

# SCIENCE, TECHNOLOGY & POVERTY

## FIVE WAYS TO MOBILIZE DEVELOPMENT IN LOW-INCOME COUNTRIES

BY JEFFREY SACHS

**P**roblems of under-development, particularly the problems of the lowest income countries in the world, extend far beyond the issues of economic strategy alone. What we find in many parts of the world is a dearth of the needed science and technology to address critical problems of health, food supply, nutrition, environmental management, climate change, that impose enormous barriers to economic development. As an economist I also find that the normal market forces we rely on, say in the rich countries, to promote science and technology simply don't work on their own with sufficient force in the case of the problems of the low-income world.

In fact as I have come to see this problem in recent years, particularly in focusing on health issues and agricultural productivity issues, it has seemed to me more and more that the low-income world is actually in a "quadruple bind". Four kinds of interrelated problems are behind the observed phenomenon of the gap between rich and poor in the world which has been widening significantly in recent decades and not showing a tendency to narrow, unfortunately.

**Mobilizing Science & Technology to Help Poor Countries.** What is that quadruple bind? Well it all starts with the proposition that

the fundamental driver of long-term economic development in this era of modern economic growth, which is now about 200 years old. Since economic growth on a sustained basis started at the time of the Industrial Revolution, the fundamental driver of that long-term growth has been science-based technology, both technology useful to solve critical ecological and health problems and also technology that has been behind the continuing supply of new production processes and new products that are at the core of the source of long-term economic growth.

When I speak of a quadruple bind of the low-income countries, what I am referring to essentially is the fact that for several interrelated reasons, that impulse of science and technology does not operate at anywhere near the needed strength in the low-income countries as it does in the high-income countries. What we have in essence is a global economic system where the impulse of growth is operating most powerfully in the already rich countries.

Science and technology operates most powerfully in those

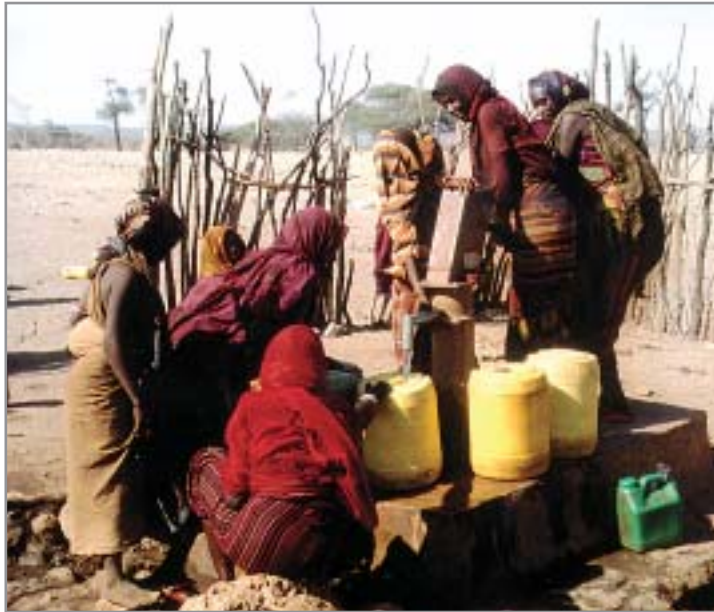
places that are already of highest income, whereas in the low-income countries, those impulses tend to be weak and sometimes essentially non-existent. That differential in the application of science and technology to solving human problems and to developing new processes and products, I believe is at the essence of the explanation of the widening gap between rich and poor that actually has been going on for almost 200 years at this point.

**The "Quadruple Bind".** Now why a quadruple bind? Well there are four elements essentially that are leading to this relative gap between the rich and the poor countries.

■ The first is obvious: science and technology, like just about every other human or social phenomenon, follows the marketplace. Where there is a large demand already for new products and innovation, the supply will respond because the profit motive will, of course, drive the scientists and engineers to focus on the problems that have a market rate of return. With innovation, you invent the blueprint once and then sell it into the market — the larger the scope of the market, the more

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incentive there is to come up with that original blueprint in the first place.

This leads to a pretty fundamental problem, which is that the rich countries through huge markets give lots of incentive for research and development (R&D), whereas the very poor countries give very little market impulse on their own for R&D. And of course since R&D of new products and processes is almost inevitably a mix of government-supported effort plus private effort, the gap is exacerbated by the fact that the rich countries have rich governments and the poor countries have impoverished governments. So the poor country governments can't afford to undertake the commensurate public supported R&D that is needed for just about any technological advance in any area. So my number one is this problem of the difference in market size.

*Photo: Steps can be taken to mobilize science and technology to solve water, health, and other problems in poor countries.*

■ Number two is closely related. It is that technological innovation tends to be what economists call an increasing returns to scale phenomenon on the supply side. What that means in essence is that if you have one scientist, he or she can produce something; if you have two scientists working together, you get twice the output of the one scientist alone. If you have ten scientists working together, you get more than five times the output of the two scientists.

We know how difficult it is to sustain the critical mass of scientific research in poor countries. What we see is that because scientists like to agglomerate and need to agglomerate for their effectiveness, lots of scientists in the developing countries move to the rich countries and end up solving problems of the rich world rather than the poor world. It makes perfect sense but it doesn't solve the problems of poverty and underdevelopment. So market demand, the increasing returns to scale phenomenon which causes scientists to seek other scientists and to go to the

rich country concentrations of science, that's the second bind.

■ The third bind is really a deep and pernicious one. Some countries are able to achieve technological dynamism, not by their own innovation, but by importing technologies from abroad. And if in this world the rich countries are mainly in the temperate eco-zones, when the USA or Europe or Japan develop new technologies safe for agriculture or health, those technologies can diffuse typically to other temperate ecologies where the problems will be similar. So US agricultural breakthroughs may be helpful for Argentina's food supply or maybe helpful for Australia and New Zealand's agricultural productivity. But an advance in wheat production for the centre of the US is not going to be of such direct value in tropical Africa.

In essence what we see is that for many, many kinds of technologies — health, food productivity, environmental management — these technologies are very strongly ecologically specific. Advances that come in the rich temperate zone world are not typically directly applicable in the impoverished tropical world, so diffusion of technology, while it works, is a very hard process.

It's not automatic because the technologies useful in one part of the world have to be translated to the ecological specificities of a different part of the world. That has again meant that the tropical impoverished world has had an even harder time keeping up with the rich temperate world. The rich temperate technologies simply are not so usable for the disease conditions, the environmental management conditions, the food productivity conditions,

the water stress, soil and other problems that are faced specifically in tropical eco zones.

■ Then there's a fourth bind. This is that the anthropogenic climate change that seems very likely to be underway right now by so many types of evidence is likely to impact even more heavily on the already poor world than on the rich world. Of course we may all be terrible losers from anthropogenic climate change if we don't get this under control. But the models that exist at least to this point suggest that the increasing temperatures and the changes in precipitation patterns, and maybe oceanic circulation patterns that will come with anthropogenic climate change, are likely to impact the tropical world more adversely than the temperate world.

So on top of all of the other problems, the forcings from man-made change could greatly exacerbate the problems that already exist in the low-income world. We have seen in the data an intensification of the El Niño cycle. We have seen in the data what seems to be an intensification of extreme weather events, plausibly these are linked already to anthropogenic climate change, although the signals are not strong enough to be absolutely sure.

But it does seem that we are going to add more headaches to a tropical world by raising global temperatures, we're going to add heat stress in disease, in food productivity, in water and so forth to an already heat stressed part of our planet.

**The Challenges of Health Technologies.** So these are the four binds - the lack of market demand, the tendency towards increasing returns to scale, the ecological barriers to diffusion

of technology, and the human forcings which are probably doing disproportionate damage to the poor world that in my view mean we can't rely on market forces alone. We can't believe that globalization by itself is going to solve the problems of the poorest countries.

For the last couple of years I have been chairing a commission for the World Health Organization (WHO) which is called the Commission on Macro Economics and Health, analysing the problems of health in the poorest countries. The health technologies for poor country diseases such as malaria are not adequate. The amount of research going into those diseases is paltry compared to the overall, global, pharmaceutical industry research budget. And of course the poor countries simply lack the current cash right now even to make use of the technologies that exist — that leads to poor health and to epidemic disease that are largely unaddressed. Poor health also contributes to the continuing spiral of poverty, social instability, bad health, turning once again the cycle to further poverty.

We have a great deal of work to do as a result of all of this. It means we can't believe that markets alone are going to solve the problem. We need international public policies, international cooperation, a great deal of financial assistance from the rich countries to the poor countries to get out of this bind of growing inequality between rich and poor.

For all of the reasons that I have stressed, the mobilization of international donor support and the mobilization of international agencies such as the

IAEA, to help draw the world's leading scientists and engineers into the challenges of the poorest of the world is a critical task ahead.

Generally the scale of work is not commensurate yet with the task and this is most critically, most immediately, the result of inadequate financing of these efforts of scientific mobilization. In health, the amount of research on tropical diseases is just a small fraction of what it needs to be.

In the area of agriculture, the network of tropical research institutes under the umbrella of the CGIAR, the Council to the Group for International Agricultural Research, is under chronic budget strain right now, meaning that it's very hard for the CGIAR units, the ones that brought us the "green revolution" to keep up in modern agro-biotechnology for example, or in the kinds of nuclear technology applications that are so vital for solving the problems of food productivity in poor countries. I found that the total worldwide budget of the CGIAR is less than the budget of individual life sciences companies in the USA and Europe. In other words, the whole worldwide official network is often operating at a budget less than the budget of a R&D unit of a single, major multinational firm and that shows the disproportion of the effort.

**Five Ways to Mobilize Development.** Now first and foremost, we need to wake up the international policy makers out of a slumber and a dream. The dream is that somehow globalization can take care of itself, so don't come to us, to the USA or to other rich countries to ask for help — it won't work. The USA

has to do vastly more, other rich countries have to do vastly more. We have to spend a lot more money to mobilize the science and technology that we are going to need to address the problems of the world's poor and to begin to turn around this process of a growing gap of income.

I think there are several mechanisms through which this can be done and I will just mention them very briefly.

■ One is targeted public sector/private sector partnerships to address particular problems. In the health area, special public/private partnerships have been set up to address pharmaceutical and vaccine needs for AIDS, a separate one for malaria, another one for tuberculosis, and for some other diseases. These public partnerships can function — you draw on the private sector that embodies a lot of the technology in multinational companies, together with public sector expertise and public sector funding.

■ A second thing I would like to see is much more globally available competitive research funds for scientists in developing countries. I think the National Institute of Health in the USA is certainly one of the world's most successful premier institutions, whether in science or not. It mobilizes now well over \$20 billion a year for scientific research, most of which is put out on a competitive basis to mainly US scientists in biomedical fields.

I think we need an international institutes of health that similarly would put out large-scale grants for researchers looking at problems of low-income countries — for instance, the disease issues facing low-income countries or the specific

climatological or ecological issues facing those countries.

■ Third, we have to fund the networks that we have, like CGIAR at a much larger scale. For some reason, even some of the major donor countries have been cutting rather than increasing their funding for international science. This is despite all of the growing evidence that it's the shortfall of science that is one of the critical reasons why globalization is not working as hoped to raise all of the world's living standards, but is acting in such a disproportionate and unequal way.

■ I think a fourth element of the strategy should be to strengthen the specialized international institutions, like the IAEA, the FAO, the WMO, the United Nations Environment Programme, the WHO. The result of underfunding United Nations agencies has been, of course, that for important institutions like the WHO, the core budget has been frozen for ten years during the greatest surge of disease in modern history. This makes absolutely no sense. We need specialized international institutions, we need to support them adequately.

■ The fifth mechanism that I would like to mention is a little bit of a trick to try to mobilize private market forces in this way. In the area of vaccine research, my colleagues and I have been proposing that the rich countries should make the following public commitment: that they would buy, at a reasonable price, any future vaccines for AIDS, malaria or TB and that they would promise that they would put that money up for purchases at a price that would cover in

essence the returns to R&D needed to develop those still unavailable vaccines.

The idea of making a public commitment and making it as rigorous as possible would be to tell private industry — whether it's the major pharmaceutical companies or whether it's smaller biotechnology companies backed by venture capital — that, yes, there is money to be made working on a malaria vaccine. And there will be a market for it. Not a market coming from impoverished people with malaria, but a market coming from the donors who would be willing to buy those products on behalf of the impoverished people.

So we are hoping that some kind of public commitment to purchase technologies on behalf of poor people could also generate a private market response, in addition to the various public mechanisms that I have been also suggesting are an important part of the mix.

All of these are simply ways to come to the same point, which is to recognize that since science and technology is the fundamental impulse of long-term development, we have to mobilize this fabulous, indeed revolutionary, period of our scientific knowledge to address the problems specifically of the poor. The markets will not do it on their own. For this we need international cooperation and international public policy.

I hope we can mobilize large-scale international support so that science really can be mobilized to find the best solutions that are available for the problems of poverty. We need to do this. We want to live in a world that is successfully sharing in prosperity. □