Science: The Magic Bullet for African Development?

Matthew Jackson

Africa is the poorest continent on the planet [1]. At least half of the 800 million sub-Saharan Africans live below the international poverty line of less than $1.25 per day, the legacy of hundreds of years of exploitation and colonisation by European nations, conflict between its peoples and corruption of the political system [2]. The human troubles are exacerbated by harsh environmental conditions and a slew of devastating infectious diseases such as malaria and HIV. These factors have combined to hinder the economic development of Africa and led to an unsustainable reliance on foreign aid. Could investment in science and technology offer a route to greater prosperity and be part of the solution to securing a better standard of living for African people?

Ex-UN secretary general Ban-ki Moon thinks so. Speaking in New York at a meeting for Africa Industrialization Day in 2007 he said that "one of the most effective channels for eradicating poverty, creating wealth and enhancing competitiveness is through the acquisition, adaptation and application of relevant technologies" [3]. At present, however, Africa produces only 2% of the worldwide output of scientific articles, with South Africa, Nigeria and Kenya accounting for two thirds of this total and many other countries struggling to generate even 100 scientific publications per year [4]. These figures are far below the theoretical critical threshold needed to trigger a virtuous interaction with technological development, described by Bernardes et al, at 150 publications per million inhabitants in 1998 [5]. This may explain in part the low conversion of research into innovations, with Africa producing only 0.2% of world patents [6].

Science Policy under the Microscope.

In recent years, African leaders have shown signs of fresh commitment to investment in science. The Ghanaian government, despite a frank admission by the Science ministry public affairs officer that the country is "200 years behind" [7], is close to finalising its first 'Science, Technology and Innovation' policy, which aims to make science the bedrock of the economy using newfound oil revenues. Plans include a Science Space Centre to provide accurate information about economic impact of climate conditions as well as more traditional astrophysics research. Some have doubts, though, as to whether the government will follow through on its new promises, as it has failed in the past. "Two years on, I have not received any money [from the government] for research," said Godfred Frempong, Deputy Director of the Science and Technology Policy Research Institute at the Council for Scientific and Industrial Research. "The government is, technically, paying me money to do nothing. Things are no better than before," he added [7].

Execution of any science policy relies upon the existence of necessary infrastructure; in 21st century knowledge economies, it is not just roads that need to be built but information highways too. If Africa wants to be included in the growing 'global village' it cannot afford to be left behind developed nations in networking capability; in 2007, just 6.8% of Nigerians had access to Internet, although this was a leap from 0.3% in 2002 [4]. Satellites are a key part of this infrastructure and are being launched to service the telecommunications needs of Africa. Nigeria Sat-X is the first satellite ever built by Nigerian engineers; its purpose will be to take high quality photographs for the monthly monitoring of Nigerian crops for food supply security, and supporting the development of the Nigerian national Geographical Information System (GIS) [8].

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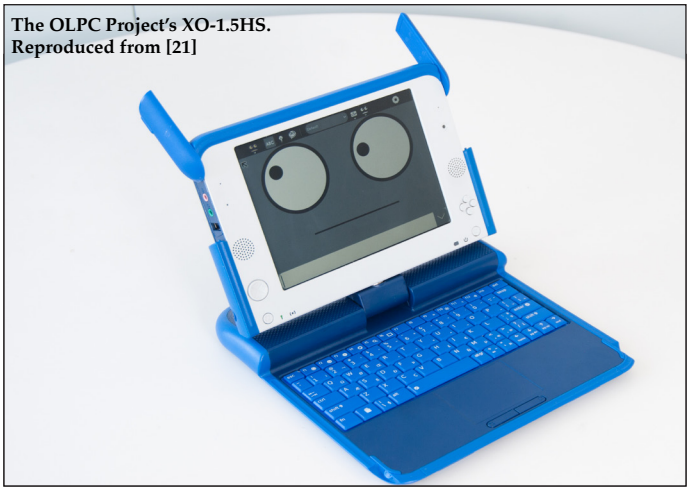
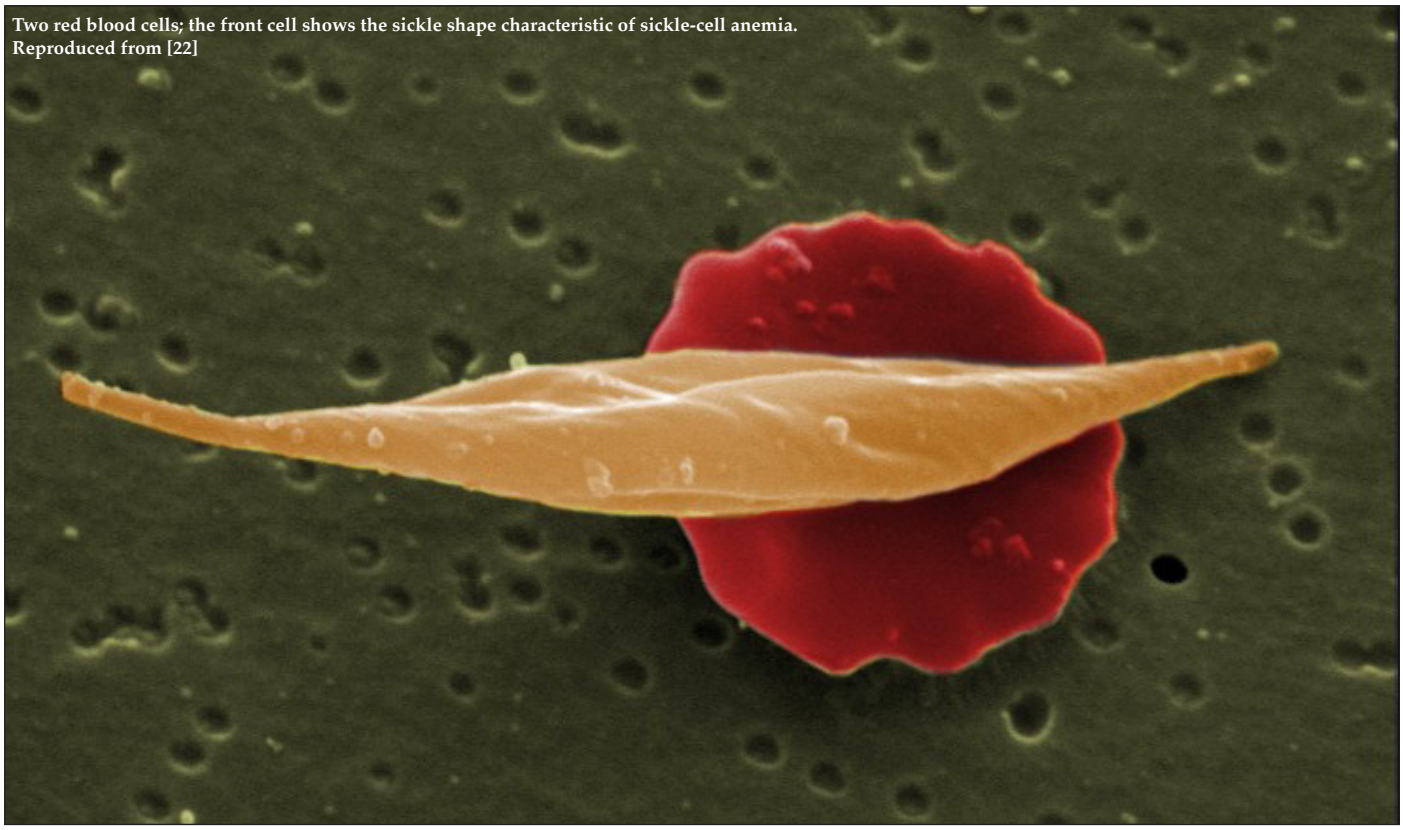
Policy to encourage basic research science cannot benefit African people and their economies alone, it must be coupled with a translation into technologies and their widespread provision. Take the example of Niprisan, a drug developed by Nigeria's National Institute for Pharmaceutical Research and Development using local knowledge from traditional herbal medicine. Niprisan can be used to treat sickle cell anaemia, a genetic condition endemic within the black African community for which few effective treatments exist [9]. Commercialisation of the drug passed several milestones, including the procurement of the US commercial partner XeChem, demonstration of clinical efficacy and safety, as well as being awarded 'orphan' drug status by the US Food and Drug Administration. Despite this, Niprisan did not achieve mainstream success; the reasons cited were challenges with manufacturing, management and inconsistent funding [10]. Clashes between the timelines of financial donors have also been blamed in some cases [11].



The OLPC Project's XO-1.5HS. Reproduced from [21]



Two red blood cells; the front cell shows the sickle shape characteristic of sickle-cell anemia. Reproduced from [22]

An increase in basic and applied scientific output in Africa can only be facilitated by an increase in the level of education to generate the highly trained scientists and engineers needed to perform research and implement new technologies. At grass roots level, organisations such as One Laptop Per Child (OLPC) have had some impact in parts of Africa, with the aims of increasing computer literacy and their mission to "empower the world's poorest children through education" [12], something which will be vital for the success of future generations. Perhaps schemes such as OLPC should be funded on a larger scale comparable to that in Peru, where over a million XO laptops have been distributed to date [11]. More fundamentally, it is good news for science in Africa that school rolls are rising; Chad tripled its literacy rate between 1999 and 2007 [4], but primary education has so far not proven sufficient to drive development. Only 4% of Africans complete tertiary education. The lecture theatres of existing universities are already overcrowded, and, in many cases, laboratories lack modern equipment. Improvement of higher education requires a long term financial commitment. The Pretorian Science and Technology Minister Naledi Pandor has therefore urged developed countries to invest in rebuilding African universities [13]. However, many developing nations must prioritise more immediate domestic issues such as the alleviation of poverty, and provision of clean water.

Scientists Neil Turok and Stephen Hawking of the University of Cambridge have proposed a £75 million plan to establish 15 African centres for post-graduate studies in advanced mathematics and physics. The centres will work similarly to AIMS (the African Institute for Mathematical Sciences) founded by Turok eight years ago near Cape Town, and be funded primarily by private investors. Google and the Gates foundation are among those expressing an interest in backing the endeavour. According to Turok, "the people who will make Africa rich are the brightest people because they will generate wealth" [14].

Despite centres like AIMS, 4 out of 10 African researchers live in OECD countries, a phenomenon which according to Pandor has a crippling effect on science on the continent. This 'brain drain' is occurring both on an international level, with 36% of Ugandan doctors and researchers working abroad [4], and on an intranational scale, with drainage to the private sector. The reasons for this are that people can find better rewards and remuneration outside of science in their native land, as well as avoid political and religious crises.

Yet, stemming this haemorrhage of talent can be achieved – for example, when Cameroon tripled Senior Lecturer salaries to $1600 per month in early 2009, it saw their numbers rise from 1800 to 2500 within a year [4]. Another strategy to combat the paucity of researchers is to work with schools to get children interested in science – currently there is a glut of finance and arts graduates – through initiatives such as festivals, exhibitions, science television programmes and the introduction of competitions between and within schools [4]. Another postulated option would be to borrow a model from football. FIFA allows foreign football clubs to release players to play for home countries during major events like the African Nations Cup. The "fifarization" of African scientists and researchers working abroad would mean asking them to return to their home countries occasionally, to return knowledge and expertise to colleagues at native institutions. They could also play a role in charting the way forward for their country's development in science and technology [4].

International Collaboration: a Conflict of Interests?

Some believe that when international collaboration becomes unbalanced, it can turn into unhealthy donor dependence. "If you look at any of the researchers who carry out any significant research in Africa, 99.9% of their funding comes

from outside," says Tom Egwang, founding director of Uganda's Med Biotech Laboratories. "Governments don't assume their responsibilities in this area, simply because the NGOs spend money in their place", adds Ahmadou Lamine Ndiaye, vice-president of the National Academy of Science and Technology of Senegal [15].

Outside funding can come with competing interests, which makes it difficult to ensure that research and development priorities match. China is becoming established as one of the major collaborators of African science, offering to train young scientists in China and build new science facilities. Sven Grimm, from the Centre for Chinese Studies at Stellenbosch University in South Africa says that "China is responding to criticism that it is not building enough capacity in Africa," and it would be plausible to assert that the world's fastest-growing economy is more interested in

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exploiting the natural resources which the continent has to offer than in aiding development [16].

Further, the reality of the Chinese assistance does not always live up to expectations, with some student placements being at universities in China utilising equipment scarcely better than that available in Africa [15]. Chinese contractors have been accused of cutting corners on projects, with buildings being proclaimed unsound a short time after construction [17]. The fact that a Chinese loan for the Malawi science university allegedly became available only after the country severed diplomatic ties with Taiwan lends further support to the suggestion of ulterior motives for helping the continent [18].

China is not the only collaborator with controversy surrounding the validity of aid. Sir David King, at the University of Oxford School of Enterprise and Environment, has hit out against western NGOs for turning African countries away from more scientifically-advanced farming practices, such as genetically modified crops, in favour of traditional organic approaches. He argues that the latter are better suited to a population with surplus food and are therefore unable to deliver the "green revolution" that is required [19].

On the Trail of Sustainability

The balance between job creation in the short term and sustainable development over the longer term is hard to strike. Japan is working with Africa in an attempt to address both of these concerns in the Millennium Villages project (MVP), a venture that hopes to lift entire communities out of poverty and starvation by implementing modern scientific approaches such as application of fertilisers and new disease resistant plant breeds. It is hoped that the MVP will help villages go from subsistence farming to sustainable market economies where some produce can be sold. If the villages prove to flourish, this project could be scaled up throughout the continent [20].

The sustainable development of Africa requires a gradual weaning from foreign aid to self-financing independence, and there are still many challenges on this front that need to be overcome. The expansion of domestic science and technology is arguably a crucial part of this development. In the short term this would be through application of current scientific knowledge to pressing agricultural and technological problems. In the long term, however, investment is required in education and research if Africa is to enter a new and resilient era of prosperity. ■

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