Thematic Section

New Institutional Arrangements for Development, Science and Technology

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ABSTRACT *Science and technology are intimately linked to global development. Investment in research for development has yielded some results. James Smith argues that the benefits and risks of increasingly complex and paradigmatic technologies means that we have to think very carefully both about how research is organized and how new technologies are governed and regulated if we are to realize the potential of science and technology as drivers of just global development.*

KEYWORDS *science; technology; development; governance; research and development*

Perfect storms

John Beddington, the UK Government Chief Scientific Advisor, recently coined the phrase ‘perfect storm’ to describe a future global confluence of food, water and energy insecurity (2009). While Beddington captured something of the unprecedented nature of the coming event, the choice of ‘storm’ as a sort of metaphorical de-anthropomorphism runs somewhat counter to the usual naming of unusual weather events; for we need to be clear that the processes and interactions that will lead to food, water and energy insecurity are driven by us, and exist only in relation to us and our use of science and technology.

In his recent book, *The Politics of Climate Change* (2009), Anthony Giddens grapples with how we can engender individual, institutional and national responsibility and action for climate change, when we have collectively behaved so irresponsibly for so long. As recent history shows us, we have struggled to come to terms with the implications of our economic and technological development, in terms of environmental impact, developmental outcome and social justice.

Since Truman’s oft-cited Presidential Address in the late 1940s the role of science and technology within development has been at the core of the development project: scientific advances would be made available for all, for the first time we had the tools necessary to relieve suffering and replace Hobbes with hope, and ignorance and tradition with knowledge and science. The 1950s and 1960s marked an interrelated globalization of development and an institutionalization of science and knowledge, which has profoundly shaped the relationship between science, technology and development to

this day. The sorts of cosmopolitan institutions that have formed the hubs of science for development endure and have implications for how science is practiced, how priorities are set, and how and what technologies are realized and which are not.

My article explore the sorts of international and national institutional arrangements that shape science and technology for development, and in doing so highlights the historicity of science and the expectations of technology, which, if we are not careful leaves us in a liminal present in which responsibility is abrogated to tomorrow and yesterday is already forgotten. If we are to ensure that new technologies are to drive us towards social justice, limit risks to the most vulnerable and support those most in need, we need to think as deeply about how we govern and organize science and technologies as we do about the science itself.

Questioning science, technology and development

Bruno Latour has referred to science and technology as 'dark matter', despite our lives being so firmly meshed with science and technology (indeed, possibly because of it), we have spent relatively little energy in digesting the implications of this (Latour, 1992). The unseen reality is that this 'dark matter' holds society together; it helps us to live our lives, relate to others and shape our interactions with the world. Science and its technologies are societal glue as well as material objects. Latour has been part of a vanguard (Barnes *et al.*, 1996) that has understood science and scientific interpretations of the world as politics and technologies as actors in the world. From this perspective, science is a social and political activity like any other and this means casting science's framing of questions, its development of methodologies, its modes of investigation, its means of reaching consensus and its dealing with risk and uncertainty in whole new lights.

The recent, apparent rise and fall of biofuels as a development panacea is a case in point. Within a couple of years biofuels (liquid fuels that are directly derived from renewable biological resources) have shifted in the eyes of policymakers

from being a multi-purpose technical solution to a range of problems – climate change, energy insecurity and underdevelopment – to a technology whose impacts are little understood and complex and that could have profound repercussions on global food security, the environment and north–south relationships.

At first glance, the unstable price of oil – and the spectre of so-called peak oil – coupled with increasing global concern with climate change, meant that biofuels seemed a viable contributor to our need for alternative energy sources. Several countries, most notably the United States and Brazil, have been actively pursuing the production of liquid biofuels from agriculture, usually maize or sugarcane for ethanol, and various oilseed crops for biodiesel. Several developing or emerging economies, including India and some East African countries, have been exploring opportunities for oil seed crops such as *jatropha*, which have potentially large export markets. This promise has been tempered by an interlocking set of concerns regarding their sustainability, their own environmental impacts and perhaps most importantly their potential impacts on food production and food security.

Food prices rose by 140 percent between January 2002 and February 2008, and staples such as grains have doubled in price in just the past year. Several reasons have been cited, including the price of oil; changes in patterns of food production and consumption; the exchange rate of the dollar (and related world macro-economic factors); and growth of the world population (Abbott *et al.*, 2009). Biofuels have been cited as another factor, although published analysis diverges widely on the extent of the impact of biofuels on food prices. In May 2008, the US Secretary of Agriculture claimed that analysis showed that biofuels production contributed only two to three percent to increases in food prices (*New York Times*, 2008). However, in July 2008 a leaked World Bank document calculated that biofuels production was responsible for 75 percent of the total increase in food prices between 2002 and 2008. Increased biofuel production was said to have led to increased demand for so-called feed crops (from which fuel can be derived), which in

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turn led to large-scale land use changes which reduced supplies of staple food crops such as wheat (Mitchell, 2008). According to a 2008 World Bank report, rising food prices have forced approximately 100 million more people into poverty (World Bank, 2008) and the Food and Agriculture Organization estimates that for the first time over 1 billion people are undernourished worldwide (FAO, 2009).

This rapid policy shift reflects several things, the inherent complexities and contradictions of new technologies that straddle complex contexts and interact with complex systems, the preoccupations of policymakers in creating networks through which technologies are framed in simple, unproblematic terms and above all the limits of our knowledge of the potential, promise and risks inherent with little-understood, paradigmatic technologies such as biofuels.

Risk and the politics of complexity

One of the most important insights regarding risk in a modernizing world is that society's concerns have shifted from the production and distribution of goods towards the regulation and allocation of 'bads', such as pollution, the impacts of climate change, or as in the case of biofuels, rising food insecurity (Beck, 1992). In some respects we might have tamed risk, our understanding of risk and probability has improved, and we have reduced our exposure to certain forms of risk (at least in some parts of the world). Modernist thought has suggested that progress and our enhanced ability to control nature meant that risks were universally diminishing; disease could be controlled through vaccines, medicines and public health, and food supplies secured through better farm management, the application of science, and global market chains, for example.

This optimistic take on modernity, science and the management of risk has been moderated by changes in the nature of twenty-first century technologies and the limitations of global development. Modern technologies are associated with new forms of risk, which may affect entire societies, ecosystems, or even the world. Likewise, poorer communities and nations may continue to

be confronted by nature; tsunamis, droughts, and the implications of modernity itself; climate change, food insecurity wrought through new technologies. Progress may result in both novel hazards and more security, or continued exposure to old risks and increasing insecurity (Giddens, 2002). To an extent we have exchanged uncontrolled risks in the natural world for risky technologies whose safety depends on their design and operation. Developed countries, at least, may be relatively free from dependence on the vagaries of the weather (or pass on this dependence elsewhere), but we are increasingly dependent for our security on the developers and operators of technology, and ultimately on the institutions that regulate them. Thus, it is regulation and the regulators of risky technologies as much as the risks of nature or the technologies themselves that are to be feared.

Unsurprisingly, regulators of risk have elaborated increasingly sophisticated arguments, systems and protocols to manage risk, and this has served to highlight more acutely the idea of the risks themselves. Given that no complex system can be guaranteed to be safe, regulation of technological risk boils down to the creation of policies and institutions that legislate for the public's exposure to risk. In relation to this, key questions include: how safe is safe enough? How are benefits and risks balanced across society? Regardless of data sets, scenarios and statistical fluency answers to these questions are inevitably subjective (Jasanoff, 1999). It is impossible to calculate risk accurately. It may be possible to assess the likelihood of a car crashing on any given journey, but it is much more difficult to assess, say, the interactions between increased investment in biofuels production and food security in sub-Saharan Africa. Such uncertainties may be crystallized into quantifiable risks as we gain more knowledge and accrue evidence, but with very complex scenarios such as climate change or emerging technologies we will always learn new things and gain new insights that we cannot yet know. 'Ignorance', or the limits of what we cannot yet know, is hardwired into any risk assessment we might make, and hence any decision based on that assessment.

There are other uncertainties against which we cannot legislate; human behaviour, for example, or the ways in which different populations perceive risk differently. For example, debates around the introduction of genetically modified crops in Africa often revolve as much around the politics of transnational companies impinging on the rights of developing countries and their citizens to make their own decisions as around the risks and benefits of the technologies themselves (Clark *et al.*, 2007).

Risk is embedded not only in the ways in which society interacts with technology, but also in the capacity of countries to regulate and manage the process that interrelates expertise, interests, and analyses of the allocation of benefits and risk. Developing countries tend to be more vulnerable to certain major risks, their populations to be more exposed and poorly equipped to deal with risks, and their governments tend to be similarly ill-equipped. Institutional, legislative and societal vulnerabilities intensify risk and amplify its impact, and consequently place even greater emphasis on the need for effective regulation of risk. Unfortunately, developing countries are often unable to do this. They lack the expertise, legal instruments or regulatory frameworks to make effective decisions. International treaties such as the Cartagena Protocol aim to provide guidance and an international context for risk regulation, but often countries struggle to keep pace with the advance of the technological frontier. For example, the development of Kenya's biosafety regulatory system has struggled to keep pace with the development of new technologies, including biotechnologies, which has reduced the capacity of the Kenyan state to legislate and govern the introduction of potentially impactful new agricultural technologies (Harsh, 2005).

De-institutionalizing research for development

The regulation of risk is increasingly supranational (it needs to be) and the role of the state in dealing with emerging technologies is constantly changing. Despite an emerging, more nuanced understanding of how new knowledge interacts

to produce new technologies (Hall *et al.*, 2001) research for development remains a highly institutionalized endeavour. One legacy of the Green Revolution has been a year-on-year ramping up of investment in a series of international agricultural research centres, the Consultative Group for International Agricultural Research, which has sought to centralize expertise and research into hubs where new knowledge would be produced and innovative technologies disseminated around the world. The annual budget of the Consultative Group has expanded from an initial US\$20.7 million in 1971 to US\$425 million in 2004 (Alston *et al.*, 2006) and it is an influential voice in terms of shaping and prioritizing research agendas in, and on behalf of, developing countries. A pre-cursor to the Consultative Group, the International Rice Research Institute, was highly successful in producing high-yielding, high input varieties of rice in idealized growing conditions on its campus in the Philippines, it was initially much less successful at producing new rice varieties specialized towards marginal environments and the most resource poor farmers. This tension between the relative 'simplicity' of improving aggregate yields and complexity of improving yields and livelihoods of the most marginal farmers has played out in developing countries since at least the 1940s (Fitzgerald, 1996).

Creating centres of research excellence, which attract the best scientists, utilize the most modern scientific techniques and accrue research funding appears an intuitive approach to maximizing resources and impact, and in some respects it is. There are downsides, however. Highly funded centres of research excellence tend to attract the best scientific talent in the countries in which they are based, denuding national and local institutions of knowledge, expertise and decision-making authority. In many places, national research institutions have simply become defunct and the capacity of developing countries to undertake their own research, and make their own decisions, has been completely removed, often in tandem with the impacts of structural adjustment (Smith, 2009). Furthermore, centralized research institutions have traditionally struggled to interact

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with and learn from end-users, which has created blind spots in terms of interpreting their needs and learning from their often deep local knowledge. In turn, this disconnect has been exacerbated by the stripping away of national and local research expertise.

There have been some limited moves towards de-institutionalizing research for development, more particularly in terms of medical research. The International Aids Vaccine Initiative has acted as a model for a new partnership-led approach to problem solving, where public funding is used to push forward promising private sector research towards HIV vaccine field trials (Chataway and Smith, 2006). This approach, which aims to build local capacity and develop synergies between the public and private sectors in an arena where there is traditionally little incentive for private sector involvement aims to learn from previous failures and disappointments which meant that vaccines – such as the polio vaccine – were only widely distributed in developing countries decades after they had been in the developed world. The science of HIV vaccine development is incredibly difficult but at least thought is being given to new institutional arrangements that focus on eventual delivery as well as research.

Philanthrocapitalism and the future

Concerns have recently been raised that a preoccupation with HIV in Africa has funnelled funding away from other, more immediate health priorities. The argument goes that focusing on HIV, which in most African countries affects less than three percent of adult populations and is relatively stable, means ignoring basic, simpler priorities like treatment for childhood diarrhoea or preventative measures such as clean water provision or the provision of contraceptives (Guardian, 2009). Similarly, a *Lancet* editorial has asserted

that while the Bill and Melinda Gates Foundation's annual \$3 billion investment has challenged scientists to be bold, it has also incentivized distortions, such as a focus on malaria in areas where other diseases cause more human harm (*The Lancet*, 2009). The emergence of philanthrocapitalism raises other questions too: who makes decisions regarding funding and science, and who should be making those decisions?

This article has attempted to sketch out the contours of science for development. New technologies suture together increasingly complex systems and within promises of benefits, risks are implicit and often little understood. Science continually pushes the frontiers of what we know and delineates the limits of our knowledge, and this means we must give careful thought to the sorts of institutional arrangements needed to maximize benefit and minimize risk.

We need to think carefully about how, why and where new technologies are developed; research shows that in context and outside research institutions more often, than not, leads to better developmental outcomes. We need to strengthen the capacities of developing countries to make their own decisions and identify priorities regarding new technologies in order to stop technology running ahead of policy, and above all we need to acknowledge the importance of supranational decision making. We must understand that new technologies may distribute 'goods' and 'bads' in ways that entrench existing inequalities, intentionally or not. Ultimately, if we wish new technologies to lie at the heart of social justice, emancipation and redistribution we need to ensure that we move beyond the political processes of government institutions and the murk of scientific decision making and embrace transparent social interaction and collective decision making, at all stages of technological development. We require a profound shift from governmentality to governance.

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