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SCIENTIFIC CAPACITY IN DEVELOPING COUNTRIES

Poverty, disease and environmental degradation hamper development in many countries and science and technology (S&T) can contribute towards addressing these problems.[1,2] However, many developing countries have limited capacity to identify where and how S&T can help to tackle their problems. Development agencies, including the UK Department for International Development (DfID) are looking at ways to assist developing countries to build their S&T capacity as part of reducing poverty. This briefing outlines the link between science, technology and development, and efforts to build developing countries' S&T capacities.

Key points:

- **Science and technology (S&T) are important in helping to meet development needs**
- **S&T for development is neither explicitly recognised nor well integrated in UK government policy**
- **In particular, the UK has no clear or explicit policy on building S&T capacity in developing countries**
- **S&T capacity building is complex and long-term, so sustained investment is needed**
- **DfID is shortly to publish its new research strategy. This may provide an opportunity for the UK to set out its policy on capacity building for S&T.**

Science, technology and development

It is widely recognised that S&T is important in stimulating and sustaining development particularly by:

- addressing pressing local problems such as food scarcity, disease control, energy insecurity, inadequate communications and environmental degradation
- building and maintaining markets in goods and services within national, regional and global economies – for example, IT-based industries in India, and cash crops for export in Zambia.

Researchers in developing countries[3]

Region	Researchers per million population
Africa*	70
Middle East	130
India	130
Asia (remainder)	340
Latin America	550
Europe	1990
North America	2640
Japan	4380

* note, South Africa has 992 researchers per million population.

S&T has featured in the development policies of international agencies such as the World Bank, the United Nations and the European Union, and in individual developed countries, such as DfID in the UK. However, the aim of building developing countries' own capacities for S&T has not featured prominently in such policies. The United Nations Economic, Scientific and Cultural Organisation (UNESCO) estimated that (in the late 1990s), 15% of the world's resources devoted to research were invested in developing countries. Of these, the lion's share went to relatively scientifically advanced developing countries (India and China), with 5% of the world's research effort invested in the rest of the developing world. Measuring national research capabilities is complex, but the table above illustrates one dimension of this issue. The box on the next page also outlines the relative levels of S&T capacity in different countries.

Where S&T has been oriented towards the needs of developing countries, historically, this has been piecemeal; mostly focused on narrow, single disciplines (such as engineering, medicine or agriculture), and often related to exploiting natural resources (e.g. mining or agriculture).

Characterisations of S&T in developing countries

The relationship of developing countries to global science has been described as analogous to a highway[4], with three groups of developing countries acting as traffic on that highway according to their abilities:

- **fast moving vehicles**: India, China, Brazil
- **slower moving traffic**: Mexico, Argentina and some countries in the Middle East and South East Asia
- **pedestrians**: sub-Saharan Africa, small island states.

A more formal characterisation has been the United Nations Development Programme (UNDP) 'technology achievement index', which reflects strongly the UNDP's general index of the level of human development. Looking at nations around the world, four groups of countries are identified:

- **Leaders**: those at the cutting edge of innovation. These are highly developed countries (such as the UK).
- **Potential leaders**: those with high skill levels, who have diffused old technologies (electricity and water supply networks), but innovate little. This group includes some European countries (Spain and Bulgaria), plus some Latin American countries (Chile, Mexico and Argentina).
- **Dynamic adapters**: those rapidly expanding their use of new technologies (e.g. internet, mobile phones), who have important high technology industries, but where the diffusion of old technologies has been slow and incomplete. This group includes many Latin American and Middle Eastern countries (Ecuador, Honduras, Tunisia and Iran) and some Asian countries (China, India, Sri Lanka, Thailand and Indonesia).
- **Marginalised countries**: where skill levels are very low, with large proportions of the population yet to receive benefits from the diffusion of old technology. This group includes very poor sub-Saharan African countries such as Tanzania, Sudan, and Mozambique, plus other countries such as Pakistan, Nepal and Nicaragua.

In recent years, there has been a widespread concern among development agencies and scientific institutions (for instance this was discussed at the Johannesburg Earth Summit in 2002) that investments in S&T have not been utilised effectively, resulting in poor uptake and diffusion in many developing countries. Previous approaches have often been ineffective in addressing poverty, disease, food scarcity and environmental degradation or fostering S&T capacity in these countries.

A new approach to development

The global approach to international development has shifted over the last few decades from developed countries effectively telling developing countries how to address their own problems, to developing countries identifying their problems and working with developed countries to achieve the assistance they need.

Many development problems are rooted in complex, multi-faceted issues, related to both scientific and non-scientific factors. The traditional single-discipline focus of S&T may therefore not be appropriate for addressing development problems. For example, the UK's Medical Research Council (MRC) has been developing insecticidal treatments on mosquito nets to prevent malaria in Gambia. It has ensured that medical science is deployed alongside social, cultural and economic research so that the nets are adopted and used most effectively. DfID has been also been working on HIV/AIDS in Africa.[5]

These examples illustrate the growing realisation that S&T needs to be more fully integrated across academic disciplines and oriented more towards problem-solving than traditional resource exploitation. Thus, S&T for development has been seen increasingly as requiring collaboration between donors and recipient countries – supporting partnerships where both parties benefit.

Building capacity in science & technology

'Capacity' is not well defined, but can be understood as the ability of individuals, organisations or societies to meet their needs. In the new approach to development described earlier, developing countries would decide their own needs. However, without sufficient knowledge and skills in many areas including S&T, developing countries may find it difficult to do this effectively. Moreover, it is unclear whether developing countries themselves see S&T as a priority. Indeed, an existing lack of primary education in many developing countries is often seen as a more pressing problem than building longer-term S&T capacity.

Historically, there has been little investment by development agencies in building the capacity of developing countries to undertake and exploit S&T. Where attention has been given to this, it has tended to be seen as investment in research - the generation of new knowledge. Collaborations for building research capacity have generally taken four forms:

- **donor country research** – researchers from developed countries carry out research about developing countries, occasionally involving local researchers
- **fellowships** – people from developing countries attend courses and gain qualifications in developed countries
- **in-country training** – developed countries train and teach within developing country institutions
- **financial support** – developing country universities and research programmes are funded directly by donors.

Of these, the first has been (and remains) the most common, but is seen[6] as being the least effective for enabling participation, learning and uptake by developing country researchers and research users. In response, the concept of 'research' partnerships has been developed to provide more equitable cooperation. It is noteworthy that none of these schemes specifically focuses on building capacity for S&T. Some analysts point out that success is often limited where capacity building is bolted onto existing research programmes. This, it is argued, often provides short-term support for individuals or institutions and does little to ensure effective diffusion of knowledge or technology. [6]

There is increasing recognition of the need for greater efforts aimed specifically at building the capacity of developing countries to generate, disseminate and use S&T to address both current and future needs in national, regional and international arenas. The box on the next page provides examples where partnerships have been aimed more specifically at building capacity for S&T.

Examples of research capacity building

International Development Research Centre (IDRC), Canada
The IDRC was created in 1970 as a Canadian Crown Corporation specialising in research for development. The Centre does not carry out its own research, but encourages and supports research in local institutions. It has 200 staff in its HQ and a further 150 in regional offices in Uruguay, Senegal, Kenya, Egypt, India and Singapore. In 2002-03 it received grant-in-aid of £48M and ~£7M from others. It operates a programme budget of ~£35m per year.

Consultative Group on International Agricultural Research (CGIAR)
CGIAR was established in 1971 to address developing countries' needs for agricultural research at the international and regional levels in critical areas not adequately covered by existing research facilities. It has 63 members (countries and other organisations such as the World Bank and the Rockefeller Foundation). It supports research of international 'public-goods' value in 16 research centres. In 2002, the CGIAR received funding of $357 million. In addition to producing research results, the CGIAR also aims to train scientists and hence build research capacity.

Centres of Excellence for Technological Innovation for Sustainability in Africa (CETISA)
The Royal Institute of International Affairs (RIIA), with UK government support, has developed a proposal for a partnership between African and Northern universities, governments and private sector representatives to design and establish a network of Centres of Excellence for Technological Innovation for Sustainability in Africa (CETISA). The centres will use a multidisciplinary, participatory approach to technology development and will base their work on country-specific assessments of technology needs and opportunities.

Issues

Principles for S&T capacity building

The traditional approach to capacity building has often reflected a dominant view among donors about the nature of the links between research, technology and policy. Conventional thinking has viewed S&T as providing straightforward answers to well-defined problems that then flow simply to commercial innovation or public policy. This 'linear' model of innovation has been shown to be inadequate. Many argue that innovation works more as a network, with knowledge flowing through a more complex 'whole system of innovation' comprising dynamic linkages between individuals and institutions involved in the production, dissemination and use of knowledge.[7]

Many thus argue that current approaches to capacity building should be refocused on the network model, operating according to the following principles:

- **responsiveness** – ensuring that capacity building activities are driven by demands from developing countries, rather than seeking to impose capacity building where such demand is not apparent
- **coordination** – establishing consortia of funding bodies rather than individual agencies working separately
- **longevity** – aiming for long-term initiatives with partners who are prepared for failures along the way and prepared to wait for tangible results
- **networks for innovation** – placing more emphasis on building capacity in institutions, and within networks of researchers, policy-makers and civil society groups (both between developed and developing countries and between developing countries)
- **flexibility** – ensuring that capacity building activities suit the specific circumstances of particular regions and countries, recognising that some poor countries may already have pockets of excellence in S&T.

The UK's role in strengthening research capacity

DfID is the lead ministry on UK international development policy. It has published two white papers (1997 and 2000), both of which include discussion of S&T (e.g. HIV/AIDS, intellectual property and information technology). It is currently drawing up its strategy for research, which is expected to be published in Spring 2004. As an input, DfID commissioned a study to put forward proposals to guide its research work. The report of the study group (the 'Surr Report') was published in 2002 and included recommendations for DfID's work on research capacity building.[8]

The Surr report found that increasing research capacities was a "*necessary condition*" for the approaches being promoted for poverty reduction. It found that DfID was involved in capacity building (e.g. through the CGIAR) but recommended that DFID should urgently review its policy and mechanisms for capacity building, taking account of international experience. Further, it recommended that DfID's country and regional programmes should seek opportunities to strengthen research and related capacities where feasible.

Other government activities

The **Office of Science and Technology** (OST) is responsible for science across government, and for coordinating the presentation of the best UK science to the world. The Government's Chief Scientific Adviser (CSA) argues that the UK should be involved in building S&T capacity in developing countries and is currently formulating his position. OST expects to deliver a scoping report on the UK's capacity building efforts to the CSA's International Committee in mid-2004.

The **Foreign and Commonwealth Office** takes the lead on foreign policy. It has established a network of S&T staff in 21 countries, including Brazil, China, South Africa and India. The network focuses on promoting UK economic interests. However, it recognises the potential impact of S&T on disease, poverty, and environmental damage, but does not currently have any specific remit or resources to build S&T capacity in developing countries.

The **British Council** is a charity mainly funded through grant-in-aid to act as the UK's main route for providing educational opportunities and cultural relations with other countries. In the area of science, the British Council aims to "*build partnerships and encourage links*

and networking between scientists, engineers and research managers to encourage innovation." It operates in 109 countries, with dedicated science staff in 48 countries. Few are in poorer developing countries.

The **Department of Trade and Industry** also has interests in this area – strengthening UK trade links and removing barriers to trade. For example, DTI has worked closely with DfID in relation to intellectual property rights.

The role of the UK S&T community

The UK research community comprises publicly funded institutions such as the Research Councils, and private sector organisations such as universities, charities and businesses. Issues arising in this community include:

- **Research Councils** contribute to the science base and to training of people from developing countries. However, they have no specific remit on developing countries. Any capacity building that does occur, may thus be unstructured. Some Research Councils have (or are developing) concordats with DfID, and some work with DfID through competitive contracts.
- **Universities** are not encouraged to invest in research capacity building in developing countries, as this is not a priority for funding. However, some academics report that capacity building happens through other sources, such as industry or charities.
- The UK's **learned societies**, such as the Royal Society, have traditionally focused on encouraging excellence in academic science. For example, the Royal Society has links with the Indian Academy of Sciences. However, its efforts have not focused on building general capacity within the scientific establishments in developing countries.
- **Civil society groups**, such as charities and campaign groups, also play a part. For example, WaterAid and the Intermediate Technology Development Group (ITDG) provide small-scale technologies appropriate to local circumstances. At the larger scale, the Wellcome Trust funds medical research in South Africa.
- **Industry** has a critical role in S&T and innovation. There are some efforts to build research capacities in developing countries (e.g. pharmaceuticals and information technology in India). However, in other regions, such as sub-Saharan Africa, there is less effort, particularly because markets are small, or the political climate creates risks for private investment.

Towards a policy for S&T capacity building

The House of Commons Science and Technology Committee is currently investigating the use of S&T in UK international development policy. Among the issues being addressed is how the Government could develop a strategy for strengthening S&T capacity building in developing countries. Evidence to the Committee has pointed out that the UK has an enviable international reputation for providing high calibre research and training. However, this does not *necessarily* translate into an ability to deliver high quality capacity building. The reasons given for this can be boiled down to:

- **Policy**: Funding to UK institutions provides inadequate resources to deliver capacity building (and often there is resistance to this). There are thus few incentives built into the system to enable or encourage capacity building. Some witnesses have pointed to their carrying out capacity building in spite of official policy.
- **People**: Capacity building requires a different outlook to training; one of long-term commitment and funding. Further, capacity building requires people from developed countries being willing to adapt to the specific circumstances in developing countries.

DfID has indicated that capacity building for S&T will be examined as part of its forthcoming research strategy. At present however, several issues remain unclear:

- the Government's current overall position on building S&T capacity in developing countries, particularly whether short term needs for poverty reduction override the longer-term benefits of capacity building
- the nature and extent of structural, funding or policy barriers (such as who would 'own' any policy for S&T capacity building in developing countries)
- how S&T capacity building could be promoted further in the UK. In particular, there is a question over whether the UK should establish a separate, long-term programme for S&T capacity building in developing countries (e.g. like IDRC in Canada –box on page 3).

Overview

Despite the acknowledged importance of S&T in addressing developing country problems, the UK government has no explicit policy on strengthening S&T capacity in those countries. Government departments and research funding bodies each have their own objectives, only some of which overlap in this area. The House of Commons Science and Technology Committee is investigating this topic, and DfID is shortly to produce a new research strategy. These activities should present opportunities for new UK initiatives to help build S&T capacity in developing countries.

Endnotes

1 In this briefing, the term 'science and technology' encompasses natural and social science, medicine and engineering. It includes basic, strategic and applied research (e.g. policy analysis).
2 *Inventing a Better Future, A Strategy for Building Worldwide Capacities in Science & Technology*, InterAcademy Council, 2004.
3 *Human Development Report*, United Nations Development Programme, 2003.
4 *Pedestrians on the highways of global science*, Wijesekera, R., Committee on Science and Technology in Developing Countries occasional paper no. 7. International Council for Science, 2002.
5 *HIV/AIDS in developing countries*. POSTnote 210, December 2003.
6 *Enhancing research capacity in developing and transition countries*, Swiss Commission for Research Partnerships with Developing Countries, 2001.
7 *Science in policy*, POSTnote 196, June 2003.
8 *Research for poverty reduction: DFID research policy paper*, Surr, M., et al, Department for International Development, 2002.

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