



**USAID**  
FROM THE AMERICAN PEOPLE

Transforming Development through

**SCIENCE,  
TECHNOLOGY &  
INNOVATION**



## **A White Paper for Discussion**

June 2010

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This work benefited from the contributions of the USAID Working Group on  
Science and Technology and Dr. Ticora Jones and her team.

*This paper did not go through the  
formal USG clearance process.*

## Section I: Executive Summary

In a recent testimony before Congress, US Agency for International Development (USAID) Administrator Rajiv Shah stated, “While the scope and complexity of the world’s challenges have grown – from the food crisis to the global financial crisis, terrorism to oppression, climate change to pandemics – we have never had the technology, resources and global imperative for action that we have today... We are moving to face these challenges [by] embracing innovation, science, technology and research to improve our development cooperation.”<sup>1</sup> Administrator Shah and his colleagues recognize that solving the world’s development challenges through science, technology, and innovation (STI) cannot be done alone. On July 13 and 14, 2010, USAID leadership will turn to some of the world’s leaders from science, government, industry, academia, and philanthropy to explore how USAID can best transform development through STI.

The conference marks the launch of a global dialogue. Over the course of this process, stakeholders are asked to help USAID select a subset of development challenges that the Agency is best equipped to tackle by applying STI solutions. To seed this process, USAID launched a website to harvest challenges from anyone who would submit them. Challenges were harvested from science fellows, USAID staff in Washington, in-field missions, federal science agencies, grass roots organizations, universities, and other donor organizations. More than 650 challenges constitute the initial fruits of this effort. Every disciplinary sector (e.g. agriculture, health, energy, etc.) is represented, but even more common are complex challenges that straddle boundaries between disciplinary sectors. With so many challenges worthy of effort, how might USAID select those most appropriate for it to tackle? Establishing selection criteria constitutes an important step in setting parameters for USAID’s action.

Of the STI tools required to solve development challenges, many already exist. Some of these—oral rehydration therapy, global information systems, etc.—were funded by US federal research budgets. Leveraging available resources to solve development challenges constitutes a double-win. Determining how best to maximize the impact for development of available US resources will be explored together.

For too many development challenges, conceivable innovation pathways lead to solutions not yet in existence. Widening the community of solvers to maximize the STI capacity in developing countries and draw from the talents of solvers outside of USAID requires selecting the right type of collaboration mechanisms. Which tools pull in the most talent? What is the best balance between programs that seek to solve challenges and those that address the need for broad-based STI capacity development? A host of new mechanisms and tools—crowd-sourcing, challenge competitions, advance purchase mechanisms—must be scrutinized for their ability to boost the impact, relevance, and effectiveness of USAID’s work. In exploring the benefits of these new mechanisms, USAID is investigating how these new mechanisms differ along two dimensions: openness (can anyone participate, or just select players?) and hierarchy (who makes key decisions—one participant or all players?).<sup>2</sup>

Looking to the future, no single story can be told about how STI will continue to help shape life in developing countries or in the US. For USAID, this presents a unique challenge: given uncertainty about the future, how can we best position ourselves to not just identify technological and scientific advances that will improve the lives of the poor, but also to help scale and spread those advances that may emerge?<sup>3</sup> Determining which tools USAID

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<sup>1</sup> Shah, Rajiv. “Testimony of Dr. Rajiv Shah Administrator, U.S. Agency for International Development Regarding the Fiscal Year 2011 Budget Requests Before the Committee on Foreign Affairs United States House of Representatives.” (Washington, DC. March 3, 2010). <http://geneva.usmission.gov/2010/03/03/usaids-shah-2011-budget/>

<sup>2</sup> Pisano, G. and Verganti, R. “Which Kind of Collaboration Is Right for You? *Harvard Business Review*. (December 2008): 1.

<sup>3</sup> Rockefeller Foundation and the Global Business Network. “Scenarios for the Future of Technology and International Development.” (New York: Rockefeller Foundation, May 2010).

should adopt to identify future challenges and the resources required to respond to them will also be explored both in this paper and over the course of the Conference.

## Section 2: Objectives

With the support of the White House and the Secretary of State, the United States Agency for International Development (USAID) is calling together the world's leading scientists and innovators and heads of key science agencies to help map a new science, technology, and innovation (STI) for development strategy. Entitled "Transforming Development through Science, Technology, and Innovation," the meeting, to be held July 13-14, 2010, in Washington, DC, is organized around four goals:

- (1) Develop a consensus around the key development challenges.
- (2) Better integrate and apply current solutions and knowledge.
- (3) Fashion a science agenda around the next generation of solutions.
- (4) Create new approaches and mechanisms to address development challenges and scale up existing innovative mechanisms.

The meeting marks the launch of a process toward embracing a new orientation toward STI support. Critical to the success of the process is the inclusion of global partners' voices, which will be listened to intently as the process unfolds. Through this process, USAID seeks to excite and engage partners from academia, the private, public, and donor sectors whose talents and resources are paramount to the success of this initiative. This first step reflects a desire to more fully understand the resources and mechanisms available to USAID before a more meaningful engagement with international partners.

The document before you is not a policy statement, nor a set of recommendations. Rather, it is a thought piece meant to stimulate, provoke, and engage. The bulk of the document centers on questions we hope you will consider in advance of the meeting. USAID is ready to listen. We hope you come ready to engage with us to transform development through science, technology, and innovation.

## Section 3: Definitions

A shared set of definitions offers a promising starting point for a constructive dialogue together. Definitions for the key concepts used throughout this document follow. We acknowledge that there are many working definitions for each of these concepts; the following establish a working baseline:

**Science** is the application of the scientific method that involves hypothesis testing through lab and field observations and evidence that is observable, measurable, and empirical (and preferably repeatable), according to the USAID Office of the Science and Technology Advisor.<sup>4</sup>

**Technology**, as defined by the Rockefeller Foundation, refers to a broad spectrum of tools and methods of organization. Technologies can range from tools for basic survival, such as a treadle pump and basic filtration

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<sup>4</sup> As provided by Alex Dehgan, Science and Technology Advisor to the Administrator of the US Agency for International Development. (Washington DC: USAID, July 2010).

technologies, to more advanced innovations, such as methods of collecting and utilizing data in health informatics and novel building materials with real-time environmental sensing capabilities.<sup>6</sup>

**Innovation** is the implementation of a new or improved product (a good or service), or process, a new marketing or organizational method in business practice, workplace organization or external relations, according to the Oslo Manual for the Measurement of Scientific and Technological Activities.<sup>7</sup>

A **Grand Challenge**, according to Grand Challenges Canada, is a barrier that, if overcome, would help solve an urgent health [or other development-related] problem in the developing world with the likelihood of global impact through widespread implementation.<sup>8</sup>

## Section 4: Learning from the Past, Gearing for the Future

USAID was created in 1961 with the passage of the Foreign Assistance Act. Set against a backdrop of the Space Race and an invigorated national enthusiasm for the transformational power of STI, the new Agency began

*“This is the time to get serious about this area of work. That’s why we will restructure our already considerable science and technology assets.*

*We will dramatically accelerate our efforts to solve the major science, technology, and engineering challenges in development and engage the full federal science community in this effort. And we will make sure innovations get out of the lab and benefit the world’s poor.”*

**Dr. Rajiv Shah, USAID Administrator**  
Speech to the Council on Foreign Relations, 2010

assembling a technical infrastructure to ensure that scientific and technical excellence underpinned development programs.<sup>9</sup> Over the years, these and other investments in STI for development delivered results. Box I and Appendix I provide a few examples.

Fifty years later, the Agency is reasserting its pledge to support STI for development. Administrator Shah brings a reinvigorated commitment to the importance of these tools, casting them as cornerstones of development assistance. However, USAID’s history reveals an uneven record

of investment in this area. This history can be characterized in five distinct eras:

- **The Early Years** 1961-1970: Ramping-up internal capacity;
- **Small is Beautiful** 1970-1980: Directing science and technology-based investments to smallholders;
- **Getting ROI from R&D** 1980-1990: Directing S&T-based investments to economic systems;
- **Seeking Middle Ground** 1990-2000: Engaging smallholders (again); balancing competing priorities amidst declining budgets;
- **Innovation for Development** 2000-2009: Renewing interest; Incorporating the “I” in “STI for development.”

<sup>6</sup> Rockefeller Foundation and the Global Business Network.

<sup>7</sup> As referenced in the Government of the United Kingdom’s Department of Business Innovation and Skills (previously Department of Trade and Industry) presentation entitled “The Oslo Manual Version 3: Summary of Main Changes”. (2005). [www.berr.gov.uk/files/file9659.ppt](http://www.berr.gov.uk/files/file9659.ppt).

<sup>8</sup> Singer, Peter. “A New Way to Change the World.” (The Mark, June 2010). <http://www.themarknews.com/articles/1772-a-new-way-to-change-the-world>.

<sup>9</sup> Dehgan, Alex, and Jones, Ticora. “A Review of the Bureau for Science and Technology at the US Agency for International Development.” (USAID: 2010).

Even as the orientation of USAID’s STI support evolved over time, a fundamental tension remained constant. According to the National Research Council, the focus of US foreign assistance swings between constituencies that embrace “bottom-up development” and those that focus on the stimulation of economic growth through technology transfer and engagement of institutional actors.<sup>10</sup> As a result, investments in STI for development shift from one approach to the other. A more thorough historical analysis of USAID’s experience with STI support may be found in Appendix I.

Missing from USAID’s history to date is an era of sustained commitment to an integrated approach—one that marries a bottom-up, smallholder-based orientation with an economic system-based orientation. What is needed is a broader understanding of innovation systems, (i.e., an Innovation

Systems Framework) and the critical institutions and interactions such a perspective emphasizes. As noted in *Innovation, Sustainability, and Development: A New Manifesto*, such a perspective enables USAID to move away from a “simple model of technical progress, to an acceptance of a broader range of interactions behind innovation of all kinds – ranging across local and global scales.”<sup>11</sup> For USAID, this requires a fuller appreciation of the resources available both within partner countries and within the US, including the federal science agencies.

**Box 1: STI for Development – Examples of USAID’s Historical Accomplishments**

*Oral rehydration therapy*, developed through USAID, is credited with saving tens of millions of lives around the globe.

USAID invested in basic research confirming that *vitamin A supplementation* is a powerful child survival tool. In vulnerable populations, it can reduce overall mortality of children under 5 by 23–34 percent.

*Agricultural research* sponsored by the United States sparked the “Green Revolution” in India and resulted in the most dramatic increase in agricultural yields and production in the history of mankind.

Sources: USAID website, June 2010; Living History of USAID, June 2010

## Section 5: The Next Grand Development Challenges

*“Science and technology innovations are critical drivers of growth... And science and engineering have opened the door to revolutions in our field, whether it was American agricultural scientists who drove the Green Revolution, or American medical researchers who pioneered immunization techniques. It's only right, then, that we recalibrate our science portfolio around a new set of grand challenges.”*

**Dr. Rajiv Shah, USAID Administrator**

On the Approach to High-Impact Development, for the Council on Foreign Relations, May 2010

Hunger. Disease. Environmental degradation. A changing climate. Natural and man-made disasters. Challenges that threaten the wellbeing of humankind and the planet we live on are far too many. Each demands the attention of USAID, the US government, and the world. Even in the narrower realm of development challenges for which the application of STI can play an instructive role, the challenges are humbling in their abundance. We recognize, of course, that STI resources do not come without baggage. Most people in rural communities have as many

<sup>10</sup> Committee on Science and Technology in Foreign Assistance. *The Fundamental Role of Science and Technology in International Development: An Imperative for the U.S. Agency for International Development*. National Research Council. (Washington, DC: The National Academies Press, 2006).

<sup>11</sup> STEPS Centre. *Innovation, Sustainability, Development: A New Manifesto*. University of Sussex. (Brighton: STEPS Centre, 2010). [http://www.anewmanifesto.org/manifesto\\_2010/](http://www.anewmanifesto.org/manifesto_2010/).

stories about technological solutions gone awry as they do about ones that enhanced their quality of life. The union of STI tools to any development challenge merits careful risk analysis. As a result of this complex reality, “We [USAID] do have to be selective and strategic about where and how to get involved.”<sup>12</sup>

The desire to be more strategic with its investments informed USAID’s decision to explore the “next grand development challenges,” and the role that STI will play in addressing those challenges. Other organizations’ experience with “grand challenge” initiatives, such as the Bill and Melinda Gates Foundation’s Grand Challenges in Global Health and the National Academy of Engineering’s Grand Challenges for Engineering, inspired the question of whether a challenge orientation might serve USAID’s objectives too. However, the USAID approach differs from these other examples, as our primary concern is identifying *development challenges* to which STI can be applied, as opposed to *STI challenges* with application for development. While seemingly just a difference in semantics, this change in orientation has important implications for the types of challenges selected through the process now underway.

In an initial “grand challenges” harvesting exercise, USAID solicited input from its three functional bureaus (Democracy, Governance, and Humanitarian Assistance (DCHA); Economic Growth, Agriculture, and Trade (EGAT); and Global Health (GH)), nine regional bureaus (West Africa, East Africa, Southern Africa, Asia, Europe and Eurasia, Eastern Caribbean, Central America, South America, and Middle East), and over 100 bilateral missions. Contributions were also solicited from former and current American Association for the Advancement of Science (AAAS) and Jefferson Science Fellows via the fellows’ listserv, as well as from the general public using Facebook and the USAID website.

In sum, approximately 650 challenges were harvested. This bounty benefits from the contribution of 100% participation from USAID’s functional bureaus. Additional submissions were received from 51 individuals (approximately half of which were Science Fellows) and three international USAID missions (Cambodia, Malawi, and Rwanda). The resulting cornucopia of development challenges for which STI can play a role in solving them – which is infinite – was seeded by ideas from 16 groups with vast experience and on-the-ground knowledge, such as the Honeybee Network of India and the African Technology Policy Studies Network. This population was further augmented by challenges extracted from the research portfolios of 12 federal science agencies. While the rate of response was relatively low compared to the size of the community, the quality and diversity of submissions indicate a solid starting point for a more robust dialogue on what constitutes the most pressing, solvable, and transformative development challenges of today and the future. USAID seeks more input as it moves forward in harvesting and selecting from the world of challenges. A more thorough analysis of the challenges submitted and the methodology used to understand them is included in Appendix V.

**Box 2: Examples of Harvested Development Challenges**

How might we produce agricultural products that are less susceptible to spoilage (due to pests or temperature)?

How might we develop new adaptable grids for economies based on distributed energy production?

How might we design energy efficient methods for removing sodium from large salt-water bodies?

How might we turn waste products into fuel?

Source: Initial challenge harvesting exercise conducted by USAID, June 2010

Of the 650 challenges, 38 were selected to spark further discussion at the “Transforming Development through Science, Technology, and Innovation” conference. The 38 rose to the top of the list by using an initial set of

<sup>12</sup> Hillary Clinton, In a speech entitled “On Development in the 21<sup>st</sup> Century,” for the Center for Global Development, January 6, 2010, <http://www.cgdev.org/doc/2009/Clinton%20Transcript2.pdf>.

selection criteria and other filters. According to the criteria, a challenge(s), defined as the “biggest solvable development problem,” should be:

- Solvable with a readily deployable solution (within 10 years)
- Scalable
- Affordable
- Enabling of both solutions and local problem solving
- Transformative in the face of underdeveloped infrastructure

Additional filters include whether the challenge: (1) is relevant to stated USAID priorities; (2) addresses a specific need in the developing world; (3) addresses specific STI-based knowledge gaps; and/or (4) addresses a question of scientific importance. The challenges selected and the selection criteria beg for additional scrutiny and review. This initial harvesting was, as noted above, conducted as an exercise to catalyze an ongoing dialogue between USAID, its international partners, and STI experts. Box 2 provides a few examples of the 38 initially selected challenges.

Once harvested, the 650 challenges were classified according to sector. These sectors align with the focal areas for the “Transforming Development through Science, Technology, and Innovation” conference. Sectoral areas include: (1) Biodiversity, Conservation, Climate Change and Water; (2) Health, Nutrition, and Population; (3) Agriculture, Poverty and Hunger; (4) Energy Access, Renewables, and Infrastructure; and, (5) Fragile States, Conflict, and Disaster. A “comprehensive”, integrated category captures challenges that incorporate multiple sectors and/or functions of the innovation system.<sup>13</sup> These may include challenges related to capacity building efforts, governance, entrepreneurship, and other areas outside of USAID’s more classical sectoral units. USAID appreciates the growing integration of sectors and the preponderance of challenges that do not distinguish between sectoral, geographic, or institutional boundaries. Any number of cross-disciplinary veins of inquiry (i.e. agroindustrial processing) also elicit an “integrated” classification in our typology. Additional information regarding the harvesting exercise, the selection process, and the typology used to organize challenges can be found in Appendix V.

### Questions to Consider:

1. Are the selection criteria as posed appropriate, useful, clear? If not, what alterations would you suggest?
2. What challenges are missing from the list of those initially selected as options? Are there challenges listed that you would exclude?

## Section 6: Designing the Process to Respond to Today’s Development Challenges

The allure of grand challenges is clear; they ring-fence some of the toughest problems of our time. Designed to “bring together optimal combinations of human minds and scientific institutions around a specific problem or goal,” grand challenges aim to “find solutions to the world’s biggest problems.”<sup>14</sup> Recasting problems into solvable challenges, these mechanisms focus resources and energy. Instead of adopting this mechanism wholesale, USAID seeks to explore how they might best be used, for what types of problems, and in combination with what kinds of

<sup>13</sup> Farley, Sara, “On Second Thought, Donor Support to Science, Technology and Innovation for Development; Approaches in the Least Developed Countries. Background Paper.” #10, 2007 Least Development Countries Report for UNCTAD, 2007, [http://www.unctad.org/sections/ldc\\_dir/docs/ldcr2007\\_Farley\\_en.pdf](http://www.unctad.org/sections/ldc_dir/docs/ldcr2007_Farley_en.pdf)

<sup>14</sup> Brooks, Sally, Leach, Melissa, Lucas, Henry, Milstone, Erik. “Silver Bullets, Grand Challenges and the New Philanthropy.” STEPS Working Paper 24 (Brighton: STEPS Centre, 2009) <http://anewmanifesto.org/wp-content/uploads/brooks-et-al-paper-24.pdf>.

other partners and tools. As researchers at the STEPS Centre and elsewhere note, during the selection of grand challenges for development, considerations of *directionality* (i.e., towards what goals?), *distribution* (i.e., for whom?), and *diversity* (i.e., by what means?) must be given appropriate space and weight.<sup>15</sup> Failure to consider these questions means running the risk of transforming needs like health and nutrition into demands for products, like vaccines and biofortified crops. Care must be taken to use challenges so as to avoid “affirm[ing] for upstream actors the soundness of decisions already made, while...divert[ing] attention away from the need to understand the diversity of ecological, political, socio-economic, and cultural conditions with which [these products] will interact.”<sup>16</sup>

For USAID to minimize the risks inherent in these mechanisms, it must actively listen to the priorities of partner countries when selecting “challenges” and designing programs to execute them. Actively listening (and incorporating the feedback of stakeholders) in the over 100 countries where the Agency works constitutes a first critical step. A number of examples demonstrate how other donors work with partner countries to marry local needs and resources to donor activities. One such example is the Uganda Joint Assistance Strategy process. Using the Government of Uganda’s Poverty Eradication Action Plan as the focal point, the Joint Assistance Strategy successfully weaves the commitments of seven international donors around Uganda’s stated development goals.<sup>17</sup> A review of the Uganda Joint Assistance Strategy by the African Development Bank found the process highly relevant to the alignment and harmonization principles identified in the Paris Declaration on Aid Effectiveness. The mechanism focuses on outcomes and the measuring of results, and explicitly identifies the links between the different donor interventions and local development results.<sup>18</sup>

Beyond listening to local voices, availability of resources in a partner country must also be taken into account when integrating new mechanisms within USAID’s portfolio. “Building on existing resources and capabilities” enables USAID to maximize its investments in STI for development.<sup>19</sup> These resources may include existing and emerging industrial actors, university-based research projects, and innovative microenterprises, as well as scientific and technical innovations and their innovators. A more effective way of capturing those innovations and incorporating them into USAID’s operations is needed now. Examples of how to effectively harness and scale local innovation abound throughout the developing world. Prolinnova (Promoting Local Innovation in Ecologically-Oriented Agriculture and Natural Resource Management), for example, builds on and scales up farmer-led approaches to development by learning how farmers conduct informal experiments for improved natural resource management and integrating those approaches into research, extension, and education practices.<sup>21</sup> Garnering additional such examples constitutes another thrust of the Conference.

Understanding the breadth and depth of resources available in partner countries is but one side of the coin. A deeper understanding of the resources available within the federal government, specifically those of the federal science agencies, reveals a flipside. The logic goes—if the US is already funding STI tools pertinent to development challenges, learning how to leverage them constitutes a double win. Even though promoting international economic and social development goals may be a secondary priority for federal science agencies, as Secretary Clinton noted in her nomination hearing, we are “living in a profoundly interdependent world in which old rules

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<sup>15</sup> STEPS Centre.

<sup>16</sup> Ibid.

<sup>17</sup> Puetz, Detlev. “Uganda Joint Assistance Strategy - Review of the Harmonization Process in Five Countries.” (African Development Bank Group: September 2006). <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Evaluation-Reports/12326239-EN-UGANDA-JASU-REVIEW-PUETZ-SEPT-2006.PDF>.

<sup>18</sup> Ibid.

<sup>19</sup> Oyelaran-Oyeyinka, Banji. “Innovation Policies and Practices in Developing Countries: A Methodological Framework.” (IDRC Innovation, Policy, and Science Program Area, April 2006).

<sup>21</sup> Ibid.



and boundaries no longer [hold] fast—one in which both the promise and the peril of the 21st century [can] not be contained by national borders or vast distances.”

The US federal government spends approximately \$150 billion on research and development annually, much of it going to areas relevant to USAID priorities (see Box 3 and Appendix II for further detail on the fiscal year 2011 budget).<sup>22</sup> As the world becomes more complex and interconnected, the US government must put the full weight of its investments and assets toward achieving not only domestic, but international, prosperity and security. Disparate federal science and technology resources collectively have been activated to address challenges that cut across agencies, disciplines, and geographies in a number of cases (see Box 4 and Appendix II for examples). Overseen by the Executive Office of the President, including the Office of Science and Technology Policy, the US Global Change Research Program, for example,

coordinates and integrates federal research on changes in the global environment and their implications for society. Thirteen government agencies (listed in Appendix II) participate in the program, which “has made the world’s largest scientific investment in the areas of climate change and global change research.”<sup>24</sup>

Building on successes and learning from failure beckons a fresh approach at USAID. A new path is perhaps the only way forward for USAID and its federal partners to catalyze “transformational change” with regard to global climate change, food security, global health, and the other major challenges of our time. This means bringing all available resources to bear, tearing down the silos so gaps and duplications of effort are visible, and then getting to work.

### Questions to consider:

1. How do we prioritize among the countless current challenges?
2. How can we capture and encourage indigenous scientific and technical innovation in developing countries?
3. How do we identify those existing resources in the US that are most responsive to development challenges for which STI play a role? How can we identify gaps in those resources?

### Box 3: Maximizing STI Investments for Development—FY2011 Budget Requests

National Institutes of Health: A \$1 billion increase to accelerate progress toward developing high-throughput technologies and global health interventions.

Advanced Research Projects Agency-Energy: An outlay of \$300 million to invest in “high-risk and high-payoff transformational research” on energy technologies.

National Oceanic & Atmospheric Administration: An increase of \$800 million, much of it going to improve our nation’s system of weather- and climate-observing satellites.

Agriculture & Food Research Initiative, US Department of Agriculture: A proposed funding level of \$429 million, a 63.4 percent increase from FY 2010, to support research in bioenergy, global climate change, global food security, nutrition and health, and food safety.

Source: American Association for the Advancement of Science Report XXXV, Research and Development FY2011.

### Box 4: US Government Initiatives for International Development

#### Feed the Future:

- The U.S. government’s global hunger and food security initiative
- Goal is to sustainably reduce global hunger and poverty by accelerating inclusive agriculture sector growth and improving nutrition status
- Pledge of at least \$3.5 billion over three years

#### Global Health Initiative:

- Builds on progress of PEPFAR (President’s Emergency Program on AIDS Relief)
- Expands effort to include investments to strengthen health systems, improve maternal child health, address neglected tropical diseases, and foster research and development
- Pledge of \$63 billion over six years

Source: The White House, “A New Approach to Advancing Development, June 2010.

<sup>22</sup> Research and Development Budget and Policy Program. “Highlights: Research and Development FY 2011,” (American Association for the Advancement of Science, 2010). <http://www.aaas.org/spp/rd/rdreport2011/11pch00high.pdf>.

<sup>24</sup> US Global Change Research Program. “Program Overview.” (2010). <http://www.globalchange.gov/about>.

4. How do we identify those existing resources in partner countries that are most responsive to development challenges for which STI play a role? How can we identify gaps in those resources?
5. How can we identify and connect resources for addressing development challenges through STI in the public, private, and civil society spheres?

## Section 7: Developing the Next Generation of Solutions to Tomorrow's Development Challenges

Our world is in the throes of rapid transformation, with a future only dimly perceived. Will the dazzling scientific advances and technological breakthroughs of tomorrow respond to the challenges of the poorest? Or will future innovations fail to meet the unmet basic needs of the Bottom Billion? Will the STI resources of tomorrow give equivalent weight to the needs of women and men? Looking to the future, no single story can be told about how STI will continue to help shape — or even revolutionize — life in developing countries. For USAID, this presents a unique challenge: given uncertainty about the future, how can we best position ourselves, not just to identify technological and scientific advances that will improve the lives of the poor, but also to help scale and spread those advances that emerge?<sup>25</sup>

Many tools can be used to identify future challenges and the resources required to respond to them. A year-long project, undertaken by the Rockefeller Foundation and the Global Business Network, used scenario planning to help guide groups and individuals in identifying forces of change in the world. A single question focused the work: How might technology affect barriers to building resilience and equitable growth in the developing world over the next 15 to 20 years? The scenarios study concluded: for everything we think we can anticipate about how STI and international development will interact and intertwine in the future, there is much more that we cannot yet even imagine.<sup>26</sup>

Positioning USAID to identify and help respond to development challenges in the future requires adeptness in forecasting and planning. In addition to scenarios planning, other tools such as Foresight and technology roadmapping can be used to target challenges and prepare strategies to address them. Embraced by the Governments of Finland, South Africa, Korea,<sup>27</sup> and organizations like the EU and the United Nations through its UN Millennium Project<sup>28</sup>, these methodologies enable

### Box 5: Korea 2030 Using Foresight to Identify Future Challenges

The Third Korean Foresight Exercise entitled “Future Perspectives and Technology Foresight for Korea – Identifying Challenges and Opportunities for Korea’s Economy and Society” represents the most comprehensive effort to date by the Korean government in the field of science and technology foresight. The foresight study’s chief purpose was “to chart the future of Korean society and technology and link people’s future needs to innovations in science and in research.” Involving more than 2,000 experts and civil society participants, the exercise revealed 21 priority areas for technology development from over 700 technologies identified. Four subject areas were chosen to visualize future systemic changes - education, labor, health services and safety. The scenario panels consisted of experts with various backgrounds, brought together to focus on integrated challenges, such as changes to the health service system likely to arise due to a convergence of ICT and biotechnology.

<sup>25</sup> Rockefeller Foundation and the Global Business Network.

<sup>26</sup> Ibid.

<sup>27</sup> European Foresight Monitoring Network. “Korea 2030, Foresight Brief.” (Seoul, KISTEP, 2005) I. [http://www.foresight-network.eu/index.php?option=com\\_docman&task=doc\\_view&gid=36](http://www.foresight-network.eu/index.php?option=com_docman&task=doc_view&gid=36).

<sup>28</sup> The United Nations Millennium Project constitutes one of the largest international experiments to identify emerging global challenges. The Project manages a global participatory process that collects and assesses judgments from over 2,500 people with 33 Future Studies Project Nodes around the world. The work is distilled in an annual “State of the Future” report. Learn more here: United Nations Millennium Project “State of the Future 2008.” (New York: United Nations, 2008). <http://www.millennium-project.org/millennium/SOF2008-English.pdf>.

participants to explore and evaluate potential futures. Using such tools and insights will help to position USAID for success in the decades ahead. See Box 5 for an example from Korea.

Building the capacity of people, institutions, and countries to become problem solvers of future challenges necessitates a bi-directional flow of STI. Increasing the “flow” between indigenous knowledge and modern research, researchers and users, developing countries and developed ones, ensures inclusivity. The one-lane road along which developed world research, technology, and science travel to developing countries can no longer be dubbed “adequate.” Encouraging feedback loops, new directions, and diverse pathways for STI is essential. More innovation pathways mean more solved challenges.<sup>29</sup>

No single aid agency will ever be sufficient to address every development challenge today or in the future. Empowering people everywhere to participate in the development process, however, catapults the number of development practitioners to 6.7 billion. Harnessing the creative talent and technical prowess of people outside of USAID widens the community of solvers aligned with USAID’s mission. A similar orientation—to tap the capabilities of problem solver networks outside of the traditional aid community—triggered a rethink at the World Bank in 2009 with the launch of a Task Force on Knowledge Partnerships. The Task Force concluded that the new leaders in innovation and in international aid will be those who figure out the best way to leverage networks of outsiders. Operationally, the future of aid may likely evolve into a “virtual model,” with partnerships and networks increasingly key, and a greater emphasis on systems thinking and knowledge management.<sup>30</sup>

The US Government, it appears, is in the midst of its own rethink about the mechanisms, tools and organizational structures required to effectively deliver foreign assistance. In July 2009, Secretary of State Hillary Clinton launched a Quadrennial Diplomacy and Development Review (QDDR) with the goal of “strengthen[ing] the institutional capabilities of the civil foreign affairs agencies to meet 21<sup>st</sup> Century demands.” Shortly thereafter, in August 2009, President Obama authorized a government-wide review of global development policy, signaling an interest in a more coordinated, all-of-government approach to foreign aid design and delivery. The impacts of these reviews are yet to be seen, as neither process is complete. Even still, insights into the coordination process may inform how USAID engages with its federal partners in the future to apply STI solutions to the development sphere. It begs the question: should there be a formal process by which international development considerations are integrated into future research agendas? Thirteen federal departments and agencies maintain significant science and technology responsibilities *and* play a role in foreign assistance, as noted in Appendix II. What if even a fraction of a percentage of their research agendas were allocated toward stated development challenges? Would an existing mechanism such as the National Science and Technology Council (NSTC), which coordinates science and technology policy across the federal research and development enterprise, be an appropriate venue for such planning? Would it then be appropriate for USAID to have a seat at the NSTC?

The next generation of STI solutions required by the USAID of 2030 is unlikely to manifest without private sector participation. Secretary Clinton recently noted the contributions to development offered by private sector firms like Starbucks and Unilever, stating that “private businesses are able to reach large numbers of people in a way that’s economically sustainable, because they bring to bear the power of markets.”<sup>31</sup> Discerning where in the problem-solving and solution-design process private sector efforts best fit begs for discussion. For wealthy countries, the private sector funds and performs the lion’s share of R&D. By contrast, in developing countries, the

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<sup>29</sup> STEPS Centre. 14.

<sup>30</sup> Rockefeller Foundation and the Global Business Network.

<sup>31</sup> Secretary of State, Hillary Clinton. “On Development in the 21<sup>st</sup> Century, For the Center for Global Development.” (Washington, DC: The Center for Global Development, January 6, 2010), page 5. <http://www.cgdev.org/doc/2009/Clinton%20Transcript2.pdf>

private sector performs less than a third of R&D. What new mechanisms best marry the private sector's responsiveness to market demands with the motivation within civil society, academia, and philanthropy to boost development? As Intel Foundation President Wendy Hawkins said, "Our view is that public and private sectors share the same objective in [many areas]." Identifying those incentives for productive public-private partnerships merits attention at the conference.

### Questions to consider:

1. How do we identify the STI development challenges of 2030? How do we prioritize initiatives and investments today to respond to the challenges of the future?
2. How can we tap into local cultures to improve the flow of STI for development?
3. What does the USAID of 2030 look like? How can STI help get us there?
4. How can we leverage existing and future solutions within the federal science agencies?
5. How can we coordinate in delivering STI solutions for development?

## Section 8: New STI Tools and Mechanisms to Address the Development Challenges of Today and Tomorrow

Leveraging the talent of solvers outside of USAID requires selecting the right type of collaboration mechanism. Which tool draws in the most talent? Which mechanisms can be used by participants with great ideas but limited means to connect via the internet? In exploring how best to maximize the benefits of these new mechanisms, USAID is investigating how these new mechanisms differ along two dimensions: openness (can anyone participate?) and hierarchy (who makes key decisions?).<sup>32</sup> Historically, a closed, hierarchical mode characterized the USAID approach. Previous mechanisms exerted a "push" on participants to adopt certain STI tools. By contrast, new "pull mechanisms" foster a more open mode of innovation, in which anyone (including non-traditional sources) can offer ideas. Benefits of pull mechanisms include increasing the number of solvers and better focusing existing solvers on key development challenges. Moreover, with pull mechanisms, sponsors only pay for success. They may have the additional benefit of improving public perceptions and stimulating broad interest in development challenges to better leverage both internal USAID and external partner resources.<sup>1</sup>

Michael Kremer defines pull mechanisms as all payments tied to the adoption of a new technology or innovation and its impact, including patent royalties and "prize" payments paid for public-domain technologies.<sup>33</sup> In an open model, the job of the donor is to help define the development problem and orient a process to choose the best solution. The selection is either flat (in which no single participant has the authority to decide what is or is not a valid innovation) or hierarchical (in which a winner is selected by the donor).<sup>34</sup> Harvard's Pisano and Verganti advise thinking carefully about the trade-offs entailed in each mode. For example, open networks (whether hierarchical or flat) produce many ideas, but screening them is costly. What to do? Table I describes two of the more popular pull mechanisms—challenge competitions and advance market commitments—as well as crowd-sourcing, an emerging tool for both pull and push mechanisms.

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<sup>32</sup> Pisano and Verganti.

<sup>33</sup> Masters, Will. "'Demand-led' versus 'supply-led' innovation." (New York, NY: Columbia University, April 2004). <http://dfid-agriculture-consultation.nri.org/maillists/science-and-technology/msg00014.html>

<sup>34</sup> Pisano and Verganti.

Table I: Popular Pull Mechanisms		
Tools/ Mechanisms	Who Is Used It?	What Is It?
Challenge Competitions (Prizes) <sup>35</sup>	X Prize, Grand Challenges, Changemakers	Cash or in kind reward for achieving a specific, pre-identified goal <sup>36</sup> ; low finance and time expenditure; reach large/diverse talent pool with ability to absorb risk; pay only for result; media-friendly; promotes sponsor/competitor images; promotes collaboration; publicity is key; type of pull mechanism.
Advance Market Commitments <sup>37</sup>	UK Dept of Health advance market commitment for development of Meningococcal C Vaccine	Sponsor promises to commit to an initial fixed price for products meeting specified conditions, creating potential for a viable future market and thus providing an incentive for solvers to invest their funds; participating companies can commit to a low/sustainable price that will hold after initial donor funds have been depleted; sponsors pay only for desired results; ensures a market; links funding and product quality
Crowd-Sourcing (Community-Based Design) <sup>38, 39, 40</sup>	Innocentive, Global Knowledge Initiative	Online tool for attracting a large, diverse community to propose and solve challenges; relies on web technology platforms with near zero marketing costs; relies heavily on word of mouth/blogs publicity; reaches out to large network of diverse internet users to use their unique backgrounds to solve challenges they may otherwise not consider or have a chance to tackle.

These new mechanisms share a common feature: the allure of a reward that pulls solvers toward challenges. Yet, rewards vary. They include social and professional rewards, like new connections with other stakeholders that will enable better problem solving in the future (e.g., Changemakers). They also extend to more tangible rewards such as cash prizes (e.g., X Prize).<sup>41</sup> Similarly, advance market commitments (AMCs) “provide a financial commitment to subsidize the future purchase of a [solution] not yet available, *if* an appropriate [solution] is developed and *if* it is demanded by developing countries.”<sup>42</sup> An AMC also can extend to the future market of an existing product in areas where it has not been disseminated due to risks and/or lack of incentives. For example, AMCs have been used to accelerate access to vaccines against pneumococcal disease. The pneumococcal vaccine, which has been in existence since 2000, is currently \$70 per dose in development countries. Through a donor-sponsored AMC, the long term price will be \$3.50 per dose for developing countries.<sup>43</sup>

The risk to rewards ratio also varies with pull mechanisms. The solver bears less risk with advance market commitments as compared to other pull mechanisms, since the solver is promised a market.<sup>45</sup> Crucial to using pull mechanisms effectively is publicity.<sup>46</sup> Communicating the opportunity to participate in a challenge competition or take advantage of a possible advance commitment mechanism to the widest possible audience boosts the caliber of contenders and assures a more inclusive process. Appendix III offers examples of both challenge competitions and advance market commitments.

<sup>35</sup> McKinsey & Company. “And the winner is...” (Sydney: McKinsey & Company, 2009).

[http://www.mckinsey.com/App\\_Media/Reports/SSO/And\\_the\\_winner\\_is.pdf](http://www.mckinsey.com/App_Media/Reports/SSO/And_the_winner_is.pdf)

<sup>36</sup> Kremer, Michael; Towse, Adrian; and Williams, Heidi. “Briefing Note on Advance Purchase Commitments.” (London, UK: DFID Health Systems Resource Centre, May 2005). [http://www.who.int/intellectualproperty/submissions/MichealKremerKTW\\_CIPHIH\\_submit\\_2.pdf](http://www.who.int/intellectualproperty/submissions/MichealKremerKTW_CIPHIH_submit_2.pdf)

<sup>37</sup> Ibid.

<sup>38</sup> Kaufman, Wendy. “Crowd Sourcing Turns Business On Its Head.” (National Public Radio, August 2008).

<http://www.npr.org/templates/story/story.php?storyId=93495217>

<sup>39</sup> Howe, Jeff. “The Rise of Crowdsourcing.” (WIRED Magazine, June 2006).

[http://www.wired.com/wired/archive/14.06/crowds.html?pg=3&topic=crowds&topic\\_set=](http://www.wired.com/wired/archive/14.06/crowds.html?pg=3&topic=crowds&topic_set=)

<sup>40</sup> Brabham, Daren C. “Moving the crowd at iStockphoto: The composition of the crowd and motivations for participation in a crowdsourcing application.” (Chicago, IL: University of Illinois Chicago, June 2008).

<http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2159/1969>

<sup>41</sup> Kremer, et al

<sup>42</sup> World Bank. “Advance Market Commitments (AMCs),” (Washington DC: World Bank, 2010).

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/EXTVACCINES/0,,contentMDK:21083416~pagePK:210058~piPK:210062~theSitePK:384076,00.html>

<sup>43</sup> GAVI Alliance, “GAVI partners fulfill promise to fight pneumococcal disease.” (Lecce: GAVI Alliance, 2009).

[http://www.gavialliance.org/media\\_centre/press\\_releases/2009\\_06\\_12\\_AMC\\_lecce\\_kick\\_off.php](http://www.gavialliance.org/media_centre/press_releases/2009_06_12_AMC_lecce_kick_off.php).

<sup>45</sup> Kremer et al.

<sup>46</sup> Kremer et al.

Through crowd-sourcing, sponsors propose challenges to an extensive network of Internet users, with the aim of tapping the brainpower of the largest possible number of solvers with an array of backgrounds. Advocates of this approach assert that it improves efficiency, saving their organizations money that would otherwise be spent trying to recruit a limited set of solvers with limited backgrounds and ideas.<sup>49,50</sup> Crowd-sourcing epitomizes the paradigm shift in innovation toward “community-based design.” Lauded for its ability to attract a large, diverse community, this model is used by a diverse array of organizations, including the InterAmerican Development Bank and Mozilla (see the Innocentive example in Appendix III for case study). Crowd-sourcing is still nascent, however, and therefore must be analyzed for its applicability to a diversity of development challenges, resources, and actors. Most often, crowd-sourcing relies on web technology platforms, online voting, viral marketing, and buzz—elements that may or may not correspond with the realities of limited Internet connectivity in some settings.<sup>51-52</sup>

Integrating new tools to solve development challenges requires an assessment of how these various pull mechanisms can bolster USAID’s effectiveness. Despite their surge in popularity, “prizes are but one part of an effective change strategy—they are useful where they are most effective, but rarely successful in isolation.”<sup>53</sup> Additionally, the STEPS Centre, whose researchers evaluated the grand challenges approach to philanthropy, issues a warning to those donors seeking to adopt this approach:

*Emphasizing the scalability and rapid pace of development of technologies that are the subject of these grand challenges, questions about the directionality of change are often overlooked...for example child health can be addressed through specific disease-focused vaccine interventions, but also through initiatives that build preventative health systems and enable parents to access them. Even if such alternative pathways hit the same target (improved child health) along the way, they carry very different implications for ongoing development pathways, and who gains, loses, or is empowered or disempowered through them.<sup>54</sup>*

If care is not taken, the grand challenges approach risks ignoring such implications, obscuring crucial questions about ‘which way’, ‘why’, ‘for whom’ and ‘who says.’ Instead, overriding prior concerns with ‘how much’, ‘how fast’ and ‘when’ can take center stage.<sup>55</sup> To avoid these risks, USAID invites each of these questions in determining how best to develop and deliver effective pull mechanisms.

Clear from the research on how best to integrate these new mechanisms into USAID’s toolkit is the need to match precise development goals to any challenge mechanism selected. A good sponsor will invest significant resources in post-competition activities that integrate the resulting solution into a more comprehensive program of implementation. Insights from the Global Knowledge Initiative and others suggest that the emphasis challenge competitions place on delivery of technical “solutions” often overshadows the effort, planning, and financing required for implementation of the solution on the ground. Yet it is this implementation piece that delivers longer-term societal impact. Selecting the right metrics that measure the socio-economic impact of solutions once implemented helps to maintain focus on the societal, cultural, institutional, and political elements integral to successful development outcomes.

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<sup>49</sup> Howe, Jeff.

<sup>50</sup> Brabham, Daren C.

<sup>51</sup> Kaufman, Wendy.

<sup>52</sup> Brabham, Daren C.

<sup>53</sup> McKinsey & Company.

<sup>54</sup> Brooks, S. et al.

<sup>55</sup> Ibid.

## Novel Investment Models that Respond to Development Challenges

Identifying the ideal investment model that best responds to development challenges can be a challenge in itself. Four examples illustrate the birth of a new breed of investment model. While these examples are diverse in their approach to investment and the clients they serve, they point to a departure from the standard investment models historically favored by bilateral donors such as USAID (e.g., loans, grants, direct infrastructure investments). Table 2 below describes these four examples in brief: (1) impact investing, (2) community development venture capital (CDVC), (3) microfinance, and (4) conditional cash transfers (CCT).

Investment Models	Who's Used It?	What Is it?
Impact Investing <sup>56</sup>	Rockefeller Foundation/UK Social Finance (NGO); Africa Healthcare Fund	Investments for financial return <i>and</i> social and/or environmental value returning capital (at minimum) and often offering market-rate returns or better.
Community Development Venture Capital (CDVC) <sup>57, 58</sup>	Community Development Financial Institutions Fund; Meritus Ventures; investorscircle.net; cdvca.org	"Private sector" risk capital to build small and medium-enterprises (SME) with 10-100 employees, weak managerial capacity, business environment risks, few exit opportunities, high transaction costs, and limited deal flow.
Microfinance <sup>59</sup>	Kiva; Grameen Bank; Bancosol; BRAC	Small monetary loans, savings, and other basic financial services for those without significant existing financial assets; protects poor households against risks
Conditional Cash Transfer (CCT) <sup>60</sup>	Bolsa Família in Brazil; Basic Education Development Project in Yemen	Cash transfers made (often to mothers) on the condition that the recipient make pre-specified investments in their children's human capital (e.g. health, education)

Impact investing, CDVC, and microfinance are based on the concept of engaging the private sector and making a long-term investment with market-rate financial returns or better. By contrast, conditional cash transfers, like grants and direct infrastructure investments, constitute finite investments for short to mid-term projects with only social and/or environmental returns. These models differ according to who constitutes the main stakeholder. For impact investing, CDVC, and microfinance, the local private sector stands front and center. With CCT, families constitute the primary stakeholder. Selecting the right investment model entails assessing the challenge at hand and striking a balance of investments for maximum short, mid, and long-term returns, be they monetary, social, and/or environmental.<sup>61</sup> Appendix III describes specific examples of each these varied investment models.

The term "STI capacity" has come to stand for communities' ability to use STI resources to respond, adapt, overcome, or succeed in the face of challenges. STI capacity hinges on a person's, an institution's, or a whole country's ability to locate, use, adapt, and generate STI tools needed for problem solving. Without emphasizing programs that support broad-based STI capacity, the ability of people to locate, use, adapt, and disseminate the tools delivered through pull mechanisms may prove insufficient, especially in the poorest parts of the world. The comparison is stark: countries that have succeeded in building the capacity to ride the fast-moving waves of technological change chart a course to prosperity. Those without the capacity to swim are left to sink. Here, entrepreneurial capability — a matter of knowing what to do and how to do it to produce and compete — is

<sup>56</sup> Rockefeller Foundation and the Global Business Network.

<sup>57</sup> Brookings Institute. "Venture Capital for Development." (Washington, DC: Brookings Institute, August 2005). [http://www.brookings.edu/global/200508blum\\_patricof.pdf](http://www.brookings.edu/global/200508blum_patricof.pdf)

<sup>58</sup> Rubin, Julia Sass. "Financing Rural Innovation with Community Development Venture Capital: Models, Options and Obstacles." (San Francisco, CA: Federal Reserve Bank of San Francisco, December 2006). <http://www.frbsf.org/publications/community/review/122006/rubin.pdf>

<sup>59</sup> Kiva. "About Microfinance." (Kiva, 2010). <http://www.kiva.org/about/microfinance>

<sup>60</sup> Fiszbein, Ariel and Schady, Norbert. "Conditional cash transfers." (Washington, DC: The World Bank, 2009). [http://siteresources.worldbank.org/INTCCT/Resources/5757608-1234228266004/PRR-CCT\\_web\\_noembargo.pdf](http://siteresources.worldbank.org/INTCCT/Resources/5757608-1234228266004/PRR-CCT_web_noembargo.pdf)

<sup>61</sup> Rajalahti, Riikka and Farley, Sara. "Designing and Implementing Agricultural Innovation Funds." (Washington, DC: The World Bank, May 2010). [http://siteresources.worldbank.org/INTARD/Resources/InnovationFunds10\\_web.pdf](http://siteresources.worldbank.org/INTARD/Resources/InnovationFunds10_web.pdf)

critical. With this entrepreneurial capability, economies are better able to produce, absorb, and use knowledge to tackle the development challenges they face.

Determining how USAID can best support problem solving and capacity building in tandem is essential. Doing so will help us wield these new tools and investment models to successfully promote inclusive growth and global development.

### Questions to consider:

1. What novel mechanisms best attract new participants to STI problem solving (e.g., technology platforms, crowd-sourcing innovation models, pull mechanisms, prizes, etc.)? Which of these novel mechanisms can be integrated effectively into USAID? Which tools would best help USAID achieve its mission?
2. What novel investment models best respond to development challenges for which STI play a role? Which should USAID consider using?
3. How can we use advance market commitments to solve development challenges?
4. How can we mobilize USAID around new tools?
5. How can we better weave STI capacity building into the solution generation process? How can help ensure that STI tools meet varied sociological contexts where we want to employ them? How do we ensure access and uptake of critically needed STI tools?