Innovation, Sustainability, Development: A New

MANIFESTO

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# Centres of Excellence? Questions of Capacity for Innovation, Sustainability, Development

Melissa Leach and Linda Waldman

Capacity

STEPS centre

## About the paper

This paper explores what 'mainstream' Centres of Excellence might mean for developing countries and poor people. It examines how development is constructed as economic growth with industry and enterprise – complemented by centres of scientific excellence and technological innovation – as its key engine. It demonstrates that, in relation to science and centres of excellence, the discourse of networking and partnerships assumes that all interested parties evaluate progress, development and excellence similarly. The paper critically reviews the core notions of 'excellence', 'centres' and 'capacity', highlighting some alternative models of research, innovation and training. It argues that science and technology should not only address the principles of economic growth and excellence; but that broader principles should underlie capacity-building for science, technology and innovation. These principles direct the focus onto who benefits (and who is excluded) from science and technology, by highlighting the '3Ds' of Directionality (towards specific Sustainability objectives); equitable Distribution (of costs, risks, benefits), and Diversity (of socio-techno-ecological systems)?

## About the authors

**Melissa Leach** is director of the STEPS Centre and leader of the Knowledge, Technology and Society team at IDS. She is a social anthropologist specialising in environmental and science-society issues. Research interests include social and institutional dimensions of environmental and technological change and issues of knowledge, power and citizen engagement.

**Linda Waldman** is a social anthropologist with experience in African poverty and the related issues of gender, racial classification, ethnicity and identity. Her research areas include indigenous identity and nationalism, environmental pollution, asbestos disease and its socio-cultural ramifications in South Africa, the United Kingdom and India.

## About the Manifesto project

In 1970 a radical document called The Sussex Manifesto helped shape modern thinking on science and technology for development. Forty years on, we live in a highly globalised, interconnected and yet privatised world. We have witnessed unprecedented advances in science and technology, the rise of Asia and ever-shifting patterns of inequality. What kind of science and technology for development Manifesto is needed for today's world? The STEPS Centre is creating a new manifesto with one of the authors of the original, Professor Geoff Oldham. Seeking to bring cutting-edge ideas and some Southern perspectives to current policy, the New Manifesto will recommend new ways of linking science and innovation to development for a more sustainable, equitable and resilient future.

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IDS Institute of Development Studies
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SPRU – Science & Technology Policy Research
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For further information please contact: STEPS Centre, University of Sussex, Brighton BN1 9RE
Tel: +44 (0) 1273915673
Email: steps-centre@ids.ac.uk
Web: www.steps-centre.org



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# INTRODUCTION

Many recent policy statements concerning science, technology, innovation and development have emphasised the creation of 'centres of excellence' in developing countries as a key goal. These are seen as a means to enhance science and technology capacity in developing countries, and hence, so it is argued, promote productive linkages between science, technology and development. Underlying this, is the idea that advanced countries support – through funding and the direct provision of skills – developing countries' centres of excellence. As argued in this paper, a central logic for this kind of partnership is that skills and resources are transferred from the North to the South because of mutual interest and obligation in a globalised world of interconnected fortunes.

The argument for building 'indigenous science and technology capability' was absolutely central to the original 1970 Sussex Manifesto. As we explore in the first section of this paper, its analysis and contentions, radical for their day, prefigure much of the recent debate about centres of excellence and why they are necessary. Yet, we suggest, these more recent debates and developments have failed to heed some of the 1970 Manifesto's more strident warnings, and in important ways have failed to carry through its vision. At the same time, other initiatives and arguments have emerged from directions unanticipated by the 1970 Manifesto.

It is in this context that this paper explores recent discourses around 'centres of excellence', reviewing and engaging critically with some of the current high-profile statements and initiatives in this area. We ask what kind of capacity is being built, and what kinds of development linkages are being assumed or promoted? Are such centres of excellence attuned to building innovation pathways that meet local needs and work towards poverty reduction and social justice in developing country settings? How will a globalised notion of excellence, coupled with a universal set of scientific and professional skills, contribute towards development and meet the needs of poor people? What alternative visions, models or elements might be required to address the '3Ds' of Directionality (towards specific Sustainability objectives); equitable Distribution (of costs, risks, benefits), and Diversity (of socio-techno-ecological systems)?

We begin by illustrating and exemplifying what might be described as a contemporary 'mainstream' Centres of Excellence discourse. This section demonstrates how development is constructed as economic growth with industry and enterprise development – complemented by centres of scientific excellence and technological innovation - as its key engine. It also argues that the discourse of networking and partnerships assumes that all interested parties evaluate progress, development and excellence similarly. The paper then reviews critically some of its core visions and assumptions, in relation to alternative literatures which address similar issues from rather different angles. This critical review is organised in three short sections, reflecting on and suggesting some recasting of the keywords of 'excellence', 'centres' and 'capacity', and highlighting some examples of alternative models – of research, innovation and training – which go some way towards responding to these critiques. Yet while there are many isolated examples of alternative practice such as these, there is a danger that they remain just that, with little broader impact on the mainstream discourse of centres of excellence and capacity. Hence in the final section, we consider some broader principles that should underlie capacity-building for science, technology and innovation if the 3Ds are to be taken seriously.

## BUILDING INDIGENOUS 'S AND T' CAPABILITY – THE 1970 SUSSEX MANIFESTO

The 'premise that the developing countries must have their own scientific and technological capability....not only for increasing production, but....for improving the capacity to produce' opened the 1970 Manifesto. In what were at the time far-reaching terms, the Sussex Group argued that advanced countries had hitherto exerted far too great an influence on the orientation of scientific efforts in developing countries. This was both through an 'external brain drain', directly undermining S&T capacity by pulling scientists away, and more insidiously, an 'internal brain drain' whereby scientists in developing countries worked on issues and problems of advanced country interest – rather than those related to local or national development problems. The Manifesto therefore made a strong plea for a shift away from reliance on the North-South transfer of technology and ideas, and towards more locally-oriented scientific capacity:

> Our starting point is, therefore, that there is a fundamental necessity to build up indigenous scientific capability in the developing countries. This capability is necessary if the people of these countries are to be able to define, analyse and solve environmental problems and escape from the narrow commitment to environmental influences that is characteristic of their present situation (4).

Several things are notable about this position, especially in relation to the more recent debates that we shall discuss shortly. First is the strong emphasis on scientific capability oriented 'inwards' towards particular contexts, including particular problem-framings – and an implicit recognition that these are diverse. This was very forward-looking for its time. Nonetheless, 'development problems' were largely seen as shared at the aggregated national or country level; the Manifesto did not attend to issues of local diversity or socio-cultural difference as relevant in defining problems or solutions. Second, the Manifesto disaggregated a number of elements of 'capability' that needed to be built, with respect to its analysis of prevailing weaknesses of scientific institutions in developing countries. These notably included not just the ability to conduct R&D and a sustained capacity to apply its methods, but also capacity for science-policy, and to apply science to social problems. In this vein, the Manifesto pitched for a style of 'development science', training and 'multidisciplinary team teaching' that was ahead of its time:

> There is a strong case for including in the education of scientists, some training in the analysis of social and economic problems, and in methods of applying scientific expertise to their solution. Science education which stops at physical science training is not enough (19).

At the same time, its discourse remained overtly rationalistic and technical; science was presented as a universalistic framework with universal concepts, methods and applicability. At several points, the Manifesto urges the importance of broader science education and the adoption of a scientific culture and worldview amongst developing country populations to provide a supportive context for its specific proposals. More challenging debates about the partiality and politics of (western) science; about science and society, about multiple ways of knowing and conceptual frameworks, and about indigenous knowledge – although starting to blossom in the 1970s, including in IDS (e.g. Howes and Chambers 1979) - did not find their way into the Manifesto.

Third, the Manifesto's analysis and proposals focused exclusively on university and government institutions. Astute insights about the resource and organisational constraints and the misguided incentives facing these were offered, and proposals for large transfers of funds from advanced countries to build a rational, planned process of capacity enhancement were advanced. The planning, statist

model fitted the modernisation paradigm of development of the period. It also emphasised a gradual process of working with and building existing institutions, which coupled neatly with the emphasis on particular national contexts.

As we shall see, these three key emphases – nationally-oriented science, multidisciplinary problem focus, and context-specific institution-building - have all been rather less prominent in more recent high-profile attempts to build 'centres of excellence'.

## CENTRES OF EXCELLENCE – A RECENT HISTORY, A CONTEMPORARY MAINSTREAM DISCOURSE

In his valedictory speech, the UK government's outgoing Chief Science Advisor summarised from a British perspective what have become key elements of a mainstream discourse on capacity-building for science, technology and innovation in developing countries:

> World poverty and sustainable development remain serious challenges where science and technology have a critical role to play...Recognising that science and innovation are international endeavours where the UK must be an effective and active global player...The GSIF[1] strategy was based on four priorities; research excellence; excellence in innovation, utilising our global influence and development. We need to use our own research and innovation progress to assist developing countries and to help meet international development goals...The Commission for Africa articulated this well - after much lobbying - in its 2005 report, calling for significant investment in centres of scientific excellence and in higher education institutes. The Commission's report was used to inform the G8 Summit at Gleneagles, during the UK's G8 (and for that matter EU) Presidency. Indeed, 2005 was a year that saw, I believe, a real turning point in our attitudes towards African development as one of partnership with Africa. Nevertheless, still little attention is being paid to the need for highly trained scientists, engineers, medical practitioners, and agriculturalists as a developmental priority. This is a recipe for disappointment, and a challenge that I hope will continue to be taken on – with UK leadership - by science policy and research communities alike. I believe we have the framework now.[2]

The framework alluded to by King is one in which advanced economies support – through funding and the direct provision of skills – centres of scientific and technical research and of training in developing countries. 'Partnership' in this view implies both a linkage in which skills and resources are transferred north-south, but also a sense of mutual interest and obligation in a globalised world of interconnected fortunes. Underlying both dimensions, then, is an implicit assumption that a globalised, universal set of scientific and professional skills, attuned to a globalised view of excellence and how it might contribute to a singular view of progress, are what is required.

In the late 1990s, in a process which subscribed heavily to this view, the World Bank initiated a 'global chain' of centres of excellence or 'Millennium Institutes'. These institutes were intended to rapidly enhance developing countries' capacity in science and technology and were seen as a way of enabling 'a

[1] The Global Science and Innovation Forum, a result of the request to Sir David King from the UK government in 2004 to set out a long term vision and commitment to invest in this area, through the Science and Innovation Framework 2004-14

[2] Sir David King, Standing on the Shoulders of Science, valedictory speech, 27 November 2007, http://www.dius.gov.uk/news_and_speeches/speeches/past_ministers/sir_david_king/science (accessed 07 September 2009)

small number of excellent researchers in developing countries to break free from the constraints on first-class international research' experienced in their countries. In funding these Millennium Institutes, the World Bank envisaged using science, technology, innovation and technological transfers to generate development. This was to be done through investing in a knowledge economy which sought to 'encourage, facilitate and develop R&D activities' and to initiate partnerships between developing and European countries (Foladori and Fuentes 2007). In Chile, for example, the World Bank invested over US$ 100 million in centres of excellence, which aimed 'to support and direct the process towards a society and an economy based on knowledge, by investing in science and innovation areas linked to the business sector in the country and the world wide networks of science and technology' (cited in Foladori and Fuentes 2007: 4).

This World Bank approach was echoed by the Millennium Project's Task Force on Science, Technology and Innovation in 2005, which saw technology and innovation in promoting industrial production as the basis for development, stating that 'creating links between knowledge generation and enterprise development is...one of the greatest challenges facing developing countries'[3] (2005: 3). In this vein, the report argued that:

> It is more important than ever for developing countries to move ahead in scientific and technological development at an advanced level. Doing so will enable them to build local capacity that can help solve the many science and engineering–related problems they face. It will also position them to take an active part in the global knowledge economy (2005: 23).

Arguing that investment in science, technology, and innovation education has been a critical source of transformation in the East Asian 'success story' economies and their transformation into so-called knowledge societies, the report suggests that what is now needed is a larger framework to extend such investment worldwide in an integrated way. Following the World Bank model of 'Millennium Institutes', they recommend donor investment in fellowships and scholarships to enable developing country scientists to train in developed countries, extending worldwide including to Africa, and with a science focus, initiatives such as the Colombo plan for Cooperative Economic Development in Asia and the Pacific which has operated since 1951. The report also recommends strengthening institutions of higher education and technical training across the developing world, with the beneficiaries of training abroad playing key roles in this process. The report emphasises the transformation of existing universities into 'powerful partners' in industrial development processes, as well as investment in technical institutes which are already disposed to work with industry:

> To help universities adopt a key development role, national development plans will need to incorporate new links between universities, industry, and government .... This is likely to affect the entire national innovation system, including firms, R&D institutes, and government organizations. Developing countries will not be able to exploit the might of new technologies unless they become seriously involved in high-technology fields (2005: 95).

In the African context, the Commission for Africa in 2005 recommended the establishment of a network of centres of excellence within Africa to help the continent catch up and keep up with the fast-moving pace of technology-led economic growth. The report's recommendations were subsequently endorsed by the G8 at their July 2005 summit, where the G8 committed a total of US$8 billion in funding over the next ten years to Africa's development: US$3 billion for a programme to develop a regional network of centres of excellence; and US$5 billion for a programme to revitalize Africa's institutions of higher

[3] Millennium Project Task Force on Science, Technology and Innovation, UN Millennium Project http://www.unmillenniumproject.org/reports/index.htm (accessed 07 September 2009)

education.

The Second African Ministerial Conference on Science and Technology (AMCOST) in Dakar (Senegal) on 30 September 2005 adopted a consolidated plan of action for science and technology in Africa which placed the development of a regional network of centres of excellence centre-stage. The conference empowered the New Partnership for Africa's Development (NEPAD) to establish an AU/NEPAD/UNESCO high-level working group to prepare a comprehensive programme for establishing and funding centres of excellence, in accordance with the Commission for Africa's recommendations. *Africa's Science and Technology Consolidated Plan of Action* states that 'one of NEPAD's overall objectives is to bridge the technological divide between Africa and the rest of the world'. Identifying four programme clusters (biodiversity, biotechnology and indigenous knowledge; energy, water and desertification; material sciences, manufacturing and ICTs; and space science and technologies), the Plan recommends developing an African network of centres of excellence for each.

Three centres launched by NEPAD led the way: the African Institute of Space Science (AISS), the Bioscience Facility for Eastern and Central Africa based at refurbished laboratories at the International Livestock Research Institute (ILRI), in Nairobi, Kenya, and the African Laser Centre (ALC). The NEPAD adviser on science and technology, Dr John Mugabe, emphasised that these were to contribute two interrelated goals for African countries: building their capacity to collectively harness and apply science and technology for their own sustainable development, and enhancing their contribution to the global pool of science and technological expertise.[4] Centres of excellence are to be encouraged to set up public-private partnerships and to act as innovation hubs to foster innovation, entrepreneurship and technology diffusion. It also envisaged that they will help to combat the 'brain drain' of African scientists, and even encourage the reverse, by attracting African scientists in the diaspora to return to their own countries to teach and research, whether short or long-term. The cost for Africa of recruiting 100 000 skilled expatriates to replace those who leave each year has been estimated at US$4 billion annually.[5]

The model of establishing new African institutes of science and technology such as these has been seen as promising, and worthy of replication. This closely emulates the four Indian Institutes of Technology established at Independence in 1947 as a 'parting gift' of the British colonial powers, and which have been widely seen as foundational to the country's economic boom. Some commentators have suggested that African Ministers are divided over whether new institutes are the appropriate way forward, or whether investment should focus on improving existing universities. [6] However Mugabe has denied that there is such debate, or even that AMCOST is concerned with any particular model beyond broad criteria and guidelines for designating centres of excellence. Rather, he suggests, 'Africa must take a pragmatic approach. There are certain scientific fields for which we will have to create new institutes, and others for which we can nurture existing ones'.[7]

A parallel development in the African context is the South Africa-led proposal for a network of five Nelson Mandela institutes within the five regions of Africa: East, West, Central, North and South, each specialising in different issues. By April 2007, a partnership agreement had been signed for a 28 month

[4] http://www.africafiles.org/article.asp?ID=6141 (accessed 07 September 2009)
[5] http://www.unesco.org/science/psd/publications/tenyears_afr.shtml (accessed 07 September 2009)
[6] David Dickson, 'Hard choices in Africa's bid for scientific excellence', 14 December 2006, http://www.scidev.net/en/china/editorials/hard-choices-in-africas-bid-for-scientific-excell.html (accessed 07 September 2009)
[7] John Mugabe, 'African centres of excellence need pragmatic approach', 20 December 2006, http://www.scidev.net/en/china/editor-letters/african-centres-of-excellence-need-pragmatic-appro.html, (accessed 07 September 2009)

project to develop a conceptual framework and criteria for these, as a collaborative project between the Centre for African Renaissance Studies (CARS) at the University of South Africa, the NEPAD Secretariat and the Knowledge Management Africa programme of the Development Bank of Southern Africa (DBSA/KMA). This research-based activity has opened up the debate somewhat, with the proposal aiming to define what centres of excellence are within the African context, to identify what Africa's knowledge challenges and needs and gaps are, and to develop parameters for mainstreaming indigenous knowledge systems into the centres of excellence. At the same time, the proposal aims to identify and adopt relevant strategies from existing centres of excellence as a basis for defining the African centres.[8]

Despite the bows to pragmatism and diversity, several emphases emerge from these statements. First, development is generally seen as a somewhat singular pathway, constructed through economic growth in a competitive globalised economy, with industry and enterprise development as its key engine. There is also some – albeit rather weaker - acknowledgement of science and technology contributing to poverty reduction more directly – for instance through innovations in agricultural biotechnology. Second, there is a central emphasis on 'high science and technology', and on centres enabling countries to be part of the elite global pool that develops this. The original Manifesto highlighted this in its caution against an 'internal brain drain' which discourages scientists from developing national agendas, as 'the weight and orientation of world scientific effort has a preponderant influence on the way science develops and is oriented in the developing countries. Many observers have noted how scientific and technological activities in the developing countries tend to form an 'enclave; in which elite, internationally recognised science priorities are addressed. Third, there is a discourse of networking and partnership, both between developing countries and regions, and between north and south. Yet this is, at heart, a discourse of integration, assuming a pooling and sharing of expertise that will enable countries and regions to succeed and compete successfully in relation to what are assumed to be shared goals and ideas of progress.

It is immediately obvious that these elements run counter to an emphasis on directionality, distribution and diversity. In the next section, we explore some of these dissonances by interrogating the mainstream discourse, especially with regard to how excellence, the notion of centres, and capacity are conceptualised.

## INTERROGATING THE DISCOURSE

### EXCELLENCE

The notion of excellence is a powerful device which not only evaluates research in particular kinds of ways, but also 'seeks to prescribe how research is conducted, organisationally and conceptually' and implicitly shapes donor funding and research activities (Chataway et al 2007: 175). Yet what constitutes 'excellence', and who is to judge this by what metric, is remarkably little-problematised in contemporary policy debates. The implicit recourse, therefore, is often to international academic standards, which judge excellence through peer reviews of articles published in reputable academic journals of international standing. While such standards are firmly established within academic contexts, however, applying them to contexts in which one hopes development will take place requires careful consideration. First, this is to overlook real institutional barriers that 'unlevel' the playing field. The Third World Network of Scientific Organisations (TWNSO) argues, for instance, that very few southern-based

[8] http://news.ahibo.com/spip.php?article486 (accessed 07 September 2009)

research organisations are able to achieve international recognition. This results in a failure to recognise and appreciate research conducted in the south which, in turn, 'prevents the scientific community from taking advantage of its full pool of knowledge workers' and 'creates an imposing obstacle to efforts for promoting science-based sustainable development' (2004: 6). It might be argued that efforts at S&T capacity-building are geared precisely to overcoming such barriers, enabling developing country scientists to join the international pool of elite-publishing academics. Yet international academic recognition might come at the cost of science that engages with diverse local contexts and problems, or which moves in directions counter to established (northern) research ideas, methods and practices.

Second, the principles and values enshrined in notions of academic excellence often differ from those in the kind of research needed to tackle development problems. Normative values in which research is geared to specific practical, political, developmental and distributional goals find little foothold in conventional notions of academic excellence. Meanwhile, a narrow emphasis on excellence by the standards of particular scientific disciplines is often inadequate to address new interrelated problems of environmental sustainability, climate change, poverty and governance. In this vein Chataway et al argue that the standards of academic excellence inhibit – rather than promote – the potential for interdisciplinary work and for researchers to engage in participatory, open-ended development work; while simultaneously undermining the significance of, and sensitivity to, cultural matters and local context (2007: 174). Science for development, it is argued, needs to be more interdisciplinary and collaborative, and developed through networks and partnerships which strive for more expanded aims than those inherent in narrow notions of academic excellence.

Despite widespread recognition that research needs to be more interdisciplinary and collaborative for development and policy contexts, the focus on narrow scientific excellence continues. Consider for example the following project description, in which the World Bank seeks to facilitate academic excellence and research commercialisation in Kazakhstan:

> The specific development objective of this pilot project is to demonstrate significantly improved scientific performance and commercial relevance of research performed by inter-disciplinary teams of scientists selected through a transparent competitive process. By using merit based selection procedures, the project will help to rebuild, strengthen and restructure selected segments of Kazakhstan's R&D base. The project will also help to link this rejuvenated R&D capacity to national and international technology markets. The Project consists of three key components: (i) a competitive grant program to strengthen Kazakhstan's science base by supporting high quality R&D, establishment of an internationally peer-reviewed journal as well as a world class instrumentation center; (ii) a technology commercialization office to link Kazakh scientists to local and international technology markets; and (iii) the establishment of a Project Management Unit to implement the project.[9]

In this extract, interdisciplinarity becomes an add-on to a scientific model of excellence which emphasises competitive process, merit-based selection and international peer review processes. Interdisciplinary does not, in this and many other development projects, imply a shift away from conventional domains of expertise and excellence. In addition, the scientific domain is reinterpreted through a development lens in which economics and the need to stimulate the economy through conventional markets becomes the focus (cf. Ferguson 1994). Indeed, the World Bank's press release states that 'This project will strengthen Kazakhstan's science base by introducing international peer

[9] http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/0,,contentMDK:21614303~menuPK:64282137~pagePK:41367~piPK:279616~theSitePK:40941,00.html (accessed 07 September 2009)

review for research funding based on scientific merit and commercial potential and connect improved research and development of scientific groups to national and international technology markets'. Neither the assumptions of excellence nor the assumptions of economic development through markets are interrogated in such a model. The World Bank is not alone in making the assumption that academic excellence, conceptualised through a model of international markets for science, will somehow automatically benefit poor countries and poor people.

In a recent attempt to explore the interface between science and policy, Jones, Jones and Walsh suggest that scientific excellence – in the form of methodological rigour and objectivity – is necessary to develop scientific credibility. They point to obstacles that hinder the use of science in policy making in both southern and northern countries. These include the difficulties of getting various actors (scientists, policy makers and civil society) to engage around scientific issues, and the different priorities and time schedules of science and policy. They suggest policy engagement is often seen as a means of undermining scientific excellence because it implies a politicisation of science. Linked to this, they suggest that democratising science – a process which challenges notions of scientific exclusion and excellence – leads to a dilution of science: 'There is a difficult balance to strike in care not to overly 'dilute' scientific knowledge in the policy making process, as this can compromise its credibility and instrumental value' (Jones et al 2008: 10). Scientists, in this view, should therefore focus on the 'fact-value distinction' in order to overcome the politicisation of their work and to ensure its objectivity. In order to further facilitate this, Jones et al recommend that 'boundary organisations' are used to 'police' the 'credible' use of science in policy processes' (2008: 32) and, in so doing, ensure scientific excellence and a lack of politicisation of science. The Millennium Institutes, fostered by the World Bank in the late 1990s, similarly considered international peer review a means to 'keep out the politics that dominates science in developing countries' (Macilwain 1998: 711). Such a notion of science as a-political, feeding linearly into policy as truth speaks to power, is of course widely discredited by social studies which reveal the partial, politicised perspectives in both science and policy processes, and the mutually-constructed, interlocked ways that they unfold – as we discuss below. Yet the linear model persists in many mainstream narratives, shoring up particular notions of scientific objectivity and excellence in the process.

Fundamentally, Chataway et al ask whether 'current definitions of research excellence are even appropriate to developing countries'? They point out that 'although institutions in industrially developed countries put much effort into judging and reviewing research performance, and can therefore legitimately claim excellence, it is not clear that institutions in developing countries benefit from using the same criteria' (2007: 184). Notions of research excellence, they argue, ignore the capacity to address specific developmental problems and to create appropriate technology that supports sustainable development. Cost effectiveness, capacity building and community outreach are also neglected. Rethinking excellence – and its role in development – is not however an easy process. Chataway et al warn that excellence 'occurs at the confluence of some of the most important and problematic issues of institutional research and development and how it should be organised, how institutions internalise change, and how institutions engage within broader networks'. These are 'political, value-laden processes' (2007: 181-2). Rethinking excellence raises questions about what the parameters of progress are, about who science is responsible to and about why science is undertaken. A broader conceptualisation of excellence is required which includes 'social and economic impacts, the development of collaborative relationships and participative forms, good governance, effectiveness and cost efficiency' (2007: 183). But excellence (from this broadened conception) also needs to be defined in relation to specific, normatively-defined development and Sustainability goals, and the directionality of the pathways towards them; as well as in relation to equitable distribution which meets the needs and aspirations of the poor.

In recent years, there have been attempts to develop 'bridging professionals' who strive to bring together ideas of scientific excellence with other development challenges. In the area of science and technology, there are several new masters' degrees available which aim to consider how science and technology can be developed in order to meet the requirements of otherwise excluded and marginalised categories of people. Such an approach recognises that science and technology do not automatically benefit all peoples and that specific processes are required to focus its benefits on poor people. One example of such a degree comes from Maastricht University, in Amsterdam, which offers a one year MA programme entitled 'Governance and Cultures of Innovation'. Another comes from the Institute of Development Studies, at the UK University of Sussex, which launched a Masters in Science, Society and Development in October 2007. Both of these degrees are concerned with casting a critical eye over science, technology and innovation. They both highlight the need to:

a) produce experts who are 'able to deal with the science-technology-society relationship in a reflexive and politically conscious way'

b) combine different disciplinary approaches in order to grapple with – and ultimately bring together – diverse perspectives, historically-bounded disciplines, theoretical insights and practical experiences.

c) direct science, technology and innovation towards addressing questions of poverty, social justice and environmental sustainability.

Bridging professions thus have a critical sensibility of science and technology. Rather than seeing these as automatic solutions, their awareness of the potential of science and technology is situated within a broader contextualisation recognises that all knowledge – including that of science and technology – is situated, partial and embedded (Haraway 1988); that science requires translation into practical knowledge and that power relations fundamentally influence how science and technology are used and for whose benefit. Their approach builds on the work of Gibbons et al (1994) who suggest a more problem-orientated, interdisciplinary and socially legitimated 'mode 2' science; on Russel and Ison (2007) who argue for a 'contextual' science grounded in local communities and where responsibility replaces objectivity and Fortmann's calls for a more 'participatory' and 'interdependent' science linked to cognitive justice and providing experience-based interpretation (2008).

These degrees – and the above critiques of excellence – all recognise a plurality of actors, all of whom define excellence differently. What is seen as scientific brilliance from one perspective might be, at best, irrelevant or, at worst, misconceived and damaging from another. Science, technology and innovation have tremendous potential for development, but there are also pitfalls and unexpected consequences. Dealing with these, in conjunction with the types of problems experienced by today's society and influenced by globalisation, climate change, and other unprecedented processes, requires a broadening of the notion of excellence and a re-evaluation of who the experts are. It is not enough to focus only on the experts and on individuals' attempts to break out of particular academic notions of excellence. Excellence is also contextual and structural, so it is therefore necessary to address critically the kinds of spaces in which 'experts' are expected to produce excellence.

## CENTRES

The idea of developing 'centres of excellence' contains within it a notion of concentration; that scientists will work and produce most effectively in centres of focused interaction with each other. It also implies the production of spaces in which scientists can work uncontaminated by the realities of everyday life and, in the developing world, unconstrained by those realities. Centres of excellence are also thus linked to an avoidance of the politicisation of science or the scientisation of politics (which involves presenting

politics as neutral scientific debates). The debate about the relationship between science and politics (or science and policy processes) is arduous and ongoing. One approach, summarised above, is that the politicisation of science undermines its scientific excellence and dilutes its objectivity. Linked to this, is the idea that the public and civil society lack the ability to understand scientific complexity and therefore credible bodies should be developed as gatekeepers who police the use of science in policy (Jones et al 2008). Ultimately, the production of centres of excellence will serve to reinforce these boundaries and, in so doing, help in the policing of science.

In contrast, another approach is to recognise the need for a politicisation of science rather than conceptualising these political aspects as essentially problematic. Such an approach acknowledges that all knowledge is politicised. Indeed, scientific knowledge which appears 'neutral' and 'objective' is more powerful precisely because of its hidden politics and ethics. In this view, scientists are called to acknowledge and express judgement and preference (and thus to be engaged in the policy process), while there is a widely expressed need for science to be democratised through participatory processes and by including indigenous knowledge (Keeley and Scoones 2003; Leach and Scoones 2006). By so doing, science – re-conceptualised more broadly as 'ways of knowing' - can challenge western and global scientific priorities which appear as universal and neutral. But creating centres of excellence risks reinforcing the distance between civil society and science, between those scientists who achieve 'excellence' and those who do not, and between science that meets international 'standards' and science that works for the needs of the people surrounding the scientists. In this vein, Chataway et al (2007: 180) warn against centres becoming 'islands of excellence' with little recognition of the applicability of science to poor people's lives, and with little interaction between centres and their surroundings.

The image of 'islands' of globalised science and technology excellence - well-connected with each other – and connected to other centres in more 'central' (read Northern, advanced economy places) but ultimately bounded off from their surroundings echoes Ferguson's (2006) description of 'point by point' globalisation in Africa. Centres of excellence risk exacerbating the divides between a globalised, interconnected world of science, technology and innovation, and surroundings that become defined as the opposite – localised, backward, left behind.

Centres may thus, in effect, serve to neutralise and objectify science. There is a danger that they will act to reinforce boundaries between experts and other people and, in so doing, undermine networks within countries (while developing relationships networks with other scientists) and other forms of participation and engagement. It is not coincidental that, when surveyed by Jones et al (2008), policy makers in the north stressed that scientists' exercising opinions for policy should be 'in conjunction with "objective" research', whereas southern respondents recognised the interplay of science and politics and sought less neutrality (2008: 18). Similarly, respondents 'from the Global North found internationally relevant information most useful, whereas those from the Global South found regionally specific information of greater value' (2008: 22). Looking upward towards international funders and scientific peers, rather than downwards to local contexts and users, reinforces 'objectivity', 'neutrality' and 'value-free' science while disguising other power relations and political processes at play. It also works against diversity, in the sense of science engaged with diverse local contexts, settings and issues. In addition, such notions of a centre, imply a linear model of science, technology and innovation in which technologies and innovations are developed – in isolation from their users – in a centre and diffused outwards to 'adopters' in a periphery. Such a view runs counter to an innovation systems perspective, in which multiple actors are understood to interact in innovation processes.

In thinking about the relationships between centres, power and politics, insights can be drawn from subaltern studies which sought to challenge 'academic notions of bounded, specialized knowledge

production', to develop 'forms of engaged political critique' (Carrington 2001: 275) and to 'discursively deconstruct cultural power' (Ludden 2001: 13). In seeking explicitly to politicise knowledge, to reveal hidden cultural power and to bring in the perspectives of the poor, these studies have developed a critique of one particular notion of 'the centre'. For these scholars, the centre is associated with the elite while the poor, marginalised, disempowered – the subalterns – are located on the margins (Fuchs and Baker 2004: 333). Western discourse and cultural production thus 'decenters' the powerless (Spivak 1988: 271). In addition, in this view western intellectual processes – including the production of science – enhance western economic wellbeing. For subalternists, discourses, power, knowledge, cultural and economic resources all require deconstruction to show where hidden interests and politics lie. Subaltern studies thus aim to undo the 'the totalizing narrative of European colonialism' while simultaneously providing some form of 'counterhegemonic ideological production' (Spivak 1988: 275). While couched in a particular language, these subaltern studies arguments echo STEPS Centre concerns to unpack universalising and neutral narratives (such as those underlying centres of excellence), and to identify alternative narratives and pathways which move in directions that better meet the needs and distributional concerns of marginalised people.

The Kigali Institute for Science, Technology and Management (KIST) in Rwanda is one example of an African institution that does emphasise engagement with users[10]. Established in 1997 as a project of UNDP and with donor support, the institute runs diploma and degree programmes which aim to build local and national scientific and technical capacity. In July 2002 it held its first graduation, awarding 403 diplomas and 62 degrees in management and computer science disciplines. However, at least in some accounts, KIST R&D and training is linked to innovation projects focused on local needs. It has won awards for its small-scale technologies in the energy arena, such as improved bread ovens and bio-gas digesters. Nevertheless this is still a centre, and one which is widely called upon in globalised science-policy discourses as an exemplar of success. Whether KIST and its styles of work thus challenge dominant (northern) models of science and development, or support a counter-politics, is thus highly questionable.

The field of agricultural research and development offers many examples of centres that engage with local people, their settings and priorities – for instance through processes of farmer participatory research, farmer field schools, farmer-back-to-farmer approaches and so on. Several decades of experience and reflection now testify to the value of such embedded centres and the context-sensitive, participatory styles of research they can foster, as well as to the struggle to sustain these in the face of centralising, universalising tendencies (e.g. Scoones and Thompson 2009).

Others go further, however, to suggest that however engaged and 'participatory' it may be, the kind of top-down, supervised styles of learning that research centres are able to promote may be fundamentally unsuited to dealing with certain development challenges. Thus Richards (2007) argues, in relation to seed selection and management in West Africa, that models of informal, unsupervised learning and 'neural networks' characterise the highly effective ways that farmers select, exchange, adapt and manipulate seed varieties to suit highly diverse ecological and social conditions.

More generally, networks, coalitions and alliances offer an alternative image to that of the centre; one more in keeping both with subaltern studies pleas to 'decentre', and with recent evidence of effective citizen action around issues involving science and technology (see Leach et al 2005). Networks that connect people and groups, often across diverse places, around issues of common concern are emerging as central ways in which otherwise marginalised people mobilise around the politics of knowledge, in arenas from agricultural biotechnology to global health. McCormick, for instance,

[10] See http://www.kist.ac.rw/ (accessed 07 September 2009)

identifies citizen/science alliances as essential for breaking down barriers between scientists and communities. In such an alliance, scientists and citizens collectively seek to solve citizens' or local problems. Working together provides a forum for 'transforming the insular nature of expert systems into one that accounts for local experience'. Collaborations of this sort not only challenge scientists' attitudes and practices, but also situate the research within an explicit set of values (2009: 45). In such networked movements, scientists and citizens, official and local experts, and producers and users of technologies often interact in sometimes unexpected, yet often highly productive, ways. Might 'learning networks' or 'learning alliances' offer valuable alternatives or complements to a 'centres of excellence' model?

## CAPACITY

A final keyword that has become central to mainstream discussions of centres of excellence is capacity. In the development context, 'Capacity development...seems to have become a catch-all that incorporates just about any form of technical assistance, and which appears to be a rather neutral, value-free form of engagement between development actors' (Taylor and Clarke 2008: 6).

This observation also applies to discussions of capacity-building in relation to centres of excellence. Here, the term is at least limited to 'scientific, technological and innovation capacity'. But beyond this, there is often little further specification of 'capacity of whom to do what, to what ends?' – i.e. little consideration of the directionality of science and innovation – and its particular distributional effects - that capacity-building might assist. For example, Goedhys argues that Tanzanian research centres built domestic research capabilities which were determined by a Science and Technology Commission. As a result, those for whom capacity had been built lacked motivation and remained unaware of the innovation needs of private enterprises. She argues that innovation can result from a locally-orientated and less scientific approach, rather than focusing on externally-driven targets (of excellence, innovation or technology): 'collaboration can indeed enable local SMEs [small and medium enterprises] in developing countries to be product innovators, even when they invest less in new machinery and engage less in training and research, development and design activities than their larger or foreign counterparts, probably due to more severe financial constraints. Local firms prove to be more embedded in the domestic industrial structure as they indeed innovate in collaboration with other local firms and through internal R&D, and by sourcing information from the Internet' (2007: 19).

Equally, discussions of capacity development in relation to science and innovation often appear oddly immune to issues of power and social relations. Thus while there is much talk of building partnerships internationally for supporting science and technology development capacity in the south, this rarely acknowledges or takes seriously the real imbalances in power relations between developing countries and highly-funded international institutions. In contrast, 'systemic' approaches for understanding and supporting capacity – such as in the recent work of the IDS-based Capacity Collective - attends to (a) individuals' abilities to construct, share and apply useful knowledge; (b) organisations' abilities to learn, adapt and manage change effectively, and (c) the dynamics of power that underlie relationships between individuals and organisations, and which shape access to and use of knowledge, learning and performance (Taylor and Clarke 2008: 7).

By defining capacity in relation to 'useful' knowledge, new and important avenues are opened up for exploring 'usefulness to whom, and for what' – enabling attention to diversity of need and context, and to directionality. It also invites attention to the particular kinds of knowledge and learning that might contribute to pathways towards specified normative and distributional goals. The emphasis on learning and adaptation also acknowledges diversity (across space and time), while in this definition, addressing power relations is intrinsic to capacity development.

If researchers and decision-makers are to embrace a greater diversity of possible science and technology pathways, and to acknowledge their implications for distribution, then a further crucial element of capacity is needed. This is reflexive capacity: the capacity to acknowledge that one's framing of a problem is positioned and partial, and open to challenge from other perspectives. This is a crucial challenge, yet one that is notoriously difficult to meet. Thus for example the Institutional Learning and Change initiative of the international agricultural research centres[11] exemplifies an attempt to foster 'learning capacity' – in some senses, reflexive capacity - at the organisational level, at the heart of the CGIAR system (Watts et al 2003). In this, scientists are encouraged to reflect on and challenge their own professional and disciplinary biases, and to learn from interdisciplinary practice. Yet in bringing difficult challenges to conventional professional hierarchies and institutional arrangements, this initiative has continually faced threat and marginalisation. In short, the power relations that continue to promote narrow notions of excellence and capacity, and centralised, hierarchical models of research and learning, are deeply entrenched and hard to shift.

## BUILDING CAPABILITY FOR INNOVATION, SUSTAINABILITY, DEVELOPMENT: TOWARDS PRINCIPLES

There is no dispute that developing countries need both to build and retain scientific expertise and to foster top quality science through new partnership arrangements. Recent arguments for, and investments in, centres of excellence have been invaluable in making this wider case, and in shifting the centres of gravity in science, technology and innovation capacity from north to south – in some respects, answering the 1970 Manifesto's clarion call. Yet as we have argued here, the dominant approach has, in many ways, served to reinforce a globalised, universalised, a-political notion of capacity and excellence that responds more to globalised conceptions of economic progress than to the diversity of development needs and contexts. In the process, questions about the alternative possible directions of technological development which science might support, and about their distributional implications, are often overlooked.

Thus we argue that there is a need to go beyond such centres – or at least to complement them – with investments, both immediate and long-term, that pursue a range of further principles and actions. These include:

- Defining scientific excellence both broadly – to encompass interdisciplinary knowledge, practical expertise and users' ways of knowing – *and* specifically, with respect to particular, normative directions of innovation and development pathways;

- Recognising and rendering explicit the politics of science and knowledge, and the ways these are implicated in research processes, institutions and research-policy linkages;

- Building capacity in relation to specific goals, constantly asking 'capacity of whom for what' and encouraging reflexive capacity to recognise framing assumptions and their implications;

[11] See: http://www.cgiar-ilac.org/. Also recent ILAC Briefs, including 'Innovation histories' http://www.cgiar-ilac.org/files/publications/briefs/ILAC_Brief05_Histories.pdf; 'Learning alliances; http://www.cgiar-ilac.org/files/publications/briefs/ILAC_Brief08_alliances.pdf and 'Innovation systems' http://www.cgiar-ilac.org/files/publications/briefs/ILAC_Brief02_Innovation.pdf (8 August 2009)

- Linking science, technology and innovation to local contexts and user needs, recognising their diversity. This includes fostering the capacity for research and innovation partnerships between scientists and potential users, especially poor people themselves;

- Promoting decentralised networks, coalitions and alliances for innovation, learning and knowledge sharing geared to particular political and development goals.

Applying - and initiating practical steps to realise - such principles will in turn require new forms of political and institutional arrangement - of governance. Thus interdisciplinary challenges demand a strengthening, and new forging, of partnerships between institutions focused on natural and social sciences or particular sectors, and crucially, between institutions and researchers based in the north and the south. Linking research with diverse contexts and user needs will require the training and empowerment of a new generation of 'bridging professionals' who combine scientific and innovation expertise with the social, political and policy understandings necessary to ensure their applicability to diverse contexts; who can act as brokers and mediators in processes of technology innovation, and who can facilitate the processes by which diverse perspectives from poorer people are brought to bear in innovation processes. Such training needs to create the spaces, frameworks and tools for critical thinking and action on issues of science and technology governance. This will require a combination of formal education and training, with processes of peer support and mentoring and the encouragement of learning from exchange programmes and from field level experience.

Meeting the challenges will require developing institutions (for research, innovation and training) which bring together poor people, frontline workers, scientists, administrators and policy-makers in new ways that promote dialogue about long-term futures and technology options; about more immediate science and technology priorities; about technology adaptation to local contexts; and about risks and uncertainties and ways to regulate these. Such institutions would need to enable both more open-ended dialogues which take their lead from peoples' felt livelihood needs and debate the technological options that might help address these, and more focused dialogues around particular problem areas (e.g. how to address the problem of clean drinking water or child deaths from diarrhoea) or particular new technologies, their potentials, benefits and risks (e.g. a new seed technology or vaccine). Some such institutions might operate at more local scales, but would need to articulate with national, regional and global equivalents, in a networked interaction. These would need to be 'reflexive institutions' which allow multiple rationalities and worldviews to shape the discussions.

Finally, there is an overarching need to acknowledge and address unequal power dynamics - between local people and formal experts, between global and local institutions, between developing and advanced economies, and between regions. This will not be easy; there is much talk of research partnerships today which overlook the real tensions and debates that arise when people and institutions from different disciplinary, geographical or political worlds come together, and yet are a necessary, creative part of what an effective partnership should be. Attempts to build effective research partnerships need to confront rather than bury the real inequalities of knowledge, power and money that divide people and disciplines, and negotiate ways to work together productively and respectfully.

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