

Chapter 2

Sustainability, Development, Social Justice: Towards a New Politics of Innovation

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2.1 Introduction

We live in a time of unprecedented advance in science and technology, with global annual spending on research and development (R&D) now exceeding a trillion dollars. Yet development challenges have also grown. For many people and places, poverty is deepening, and the environment is in crisis. Thousands of children die daily from waterborne diseases, and more than a billion people go hungry. Meeting the interlinked global challenges of poverty reduction, social justice and environmental sustainability is the great moral and political imperative of our age, and moreover, one that must be pursued in an increasingly complex and interconnected world. Science, technology and innovation of many kinds have essential roles to play. However, in this chapter, the author argues that this imperative can only be fulfilled if there is a radical shift in how we think about and perform innovation – amounting to a new politics.

Debates about the relationship between science, technology and development have a long history, with formal discussions in the United Nations (UN) circles going back more than 40 years. With the late 1960s witnessing the moon landing, the burgeoning Green Revolution and a global smallpox eradication program, this was a time of great interest in the potential for science and technology to address development challenges. Yet science and technology were overwhelmingly steered by the interests of the global rich rather than the poor. At that time, however, some began to argue that research agendas needed to focus much more strongly on the world's 'developing' countries and their needs. In some quarters – for instance, in a study commissioned by the UN in 1969 which became known as the 'Sussex Manifesto' (Sussex Group 1970), published in 1970 – calls were made for large increases in investment and funding, as well as the building up of institutions and

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infrastructure – to support science and technology in, and for the interests of, developing countries. This document, along with a number of other related initiatives during this period, did help to advance broadly progressive aims for building science and technology geared to development goals and capabilities in developing countries to realize these. Indeed, since then, there have been significant achievements. The share of global research and development expenditure in ‘developing’ countries has increased from 2% in 1970 to roughly a fifth, whilst expenditure on research and development across ‘developing’ countries has risen to approximately 1% of aggregate gross domestic product. The scale of science and technology for development has therefore undoubtedly increased. However, this chapter argues that scale is not enough. By examining current patterns and debates about how to link science, technology and development, and drawing on arguments developed in a New Manifesto (STEPS Centre 2010), this chapter argues that much more attention should be given to the *direction*, *distribution* and *diversity* of scientific, technological and innovative activities, illustrating the practical and political implications of this ‘3D’ agenda.

2.2 Scientific and Technological Promise: For Whom?

Today, we are witnessing a range of coordinated international efforts to solve global problems using science and technology. Modern advances appear to offer more promise than ever, and private sector and philanthropic foundation involvement has added significantly to the potentials.

Two main arguments are now put forward in favour of science and technology as the core solution to development challenges (Leach and Scoones 2006). In the first, scientific and technological innovations are seen as routes to national economic growth in a highly competitive global economy. The emphasis is on fostering scientific and technological infrastructure, connectivity, markets and capacity through ‘centres of excellence’ towards an increase in growth-focused technological activity. This is held also to lead indirectly to poverty reduction and capacities to deal with environmental protection – in line with general ‘trickle-down’ models of economic development. Yet, whilst scientific and technological advance has undoubtedly contributed to growth in particular areas, the benefits – and sometimes risks – have been very unevenly distributed. For instance, China and India have experienced rapid economic growth assisted by hi-tech knowledge industries, yet the poor peri-urban populations of these countries’ new ‘shining cities’ must struggle for livelihood and health, often amidst polluted land, air and wastewater. Or take Africa, where the development of continent-wide network connectivity with fibre-optic cables promises a new era of opportunity and investment for some, but will not directly help the poorest, those who remain isolated, or those who do not speak a global language. This route and its consequences therefore follow and support a ‘lock-in’ to particular growth-focused styles of technological activity – from which other people and problems are excluded or lose out.

The second argument responds to this problem through focusing more directly on particular poverty and environmental challenges. The emphasis here is on targeted scientific and technological solutions – ‘silver bullets’ – that can be rolled out and applied at scale. In particular, new philanthropic and public-private investments have massively expanded the scope to address challenges that were once neglected because addressing them was seen as unprofitable. Again, this has yielded many successes and much promise. Thus in 2010, for example, the Bill & Melinda Gates Foundation committed an unprecedented £6.24 billion investment in vaccines for children, geared to saving eight million lives by 2020. But often, hoped-for technological successes founder amidst particular local contexts, with their diverse realities, perspectives, priorities and socio-cultural understandings. Thus, for example, the biotechnology-led ‘Green Revolution for Africa’, as manifested in the scientific search for drought-tolerant maize in East Africa, is proving inappropriate to the needs of dryland small farmers in Kenya who see their resilience amidst climate change better built through cropping and livelihood diversification, moving in and out of maize (Brooks et al. 2009). The vaccine-led Global Polio Eradication Initiative foundered in Northern Nigeria where local priorities focused on other diseases and basic health care and socio-political contexts associated highly resourced external technology interventions with political terror in a post-9/11 world (Yahya 2007). The roll-out of bednets – at least partly responsible for massive declines in child mortality from malaria in Africa in the last decade – foundered in Western Kenya because they were the colour of the shrouds used to wrap the dead. Such problems and missed targets arise, again, because of concentration and lock-in, this time around big-win, scaleable technologies that are seen to meet grand challenges. However, context matters, and technologies that work in one place will evidently carry quite different meanings and implications in others.

2.3 A ‘3D’ Agenda for the Politics of Innovation

Neither these successes nor the generic importance of either of these routes to technology and development progress should be denied. They need political commitment and investment. However, this needs to be oriented in new ways, in line with what can be termed a ‘3D agenda’ (STEPS Centre 2010). This aims to foster far more *diverse* and more *distributed* forms of – and *directions* for – innovation, in turn requiring far more attention to deliberative, democratic politics.

Before elaborating this ‘3D agenda’, it is important to acknowledge that this refers not just to science and technology but also to innovation – and innovation systems. Amongst many possible definitions, *science* can be defined as the process of generating knowledge, whilst *technology* refers to the application of scientific knowledge, frequently involving invention – the creation of a novel object, process or technique. *Innovation*, however, refers to developing new ways of doing things in a place or by people where they have not been used before. This may involve the

bringing together of new ideas and technology or finding novel applications of existing technologies (Conway and Waage with Delaney 2010). Innovation therefore can make use of science and technology, but goes beyond it. We also need to move our conceptualization beyond a linear model, in which research leads to translational research, product development and then to application or consumption, to recognize innovative activity and innovation systems as involving multiple interactions between a wide array of actors – from laboratories and firms to funders, civil society organizations and users. These interactions often involve interplay, feedback, experimentation and embedded learning in multiple directions. They encompass not just research and development but also design and engineering; not just technologies and applications but also social meanings and arrangements. These interactions, in turn, take place in wider institutional environments – involving policies, regulations, property rights and finance – extending across local and global scales. This broad conceptualization of an innovation system, in which creativity and learning are dispersed throughout, is an essential basis for a 3D agenda.

Whichever link with development is the focus – competing in a global economy, or meeting challenges directly – current mainstream discourses focus quite narrowly on science and technology, rather than broader innovation systems. Equally, they emphasize the scale and pace of innovative activity, over its direction, distribution or diversity. When thought about in relation to any given challenge (dealing with a disease, addressing hunger amidst drought, building low-carbon energy systems), the image is that there is an optimum pathway to be followed. But if we look more closely, it becomes clear that for most challenges, innovation pathways are chosen; particular directions are promoted over others and gain momentum and lock-in. This is a political process involving power, markets and the interests of incumbent institutions.

A 3D agenda involves making such questions of *direction* far more explicit, asking ‘what is innovation for?’, ‘which kinds of innovation, along which pathways?’ and ‘towards what goals?’ This includes – but goes beyond – prioritization across different sectors, such as military, health or energy, to address the particular directions of change supported in any given sector. For instance, even quite a narrow field such as low-carbon electricity production presents a host of alternative directions for innovation pathways: such as those emphasizing small-scale distributed renewable energy; large-scale, centralized renewables in continent-spanning infrastructures and nuclear fission or fossil fuels with carbon capture and storage. None of these strategies can be pursued to their full potential without detracting from support for others. This inevitably involves political choices.

Direction matters because it shapes the *distribution* of benefits, costs and risks from innovation. As we have seen, marginal people and places are often the ones to lose out. So turning to the second D, for any given problem, we need to ask: ‘who is innovation for?’, ‘whose innovation counts?’ and ‘who gains and who loses?’ This means deliberating, explicitly and inclusively, what different innovation pathways imply for equity and justice – across rich and poor, place and circumstance, gender and generation, and ethnicity and identity. It also means, I argue,

enabling poorer and vulnerable women and men to be far more central to choosing amongst and promoting different innovation pathways and to be valued as innovators themselves.

In turn, this raises further questions about *diversity*: ‘what – and how many – kinds of innovation do we need to address any particular challenge?’ To take direction and distribution seriously means deliberately pursuing a diversity of innovation pathways. This is important to resist the processes of concentration and lock-in that close down directions and crowd out the paths that would bring justice to more marginal groups. Greater diversity also brings other advantages. It enables sensitivity to varied ecological, economic and cultural settings. And it fosters resilience – hedging against our uncertainty and ignorance about the future. However, an argument for diversity does not mean that ‘anything goes’. Diversity must be linked to questions of direction and distribution; with a *politics* of technological diversity addressing which options present the best ways to address poverty alleviation, social justice and environmental sustainability.

These three Ds – direction, distribution and diversity – are therefore mutually complementary. Together – and as envisioned in our New Manifesto (STEPS Centre 2010) – pursuing them could help to shape a world where science, technology and innovation work far more effectively for social justice, poverty alleviation and the environment, across diverse contexts, unleashing and supporting the energy, creativity and ingenuity not only of scientists but also of users, workers, consumers, citizens, activists, farmers and small businesses.

2.4 3D Innovation in Practice

There are many worldwide who share this kind of vision, and numerous practical examples are emerging where, in different ways, elements of these 3Ds are being pursued – towards innovations that work for particular, poor people and their environments.

One such example highlights the role of bottom-up innovation in addressing local challenges. Sanitation, previously neglected in much development funding, is now enjoying increased support. In contrast to many top-down sanitation projects, community-led total sanitation (CLTS) is an example of an alternative approach that takes communities themselves as the point of departure (Kar 2003; Mehta and Movik 2011). This originally began in South Asia and involves the facilitation of a participatory process in rural communities whereby residents come to analyze and reflect on their defecation practices and their consequences in terms of hygiene and health. In numerous cases, this has triggered a change in mindset in which villagers embrace the desire to eliminate open defecation completely. Thereafter, they have developed an array of locally appropriate, innovative, social and technological arrangements for sanitation to achieve this goal – for instance, combining low-cost, self-built latrines with peer pressure to ensure that people use them. CLTS has now spread throughout large areas of Asia and Africa, with varying degrees of

success. A massive diversity of technological designs has emerged, adapted to local conditions. Widespread sharing of local innovations and experiences, and ongoing research, are paving the way for further improvement geared towards greater sustainability. This emerging second ‘wave’ of CLTS emphasizes greater diversity of CLTS pathways adapted to particular climatic, ecological and cultural settings and greater attention to distribution within as well as between communities (Kar and Pasteur 2005; Movik and Mehta 2009).

A second example highlights the role of innovative marketing arrangements in meeting particular technology distribution challenges Bloom (2009). The social enterprise Scojo designs and produces low-cost eyeglasses for people with age-related vision problems. In the vibrant markets of South Asia, it has established distribution systems or linked with other organizations that have a local distribution network. In Bangladesh, Scojo is working with BRAC, a very large non-governmental organization (NGO) with a major health program, which has trained an extensive network of village health volunteers. To motivate continuing involvement, BRAC also identified a need to ensure that this volunteering helps to maintain a livelihood in a context where there are increasingly other opportunities for the volunteers to earn a living. Thus, Scojo is filling an important need in rural populations for the distribution of low-cost eyeglasses whilst also providing income to BRAC’s health volunteers, effectively linking need and demand through an innovative organizational arrangement.

The example of participatory plant breeding in marginal environments highlights the value of bringing technology users centre stage in shaping innovations Millstone et al. (2009). In contrast with the convention of breeding for optimal environments, the innovative CIMMYT¹-led African Maize Stress (AMS) project, for instance, developed new methodologies for diverse ‘managed stress’ conditions. The research team employed a participatory varietal-evaluation methodology popularly known as ‘mother and baby’ trials and went on to instigate a second stage of farmer participatory field research. As ‘Farmer First’ approaches have long advocated and illustrated (Scoones and Thompson 2009), starting with the concerns of the most routinely marginalized groups such as women and resource-poor farmers, involving them centrally in designing and implementing the selection and testing of different plant varieties, can enable context-sensitive adaptation and shaping of technologies – paying attention to their social as well as technical dimensions.

Methodologies also have roles to play in contributing to a 3D agenda, in ‘opening up’ processes of technology appraisal to appreciate a wider diversity of possible innovation pathways and their distributional implications (Stirling 2008). For instance, ‘Multicriteria Mapping (MCM)’² is an interactive, multi-criteria appraisal method for exploring contrasting perspectives on complex strategic and

¹ Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT).

² <http://www.multicriteriamapping.org>

policy issues. An MCM exercise usually involves a series of one-to-one interviews with stakeholders, using a dedicated software tool and making special efforts to include all relevant perspectives. These involve (a) developing a set of options, or alternative ways to achieve a particular aim; (b) characterizing a range of ‘criteria’, or issues that are seen to be relevant in appraising the options; (c) ‘scoring’ each option under each criterion and (d) assigning a ‘weight’ to each criterion. One end product of these four steps is the calculation of an overall ‘rank’, expressing – for the viewpoint in question – the relative performance of each option under all the criteria taken together. MCM thus helps to ‘open up’ technical assessment by systematically ‘mapping’ the practical implications of alternative options, knowledges, framings and values and allowing non-quantifiable factors to be explored on a par with quantitative measures. MCM exercises can thus provide policymakers with information that attends to issues of distribution and diverse values, as a route to more democratically accountable decisions. The STEPS Centre’s project ‘Environmental change and maize innovation pathways in Kenya’ is providing MCM-based outputs for decision-makers that identify alternative pathways in and out of maize in risk-prone environments. Participatory methods with farmers, with scientists and with decision-makers explore alternative innovation pathways and distributional implications.³

Funding allocations also have roles to play. An example of where these have been ‘opened up’ to help foster elements of a 3D agenda is provided by the African Technology Policy Studies (ATPS) Network. This is a network of researchers, policymakers, private sector and civil society representatives that serves to link producers and users of science, technology and innovation policy research from across the African continent. The network has begun to adopt an innovation in its resource allocation process that invites quantitative assessment and qualitative comments on proposals presented at its annual meeting. These inputs from different stakeholders are fed to the ATPS science, technology and innovation committee as it decides on a list of funded projects. Whilst some administrative challenges still remain, this represents a step towards opening up and democratizing the process of research funding around innovation, sustainability and development in Africa.⁴

2.5 Moving Ahead

This is only a small selection of many possible examples. Indeed, taking direction, distribution and diversity seriously both endorses and builds on many shifts and exemplars in thinking and practice around innovation in recent years, recognizing

³ <http://www.steps-centre.org/ourresearch/crops,%20kenya.html>; www.multicriteriamapping.org

⁴ <http://stepscentre-thecrossing.blogspot.com/2009/12/opening-up-research-funding-at-atps.html>

and paying greater attention to the significance of things that are already happening and that people are already doing. The crucial question is: how can such efforts be more widely recognized and supported? The STEPS Centre's New Manifesto proposes five broad areas of recommendation, targeted to different dimensions and hence actors in innovation systems, which are intended to catalyse, provoke and support specific concrete actions in different places and which are reproduced below. These address *agenda setting, funding, capacity building, organizational arrangements and monitoring, evaluation and accountability*.

2.5.1 Funding

The funding of science, technology and innovation – whether from public, private or philanthropic sources – needs to be geared much more strongly to the challenges of poverty alleviation, social justice and environmental sustainability. This requires that the needs and demands of poorer and marginalized women and men as potential users of technologies, as well as the outcomes of innovation, are addressed in funding allocations. Therefore, all science and technology funding agencies should regularly review their portfolios to ensure that a significant and increasing proportion of their investments are directly focused on these challenges. Such agencies should also progressively improve the balance in investments across basic science, technology, engineering, design and science services. Moreover, transparent accounts linked to these criteria should be produced and made available to public scrutiny.

In order to encourage diversity in innovation pathways, funding allocations to support experimentation in niches, and networking and learning across these, involving the private sector, community groups and individual entrepreneurs should be promoted. In order to help democratize the process of innovation, procedures should be established directly to involve end users of science and technology – including poorer and marginalized people – in the allocation of funding. Also, incentives for the private sector to invest in forms of innovation geared to poverty alleviation, environmental sustainability and social justice should be enhanced.

2.5.2 Capacity Building

Capacity building for science, technology and innovation must move beyond a focus on elite science and so-called centres of excellence to support science that works more directly for diverse social and environmental needs. As a vital complement to training scientists and technology experts, this means extending the scope of capacity building to other players in the innovation system, including local entrepreneurs, citizen groups, small businesses and others. A key challenge in improving innovation processes is linking between groups and facilitating inclusion

of otherwise excluded people. Therefore, an extension of capacity-building support towards ‘bridging professionals’ who are able to link technical expertise with particular social, ecological and economic contexts should be enhanced. Further, the support of civil society networks and social movements should be encouraged to facilitate the sharing of technologies, practices and wider experiences and learning. Capacity support should further enable such groups to engage with national and international political debates about science, technology and innovation.

This, in turn, will involve investment in new priorities for training, including key reforms to tertiary, further and higher education in the area of science, technology and development. These will require new institutions (or refashioned old ones) that actively link science and technology to located needs and demands, and the building of new learning platforms, virtual and face to face. They will also include greater provision for local community engagement in tertiary, further and higher education as well as wiki spaces for innovation support of a kind that enable more inclusive, networked and distributed forms of innovation.

2.5.3 Organizing

Organizing for innovation requires identifying and supporting social and institutional arrangements that enable technologies to work in particular contexts and to meet the needs of poorer and marginalized women and men. Firms, public and philanthropic organizations developing specific technological innovations should invest in concrete plans to ensure that these social, cultural and institutional aspects of application are addressed. Further, local experiences with these organizational aspects of innovation need to be shared and learned from more widely. This requires an open, distributed and networked approach, with active investment in linkages between public, private and civil society groups. Therefore, future investments – by the public and private sectors – should especially highlight bridging functions, connecting formerly separate organizations and linking upstream and downstream research and development activity. Overall, investment should extend its focus from basic science to emphasizing other aspects of the innovation system, including engineering, design, science services and social entrepreneurship. Further, support needs to be increased for open source innovation platforms, with limits placed on narrowly defined property-based systems which impede competition and constrain innovative activity.

At national level, and led by Strategic Innovation Fora, a broad framework for science and innovation policy should be developed, putting poverty alleviation, social justice and environmental sustainability at its core.

2.5.4 Monitoring, Evaluation and Accountability

Increased accountability and full transparency must be at the centre of democratized innovation systems – across public and private sectors and at local, national and

international levels. This requires active engagement by citizens in priority setting, monitoring and evaluating innovation activities. Benchmark criteria, relating to the priorities of poverty alleviation, social justice and environmental sustainability, should be set in all countries and so become the basis of indicators for monitoring innovation systems. At the international level, overseen by the Global Innovation Commission, similar criteria should be established for monitoring and annual reporting. Further, data collection systems and methodologies need to be improved, switching the focus from indicators such as publications, patents and aggregate levels of expenditure to assessments of the wider development outcomes of innovation efforts. All organizations – whether government departments, philanthropic foundations, non-governmental organizations and private sector firms registered in a particular country – investing in research and development above a certain amount should be required to report on expenditures in relation to these criteria. Such data should be freely available and open to public scrutiny. Finally, the Strategic Innovation Fora (or similar bodies) should have a statutory obligation to report publicly both to national parliaments and the Global Innovation Commission on a regular basis concerning innovation direction, distribution and diversity, presenting full data from all research and development organizations.

Only in such ways may the promise of more diverse and equally distributed directions for innovation be fully realized.

2.6 Conclusions

Networks are already building around the 3D vision and agenda. The task ahead is to take the key messages to national governments, international organizations and civil society groups in an effort to affect long-term change at multiple levels.

It is clear that a vigorous new critical global politics of innovation is needed. This will mean moving beyond narrow conceptions of science, technology and development, to embrace innovation more broadly as ‘new ways of doing things’ that also involve changes in social arrangements and institutions. It also means addressing innovation not as merely a technical matter but as part of a political process, with its directions, distributive implications and required levels of diversity a matter for democratic debate and political argument. It will also mean harnessing the energy, creativity and commitment of marginalized groups, small business and civil society – as well as existing organized innovation systems. No single prescriptive set of actions will be sufficient, or universally appropriate, to achieve this. The potential value of practices and actions like those highlighted in this chapter, and the new networks forged around them, is their capacity to help catalyse and enable this new politics so that people’s creativity may genuinely rise to the environment and development challenges ahead.

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and development (STEPS Centre 2010; see also Leach et al. 2010). Many of the arguments made here draw directly on the New Manifesto, and acknowledgement is therefore due to the STEPS Centre co-directors, team members, international partners and particularly the project Convenor Adrian Ely for their essential contributions.

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