

SPECIAL REPORT: SCIENCE & AFRICA

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REASONS

A message to the G8 summit

When the G8 leaders meet in Scotland next week to discuss how to help Africa's poorest nations, they are unlikely to hear the chants of the protestors — an 8-kilometre fence around their luxury hotel will see to that. But the activists have, to some extent, already been listened to: a debt-relief package has been signed by the group of eight industrialized countries and a hike in aid is also on the cards. But when it comes to spending this extra money, one question is whether the voices of Africa's scientists will be heeded.

On the following three pages, *Nature* presents those voices. They need to be heard, as science and technology are more of a priority for aid agencies than ever before. African universities, for example, are the subject of a new focus by the World Bank. Africa's leaders have also singled out science and technology in their continent-wide political strategy — the New Partnership for Africa's Development (NEPAD).

The comments that follow make for challenging reading. Every area seems to require immediate attention, from disease and climate change to a lack of access to education and sanitation. But themes emerge nonetheless. Solutions must factor in the needs of local communities and environments. Projects should be run as far as possible by Africans, not the donors. And Africa needs long-term backing from rich nations, not an uncertain future in which aid waxes and wanes. If science and technology projects are to help shape Africa, these are the strategies that should shape them.

Interviews by Peter Aldhous, Declan Butler, Jim Giles, Michael Hopkin, Mark Peplow and Quirin Schiermeier



SOUTH AFRICA

John Mugabe

Adviser on science and technology to NEPAD, based in Pretoria. Helped to establish the partnership's African Forum on Science and Technology for Development (AFSTD).

I spend most of my time working with governments and donors to ensure that scientific knowledge is incorporated into African skill sets, policies and strategies. We need more capacity for African countries to apply science to their problems, focusing on health, water, agriculture and the environment, and to generally increase economic competitiveness.

A big part of this will be technological innovation. You can never say when you have 'enough' technologies. There are many technologies available to manage water supply, for example, but few to improve water quality.

The hope of every country in the world is to have more scientists. But for us in Africa it is difficult. There is not just the task of training more scientists, we also need to create solid institutions and ensure that our scientists have specific, well-resourced projects to work on.

Debt relief will help, but developed countries need to ensure that the money is going to benefit productivity in Africa. Knowledge needs to be shared better between developed countries and Africa, to enable African countries to improve their technologies.

But in the short term, we want to see a commitment from the G8 to put together an African science fund that would be available to countries on a fairly flexible basis to address their problems — not necessarily without certain minimum conditions. That will be a better way for African scientists to get the relatively small amounts of money they need to work on projects that will benefit Africa.

KENYA

Kevin Marsh

Epidemiologist and director of the Wellcome Research Programme at the Kenya Medical Research Institute, Kilifi.

Despite receiving 30 years' worth of aid to develop medical science, Africa simply hasn't managed to build up a high-quality research network. Outside South Africa, there are probably fewer than a dozen health researchers with a high international profile, actively driving big, imaginative programmes that draw in substantial funding and scientific interest from around the world.

Nothing will change until research initiatives start coming from within African research centres. Without an established career structure, it is hard to get that critical mass of expertise.

Because there is no research culture at many African universities, people do not see science as an attractive option. And once trained, the best African scientists are often attracted abroad. If you want good scientists in Africa, you need to pay them.

A continent-wide group is putting together a detailed plan for developing medical science in Africa. We hope to discuss these proposals with the UK government in the next few weeks.

We need to develop training programmes and set up collaborative research links across Africa and abroad, rooted in African health problems. We can start by focusing on the African research centres that are already doing world-class research. We need to turn them into engines for training home-grown PhDs and postdocs, and they can also play a critical role as the nodes of an African research network.

The G8 nations should act on the Commission for Africa report drawn up in March, committing up to US\$3 billion over 10 years for African centres of excellence in science and technology. Of that funding, US\$900 million should go towards developing a vibrant research network that links these centres.

RWANDA

Romain Murenzi

Rwandan minister of education, science, technology and scientific research. Previously a professor of theoretical physics at Clark Atlanta University in the United States.

Ten years after its gruesome civil war, Rwanda is still widely associated with the second-worst genocide of the twentieth century: the conflict

between the Hutus and the Tutsis that killed 800,000 people in just 100 days. Less widely known are Rwanda's serious attempts to promote science, technology and education as a means to combat poverty, backwardness and conflict.

Since the war, the number of people being trained in Rwanda to degree level in

science has increased eightfold. And 25,000 students are enrolled at the National University of Rwanda and other higher-education institutes. By 2020, we hope that about 100,000 Rwandans — around 1% of the rapidly rising population — will have a higher academic



GHANA

Fred Binka

Head of epidemiology at the School of Public Health, University of Ghana, and executive director of the INDEPTH pan-African network of field epidemiological centres.

If the G8 summit is really to improve the lot of Africa, it must make a big commitment to controlling infectious diseases, particularly the three big killers: AIDS, malaria and tuberculosis. Without this, all other efforts to raise Africa out of poverty will be futile.

That is because, although it's accepted that poverty causes disease, it is too often overlooked that disease causes poverty. AIDS is destroying African economies and workforces, and malaria, my own field of work, is estimated to slow African economies by 1.3% a year — crippling the poorest households and workers.

Plans for debt relief, easing of trade barriers and new development funds will be good news for Africa. But these measures address just one side of the problem — poverty. If we do not also tackle health we will just continue in a vicious circle, where disease breeds poverty, which breeds disease.

“Without controlling infectious diseases, all other efforts to raise Africa out of poverty will be futile.”

The Commission for Africa report mentions health research, but it is vague. The fact is that malaria is right here to be controlled. The situation is getting better, and more money is flowing in. But even the Global Fund to fight AIDS, Tuberculosis and Malaria is still supporting fragmented efforts; it is not taking the bull by the horns.

What the G8 needs to advocate is much wider use of current intervention tools. We need to be putting 50 million bednets a year into Africa and we need to scale up drugs and

house-spraying to cover entire countries. Zambia recently pledged to do this and aims to cut mortality by 75% in three years. When I first heard this I was really excited — I'm not joking; if the G8 backs and helps fund that approach across the

continent, we will reduce the malaria burden dramatically.

To create major change we need African-led efforts, supported by the international community. I think the message is also getting through to the G8 that we need research, and that we cannot do this without scientists, trained and working in Africa. The G8 must make a strong commitment to building human capacity, and this must not be lip-service.

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SOUTH AFRICA

Mark Henning

Chair of South Africa's Sector Education and Training Authority.

Education is vital. All sorts of studies say that the best thing African countries can do is to have universal primary education, including bringing girls into schools. That should be a priority. It's always been assumed in Africa that if you get a university degree your future is secure, but if you don't, then life holds nothing. That's false. We need to find a balance between providing high-quality

"It's got to be the right education for the right people."

specialized education and uplifting the poorly educated majority.

The relationship between education and economic growth is complex. Economic success depends on many things other than education, and it has to be the right education for

the right people. Zimbabweans are well educated, for example, but the country's disastrous economic policies mean that people are starving.

Malaria and HIV/AIDS are huge problems too. Where you have family groups headed by ten-



year-old children, it has a profound effect on education. Financial support and development of drugs by the G8 can make a big difference.

Youth unemployment is a time bomb — well over 60% in South Africa. 'Trade not aid' is a critical slogan. The G8 needs to free up trade in a way that will let African nations stop relying on aid. With 60 undernourished children in a class it's hard to make progress. And don't forget the cancer of corruption — a lot of that is coming from G8 countries, whose entrepreneurs are buying favours. Fix these problems, and maybe educational reforms can deliver.

qualification. And attempts to interest Rwanda's young generation in science will start early. From next year, all the country's 2,200 primary schools will be equipped with 'science corners', displaying basic information about the Sun and the planets, the cycle of life, or a map of the world — plus a computer with an Internet connection.

Scientists and engineers will find plenty to tackle in Rwanda, from soil erosion to water management, health, biodiversity and ecosystem conservation. But one particular problem is that there are not enough science teachers, as many were denounced by their colleagues and killed during the civil war.

The horrible conflict was partly rooted in academic circles: some intellectuals sowed the ethnic hatred that led to the genocide. It is now crucial that Rwanda creates an education system that rewards merit, rather than ethnicity. Such a system can become a model for the reconciliation of Rwandan society.

To this end, an ambitious national science, technology and innovation project was launched at a conference in May, supported by science-policy experts from Australia, Britain, Sweden and the United States. It aims to give children and young people access to basic and higher education, to strengthen

"Rwanda must create an education system that rewards merit, rather than ethnicity."

human rights and peace education, and to eventually transform the country into a knowledge-based economy. The Rwandan government has requested US\$130 million from the African Development Bank for the programme. Additional support from the G8 countries is both necessary and very welcome.

MOZAMBIQUE

Pascoal Mocumbi

Prime minister of Mozambique from 1994 to February 2004. Now high representative of the European & Developing Countries Clinical Trials Partnership programme.

Decisions taken at the G8 summit will be important in building the strong science and technology base that Africa needs, particularly for developing the tools needed

to control disease. The major killers are causing devastation in Africa. In my own country, Mozambique, one in four children dies before the age of five, and malaria is the biggest cause.

What is lacking at the international level is an understanding of the importance of research and development, particularly within Africa, in the fight against disease.

Much can be done to fight malaria with existing tools. But we need more effective drugs, and we need a vaccine. We need research and clinical trials in Africa. On vaccines there is light at the end of the tunnel — the number of candidate vaccines is growing. But the G8 needs to push for a more coordinated effort. We need a new international malaria vaccine enterprise, drawing, for example, on the work of the Malaria Vaccine Technology Roadmap, a project in which I am involved.

The G8 must also address infrastructure, particularly for health research. Things are much better than they were ten years ago. African countries now have their own draft strategy for science and technology, drawn up by the AFSTD (established by NEPAD) to promote their economies and reduce poverty. The G8 must build on this to achieve sustained progress. Debt relief is an important decision, and African countries must plough some



of this money into science, technology and health, where it could make a big difference.

Education is a key plank: we need nothing less than a comprehensive system from primary school to higher education. Another is telecommunications. The Internet is already revolutionizing African research, but bandwidth remains too slow and expensive.

But most important, the G8 must urgently respond to the call from Africans for a flow of predictable funding to support NEPAD's strategy. We need to think at the country level; change will only come when the leadership of the country is in the driving seat. Take the UN Millennium goals to slash poverty and diseases. Unless these are tackled at the country level, we will simply continue to have more talks, more meetings, and little progress.

NIGERIA

Anthony Nyong

Expert on environmental resources and natural hazards at the University of Jos.

Poverty is a major cause of environmental degradation and causes people to live unsustainably. Take deforestation: people who cut down trees don't do it for fun: it is a bid to survive. Much of the rural population depends on wood as fuel for domestic energy and cooking.

Faced with the need to survive, people even have to encroach on protected forests and game reserves. It is unfair and impractical to think that force can prevent this. Africans need appropriate science and technology to develop cheap and affordable energy sources.

Climate change is likely to make matters worse: major international reports conclude that Africa is the most vulnerable continent. A first step towards reducing this vulnerability is to assess the potential impacts of climate change. But most African nations have neither the capacity nor the technical ability to do this. The few studies that do look at Africa have



largely been conducted by Western scientists. Africans need to build scientific capacity so that we can develop our own models, validated over Africa.

Africans also need science and technology to help adapt to predicted changes — to develop affordable, accessible and sustainable tools, such as early warning systems, drought-resistant crops, water-extracting and harvesting systems, and flood-protection.

It is time to stop the 'mercenary' form of development that has long been practised. Africa does not need food aid that continually impoverishes its own people. We need to enable farmers to grow their own food in the face of environmental challenges.

SOUTH AFRICA

Mike Jensen

Telecommunications consultant working with NEPAD and international agencies, and an expert on African Internet connectivity.

Improving Internet connections for research centres and hospitals in Africa would be one of the most cost-effective actions the G8 could take. It would empower African scientists and medical researchers by giving them high-speed access to the wealth of information and vast scientific databases available on the Web.

Although some African countries have high-speed Internet connections, Africa lags far behind the rest of the world. The root problem is that telecoms in Africa are national monopolies. High-speed Internet connections usually have to go through the national operator, and bandwidth costs 10 to 100 times more than in Europe or North America.

The G8 should encourage liberalization of these markets. Meanwhile, the international community should subsidize national research networks directly. The European Union has already connected North African countries to Europe's research network. And the provision of high-speed satellite links to malaria research centres has shown how the Internet can boost productivity and cooperation.

Research centres and networks need to band together to increase their bargaining power in negotiations over bandwidth costs. The G8 should support such initiatives, including NEPAD's plan to create a network of optical fibre cables across Africa. It should support the Indian government's project to fund a satellite for educational purposes for the African Union. And it could address the lack of computing infrastructure and human resources in scientific research centres.

But we have to start somewhere: the creation of Internet-connected research centres in universities and hospitals would be a good place.

KENYA

Florence Wambugu

CEO of A Harvest Biotech Foundation International, a Kenyan organization dedicated to promoting sustainable agriculture through the use of biotechnology.

We cannot develop Africa without biotechnology. Enormous numbers of people suffer from malnutrition in some regions, and this is where biotechnology has huge potential.

One example is NERICA (New Rice for Africa), a variety developed by the West Africa Rice Development Association in Bouaké, Ivory Coast. The rice was created by conventional breeding and combines high-yield Asian strains with drought-resistant African ones. It is a good example of the research and development we can do when there is partnership between scientists in Africa and abroad.

But we have to take a holistic approach — we also need to address other issues such as soil fertility, water management, human infrastructure and capacity development.

The problem is that there is a disconnect between high-level international research and the perspectives and priorities of African leaders. Most research here is donor-funded. There is an urgent need for African countries to fund their own research so that they have

a stake in the results. That way the results will be more relevant and can be linked to local communities.

Involving rural people is crucial. The poverty in Africa is in the villages. We need education and training for farmers so that they can make use of opportunities such as improved seed banks. That will empower them. You can't just give them an agricultural innovation and leave them to it. I believe in science and technology, but the way it is implemented is very important.

For example, genetically modified (GM) crops have a major role to play in Africa, especially in tackling problems such as pests, drought and malnutrition. To succeed, GM technology must be implemented in a way that gives Africans true ownership. Although there is room for many different players, including the private sector, researchers and agricultural organizations, greater emphasis should be placed on collaborations with countries outside Africa. When it comes to staple crops, the possibility of royalty-free technologies must also be explored.



SIERRA LEONE

Ogunlade Davidson

Professor of mechanical engineering and energy systems at the University of Sierra Leone in Freetown, and co-chair of Working Group III of the Intergovernmental Panel on Climate Change.

Development in Africa will need energy. A Latin-American household consumes 3.5 times more energy than a sub-Saharan one, and North Americans consume 22 times as much energy as we do. Almost 75% of energy in Africa is consumed by South Africa and six North African countries — the other 46 countries account for a mere quarter of consumption. Sub-Saharan countries will demand substantial amounts of extra energy in the next decades.

In theory, Africa has abundant energy resources — oil, gas, coal and hydropower, depending on the region — to meet the increased demand. But enough energy does not reach consumers, and the quality of refineries and fuel products is often poor. Two thirds of the gas obtained as a by-product of

oil production is wasted, because producers claim there is no demand for it. Here is a case for the G8 countries to put pressure on the big oil companies, because African governments are too weak to urge them to invest in new and more energy-efficient infrastructure and in power systems that use gas.

Climate change is also a key issue, because although Africa contributes least to greenhouse gas concentrations, it is most vulnerable to global warming. Malaria, sea-level rise, droughts and other impacts on rain-fed agriculture are some of the most difficult problems facing the continent. Rainfall has decreased substantially since 1900, which can partly be

"The G8 countries must put pressure on the big oil companies to invest in new and more energy-efficient infrastructure."

attributed to global warming. And air pollution from antiquated coal plants and cooking fires is a widespread problem in countries such as Zimbabwe and South Africa.

For all these reasons, it is essential that Africa's growing hunger for energy is satisfied by clean and environmentally friendly means. The rich countries should help by promoting advanced production of renewable energy, such as from biomass.