The scope and potential of innovation for health and health equity

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Innovation encompasses not only the birth of an idea or a discovery, but its application in practice – taking the outputs of research and invention and using them to put new goods, services or processes into use.

The products of innovation in science and technology are usually tangible (e.g. machines, equipment, devices, materials) and their value is clearly visible as they often greatly contribute to the wealth of individuals, corporations and countries. But innovation in other fields – such as economic, political and social spheres – is also of great importance and can also contribute, in sometimes less tangible but nevertheless highly valued, ways to the conditions in which people live and their quality of life.

The Global Forum for Health Research1 espouses this broad view of innovation (see Box 1) and seeks to promote innovation in all fields that will improve the health of poor populations and reduce health inequities.

The importance of capturing the benefits of innovation to achieve the Millennium Development Goals, including those for health, has been emphasized (see Box 2).

Research and innovation for health: dimensions and sectors and elements needed

Research for health

The role of research in contributing to better health in low- and middle-income countries (LMICs) has been stressed repeatedly in the last two decades, placing emphasis on the range of health research that is relevant – including basic sciences and biomedical research, health policy and systems research and social, behavioural and operational research.

However, in the last few years there have been efforts to direct attention to a wider range of determinants of health beyond biological and health system factors – including economic, environmental, political and social determinants – that need to be better understood and managed to improve health and reduce health disparities within and between populations. This enlarged domain of relevant research is referred to as “research for health”6,7 and is attracting increasing attention.

The newly published report8 of the Commission on Social Determinants of Health provides a wealth of evidence on the important influences of social factors and highlights the need for more research to understand the “causes of the causes” of ill-health. The Global Ministerial Forum on Research for Health (Bamako, 17–19 November 2008) is the first meeting at this level to address the complex array of cross-sectoral issues involved in addressing some of the world’s major health challenges through a broad and multidisciplinary approach9.

The Global Forum for Health Research10 defines “research for health” as research undertaken in any discipline or combination of disciplines that seeks to:

- understand the impact on health of policies,
Introduction

programmes, processes, actions or events originating in any sector – including, but not limited to the health sector itself and encompassing biological, economic, environmental, political, social and other determinants of health;

assist in developing interventions that will help prevent or mitigate that impact;

contribute to the achievement of health equity and better health for all.

Innovation for health

Taking this broad view of research for health, innovation for health and health equity can be defined as shown in Box 1 and the systemic relationship between research and innovation for health can be depicted schematically as in Figure 1:

The system which encompasses research for health in a country is only partly in the health sector, since: (1) it also involves many other sectors that help to determine the eventual health status of individuals. These include sectors concerned with education, employment, the environment, transport, the law, etc; (2) it includes many kinds of researchers in different disciplines, often not employed within the health sector or dedicated research institutes such as Medical Research Councils or National Institutes of Health but working within higher education or other research institutions, nongovernmental organizations or the community.

Research for health can therefore be seen as a component of the wider research system which includes all the researchers, institutions and funders in the public and private sectors that make up a nation’s total research effort.

The innovation system partly overlaps with the research system, from which it draws new ideas and discoveries. It does not include the entire research system, however, since not all research is directed towards eventually producing new products, services or processes but may be aimed at expanding knowledge and understanding in many different fields, including the arts and humanities.

The innovation system crosses many sectors and disciplines involved in the development and application of a new product or process – for example, including legal, financial and commercial aspects.

Both research and innovation take place in a national environment whose characteristics (e.g. political, legal, economic, social, cultural) can have a major influence – determining the extent to which innovation is fostered and how well it succeeds. This is further impacted on by the global environment which again can strongly influence the likelihood of innovative ideas being developed, translated into practice and effectively applied.

Elements for successful research and innovation

The conduct of research requires a set of specific knowledge and skills, as well as an institutional environment in which the researcher can function. Considerable effort and resources have been expended in recent decades in strengthening individual and institutional research capacities in LMICs\textsuperscript{11}.

Innovation also requires both skilled human resources and an enabling environment. One element that is crucial for successful innovation is entrepreneurship – a set of attributes that collectively add up to the capacity to practically exploit a novel idea or product and to ensure its successful application in practice. Some of the attributes of successful entrepreneurship may be innate – drive and flair for commercialization and interpersonal skills are often seen in this light – but, in fact, the key skills of entrepreneurship that contribute to success can be learned from well-designed courses. Many entrepreneurship courses are provided in high-income countries (HICs)\textsuperscript{12} and on the Internet\textsuperscript{13} – often linked with business schools – and such courses are increasingly being taught in LMICs\textsuperscript{14}.

Technological innovation

Technological innovation for health includes the development and use of drugs, vaccines and diagnostics. Since the invention of aspirin in the late 19th century, this field has been largely driven by the private sector, which created a thriving industry based in HICs that has provided thousands of new drugs and generates a market currently worth more than US$ 0.5 trillion per year – predicted\textsuperscript{15} to double to around US$ 1.3 trillion by 2020.

However, despite this impressive record, three factors are at work that presage major changes ahead:

The pharmaceutical industry is becoming increasingly unwieldy and unproductive and will need to change its business model. The report\textsuperscript{16} of the Commission on Intellectual Property Rights, Innovation and Public Health observed that, following a decade of concentration in the global pharmaceutical industry, many large pharmaceutical companies moved towards a more focused role. They license more potential products in from
biotech and other small companies and increasingly outsource clinical research to specialist research organizations, with an increasing emphasis in recent years on trials in developing countries such as India and China. It was estimated that 35% of drugs in Phase III trials in 2001 were either licensed in or the product of collaborative research, and two thirds of clinical trials involved contract research organizations. The Commission noted that developing country R&D expertise, in both the public and the private sector, was being used increasingly at all stages of the innovation cycle, with foreign collaborations increasing in Brazil, China, India and other innovative developing countries. The rise of a biotechnology industry, often comprising companies spun off from university laboratories, has offered additional opportunities for the discovery of new classes of drugs and is resulting in significant changes in the structure of the industry.

According to a PricewaterhouseCoopers report, the current business model of the pharmaceutical industry is both economically unsustainable and operationally incapable of acting quickly enough to produce the types of innovative treatments that will be demanded by global markets. Pharmaceutical companies are facing a dearth of new compounds in the pipeline, poor share value performance, rising sales and marketing expenditures, increased legal and regulatory constraints and tarnished reputations. The report considers that “The core challenge is a lack of innovation. The industry is investing twice as much in R&D as it was a decade ago to produce two fifths of the new medicines it then produced. It is simply an unsustainable business model. Over the next decade, the industry must shift its investment focus more towards research and less on sales and marketing... It must focus on the development of medicines that prevent, treat or cure. These must demonstrate tangible benefits and tackle unmet medical needs. Governments and payers must play their part and ensure the industry is rewarded for these efforts.”

- The market-driven model has provided enormous health benefits for people in HICs, but has done relatively little to address the health problems of LMICs. As an illustration of the market failure, of 1393 new chemical entities marketed between 1975 and 1999, only 16 were for tropical diseases and tuberculosis, while tropical communicable diseases were responsible for well over 10 million deaths per year, 90% of which occurred in LMICs. Mahoney and Morel have argued that this failure, along with science and public health failures, need to be addressed by paying attention to the global health innovation system.

- New markets and new innovative actors in LMICs are causing a shift in the centre of gravity of the pharmaceutical industry. Markets are changing and the recent PricewaterhouseCoopers report notes that the E7 countries, the largest emerging market economies (Brazil, China, India, Indonesia, Mexico, Russia and Turkey), are also becoming much more prosperous, with real gross domestic product (GDP) projected to triple by 2020, when they could account for as much as one fifth of global pharmaceutical sales.

As well as providing increasingly important markets for health products, these and other innovative developing countries are also increasingly engaged in the creation of new products and have considerable potential in the biotechnology field. An analysis of responses from 232 developing world experts from 58 countries, asked how best to harness biotechnology to improve health in their regions, divided their recommendations into four categories.

- Science: Develop regulatory and intellectual property frameworks for commercialization of biotechnology; Develop capacity to address ethical, social and cultural issues; Improve accessibility and equity.

- Ethics, society, culture: Develop public engagement strategies to inform and educate the public about developments in genomics and biotechnology; Develop policies outlining national biotechnology strategy.

- Politics: Strengthen understanding, leadership and support at the political level for biotechnology; Develop policies outlining national biotechnology strategy.

The Commission on Intellectual Property Rights, Innovation and Public Health (CIPIH) has emphasized the “innovation cycle” (see Box 3) as a framework of particular relevance to LMICs.

Innovation for health in social and other sectors

It has been emphasized that, to maximize the potential for improving global health afforded by the growing capacity for innovation in some developing countries, both countries and donors need to link two disparate schools of thought: (1) a search for technological solutions exemplified by global public-private product development partnerships, and (2) a focus on systemic solutions exemplified by health policy and systems research. According to Gardner et al, strong capacity for both technological and social innovation in
developing countries represents the only truly sustainable means of improving the effectiveness of health systems. Local public-private research and development partnerships, implementation research and individual leadership are needed to achieve this goal.

Recognizing the importance of socioeconomic factors in determining health status, a number of initiatives have focused on linking welfare, work and microfinancing schemes with health. A range of innovative family welfare, social protection and conditional cash transfer schemes in Latin America and elsewhere have demonstrated significant improvements in a variety of health indicators.26-29

Innovative models of health-care delivery that have been field-tested include microfranchising of community health clinics30 and other community-based clinic approaches31, social franchising as a strategy for expanding access to reproductive health services for adults32 and youths33 and

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**Box 3: The innovation cycle**

The scientific and technical components of the discovery and development process represent only one aspect. Whether the whole process actually delivers products needed by poor patients in developing countries at prices that are potentially affordable depends on a host of political, economic, social and cultural factors.

We prefer to consider innovation as a cycle. This cycle depicted in right represents a schema that applies principally to developed countries and the diseases which predominantly affect them, where effective demand and the population’s health needs most closely coincide. For conditions such as cancer and asthma, incremental improvements are commonplace, and companies have a reasonable assurance that health-care providers and patients will purchase their products. That provides the basic economic and financial incentive for innovation. Whatever the various problems encountered in the innovation cycle, either technical or in terms of the policy framework (…), it broadly works for the developed world and sustains biomedical innovation directed at the improvement of public health.

For developing countries, where the demand is weak – but not the need – there is little incentive to develop new or modified interventions appropriate to the disease burden and conditions of the country. This economic reality introduces an important gap in the innovation cycle: either no products exist in the first place, or if they do, then there is often disproportionately small effort, globally, to make them more effective and affordable in poorer communities. Broadly speaking, the innovation cycle does not work well, or even at all, for most developing countries.

Making the innovation cycle work in developing countries depends on improving the efficiency of the innovation process by addressing both technical and policy challenges at each stage of the cycle (discovery, development and delivery). Special issues arise at the interfaces between the stages of the process, and within each stage. For example, improved research tools and platform technologies could go a long way towards streamlining innovation, both leading up to and within the discovery stage. Many of the approaches used in the development stage have not changed significantly in decades. The regulatory framework poses specific challenges in the process of development and in facilitating delivery.

Our concept of innovation sees the process as a cycle consisting of three major phases that feed into each other: discovery, development and delivery. This is in contrast to conceiving of innovation as an entirely linear process that culminates in the launch of a new product. Within the innovation cycle, public health need creates a demand for products of a particular kind, suited for the particular medical, practical or social context of the group in question, and feeds into efforts to develop new or improved products.

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Endnotes

13-20 Matlin Stephen:GF5 23/10/08 09:46 Page 17
linking microfinance with gender and HIV/AIDS awareness. The agriculture sector is of critical importance to livelihoods, basic health and nutrition, with enormous benefits having been reaped from the green revolution of the 20th century. The need for a second such revolution to cope with population increases and climate change impacts in the present century highlights the importance of understanding and addressing barriers to technological innovation and transfer.

Global innovation capacity for better health and health equity
United Nations Development Programme (UNDP) has developed a Technology Achievement Index which focuses on four dimensions of technological capacity that are important for reaping the benefits of the network age. The indicators selected relate to important technology policy objectives for all countries, regardless of their level of development:
- Creation of technology;
- Diffusion of recent innovations;
- Diffusion of old innovations;
- Human skills.

In 2001, estimates were prepared for 72 countries for which data were available and of acceptable quality. The results (Figure 2) show three trends: a map of great disparities among countries, diversity and dynamism in technological progress among developing countries and a map of technology hubs superimposed on countries at different levels of development. The 30 leading exporters of high-tech products included (with rankings) Malaysia (9), China (10), Mexico (11), Thailand (18), Philippines (22), Brazil (27), Indonesia (28) and Costa Rica (30). Within the top 30 group, China, Mexico, Philippines, Indonesia and Costa Rica showed rates of increase during the 1990s that far exceeded those of any other countries in the rankings.

It should not be taken for granted that LMICs will necessarily take the best and most speedy advantage of the new opportunities afforded by innovation. For example, a recent commentary questions the pace at which innovative companies are appearing in India, as evidenced by the slow growth in home-produced patents filed in the country. It notes, however, that one out of ten US patents in 2006 had an owner or co-owner with an Indian name, showing that Indians can be exceptionally innovative when given the opportunity in an environment that supports risk-taking and innovation.

While science and innovation in much of Africa has long lagged behind, new approaches are now being seen, as reflected in the Tshwane Consensus. The emergence is now being foreshadowed of a more socially responsive innovation system that will ensure that scientific priorities are selected according to social and economic priorities (e.g. using “technology foresight” exercises to determine the allocation of research resources). As noted by the Science and Technology Adviser for Africa’s New Partnership for Africa’s Development (NEPAD), it is important that scientific and technological capacity for health is not reduced to focusing on equipment, funding and the numbers of health scientists and technicians. It requires attention to the configuration of skills, policies, organizations, non-human resources, and overall context to generate, procure and apply scientific knowledge and related technological innovation to identify and solve specific health problems.

As innovation theory and practice evolve, valuable new insights are emerging of direct relevance to the advance of innovation in developing countries. For example, one recent report argues that we are witnessing forces in play which are transforming the industrial landscape and that can be understood within the umbrella concept of “global open innovation”. Open innovation, while not a new phenomenon, is importantly being given fresh impetus by globalization, linked to the interplay between subtle organizational...
Introduction

processes and interorganizational linkages and networks. The report examines the role of globalized innovation networks for innovation performance and concludes that, among a number of different types of innovation collaboration – vertical (collaboration with suppliers and customers), horizontal (with competitors) and science-based (with universities and government research institutions) – innovation collaboration along the value chain (i.e. vertical collaboration) is significantly positively correlated with superior innovation performance of firms in all analysed countries.

For the goals of achieving improved health and health equity, this analysis supports the idea, referred to above, of closer engagement with the end-user in a socially responsive mode; and it also helps frame observations on the expanding roles of innovative offshoring and global knowledge networks.

The Global Forum for Health Research will work to:

- generate informed debate on innovation for health in LMICs, including social as well as technological innovation;
- promote the development and study of health innovation systems across and country levels, with a particular emphasis on innovations to enhance health equity.

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Key messages

Historically, HICs have contributed most to research and innovation for global health and to the health of populations in LMICs. However, LMICs are increasingly developing their own capacities to conduct and utilize research and to apply innovative solutions to their immediate health problems, as well as to strengthen their systems of innovation as vital drivers of development.

The global agenda must encompass how to:
- strengthen health research systems and innovation systems in LMICs;
- incentivize the systems to create relevant products accessible to poor populations;
- enhance coherence between policies and actions of global players and national forces shaping country research and innovation systems.

References

1. The Global Forum for Health Research was established in 1998 with a mission to focus more health research on the needs of the poor. See: www.globalforumhealth.org
10. See www.globalforumhealth.org.
12. See, for example, a list of postgraduate entrepreneurship courses available in the UK, at: http://www.hotcourses.com/uk-courses/postgraduate-Entrepreneurship-courses/hc2_browse.pg_loc_tree/16180339/90904/p_type_id/3/p_bcat_id/2084/page.htm
14. See, for example, the Entrepreneurship Course of the Africa Technology Forum for Health Research’s Entrepreneurship Hub based in Luaka, Zambia. The primary goal of the Hub is to promote entrepreneurship and innovation as a way of creating wealth and jobs and reducing poverty. http://www.atdforum.org/spip.php?article230
20. See, for example, a list of postgraduate entrepreneurship courses available in the UK, at: http://www.hotcourses.com/uk-courses/postgraduate-Entrepreneurship-courses/hc2_browse.pg_loc_tree/16180339/90904/p_type_id/3/p_bcat_id/2084/page.htm
22. See, for example, the Entrepreneurship Course of the Africa Technology Forum for Health Research’s Entrepreneurship Hub based in Luaka, Zambia. The primary goal of the Hub is to promote entrepreneurship and innovation as a way of creating wealth and jobs and reducing poverty. http://www.atdforum.org/spip.php?article230
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