for her work using psychotherapy to treat depression and alcoholism in Ugandans with HIV.
  Depression is a serious problem for HIV patients throughout Sub-Saharan Africa, making it more likely that those patients will stop taking their HIV-antiretroviral medications. Nakimuli-Mpungu is working with service providers to integrate depression screening with HIV-treatment, as well as to include local communities in discussions of depression to help destigmatize the illness.
- **Sri Fatmawati**, of Kampus ITS in Sukolilo, Indonesia, for her work analysing the medical and pharmaceutical potential of plant and fungi extracts normally used in herbal medicine.
  Fatmawati has also received the prestigious International L'Oréal-UNESCO for Women in Science Fellowship for research analysing substances from sponges that may lead to treatments for malaria, cancer and Alzheimer's disease.
- **Sushila Maharjan**, of the Research Institute for Bioscience and Biotechnology (RIBB) in Nepal, for her work using soil microbes to develop medically useful chemicals.
  Microbes create a great number of the materials used in medicine, including antibiotics. Maharjan is currently researching bacterial strains from the high-altitude regions of Nepal to identify substances useful for development of new antibiotics, as well as other medically useful compounds.

- **Magaly Blas**, of Cayetano Heredia Peruvian University in Peru, for her work using information and communication technology to solve health problems, particularly sexually transmitted diseases in urban and rural Peru. Blas also leads the Mama River Programme, training community members to use smartphones to collect basic information from pregnant women and forward this information to a medical ship to schedule visits.
- **Ghanya Al-Naqeb** of the Faculty of Agriculture, Sana'a University in Yemen, for research using chemicals isolated from Yemeni herbal plants for disease prevention. For example, a major focus of Al-Naqeb's work has been black cumin seeds, which are commonly used as a spice in Yemen, other Middle Eastern countries and India. Her research on these seeds has focused on their effects in protecting the heart from cardiovascular diseases.

The 2016 Elsevier Foundation awards competition focused on biological sciences (agriculture, biology and medicine) and a panel of eminent scientists selected each winner based on her achievements. The prize includes USD5,000 and all-expenses-paid attendance at the 2016 AAAS Annual Meeting.

For more information: www.twas.org/node/11560/

To find a video about the winners: www.bit.do/Els2016

This recognition gives the winners improved visibility and helps them to build extended international professional networks. The winners, in turn, serve as an inspiration for women and girls at home and in other countries.

"The determination, commitment and enthusiasm of these five women is an inspiration to us all, but especially to other women undertaking scientific research in developing countries," said Fang Xin, president of OWSD. "This award celebrates their excellent science and demonstrates that their hard work has had an impact both regionally and internationally, despite the difficult local conditions."

"These are exemplary researchers, and their work has enormous potential to improve people's health and support stronger communities," said TWAS Executive Director Romain Murenzi. "Their work will be widely appreciated for the benefits it can bring to developing countries. Just as important, they will serve as models and as inspiration for young scientists – women and men – of a new generation."

> "We hope that our awards help shine a light on these emerging women leaders and the important work they are doing in their fields."
>
> *David Ruth, executive director, Elsevier Foundation*

David Ruth, executive director of the Elsevier Foundation, said, "Over the past five years, we've evolved these awards together with OWSD and TWAS and each year we learn more about the incredible challenges faced by women researchers doing science in low-resource settings. We hope that our awards help shine a light on these emerging women leaders and the important work they are doing in their fields — and what better place to do this than at the AAAS conference where the latest science, issues and leaders come together each year." ◘

SCIENCE AND DIPLOMACY FOR THE HIMALAYAS

by **Sean Treacy**

ICIMOD – the International Centre for Integrated Mountain Development – is a model for high-impact science cooperation and the focus of a new TWAS monograph.

Landscapes are not bound by national borders, and the Himalayas are a colossal landscape that stretches almost the full breadth of Asia, from the world's highest peaks to sprawling cities, fertile plains, jungles and river deltas. In order for researchers to understand the mountains' vast influence, many countries had to come together in the interest of strong science and mutual prosperity.

The result was the International Centre for Integrated Mountain Development, or ICIMOD, based in Kathmandu, Nepal. Founded in 1983, the centre is the combined creation of eight countries in the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan.

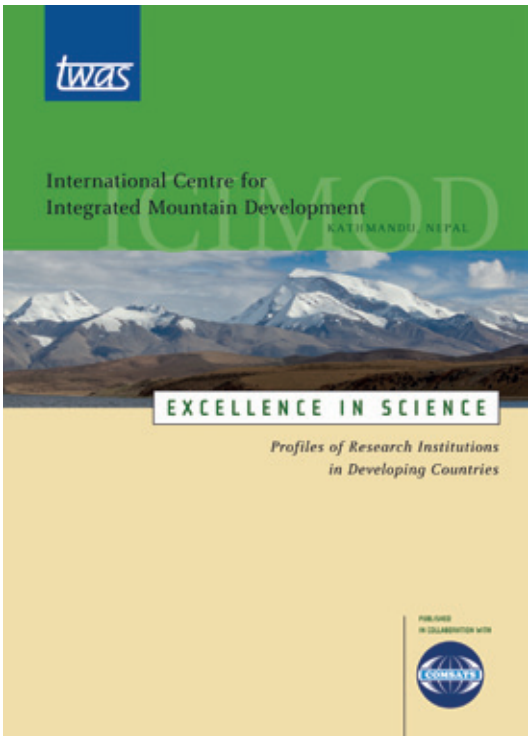
ICIMOD's far-reaching impact is captured in a new TWAS monograph – the latest in the Excellence in Science series. Published with support from COMSATS, the Commission on Science and Technology for Sustainable Development in the South, it is the 13th book in a series that debuted in 2007. It explores ICIMOD's history, work and challenges, from efforts to help nations address flooding and climate change to providing essential help in response to 2015's devastating earthquake in Nepal. The book was written by journalist Giovanni Ortolani of Trieste, Italy, with images by Italian photographer Paola di Bella.

ICIMOD represents the power of international collaboration and science diplomacy to build extensive, detailed knowledge of the mountains, valleys and rivers of an important but sensitive environmental system.

"We picture ourselves as spanning a gap between people who are producing basic science, like universities, and people who need that information, like practitioners and policymakers," says ICIMOD Director General David James Molden.

"ICIMOD takes a holistic view of science," says Bai Chunli, president of TWAS and the Chinese Academy of Sciences (CAS), in the book's foreword. "It understands that knowledge about the atmosphere and the Earth's tectonic plates – and everything in between – can help to support the health and sustainable prosperity of human communities."

ICIMOD also organizes numerous regional programmes that include three countries or more. For instance, it has a mentorship programme that allows researchers from the region to meet twice a year to deepen their knowledge about this landscape and develop solutions for sustainable ecosystem management.



▲ TWAS's new monograph on ICIMOD, the International Centre for Integrated Mountain Development.

The book also explores how ICIMOD strengthens international cooperation through research. For example, Molden says in the book, areas such as water management are politically more difficult to discuss than others, yet ICIMOD still works to engage different nations on these sensitive issues. ■

To request a copy of the book without cost, please email info@twas.org

View a multimedia production on ICIMOD: www.bit.do/ICIMODslideshow

PEOPLE, PLACES & EVENTS

NYOKONG WINS AU SCIENCE AWARD

Tebello Nyokong, a South African scientist elected to TWAS in 2009, was awarded the African Union Kwame Nkrumah Scientific Award in January 2016.

Nyokong is a distinguished professor of chemistry at Rhodes University, South Africa, and director of South Africa's Nanotechnology and Innovation Centre.

The Kwame Nkrumah award is given annually to African researchers for outstanding results in science, technology and innovation.

Born in Lesotho, Nyokong obtained her PhD from the University of Western Ontario in Canada before returning to South Africa. She received the 2013 TWAS Medal for her research on using light in the development of drugs for cancer treatment. She also won the 2009 L'Oréal-UNESCO Award for Women in Science for her studies on cancer therapy and for environmental clean-up.

She has been named by IT News Africa as one of the continent's ten most influential women in science and technology.

KARACHI UNIVERSITY HONOURS VOELTER

For the first time in its history, Karachi University (KU) in Pakistan has named one of its buildings after a Western scientist – **Wolfgang Voelter** of Germany – for his contributions to Pakistani science.

Voelter, elected to TWAS in 1995, is a medical doctor and a chemist. He paid his first visit to KU in 1974, looking for collaboration. That visit impressed him so deeply that he decided to move to Pakistan, and then worked with the German government and the German Technical Cooperation Agency to obtain grants that were used to buy sophisticated equipment.

The Wolfgang Voelter Laboratories Complex is a three-story building fully operational on applied chemical science, textile chemistry, nanochemistry and other important disciplines.

A ceremony was held on 11 February at KU, attended by the German ambassador. Atta-ur-Rahman, a 1985 TWAS Fellow, gave an inspiring speech to remember Voelter's commitment and contributions. Among Voelter's numerous honours, there are two Pakistani civil awards: Hilal-i-Pakistan and Sitara-i-Pakistan.

SHUKLA JOINS CLIMATE PANEL

Jagadish Shukla, elected to TWAS in 1995, has been appointed to the Prime Minister's Council on Climate Change (PMCCC) for India.

Shukla is an Indian meteorologist and distinguished professor at George Mason University in the United States.

In his new post, effective September 2015, he will advise his country on scientific issues that lay behind climate change. He was among the distinguished attendees in the United Nation's Conference on Climate Change in Paris last fall.

Shukla received his PhD in geophysics from Banaras Hindu University in 1971, and his ScD in meteorology from the Massachusetts Institute of Technology (USA) in 1976. He has investigated climate dynamics, atmosphere-ocean interactions and long-range weather forecasting.

He is the founder of Gandhi College for the education of rural women in his native village, Ballia, Uttar Pradesh, India.

BARRERA RAMÍREZ RECEIVES COLOMBIAN AWARD

John F. Barrera Ramírez, a 2014-18 TWAS Young Affiliate, has received the 2015 National Award of Scientific Merit from the Colombian Association for the Advancement of Science, in the category "Excellence in Research".

Ramírez is an associate professor in the physics institute, University of Antioquia, Medellín (Colombia), and the coordinator of the optics and photonics group. He is among 30 leading scientists in South America conducting research on optics. His work has led to novel and simple applications for protecting information with optical processors.

He is the recipient of fellowships from TWAS, The Abdus Salam International Centre for Theoretical Physics (ICTP) and of the 2014 Gallieno Denardo Award bestowed by ICTP and the International Commission for Optics.

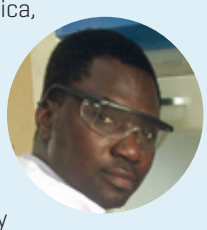
TWAS AFFILIATES SELECTED FOR AFRICAN PROGRAMME

Adewale Adewuyi from Redeemers University in Nigeria and **Fawzi**

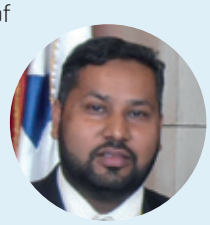
PEOPLE, PLACES & EVENTS

Mahomoodally from the University of Mauritius, both TWAS Young Affiliates, are among 22 outstanding scientists selected as new fellows in the Africa Science Leadership Programme (ASLP).

Adewuyi is a TWAS Young Affiliate (2014-18) from the Regional Office for Sub-Saharan Africa, and the recipient of the 2014 African Union-TWAS Young Scientist National Award in basic sciences, technology and innovation. He earned his PhD in industrial chemistry (2011) from the University of Ibadan, Nigeria, then received fellowships to work in Padova, Italy, and Dresden, Germany. His research is focused on industrial applications of underutilized seeds and seed oils in Nigeria.



Mahomoodally, a TWAS Young Affiliate (2012-16), is a full-time senior academic at the University of Mauritius since 2009 and currently the head of the department of Health Sciences. As a biochemist, he has worked on new methods to document and assess the pharmacological and nutritional properties of Mauritian medicinal herbs and food plants. He has authored 122 full publications and 40 abstracts in international and national conferences. Today he is the principal investigator and co-principal investigator of four regional and international research grants and consortia. He is also active on public-social themes, and gives public lectures on phytotherapy, herb-drug interaction and risk factors and prevention of diabetes.



ASLP, funded by the Robert Bosch Foundation, is jointly run by the University of Pretoria and the Global Young Academy. Its goal is to help young African researchers establish collaborations and partnerships at the international level, developing projects that address regional problems. Membership in the Global Young Academy is comprised of early-career researchers who have done distinguished work. It has members from 58 countries on six continents.

OBITUARY: ABBAS SHAFIEE

Abbas Shafiee, an Iranian physicist and 1995 TWAS Fellow, passed away 15 June 2016 in Tehran. Shafiee was an active member of TWAS, and the head of the Pharmacology Research Center at Tehran University of Medical Sciences.

He was a permanent member of the Iranian Academy of Medical Sciences (1990) and of the Iranian Academy of Science (1991). He earned his master's degree from Columbia University's College of Pharmaceutical Sciences (US) in 1965, and his PhD in pharmaceutical chemistry from the same institution in 1968. His scientific interests covered studies on calcium channel blockers as well as anti-inflammatory and anticancer drugs.

OBITUARY: GIUSEPPE FURLAN

Giuseppe Furlan, an Italian professor of theoretical physics elected to TWAS in 2000, passed away on 18 July 2016. Furlan's research contributions were in the field of theoretical elementary particle physics and quantum field theory. With colleague Sergio Fubini, he developed a famous approach to the algebra of currents and symmetry breaking, which is now known as the Fubini-Furlan method.

He began his collaboration with the Abdus Salam International Centre for Theoretical Physics (ICTP) as a supervisor in the field of elementary particle physics. Then he became the coordinator of ICTP's activities in environmental physics and in 1983 founded the programme TRIL - Training Research in Italian Laboratories, aimed at promoting the participation of scientists from developing countries to experimental research.

From 1968, Furlan served as theoretical professor at Trieste University.

He built a vast network of international collaborations, working at CERN in Geneva and serving as a visiting professor at Stony Brook, Princeton, Stanford and MIT in the United States. He has authored two books and more than 90 scientific papers.

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- Respond to the needs of young scientists in countries that are lagging in science and technology;
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- Encourage scientific and engineering research and sharing of experiences in solving major problems facing developing countries.

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TWAS hosts and works in association with two allied organizations on the ICTP campus:

The Organization for Women in Science for the Developing World (OWSD). At its founding in 1989, OWSD was the first international forum uniting women scientists from the developing and developed worlds. Today, OWSD has nearly 4,800 members. Their objective is to strengthen the role of women in the development process and promote their representation in scientific and technological leadership.

The InterAcademy Partnership (IAP) brings together three renowned global networks of academies of science and medicine, representing some 130 academies worldwide. Two of these networks, 'IAP for Science' [formerly IAP - the global network of science academies] and 'IAP for Health' [formerly the InterAcademy Medical Panel] are hosted by TWAS in Trieste. IAP provides high-quality independent information and advice on science, health and development to national and international policymakers and the public; supports programmes on scientific capacity-building, education and communication; leads efforts to expand international science cooperation; and promotes the involvement of women and young scientists in all its activities.

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