Thirtieth Annual
AAAS Forum on Science and Technology Policy

INVESTING IN KNOWLEDGE FOR DEVELOPMENT:
THE ROLE OF SCIENCE & TECHNOLOGY IN THE FIGHT AGAINST GLOBAL POVERTY

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Friday, April 22, 2005

Loews L'Enfant Plaza Hotel
480 L'Enfant Plaza, SW
Washington, DC

A CENTRAL CHALLENGE OF OUR TIME

Development is a central challenge of our time. The demographic trends are crystal clear: the international balance of power, when measured in population, is undergoing a tectonic shift. The developing world is becoming more populous, younger – and more assertive.

Over the next two decades, our planet is expected to absorb an additional 2 billion people—an increase of one third. Developing countries will account for almost all of that increase, swelling the ranks of the developing world to nearly 7 billion–85 percent of the world's population.

In sharp contrast to the graying rich world, the growing population of the regions making the least economic progress is young, and getting younger. In the Middle East, the share of the population under 14 will increase from 35 percent today to 42 percent in 2025, while in Sub Saharan Africa, the under-14 share will rise from 47 to 50 percent. Here in America, the under-14 share will remain at around 17 percent.

The future of these children is already being shaped. Today's educational and health opportunities for hundreds of millions of poor young people will have lasting effects through their contributions as workers and parents. And if their legitimate aspirations to economic and political freedom are thwarted, it could unleash a tsunami whose full force will reach our shores.

Recognition of this global challenge is seeping into some unusual arenas. In *The Pentagon's New Map of the World*, U.S. Naval War College member Andrew Barnett points out that America's military is increasingly pulled into nation stabilizing and nation building in the growing portion of the world that suffers from extreme poverty, fragile institutions and shallow integration.

Yet despite these looming challenges, this should be a moment of extraordinary promise for the world's poor. Never before has the world had access to so many resources and so much knowledge to combat deadly disease, sustain economic growth, develop clean energy, and ensure broad access to education, clean water and basic health.

A MIXED RECORD OF SUCCESS

But surely, some will object, combating global poverty is a quest for Don Quixote, not serious scientists. We hear endlessly about the abysmal failures of development. The stubborn gap between rich and poor remains the most elusive of windmills: the poorest three fifths of the world's population still command per capita income less than one eighth that of the richest fifth.

Yet equally impressive triumphs are too rarely highlighted. The income statistics obscure some stunning successes on life expectancy, child survival, nutritional outcomes, and education in the final four decades of the last century, although the global HIV/AIDS pandemic is tragically reversing progress on many of these fronts.

Thanks in large part to infusions of technology in the areas of medicine, family planning, and agriculture, life expectancy for the poorest fifth of the world increased from 53 percent of the richest fifth in 1960 to 87 percent in 1999 – even as the richest saw their life expectancy rise from 69 to 76 years. Child survival for the poorest fifth of the planet has reached 80 percent of that for the richest fifth. And nutritional outcomes of the poorest measured in caloric intake has gone from 57 to 70 percent of the rich country benchmark over 40 years.

There have also been stunning successes on straight economic growth within particular countries. Over the past decade, China and India have lifted 300 million people out of extreme poverty.

So what explains the differences in success rates? Speculatively, it appears that science and technology transmit a lot better than economic systems. Put differently, countries with a range of institutional capacities have achieved greater success in absorbing knowledge in areas such as medicine, nutrition, education, and agriculture, than in raising overall productivity, which seems to be more sensitive to the institutional environment. Let me elaborate in two areas where the track record is already established and the case for further investment is compelling, highlight an area where I think there is enormous potential, and then conclude by considering whether we are focusing enough resources and attention upon science and technology for development.

HEALTH

I'll start with health, where the successes have been stunning, and science and technology have been at the center. Overcoming the still-daunting challenges in this field will require further investments in knowledge for development.

Over the past several decades, immunization campaigns, simple technologies for child survival, and education have contributed centrally to stunning improvements in life expectancy and child survival. Improved sanitation combined with inexpensive oral rehydration therapy helped to achieve a 2/3 drop in deaths from diarrheal disease between 1980 and 1999. In one of the biggest triumphs of science and political will, small pox has been completely eradicated (although bioterrorism could threaten this remarkable achievement), and polio is well on its way to eradication. WHO estimates that it is possible to eradicate measles– the single leading cause of death among Africa's children– through vaccinations costing only 26 cents per child.

Moreover, unlike economic interventions, which are highly context dependent for their success, many health interventions have been effectively implemented even in environments with dysfunctional governments, poor public health systems, and, in the extreme, civil conflict. While many well-meaning economic development projects fall prey to deeply rooted corruption or the inertia of ineffective bureaucracy, it is not necessary to fix the entire institutional context to, for example, immunize school-age children. Perhaps the most striking examples include the 1995 cease fire in Sudan's civil war, which was instituted in order to treat guinea worms, and the "days of tranquility" set aside each year during Afghanistan's years of strife in order to undertake national immunization campaigns.

The cases of small pox and polio are instructive because both involved getting technologies invented for the rich world distributed and implemented in poor countries. The technology already existed, pulled along by rich country demand. A key challenge in addressing the health challenges robbing the world's poor today is encouraging innovation for diseases that are not likely ever to be profitable. According to the Global Forum for Health Research, only 10 percent of global medical research is devoted to diseases that cause 90 percent of world health burden. Of the1233 drugs that reached the market between 1975 and 1997, a measly 13 were intended for treatment of tropical infectious diseases in developing countries.

The clear answer is that public and philanthropic funding is critical to leverage research and development for the diseases of the poor, where effective market demand falls far short of the social value of the potential innovation. The potential here is enormous. Brookings and Harvard scholar, Michael Kremer put forth the powerful proposal that public and philanthropic funding could provide the greatest leverage by mimicking the market, providing biotech and pharmaceutical companies market incentives to invest in the R&D and the expensive clinical trials that often block promising innovations from reaching the market. The Gates Foundation dedicated extensive resources to turning this idea into an actionable policy proposal, so-called Advance Market Commitments, which were recently endorsed by the UK Chancellor of the Exchequer, Gordon Brown, and are likely to get a further lift at this year's G8 summit. In another instance, the Rockefeller and Gates Foundations have paired up with some official funding to fund research on microbicides that can help poor women protect themselves from the HIV virus.

AGRICULTURE

Like health, the field of agriculture has already witnessed successes in the area of science and technology for development. And while enormous untapped potential remains, there is also substantial potential for controversy.

Agriculture is central to development for several reasons. In many of the world's poorest and most populous countries, between 2/3 and ¾ of the population is rural compared with 2-3 percent in the US and Europe. Virtually every development success story includes an enormous early boost from improved agricultural productivity that provides a cheaper domestic food supply for the growing urban population, and frees up surplus rural labor to migrate to higher productivity activities.

Agricultural development has not yet come far enough. Hunger is a grim specter that continues to haunt a shocking 47 percent of preschool children in South Asia and 31 percent in Sub Saharan Africa. Hunger and malnutrition too often imposes a life sentence of cognitive deficiencies, stuntedness, and learning disabilities that prevent millions from earning a decent living. The economic costs of hunger are well documented. In Mexico, nutrition supplements for children have been shown to improve lifetime earnings by 3 percent. And Bangladesh loses an estimated 1-2 percent of annual economic growth due to preventable anemia.

The touchstone for future agricultural improvement is the green revolution, one of the biggest development success stories and undoubtedly one of the highest returning investments in history. It took 20 years and a visionary commitment by the Rockefeller Foundation to develop high-yield dwarf wheat that resisted a variety of plant pests and diseases and yielded two to three times more grain than traditional varieties. The green revolution enabled India and China to quadruple grain production and increased world grain output by 175 percent over the first four decades–using roughly the same amount of acreage. During that time, malnutrition was cut in half even as the world's population roughly doubled.

Some critics deplore the increased use of genetically engineered plants, but as Norman Borlaug (the "father of the green revolution") points out, the alternative would have been enormous amounts of deforestation and environmental degradation to produce enough cropland. Borlaug believes that a green revolution is also possible for Africa, using a combination of conventional methods and biotechnology. Not only is such a revolution possible, it is also critical, if the planet is to supply another 1 billion tons of grain annually by 2025 to feed the growing population.

Sub-Saharan Africa faces special challenges such as poor soil, uncertain rainfall, and utterly inadequate transportation networks. But there is a big potential for biotechnology in Africa to increase yields, reduce environmentally harmful farming methods, and ultimately enhance nutritional outcomes.

Of course, a genuine green revolution will also require resolving basic infrastructure bottlenecks. The lack of viable road and railroad networks in much of the landlocked continent makes the costs of supplying fertilizer and other inputs and of moving product to market sky high. For instance, road density in Nigeria today is 1/7 that of India in the 1950s.

Despite its manifest importance, the USAID budget has seen a dramatic decline on agricultural development--both in terms of R&D and support for rural infrastructure and extensions services. The decline is especially striking, since rural development appears to be an area of urgent priority for many developing countries. When the new demand-driven U.S. aid program, the Millennium Challenge Corporation (MCC), put beneficiary countries in the drivers' seat to define their own priorities for the first time, almost all of the initial grant proposals included rural agricultural development.

Meanwhile, the fight over biotechnology between the two first world elephants is trampling the grass in the developing world. Who was not stunned when the President of Zambia rejected food aid with 2 million lives hanging in the balance? It turns out that wealthy consumer distrust of genetically modified foods has colored attitudes in Africa as well, partly because of concerns about possible barriers to future exports of corn to Europe.

Yet, already more than three quarters of the 5.5 million growers of bioengineered crops are resource-poor farms in low income countries. And low income farmers grow fully one quarter of world's bioengineered crops. One little-known benefit of biotechnology so far is an enormous reduction in pesticide poisonings in China.

Ultimately, the most apparent benefits of agricultural innovations for undernourished poor households may lie in the area of bio-fortified crops. Early victories are likely to include "Golden Rice" formulated to help overcome Vitamin A Deficiency, which causes widespread blindness and impaired immunity. Another strain of rice under development will deliver increased iron to combat deficiencies known to impede cognitive development. This is a truly global endeavor with funding by the Rockefeller Foundation and research collaboration between public universities in Switzerland and Germany along with the Philippine International Rice Research Institute

RANDOMIZED TRIALS

It is worth calling attention to a final area that holds great promise, where social science is borrowing from medical clinical trails. The Holy Grail in the field of development is the ability to scale up effective interventions with proven performance. Yet in reality, our ability to evaluate performance is embarrassingly primitive.

For instance, one of the central tenets in the design of the MCC, the first new bilateral development assistance facility in decades, was a great emphasis on measuring results, in other words, performance-based evaluations. Yet evaluation has traditionally been one of the weakest areas for US assistance, which generally has relied on process or input accounting rather than true impact analysis.

Increasingly, researchers at Brookings, Harvard, MIT, and elsewhere are evaluating impact based on randomized field trials analogous to clinical trials conducted by medical researchers. Mexico inadvertently pioneered this approach when it rolled out PROGRESA, a government-funded program that provided mothers with cash grants and health interventions as an inducement to send their children to school. The program made a virtue out of necessity. When initial funding permitted the program to reach only 500 out of a potential pool of 50,000 poor communities, it selected the initial recipients through a randomized process and made data on the program accessible to the research community. Once the program's successes began to be disseminated, there was enormous demand from other communities, and the program was scaled up rapidly, despite a change in government. Subsequently, this approach has been adapted for use in other Latin American countries.

Subsequent research employing randomized field trials in India and Kenya have reached some surprising conclusions. For instance, it appears that targeted health interventions, such as deworming and iron supplementation, actually improve educational attendance and test scores more than a host of direct educational interventions, including teacher prizes and support for textbooks and uniforms.

This fascinating transplant from the field of medicine underscores a point that is made far too rarely: development is an area of social experimentation. We need to raise the tolerance for failure in initial pilot projects, and indeed expect failure, publicize it, and learn from it. It is important to realize that the history of development over the past half century is littered with a string of abandoned former fads, which should come as no surprise given the inherent complexity and diversity of the institutional environments involved. This argues for more experimentation, not less, and a much more systematic and research-based approach to evaluation.

Investing in knowledge for development has great promise and critical import. The case is just as compelling for areas such as environment, energy, and family planning, which I will not go into in detail here, as it is for agriculture, health, and evaluation. Moreover, investments in science and technology to fight global poverty are not vulnerable to the constraints on absorptive capacity in poor countries that afflict some other areas of development.

And since the social value of many innovations targeted to poor country challenges far outstrips the market value, funding is the natural province of government and philanthropy. However noble their intentions, most strictly for-profit businesses simply are not able to make large-scale investments in this area without risking a decline in market valuation.

The United States should be uniquely advantaged in this field based on the depth and breadth of our R&D clusters, the strength of applied research more generally, and the tradition of the land grant universities. We also have a tradition of visionary foundations in this arena, ranging from the longstanding record of the Rockefeller Foundation to the Gates Foundation's breathtaking entry into the field. The Gates Foundation's giving on global health last year was at least as great as every bilateral donor with the sole exception of the US. Foundations often can afford to take greater early-stage risks than government, but there should be a hand-off to governments as the scale of investment rises and the risks decline.

Unfortunately, there are not many takers in the U.S. government at the moment. The U.S. Agency for International Development has no research department and negligible capacity to support research and innovation on problems related to its mission. Similarly, the research budgets of agencies like the national Institutions of Health and the U.S. Department of Agriculture include minimal support for developing country challenges. Thus, we miss not only the opportunity to foster path breaking research itself, but also contacts with the research community – a professional network of researchers that bridges poor countries and the US, and could provide a useful feedback loop.

The paucity of America's public support for research for development stands in sharp contrast to other donors. For instance, the UK Department for International Development has a Central Research Department, which just announced a 60 percent increase in their research budget by 2007–over 4 percent of their overall current budget. Their mission statement is a perfect description of what we should be funding USAID to do but are not, including commissioning research and working to shape university and private sector research agendas more generally:

> *New science, technologies and ideas are crucial for the achievement of the Millennium Development Goals, but global research investments are insufficient to match needs and do not focus on the priorities of the poor. DFID's Central Research Department (CRD) commissions research to help fill this gap, aiming to ensure tangible outcomes on the livelihoods of the poor. We also seek to influence the international and UK research agendas, putting poverty reduction and the needs of the poor at the forefront of global research efforts.*

It is high time that the U.S. instituted a vigorous effort to unlock the power of innovation for developing country challenges by directly supporting path breaking research and helping to

foster a network spanning the U.S. and developing country research communities that would provide an invaluable feedback loop on policy and program priorities.

WANT TO READ MORE?

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