

Perspectives on science and technology in development: Does the urgent drive out the important? ☆

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Abstract

Around the world every year, nations urgently need assistance to cope with natural disasters, refugees, famines. Such chronic urgencies for “foreign aid” tend to drive out actions aimed at achieving crucial goals for long-term economic development. Just as these pressures affect all donors of foreign assistance, they undermine the capacity- building essential in all developing countries. The program of the US Agency for Development (AID) is a prime example of the distortions that result. Past priorities in foreign assistance on enhancing science and technology, and on nurturing human capital, now rate much less attention. Yet progress in S&T is central for economic growth, and historical trends show that the path to innovation demands multiple incentives rewarding autonomy, diversity, and experiment within the private sector. Further, development must be bolstered—over decades—by patiently reinforcing and building the educational and technological institutions of the recipient of “aid.” Accordingly, this article proposes that AID appoint an S&T Adviser and establish a \$50 million R&D effort. And it is also imperative to restore an emphasis on human capital throughout AID’s strategy. To do this well means conducting rigorous evaluations of results and responding thoughtfully to the priorities seen by the recipients of aid.

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1. Introduction

The wide-ranging literature on “economic development” ignites great controversy about purposes and means. There is disagreement among economists and policy makers about the theories and the best practices for economic growth. Similarly, hot debates surround the roles for science and technology in the developing world.

☆ This article was prepared by the author on the basis of his statement delivered to the bipartisan HELP Commission at their meeting of February 9, 2007 and contains some additional material by the author. The mission of the Helping to Enhance the Livelihood of People Around the Globe (HELP) Commission, as established by the US President and Congress, is to “develop and deliver actionable proposals to the President, Secretary of State and Congress to enhance and leverage the efficiency and effectiveness of US foreign assistance programs in order to reduce poverty through the recipients’ sustained economic growth and self-reliance...” See <http://www.helpcommission.gov>. Nothing herein should be attributed to the Commission itself or to any of its members.

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My strongly held conviction is that technological progress is central for economic growth. Surely governments have a key role, too; but it is too often assumed that governmental interventions create economic growth. The truth of the matter is that governmental programs depend upon prosperity's fruits. Governmental actions cannot sow every seed.

Consider the famous anecdote about the 19th century British physicist and engineer, Michael Faraday. One day Faraday was asked to demonstrate his new electromagnetic phenomena, basis of modern electrical generators, to a parliamentary committee. Faraday, a brilliant speaker, mesmerized the group. But then one parliamentarian said: "Professor Faraday, this is fascinating, yet isn't it a curiosity of the lab? What use it is to anyone?" Faraday paused and answered: "I'm not sure, sir, but one day you will tax it."

I will not reexamine all of the foreign assistance issues here. Instead, I will highlight my views on: the mission and strategy for US assistance in the developing world, especially regarding science and technology; the organization of the US Agency for International Development (AID) with its partners; analytical approaches to improve performance and accountability; and, briefly, the imperative for lifting AID's priorities on human capital and on international scientific collaboration.

In general, my argument is that throughout current operations, "the urgent drives out the important." This tendency, a rueful drift in most governments, has especially harmful, if inadvertent, effects on the critically enabling functions for science and technology in economic growth among the least developed countries.

2. Humanitarian mission

First I must underline with great respect the compelling case for effective "humanitarian assistance." For the highest and best expressions of consistently extraordinary American generosity whenever disasters, droughts, and famines strike, the technologies of transportation, communications, and logistics management are essential. I will not examine this function of urgent relief, because that is already high on the HELP Commission's agenda. Yet I am positive that as AID tries to achieve even greater flexibility and efficiency in such assistance, the S&T community will pitch in. If the US government sets a high standard for the services desired, high technical performance will follow. What is genuinely urgent must be managed well.

3. History's lessons for strategy

For all of the rest of AID's choices within its overall mission—aimed at economic development—the strategy should pivot around the crystal clear lessons drawn out in the conclusions of Stanford economic historian Rosenberg in his 1986 book, *How the West Grew Rich*. His succinct summary may seem academic, yet it is a practical and powerful reminder of what works and why. Rosenberg said:

"...the underlying source of the West's ability to attract the lightning of economic revolutions was a unique use of experiment in technology and organization to harness resources to the satisfaction of human wants. The key elements of the system were the wide diffusion of the authority and resources necessary to experiment; an absence of more than rudimentary political and religious restrictions on experiment; and incentives which combined ample rewards for success, defined as the widespread economic use of the results of experiment, with a risk of severe penalties for failing to experiment."^[1]

What are the implications for AID? Put starkly, whenever top-down plans are imposed on the recipients of aid, using today's (or yesterday's) technologies, programs falter or fail. In contrast, if the goal is to trigger globally competitive economic growth, as Rosenberg underscores, the "thematic terms" must be "autonomy, experiment, and diversity." And this approach must rest largely upon the priorities set by the "recipients." For this to occur, technological verve—and organizational flexibility—will be essential across any agency that provides "assistance."

The point here is to ask: how can government foster the entrepreneurial culture that is, in the long term, the engine and fuel for economic growth? A vivid reminder of the problem is the black humor in India where astute observers note that if there had been a Ministry of Information Technology, the spectacular and rapid success of India in IT would not have happened. Government's best roles are in macroeconomic policies such as less regulation, lower taxes, robust property protection, strong elementary and secondary education,

infrastructure, investment in R&D, and open trade. Baumol et al. recently outline how countries can nurture the core of entrepreneurial culture in what they call “good capitalism”.^[2] AID should pay attention to their analysis.

One institutional example of a government agency thinking this way—that is, dynamically and for the long term—is the Advanced Research Projects Agency (ARPA) in the Department of Defense. It was successful, most agree, because of a critically potent approach: select first-rank professionals (often young), encourage them to experiment with long-range projects in any field relevant to national security, evaluate the projects’ results with rigor, and then start this process all over again.

Of course, I realize that “experiments” in reducing human poverty are more difficult than “experiments” in advancing telecommunications. Nonetheless, the underlying point is that US assistance will be more effective to the degree that its programs look over the horizon. Every effort should embody the attributes shown to be the basis for economic growth and perceived as the long-term objectives for “aid.”

The past generation had scathing critics of stop-gap, dependency-deepening “aid”—such as Bauer in his book¹, *Equality, the Third World and Economic Delusion*.^[3] I believe Professor Bauer would agree today that India and China have awakened to the more important, independence-building, dynamic technological and organizational drivers of economic growth. Certainly the *East Asian Miracle*,² documented by the World Bank, for example, showed convincingly that “market-friendly policies are the foundation” for success.^[4]

4. Science in foreign assistance

In this new century, Rosenberg’s prescriptions for “experiments in technology and organization” must be adapted by each country to its local conditions as well as to globally competitive benchmarks. Yet the ideas remain potent, needed more than ever. As the Council on Competitiveness pointed out in its November 2006 *Competitiveness Index*, “80% of middle-income consumers are predicted to reside in the developing world by 2020.”^[5] Given this pace of change, US foreign assistance cannot permit itself to be trapped by half-century old, flawed top-down notions about the paths to economically thriving societies.

Before turning to comments on how to implement a reformed strategy, I introduce the traditional distinction between issues of “science-for-policy” and issues of “policy-for-science.” AID’s reforms and its new strategy ought to take this idea into account.

What is “science-for-policy” within say, the domain of projects on energy? AID’s programs would weigh all evidence, in this instance, about the costs and benefits of the using available technologies for “renewable” energy. This review would span solar power and it would surely include nuclear options. AID would have to explore much evidence—preferably collaborating with the private sector and university specialists—before deciding on investments in any energy projects, whether short or long term.

In the “policy-for-science” category, views about energy are quite different. AID and the US foreign assistance community—cooperating with private groups as well as with the Department of Energy and the National Science Foundation—would have to decide whether to emphasize longer range R&D. Should AID—over the next decade—try to advance, for example, materials technology underlying the development of much more efficient solar panel arrays? The goals would not be short-term. But the stakes are large.

I recognize that AID does not usually imagine itself to be a research-supporting mission agency, such as the Department of Commerce or the Department of Agriculture. But to the degree that the goals of its mission demand scientific and technological progress—and most do—I advocate funding for some “mission-oriented R&D” in the same fashion followed by other major Federal agencies. Why not? More on this next.

¹His critique is brisk. Bauer argues: “Foreign aid is perhaps the least questioned form of state spending in the West.” And, later, he asserts: “it is plainly untrue that poverty is self-perpetuating, that poor persons and societies cannot emerge from it without external alms.” Further, he adds: “Professor Kuznets has estimated that increase in physical capital and in labor together accounted for less than one tenth of long term growth in the West over the last two centuries.” [3, p. 89–99]

²This report reaffirms that “the appropriate role of government is to ensure adequate investments in people, provide a competitive climate for private enterprise, keep the economy open to international trade, and maintain a stable macro-economy.” [4, p. 10]

5. Organization and operations for AID

In 1992, the Carnegie Commission on Science, Technology, and Government released a report entitled *Partnerships for Global Development*. It had an optimistic subtitle, “The Clearing Horizon.” The diverse 12-person Task Force involved in the intensive two-year analysis included former President Jimmy Carter, former Secretary of State George Shultz, Ambassador Anne Armstrong, Harvard physicist and Dean Harvey Brooks, former AID Administrator Peter McPherson, and distinguished participants from developing countries including Lydia Makhubu from Swaziland and Francisco Sagasti from Peru. All recognized the overarching needs to improve US initiatives in development. I was honored to serve as vice chair of the Task Force.

I emphasize one of this group’s main conclusions:

“To fulfill its mandate, AID must increase its access to American expertise in science and technology, enhance staff skills, decentralize authority, improve long-range planning, and match its organization to evolving international conditions.[6]”[6, p.19]

Anyone reading such an injunction today might say: that is a tall order, easier said than done, probably unlikely to happen. But I urge the HELP Commission to lift up and pursue these recommendations.

AID today apparently has few senior scientific and engineering staff. AID also links poorly with the extraordinary American community in research and development. This community encompasses hundreds of thousands of trained individuals in the life, engineering and physical sciences, working in universities and industry, as well as in the Federal government’s in-house and national laboratories. AID often seems to suffer from the twin maladies of being far from changing needs in the field and far from the moving fronts of technology. This isolation, not total but pervasive, is almost as severe a constraint on AID’s effectiveness as the punishing constrictions imposed by plentiful and idiosyncratic Congressional earmarks on its appropriations.

So, what to do? I suggest three steps:

1. Create the position of Science and Technology Advisor to the AID Administrator, supported by a small senior staff of, say, five professionals. The group would advise on programs throughout the agency, catalyze links with those many global S&T networks having skills and interests oriented toward development, and thereby bring the nation’s S&T into AID’s long-range planning.
2. Set aside a fund of, say, \$50-100 million per year, to operate as an ARPA-like arm of AID. The projects would tackle long-range problems demanding inventive research, making grants/contracts on a nationally competitive basis. The fund would be administered by the S&T Advisor. The competition would be governed by an independent panel of external reviewers; this panel could also advise the AID Administrator on broader themes.
3. Establish, with the State Department, an expanded S&T staff in more embassies around the world. Many ambassadors need greater technical support and most countries seek S&T “partnerships” with the US—from agriculture to space, and from health to forests. AID is on the front line. Yet it often lacks depth. Enhancing and decentralizing the S&T functions, along with restoring a senior advisor in Washington (as in #1 above), will go a long distance toward putting AID “in the 21st century game.”

I am keenly aware that such suggestions often have been made, and then rebutted or watered down, in the past. Sweeping reforms are difficult to fulfill, and whenever made, need adjustment as the circumstances unfold. Yet, unless consequential changes of this character were soon adopted, AID and its intended beneficiaries would run more risks of being lost in technological backwaters and economic troughs.

Peter Drucker once remarked “long-range planning does not deal with future decisions, but with the future of present decisions.” Unless the long-standing ruts of past programs are illuminated soon by rigorous rethinking, the “present decisions” will not yield the results envisioned.

Here is one example: the relationships between AID’s programs on health and the prospects for economic growth. Raymond’s seminal article, “Foreign Assistance in an Aging World,” emphasized that by 2020—that

same year I mentioned earlier, i.e. when “80% of middle-income customers will be in the developing world”—“there will be more people over 65 in LDCs than children under 5.”[7] This incontrovertible evidence shows that the past generation’s rationale for AID’s continuing work in public health must be rethought. Public health is “part of an economic strategy targeted at the work force,” Dr. Raymond urged, “not just provision of care to women and children.”

The requisite intellectual resources needed for this shift—from “health delivery” to “healthy workforce”—must be mustered partly from science and technology—along with, of course, economic analysis and large reallocations of funds. Garrett also recently pressed for recognition of the rising need to avoid “putting nations on the dole” regarding global health.[8] S&T capacity-building is the only effective path for achieving the desired independence in the foundations for a health system that meets socioeconomic aims.

6. Measures of goals and effectiveness

A high-quality organization sets clear goals, evaluates its performance, and then adapts its programs to improve its effort. The HELP Commission’s review of foreign assistance should begin with that simple concept. Let me explain with a few examples.

Consider the complex intersection of climate change, energy, and economic development. The release in early 2007 by the UN’s Intergovernmental Panel on Climate Change (IPCC) of its “Summary for Policymakers” was a vivid reminder of the category, “science-for-policy,” that I mentioned earlier.[9] Yet after reading it, questions arise: which “climate change” goals to pursue, where, how, and why?

Whatever the views of those engaged in the debates on climate—from Michael Crichton to Albert Gore—all analysts and citizens ought to agree on at least five points: the issues are significant; the analysis must be quantitative; research and experiments on options must be conducted; economic impacts must be estimated and debated; and the cost/benefits of mitigation and adaptation must be confronted. AID must be “in the game” for work at this intersection of global trends. With little capacity in science and engineering, AID rarely is.

Let us explore this further. In 2004, Victor published a splendid monograph on *Climate Change*.^[10] The evidence in his hypothetical “Memorandum to the President” covered all the principal arguments, for and against, three distinctly different paths for US policy. His three hypothetical speeches, exemplifying those paths, give pause to any thoughtful reader. AID today hardly seems to figure in the exploration of these public policy options and their consequences.

In a comparative analysis that went way beyond the environment, considering climate in relation to the host of other obstacles faced by developing countries, Lomborg edited a stunning volume called *Global Crises, Global Solutions*.^[11] For that study, a world-class panel of economists ranked possible add-on investments in several activities. Funds could be used to mitigate climate change, or to attack a dozen other major global problems, e.g., reducing the incidence of communicable disease, easing trade barriers, and increasing access to clean water. True enough, every one of these “crises” calls for action. But resources are scarce. In weighing options and returns for investment, the economists’ decision criteria were, in short, whether the technologies proposed for action had been established and whether the anticipated benefits were likely and substantial. A consensus emerged: the “crisis” of communicable disease ranked first, climate change last. AID’s professional staff needs to know and apply such a calculus, even if its independent analysis turned out to be different.

As a final illustration of the complexities for US foreign assistance policy arising from projected climate change, consider national security. In a recent report 11 retired general and flag officers assessed the “influence of climate change on geo-strategic balances” over the next two or three decades.^[12] Much of their analysis hinged on the possibility of grave damage in and between highly vulnerable developing countries. These scenarios would confront the US and Europe with dire consequences for global stability. So AID is, in fact, from this perspective an agency with national security responsibilities, both urgent and important, both concrete and uncertain.

My purpose in sketching these illustrations is not to advocate any particular format for analysis, nor to support any specific policy course of action on climate. No, my purpose is simply to urge AID to participate actively—indeed, as a leader—in these debates across this marketplace of ideas to help clarify the global and

Table 1
R&D expenditures per capita in purchasing power parity (PPP) Dollars (2000)

Region	R&D expenditures per capita in PPP (\$)
US	934
Japan	775
North America	687
Germany	621
Europe	279
Asia	57
S. America/Caribbean	42
Africa	6

Source: Ref. [13].

Table 2
R&D expenditures in (PPP) dollars and share of world total in 2000

Region	Expenditures	
	Billions PPP (\$)	%
North America	285	39.1
Asia	209	28.7
Europe	203	27.9
S. America/Caribbean	18	2.5
Oceania	9	1.2
Africa	5	0.6

Source: Ref. [13].

the US interests. But only occasionally do I see AID's staff taking this role. One of the great benefits of adding to AID's S&T capacity is that it would become more feasible for the staff to know about and carry out research on the challenges facing AID every day. And that capacity would immunize AID from the diseases of obsolescence and political fashion.

Because the HELP Commission's charter includes "technology," I will push my emphasis on analysis a little further. Recall Lord Kelvin's remark: "When you cannot measure it, when you cannot express it in numbers, you have scarcely, in your thoughts, advanced to the stage of Science, whatever the matter may be." This is crucial for comparing the estimated costs and outcomes of results to date, and plans for the future, particularly on the main mission of fostering economic development.

One dimension of such assessments is sizing up the specific needs in various regions and countries. Consider, for instance, the data from the National Science Foundation's S&E Indicators 2006 (Tables 1 and 2).

This snapshot of the "whole board" is a stern reminder of the startlingly limited capacity, and thus the likely future slow growth, for S&T among countries in South America and Africa. China and India have rapidly increased their R&D; and the data above do *not* reflect the double-digit increases in their S&T during the past few years.

For all nations, unflinchingly realistic appraisals will be needed to "compute" who is lagging, and why, who could be a US AID partner, and how, and who will be a US competitor. Throughout AID's strategic planning, such data count.

7. Human capital and international partnerships

The phrase "human capital" seems cold. For modernization and economic growth, however, this deceptively simple idea is vital. Nobel prize-winning economist Schultz argued, for example, that "All too little foreign aid has been allocated to enhance the stock of human capital"... and "the future productivity of the

economy is not foreordained by space, energy, and cropland. It will be determined by the abilities of human beings.”[14]

Recently, Mohamed H. A. Hassan, executive director of the Academy of Sciences for the Developing World in Trieste, noted that in the past, “the thinking was that the scant resources and expertise in the developing world should be used to address more immediate concerns, such as increasing agricultural productivity and providing greater access to safe drinking water ... but such thinking ignored the fact that many of these challenges could not be met without first building indigenous capacity in science and technology.”[15] Dr. Hassan seems to agree with me: the urgent has been driving out the important.

Accordingly, in weighing priorities, AID’s objectives must include building human capital. It is the most fundamental driver for economic development over the long term.

Consider Taiwan’s and South Korea’s historical emphasis on education. At the risk of oversimplification, here is my view. Despite the large external resources of “aid” these countries received, a persistent domestic priority on education was arguably the indispensable source of their rapid development. Gradually, as their elementary and secondary schools succeeded, and as excellent technical/vocational training thrived, the college and university system came into its own. In the early stages, the schools produced students with the “know-how” essential for employees working in industry. Later, as value-added innovation became critical for Taiwan’s and South Korea’s global competitiveness, their advanced institutes (with returning foreign-trained nationals) produced leaders who possessed the “know-why” central for mastering the fast cycles in world-wide trade dependent upon new technological applications.

Not so long ago, in fact, AID was a leader in helping to create and nurture great educational institutions. Consider India’s much-respected, world-class Institutes of Technology. One, in Kanpur, was founded in 1960 with critical support from AID along with the Ford Foundation and an American consortium of universities. Even when diplomacy between the US and India was strained, India respected that American initiative; India still benefits from it. Indians and Americans take pride in the institution and recognize the global leadership of its alumni.

More recently, in 2000–2002, the US embassy in New Delhi helped to found the US–India Science and Technology Forum, a “private society” (akin to a US 501(c)3 organization) jointly supported with an endowment from the two governments.[16] The Forum facilitates highly visible, excellent exchanges and workshops to bring together S&T leaders from both countries for work on topics of mutual research interest and joint national priority.

Why cannot AID expand activities that nurture human capital? After all, such projects brought success in the past. Only these kinds of imaginative ventures will assure enduring, long-term support from the host country. These ventures also always serve US goals while enhancing robust bilateral relationships.

Finally, in this brief reflection on human capital, I urge the HELP Commission to consider exploring how AID could buttress the frameworks for international cooperation in science, engineering, and medicine.

When President Bush announced at the UN on 12 September 2002, that the US was returning to UNESCO, he implicitly challenged us to answer the further question: What other steps are needed to strengthen, in the US interests, all of the international institutions in science and technology? The question has not been answered fully, despite varied proposals and a few prospecting forays.[17]

I believe AID’s “best practices” should encompass selective initiatives that would shore up and extend American global partnerships. The initiatives would span topics from food (FAO) to energy (IAEA) and in regions from Africa to Asia. They would engage international professional associations, multinational firms, and philanthropic foundations.

American philanthropy has a spectacularly effective record in international activities—such as by Rockefeller and Carnegie, dating back a century.[18] And, recently, unusual commitments by private donors—such as Gates and Soros—have grown in scale and scope. AID must tap into the drive and originality animating these constructive global initiatives taken by the private, non-profit sector.

8. Closing note

“Trouble shared is trouble halved.” The old saying is as true for nations as it is for individuals. I refer not only to the voluntary and compassionate actions of people and governments in helping nations during an

emergency such as an earthquake but also to the long-lasting cooperative bonds aimed at accelerating social and economic advance. Just as students must master the “three R’s,” nations must master the “three C’s”—curiosity, capitalism and conscience. Let this be the banner for AID.

Curiosity is the engine of science. More expansively, as the English historian George Macaulay Trevelyan remarked, “Disinterested curiosity is the lifeblood of real civilization.” By exploring their own nation’s natural and cultural history, citizens come to understand their own assets and to respect their distinctive traditions. Democratic governance nurtures creative curiosity by defending the freedom to investigate, to speak, to vote, to publish, to travel. Science and technology need these freedoms and thrive best in their freshening air.

Capitalism and the competitive pluralism of global markets are essential for lifting productivity and living standards. But markets are often punishing. Governments confront cruel conflicts in trying to trigger and manage economic growth. For example, whenever the public sector experiences financial trouble, it is tempting to slash academic budgets and increase the tuition for students. Even when such budgetary squeezes are portrayed as temporary, families scramble to pay for the education they know their offspring will need in order to compete in a twenty-first-century workforce.

Yet conscience calls for a society to maintain the baseline for sufficient education, food, housing and health care. When countries undergo economic upheaval, citizens often doubt whether the social imperatives of conscience can be reconciled fairly with the often unnerving, and socially unsettling demands of individual curiosity as well as with the relentlessly transforming stresses of markets.

The chronic challenge is to ensure that constructive economic change is humane. Every country, bar none, struggles with the process; and the sharing of national experiences will surely clear better paths. Just as confident 21st century firms must drive productivity growth with vigorous technology and science, confident “foreign assistance” must look ahead and spark its own productivity. If AID encompasses the three C’s, it will shift the balance at the agency so that the urgent no longer will drive out the important.

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