Health dynamics, innovation and the slow race to make technology work for the poor

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The science, technology and development races are on[i]. Nowhere is this clearer than in international health, where a new generation of donor, philanthropic and public-private initiatives is emerging and attracting increasing funding. These hold out promises of new drugs, vaccines and infrastructure applications, with some claiming major technological breakthroughs that could solve longstanding health problems and tackle emerging disease outbreaks in the developing world. This "race to universal fixes" for health and development problems is valuable. It is an important counter to innovation approaches aimed simply at a race to the top in the global economy, assuming that health and poverty-related problems will be solved by trickle down. Yet as this article argues, it risks missing the finishing line if a complementary – and slower – race is not pursued. This "slow race" emphasizes pathways to tackling ill-health and disease which are specific to diverse and dynamic local contexts; creates hybrids between local and external knowledge and perspectives for appropriate solutions; recognizes that technological fixes are not enough and that social, cultural and institutional dimensions are key, requiring a systems approach to health and innovation, and embraces uncertainty and unpredictable change through adaptation and learning. In this view, innovation for health and development is part of a bottom-up, participatory process in which citizens in resource-poor settings must take centre stage.

In the race to the universal fix, much current investment is justified by the prospect of "big hit" technologies with the potential for global scope and applicability, and the capacity to deliver these on a large scale. This is exemplified by the 14 "grand challenges" for research in global health identified by the Bill and Melinda Gates Foundation, which range from new and improved (e.g. needle-free, non-refrigerated) vaccines, to genetic and chemical technologies to control disease vectors, and enriched crops to improve nutrition. Another, and growing, strand of investment focuses on responses to outbreaks and pandemic threats. Here, as in the approaches of the World Health Organization and others, the focus is on universalized, generic emergency-oriented control of outbreaks at source, aimed at eradication – as for example in responses to human pandemic and avian influenza, and to haemorrhagic fevers such as Ebola. The emphasis is on a plethora of technological and infrastructural initiatives focused on early warning, risk assessment, surveillance, rapid response teams, treatment and vaccination. In both cases, the nature of the health problem is assumed to be broadly similar across vast areas, so that technological and associated institutional solutions are unproblematically transferred, and can be applied "at scale".

Alongside the obvious merits of these approaches, however, lie many telling examples of failure. These include potentially good health technologies left sitting on laboratory benches because they failed to fit local circumstances. They include examples of disease eradication programmes thwarted by unexpected microbial resistance to the drugs involved, or by public resistance to programmes perceived as inappropriate – as in the cases of the global polio eradication initiative in Nigeria in 2003–04[2], or tetanus toxoid campaigns in Uganda and Cameroon. In Gabon in 1995–96, for example, American and French Ebola control measures were perceived as so inappropriate and offensive by villagers that they aroused deep suspicion, and international responses to a further outbreak there in 2001 met with fierce local armed resistance[3]. Avoiding such problems requires complementary approaches to understanding and policy, with four key elements contributing to the necessary slow race.

First is to recognize the diversity of interlocking dynamics that shape health problems, and must inform responses to them. Challenges to human health have always involved intimate relationships between social, political and economic processes, ecosystems and potential pathogens. The acceleration of population growth, mobility and urbanization, human-animal interactions, change in industrial, livelihood and food production systems, and technological and environmental processes has in many instances brought new challenges[4], such as the emergence of new infectious diseases and zoonoses[5]. Yet these dynamics play out in specific ways in diverse local settings, varying across regions, localities and sometimes even within communities, producing multiple patterns and multiple needs. Thus a one-size-fits-all solution is often inappropriate. And given that problems of

[i] The title, race metaphor and central arguments in this article are drawn from Leach and Scoones, 2006[1].

disease and ill-health are not just the result of technical matters, a focus on technology as a separate domain carries many dangers, leaving important social and political causes unaddressed. A more context-specific and integrated approach to linking technologies, health and development is therefore needed.

Second, different people and groups in society tend to understand and experience these dynamics in very different ways. The scientific perspectives of biomedical doctors or epidemiologists offer only some among multiple "framings" of health problems and possible solutions. Other framings emerge from, for instance, local cultural understandings, knowledge and experiential expertise. Such cultural framings can be crucial to understanding both why technologies work and are acceptable in particular settings – and why they are sometimes rejected. For example childhood vaccines are high on global policy agendas. In The Gambia, mothers go to great lengths to build and protect their own and their children's strength, which they see as dependent on proper quantity and flow of blood and body fluids. They value immunizations in these terms, as introducing a powerful substance that, going into the blood, either builds its strength or builds in the blood defences against disease: "The injection strengthens the health of the child. It gives the child good body". Within this logic, many feel that vaccinations are effective against illness in general. 29% of urban and 48% of rural mothers could name no biomedically "correct" vaccinable diseases, yet were actively seeking immunization – reflected in national coverage rates of 90% in 2003. Such ideas about strength, fluid and substance do not conform to biomedical notions of an immune system, disease-specific vaccines and strong distinctions between prevention and cure. Yet they ground strong appreciation of immunization in areas across The Gambia, Guinea, Sierra Leone and beyond. Yet the same framing can also underlie anxiety: in a social context in which mothers often miss clinic sessions due to workloads and problems at home, they often worry greatly that a backlog of such vaccinations will have "stacked up" and that nurses will give their child several at once. This can be seen as too much substance for the blood and body to cope with[6]. Thus understanding why people accept (and why they sometimes reject) technologies such as vaccines requires engaging with local cultural framings that may differ strongly from those of mainstream scientists and policy-makers.

Local knowledge and cultural logics can similarly inform and be integrated into epidemic response strategies, helping to make these more context-specific, locally appropriate and acceptable. In Uganda, for example, local cultural categories around Ebola outbreaks were linked to elaborate social protocols to control the disease, and from 2001 these were successfully integrated into responses by the World Health Organization[3]. Attention to local cultural logics also offers ways to understand local resistance to top-down external interventions and adapt accordingly. Thus, understanding local categories and fears would assist with several current challenges in dealing with haemorrhagic fevers: encouraging more cases to be identified early and brought to hospital, and addressing prevalent anxieties that treatments themselves "kill". Overall, there is a need for responses to be attuned to local knowledge and circumstances. Context matters, and technologies and practices suited to one place might be rejected in another.

Third, the slow race implies a different approach to thinking about innovation. Rather than assume – as in the "universal fix" view – that technologies can be developed "upstream", often in international centres, and then transferred in a linear way to the resource-poor settings that need them, a more participatory and systemic approach is required. This can helpfully draw lessons into the health sector from participatory technology development approaches – as pioneered in agriculture and natural resource management, for instance – that put local users at the centre of the innovation process, working in collaboration with scientists both to design new technologies and to adapt existing ones to local circumstances. These approaches recognize the value of local knowledge, moving away from the image of people as passive recipients of externally-derived health technology, to involve them as active, creative partners in technology development processes.

Yet such participatory interactions raise many questions about who controls the innovation process, and whose perspectives drive it. Too often, participation has meant simply co-option of local people into pre-set technological agendas. The huge imbalances in the power, reach and resources of people living in resource-poor settings and research agencies has contributed to this. Even where true collaborative arrangements have been established, these have often been isolated and dependent on the interest of key individuals and on temporary project funds, rather than being fully institutionalized in national and international innovation systems.

Rather than isolated project examples, an innovation systems approach emphasises the networked interaction of multiple actors, both public and private, local and national, in processes which initiate, import, modify and diffuse technologies[7]. It emphasizes the links between these actors that enable them to operate as an effective system, involving issues of funding, marketing and the encompassing policy and legal framework. This involves not just building the "hardware" of research and development (R&D) infrastructure and capacity, but fundamentally, considering the "software" of social and political relations among the many actors that are now involved, and the question of who controls science and technology agendas in whose interests. The development of the International AIDS Vaccine Initiative (IAVI) illustrates many aspects of this approach[8]. The initiative aims to further HIV vaccine research worldwide, including the search for candidate molecules, the funding of clinical trials, work on delivery issues and wider policy and advocacy efforts, working towards an effective and cheap vaccine for resource-poor settings. Vaccine development partnerships have been created between developing country organizations and northern research agencies, both public and private. The initiative spreads its funding across a diversity of players, and focuses on vaccine development and delivery issues rather than upstream research. It currently

operates in 22 countries, and is increasingly decentralized in its operation, responding to early accusations of top-down, central control. The existence of regional offices and growing links with nongovernmental organizations (NGOs) and civil society means the initiative is broad based and attuned to social and political issues. Nevertheless despite its scale it still remains a small player in the overall HIV/AIDS technology innovation and delivery network, dwarfed by larger funds spent on more conventional upstream research.

Furthermore, innovation should focus not just on the technology, but also on the social, cultural and institutional relationships that make it work. There are numerous examples where technologies already exist that could have major impacts on health and poverty problems, yet they remain out of reach. To make existing technologies – sometimes everyday, old technologies – accessible to people living in poverty often means linking the technical with the social. For example in parts of South Asia, a revolution in "community-led total sanitation" has occurred as community organization, empowerment and learning has facilitated the widespread building of extremely low-tech, low-cost latrines – in contexts where adoption of existing sanitation technologies in the past had been very low[9]. To enable people to make use of technologies that may be available, but are poorly understood often requires culturally-appropriate communication strategies, improving people's knowledgeability, capacity and power to make technology choices.

In other cases, institutional innovations – for instance in the ways that health services are financed, delivered and relationships between people and providers negotiated – can be crucial in enabling people to access technologies and their benefits, as part of building health systems that work for the poor. For example many health systems in Nigeria have become increasingly pluralistic and poor people are faced with a confusing myriad of health providers and drug sellers. Old barriers between private and public, modern and traditional, and formal and informal health providers are breaking down. In this context innovative learning and regulatory arrangements are being developed to increase the knowledge of medicine vendors and local people about appropriate drug treatment for malaria, and to address the problems of access to and use of low quality anti-malarial drugs by the poor (http://www.futurehealthsystems.org/country/nigeria.htm).

Fourth, the complex interaction of multiple dynamics involved with health issues today – biological, demographic, ecological, economic, social, political, cultural – operating at different scales and at different speeds – results in deep uncertainties – and often ignorance – about likely outcomes and their consequences[4]. Despite this, the design of technological research and development, of health systems and of approaches to epidemics frequently proceed as if the world were stable, and as if uncertainties and possibilities of surprise could be reduced to risks which can be assessed and managed. In today's world, in which deep uncertainty and surprise are inevitable, this is, more than ever, a flawed approach. It may be time to move towards more adaptive, learning-process approaches in building pathways to health and development. This will require new institutional and administrative arrangements which can embrace surprise, deal with uncertainty and accept ignorance, along with appropriate bureaucratic and other procedures. There are as yet few examples in the health sector, but this is a frontier area for future development.

Running the slow race to make health technologies work for the poor therefore requires an embracing of dynamics and diversity; of multiple forms of knowledge and framing; of an innovation and health systems approach, and of adaptation and learning to cope with uncertainty. This in turn carries major implications for the organization of research, funding and policy.

An overarching challenge is to foster more, and more effective, interdisciplinary, user-oriented and participatory research of various kinds. This involves creating research and innovation partnerships between scientists and potential users, especially poor people themselves, remembering and recapturing longstanding experiences in participatory technology development that have been overshadowed of late by today's new global technology-transfer hype. It involves linking natural science and biomedical disciplines with the social science that can illuminate how technologies might engage with society. It involves linking different sectors – and the social and technical debates within each – so as to generate, for instance, lesson-learning from the agricultural and natural resource management fields across to health, and vice versa. This carries implications for research funding, much of which – whether from development donor agencies, foundations or research councils, is still strongly divided by natural science – social science boundaries, or split into sectoral silos. The last few years have seen the take-off of some exciting and important funding initiatives which do promise support for the kind of interdisciplinary and international partnership work which is needed, but these remain drops in the ocean of the levels of funding devoted to disciplinary, technical research. The challenge is to mainstream the social into the technical and vice versa, through genuinely trans-disciplinary openness in funding regimes focused on (health) problems and issues, not disciplines.

At the same time, new policy approaches and institutions are needed which bring together poor people, health providers, scientists, administrators and health policy-makers in new ways that promote dialogue: about long-term futures and technology options; about health problems; about technology adaptation to local contexts; and about risks and uncertainties and ways to understand and adapt to these. Such institutions would need to enable both more open-ended dialogues which take their lead from peoples' felt health and well-being needs and debate the technological options that might help address these, and more focused dialogues around particular problem areas (e.g. how to address child deaths from diarrhoea, or an emerging zoonosis) or particular new technologies, their potentials, benefits and risks (e.g. a new vaccine). While some such institutions might operate at local scales, they would need to articulate with national, regional and global equivalents, in a

networked interaction.

This slow race may be less glamorous than the technology breakthroughs that capture global headlines. It is not a substitute for these, but it is a vital complement in the ongoing, painstaking task of linking science and innovation to the complex, diverse needs of people in resource-poor settings, and in helping to ensure that, in a dynamic and uncertain world, investments in science and technology for health are firmly enmeshed with inclusive debate about the social and political values they serve. ❑

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