

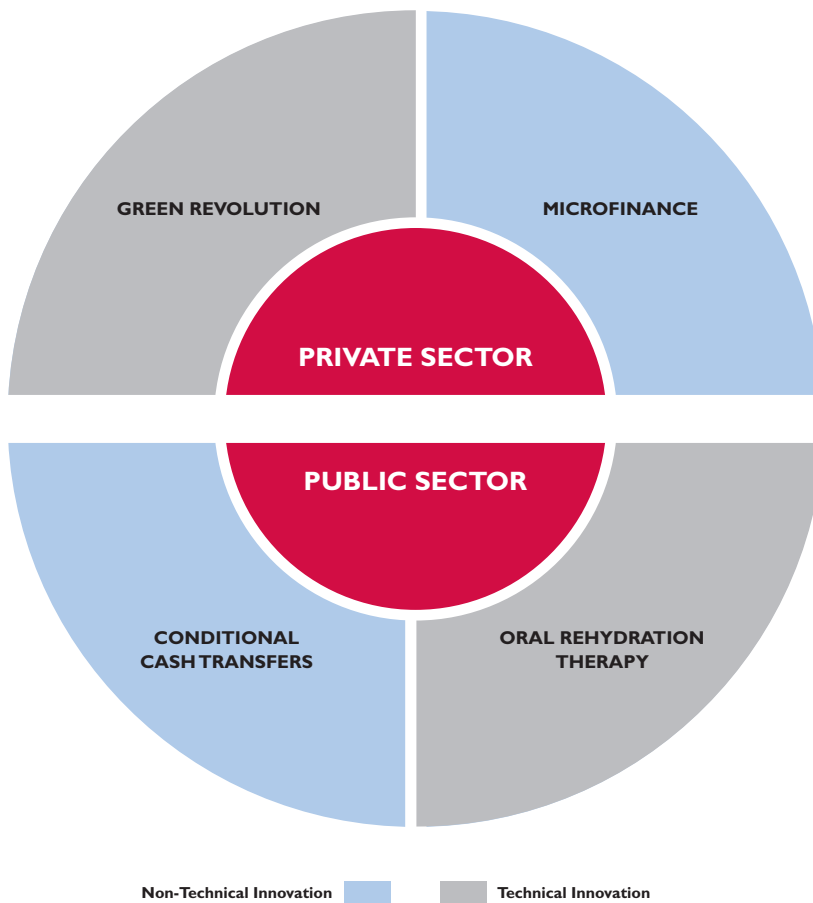
Linking Innovation and Evidence to Amplify Development Impact

In all aspects of life, we often stumble either upon or through methodical collaboration to discover unexpected solutions that change the course of our lives or the history of a people. Polio vaccines, broadband Internet, and new high-yield cereals are all examples of game-changing innovations that are significantly improving the health and prosperity of people around the world. Contemporary development thinking is characterized by a push for innovation but also for accountability, cost-effectiveness, and evidence. In this essay, we discuss the role of evidence in innovation. Evaluation is often thought of as a task for the end of a project. We think it should also be seen as a stage in the innovation process, similar to beta-testing in software development. Innovation should include an iterative process of piloting, testing, refining, retesting, and scaling. Efforts to invest in innovation need to be tempered and disciplined by gathering evidence on what is working and what is not so that failures can be modified or abandoned, and potentially transformative approaches can be refined and scaled.

Innovation in Development Successes in Innovation

There have been many dramatically successful innovations in global development. Some involve new technologies, while others involve innovations in systems and service models. Some innovations have scaled via private-sector commercialization, while others reached widespread adoption through the public sector. It is worth considering several examples of each pathway to scale as shown on the next page.

The Green Revolution: In the 1960s and early 1970s, many observers predicted massive famines in Asia, believing that food supply could not keep up with population growth. The predicted famines were in part averted by the development of new high-yield seeds that increased agricultural production across the region. The Green Revolution seeds were developed with financing from the Rockefeller Foundation, the Ford Foundation, USAID, and others, but production of the seeds is now sustained by the private sector.¹



There are multiple pathways to scale, as demonstrated by the major development innovations illustrated here. Some were brought to scale via public-sector adoption, while markets and the private sector catapulted others into wider use.

Source: Michael Kremer/
Maura O'Neill

Oral Rehydration Therapy: Diarrhea, one of the leading killers of children in the developing world, is responsible for millions of deaths each year. Historically, severe diarrhea was treated with the administration of intravenous fluids, but since this method is costly and requires trained medical personnel, and because diarrhea can quickly cause fatal dehydration, the vast majority of children do not receive the treatment. Oral Rehydration Therapy (ORT), which is a solution of salts and sugars that a patient ingests orally, was developed as a low-cost

alternative treatment that could be administered at home. It was promoted by some doctors as early as the 1950s but was not used on a widespread basis. Clinical trials in the 1960s financed by USAID helped establish the physiological case for ORT, and in 1971, it was used to treat 3,000 patients in Bangladesh refugee camps. The death rate from diarrhea amongst ORT-treated patients dropped to 3.6%, well below the average 30% of those treated by intravenous fluid.² Subsequently UNICEF,

1 Peter Hazell, "The Asian Green Revolution," International Food Policy Research Institute Discussion Paper 00911, November 2009.

2 Richard Guerrant, Benedito Carneiro-Filho, and Rebecca Dillingham, "Cholera, Diarrhea, and Oral Rehydration Therapy: Triumph and Indictment," *Clinical Infectious Diseases* 37, no. 3 (August 1, 2003), 398–405.

USAID, other donors, and national governments put forth a major effort to scale the approach worldwide. ORT is now used to save an estimated two million lives every year, at a reduced treatment cost of \$6 per treated person per year.³

Microfinance: Traditional financial services are inaccessible to most of the world's poor. Dr. Muhammad Yunus founded Grameen Bank in 1983 to provide microcredit to the rural poor in Bangladesh. This effort provided small loans to poor borrowers who typically lacked collateral, steady employment, and a verifiable credit history, excluding them from traditional loans. Since then, the group-based microcredit model and other services have been scaled worldwide to at least 1,084 microfinance institutions in 2009 serving 74 million borrowers with \$38 billion in outstanding loans and 67 million depositors banking \$23 billion.⁴

Conditional cash transfers: Conditional cash transfers, initially piloted in Mexico, have been widely adopted by national governments. Mexico has traditionally had a patchwork of social programs, some of which were used as a source of political patronage. In 1994, Mexico's Ministry of Finance and Public Credit introduced PROGRESA, an innovative conditional cash-transfer program that provided payments to poor women who ensured their children obtained basic preventive health care and attended school regularly. A randomized control trial of the program, which compared a randomly selected treatment group to a randomly selected control group, much like a clinical trial in medicine, showed that

PROGRESA reduced childhood illness by 12%⁵ and increased school enrollment by 10% for boys and 20% for girls.⁶ The combination of strong evidence from a rigorous trial and a demonstrated track record of operational success in running the program at scale led subsequent governments in Mexico to expand the program. Since then, the governments of 30 other countries have elected to adopt the conditional cash-transfer approach.

In each case, the benefits from developing a particular innovation extended far beyond a single country or organization. From the standpoint of economic analysis, this result indicates that no single country or private investor will have socially appropriate incentives to invest in innovation. This market failure provides a rationale for international organizations or donors to promote and invest in innovation that might benefit the developing world.

Yet, at the same time, there are many cases of failure. Some risk is inevitable with innovation. Unfortunately, there are all too many cases in which donors have continued to throw good money after bad, or not performed basic due diligence. The water-fetching merry-go-round PlayPump[®], for instance, was designed to draw water from deep wells when children pushed a large revolving wheel meant for play. The program launched with a \$16.4 million campaign in 2006.⁷ By 2009, hardly any pumps were still in operation.⁸

3 Ruth Levine, and What Works Working Group, *Millions Saved: Proven Successes in Global Health* (Washington, D.C.: Peterson Institute, 2004).

4 Microfinance Information Exchange, Inc., "The MicroBanking Bulletin," no. 19, 2009, www.themix.org/publications/microbanking-bulletin/2009/12/mfi-benchmark-analysis-microbanking-bulletin-december-2009, accessed March 29, 2012.

5 Paul Gertler, "Do Conditional Cash Transfers Improve Child Health? Evidence from PROGRESA's Control Randomized Experiment," *The American Economic Review* 94, no. 2 (2004), 336–341.

6 T. Paul Schultz, "School Subsidies for the Poor: Evaluating the Mexican PROGRESA Poverty Program," *Journal of Development Economics* 74, no. 1 (June 2004): 199–250.

7 Clarissa Brocklehurst and Peter Harvey, "An Evaluation of the PlayPump[®] Water System as an Appropriate Technology for Water, Sanitation and Hygiene Programmes," UNICEF, October 2007.

8 Amy Costello, "Troubled Water," *Frontline/World* video, Boston: WBGH Educational Foundation, 2010, www.pbs.org/frontlineworld/stories/southernafrica904/video_index.html, accessed March 29, 2012.



Ethiopian entrepreneur Bethlehem Tilahun Alemu (left), checks a pair of sandals on September 18, 2009, at her workshop in Addis Ababa. Using recycled tires and brightly colored fabrics, Alemu’s company, SoleRebels, manufactures shoes now sold around the world. | AFP Photo: Aaron Maasho

Likewise, the “One Laptop Per Child” campaign, launched in 2008 and initially supported by private companies as well as the United Nations Development Programme, aimed to create affordable educational devices for use in the developing world, most notably a \$100 laptop. The laptops were sold to governments, to be distributed through the ministries of education. But the program was plagued by a host of issues: full implementation, meaning one laptop per child, would require obligation of some countries’ entire education budget to purchase the technology. This investment was difficult to justify when more cost-effective tools were available to achieve the same expected outcomes on learning. Beyond

cost, it was not clear whether laptops were the most pressing investment, or if they would be useful educational tools in countries where basic educational infrastructure is lacking. Finally, the campaign lacked the resources to provide the necessary complements: educator training, software and digital content, and maintenance and support. These popular programs and failed experiments point to the clear need to carefully design mechanisms for supporting innovation in development to ensure that efforts to innovate incorporate careful consideration of appropriate design, demand, cost, and sustainable distribution models.

Failure is a necessary part of discovery in development as it is in pharmaceutical therapies

or information technology breakthroughs, and it often leads to a next iteration that proves highly successful. The key is whether the innovation is tested and evidence garnered early on so investments whose results are not cost-effective are either tweaked for optimal results or diverted to more promising ventures.

Mechanisms for Supporting Innovation

Different approaches to supporting innovation are needed depending on the context. In cases where the innovation requires considerable research and development for scientific or technological breakthroughs, a combination of “push” funding and “pull” funding is useful. Push funding finances inputs into the research process; for example, the National Science Foundation and National Institutes of Health provide grants for research based on a system of peer review.

In developed countries, push financing is typically complemented by the “pull” of a market that incentivizes private firms to develop usable products from which they will make a profit. However, this incentive is often missing for products that have a primary market in the developing world, such as a new disease-resistant cassava variety, because the potential market (and ability to pay) is not clear. One approach to catalyze pull funding in these cases is to use advance market commitments (AMCs), which pay based on results. The pneumococcal AMC, for instance, is a funding mechanism that rewarded vaccine developers for producing affordable pneumococcal vaccines that protected children against strains common in developing countries. Pneumococcal disease causes a half million children under 5 to die each year worldwide, making it the leading vaccine-preventable cause of death among young children. Under this mechanism, vaccine developers only received payment if they achieved pre-specified

technological goals and if countries ordered the vaccines. Based on the recommendations of a 2005 report from the Center for Global Development, an international AMC fund has incentivized the delivery of vaccines, and multiple producers are now manufacturing qualifying vaccines, which are reaching some of the world’s poorest children.

In other cases, the innovation is not a new technology, but rather, a new approach that can be scaled up privately, such as with microfinance. Once an approach is successful, it can be scaled by hundreds or thousands of different organizations, but first it must be piloted, which will likely require trial and error to refine the model. Spillovers to other firms and the inability to

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appropriate the full return resultant from creating a successful business model can create a case for public support at this initial stage. How can donors support the initial development costs for promising projects that will be taken up by the private sector without subsidies turning into indefinite commitments that drain taxpayer funds and starve more promising projects of support? Before providing more than exploratory pilot-stage financing, donors should require initial market signals showing that customers would be willing to buy at a price that substantially covers costs, and that private investors would be willing to take a stake. Stronger market

signals as well as prima facie evidence of development impact should be required for continued or higher-level support.

Finally, in other cases, innovations are not technological and would require sustained support from public-sector funders such as donors or country governments. For example, consider a new method of teaching third-grade math in public schools to improve learning. Governments and donors have a natural role to play in promoting this type of innovation because it is particularly difficult for private investors to reap the social benefits from developing more effective and less expensive ways for governments to operate. However, the challenge for donors of supporting promising innovation while avoiding the trap of sinking large sums into failures or fads has to be faced without the useful discipline of a competitive market. While failed experiments in the domestic arena may generate political consequences, that chastening process is much more complicated in foreign assistance. Thus, it is incumbent on foreign aid donors to be realistic about the testing methods and the experimentation needed with new approaches and critically examine progress when investing in the latest innovations. Donors can manage the risk of investing in innovation by seeking rigorous evidence that a particular approach is achieving the desired impact before investing at scale. This will help protect governments and donors from the all-too-common problem of investing massive sums in new fads that sound good or have early promising results, but turn out to be unworkable, ineffective, or unable to scale.

Evidence from Randomized Evaluations

As discussed above, in the case of technological innovation, support can be provided on the basis

of hitting technological benchmarks or finding users. In the case of innovations that will scale through the private sector, the ability to find paying customers and investors willing to finance capital requires a market test. However, in the case of innovations in public-sector practice, these tests are not present, so rigorous collection of evidence on ultimate impact becomes critical. If a solar lamp is selling in off-grid villages at a price sufficient to cover the cost of manufacture and distribution, there is a strong prima facie case that its development impact is strong, so it may be unnecessary to prove that it is raising test scores by helping children study at night. But before a government trains all its teachers in an innovative new math curriculum, it should rigorously test whether it will improve learning outcomes. In Silicon Valley, the business model of new companies usually changes multiple times before a profitable, scalable pricing and distribution system is perfected. It should be expected that this will also be the case in development and thus planned for.

In the past 15 years, there has been a movement to use randomized control trials to measure the impact of new approaches to address development challenges with a treatment group and a comparison group, as in a medical trial. This is in part because it is often difficult to isolate the impact of programs from those of confounding factors. For example, if schools that adopt a new math program see better outcomes for their students, it might simply be because there are better teachers in the schools—not because the program itself is working. With a randomized control trial, randomized assignments would determine which schools would receive the new math program, the same way randomized assignment occurs in a medical trial. The results would then provide evidence that any effect was a direct consequence of the intervention and nothing else. In many cases,

these findings have been used not just to establish the impact of existing approaches, but also to beta-test new, innovative approaches.

We now have evidence that a number of new approaches can have a dramatic impact. Some examples:

Effective HIV/AIDS education: An evaluation in Kenya found that informing teenage girls that men in their 20s or older are more likely to have HIV than younger men reduced the number of pregnancies with older men by 65%, with no corresponding increase in pregnancies with younger men. The program cost just \$1 per student.⁹

Combining vaccination with nutritional programs: Vaccines are among the most cost-effective health strategies available. Yet there are areas with very low vaccination rates, in part because the benefits are not immediately visible. An evaluation in India found that when a nutritional program provided one kilogram of lentils together with vaccination, full immunization rates rose from 5% to 35%. By encouraging more families to attend immunization clinics, these incentives can even reduce the per child cost of vaccinations.¹⁰ This research could also indicate that sometimes combining items that people place higher value on in the short run (food) with items that provide long-term benefit (vaccines) can produce better results.

Remedial education programs for basic skills: Many children in developing countries fall behind in school and find it difficult to catch up.

Concentrating on basic skills can prove remarkably effective. Evidence from a randomized control trial shows that children who attended a pilot version of the after-school “Read India” program for just three months jumped from simply recognizing letters to reading entire paragraphs on their own, at a cost of no more than \$2.25 per student, per year.¹¹

On the basis of these types of randomized experiments, there is now strong evidence of impact for a range of approaches, including commitment savings accounts, support for microenterprise, providing iron and vitamin A supplements through schools, providing school and child-level report cards, community-based monitoring of primary healthcare providers, publicizing findings of random audits to reduce corruption, and more.¹²

This type of evidence can also help induce governments to adopt and scale successful approaches, but operational models that take effort to build and outreach and dialogue with policymakers are also needed. The spread of conditional cash transfers involved both rigorous testing and accumulation of evidence and years of sustained work on an operational model by a dedicated team from the Mexican government. The Inter-American Development Bank and World Bank put forth a major effort to disseminate the results and work with policymakers in other countries beyond Mexico to adapt the program to their needs and to help finance programs and further evaluation.

This combination of rigorous evidence and work to develop operational models also led to the scaling of the highly cost-effective deworming effort that began in Kenya. Many kids miss

9 Esther Duflo, Pascaline Dupas, Michael Kremer, and Samuel Sinei, “Education and HIV/AIDS Prevention: Evidence from a Randomized Evaluation in Western Kenya,” The World Bank Policy Research Working Paper Series, October 1, 2006, econpapers.repec.org/paper/wbkwbrwps/4024.htm.

10 Abhijit Banerjee, Esther Duflo, Rachel Glennerster, and Dhruva Kohari, “Improving Immunization Rates through Regular Camps and Incentives in Udaipur,” 2004–2007, www.povertyactionlab.org, accessed March 29, 2012.

11 Esther Duflo and Rachel Glennerster, “Read India: Helping Primary School Students in India Acquire Basic Reading and Math Skills,” 2008–2010, www.povertyactionlab.org, March 29, 2012.

12 For more details on these approaches and the underlying evidence, see the DIV Annual Program Statement, available at <http://idea.usaid.gov/organization/div>.



Immigrants follow a computer class at a Catholic mission in the port city of Nouadhibou, Mauritania. Nouadhibou is a departure port for migrants, often illegal, seeking passage to the Spanish Canary islands.

AFP Photo: Seyllou

school for reasons that include family needs, work, menstrual cycles, and apathy. An evaluation of an NGO-run deworming program in Busia, Kenya, showed that a program to distribute a pill that eliminated intestinal worms (once or twice per year) decreased student absenteeism by 25%, making it one of the most cost-effective ways of increasing school attendance.¹³ Children were too often missing school because they were sick. Scaling this approach throughout Kenya required:

- Combining evidence with a concerted effort by

researchers and practitioners to work with the media, senior civil servants, and political leaders to spread awareness of the problem

- Raising funds to cover the start-up costs of new programs
- Working together with mid-level Kenyan civil servants to undertake the practical tasks needed to operationalize a scaled-up program

Senior civil servants and political leaders in Kenya committed government funds to implement a national program, and Kenya has since dewormed 3.5 million children. Based on the success of this work, the government of Bihar, India, recently launched a school-based deworming campaign reaching 17 million children. The

¹³ Edward Miguel and Michael Kremer, "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities," *Econometrica* 72, no. 1 (January 1, 2004), 159–217.

Children's Investment Fund Foundation, Douglas Marshall Foundation, and USAID just announced a partnership to scale the intervention up throughout Kenya and to begin preliminary work in three other countries.

In each case, successful scale-up involved close cooperation and coordination between practitioners and academics to try new approaches, carefully evaluate the results, and develop cost-effective, operational, scalable models. A key insight from these examples is that focused, concentrated, and sustained effort is required not only to develop new innovations, but also to engage in an ongoing dialogue with key policymakers and undertake a process of evidence-based trial and error to adapt and refine ideas to the point where they can be widely adopted.

The Staged Financing Model

How can we apply these experiences to develop, test, and transition to scale other innovations in global development? One approach development agencies can take is to offer staged financing for applicants with innovative concepts. The first stage would provide seed funds to support initial research and design, small-scale pilots and field testing, and initial focus groups or stakeholder consultations to establish viability (that is, technical, organizational, distributional, and financial) and user adoption rates. The second financing stage would support rigorous testing to assess impact at a larger scale. In the case of projects that would receive sustained public support, it would be critical to establish rigorous evidence of cost-effectiveness. For successful innovations expected to achieve widespread adoption through private-sector commercialization without long-run support from donors, government, or philanthropy, the needed evidence differs. Successful innovations would have to provide evidence such

as profitability, beneficiary demand, willingness to pay for the product or service, later-stage leverage from private-sector investors, government receipt of associated tax revenue, and development outcomes. The third financing stage would provide support for replicating the approach and transitioning the most successful projects to

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scale. In this third stage, operational challenges for scaling would be identified and addressed, potentially including additional trials of alternative approaches. This stage would involve in-depth and ongoing consultation with the organizations that will ultimately scale up the program to understand their needs.

USAID created Development Innovation Ventures (DIV) to operationalize this model of staged financing. DIV aims to identify, develop, test, and scale innovations that prove (through rigorous testing) to be cost-effective and scalable approaches to development challenges. DIV does not support major new science and technology research, such as the development of new vaccines, but helps support other new approaches with direct application to development challenges that are designed to scale through the public or private sectors. DIV's portfolio includes innovations designed by development economists, business and

NGO leaders, and award-winning start-up social enterprises. As host countries, the private sector, bilateral or multilateral development agencies, or others adopt the proven interventions at scale, these approaches will no longer require support from DIV.

Cost-effectiveness is a key metric for success and, ultimately, cultivating funding for innovations that are likely to be publicly provided. For some projects—for example, those targeting improved agricultural productivity—cost-effectiveness can be assessed through cost-benefit or net-present-value calculations. For projects in other sectors, the project application must include some other means of assessing cost-effectiveness. Thus, for example, a health application might use a cost per Disability Adjusted Life Year metric. Or a program designed to reduce school dropout rates might use an estimated cost-benefit calculation based on estimates of the returns to education. In such cases, a short-run impact evaluation funded in the second stage might examine only dropout rates, but as part of later scale-up funding, the application would be expected to validate impacts on wages that were only estimated in the initial evaluation.

Examples from the DIV portfolio help illustrate the potential for the DIV model to help beta-test and scale successful development solutions. The following descriptions are illustrative of the model's application in both the public and private sector:

Maternal health: Post-partum hemorrhage is the leading cause of maternal mortality, responsible for the deaths of 140,000 mothers per year worldwide.¹⁴ Balloon tamponades can save a woman's life 76% to 100% of the time, depending

on the design.¹⁵ However, with current costs ranging from \$77 to \$312 for a single-use tamponade, they are prohibitively expensive for widespread use in developing countries. DIV is supporting the Program for Appropriate Technology in Health (PATH) and Health Tech's development of a balloon tamponade that, at less than \$10 per device, would be more affordable in the developing world. The tamponade could stop hemorrhage and control uterine bleeding for as much as a 97% reduction in cost.

Sustainable sanitation in urban slums:

Across the world, 2.5 billion people lack access to basic sanitation. The resulting infection from contact with human waste contributes to the global burden of diarrheal disease and claims the lives of nearly 1.6 million children each year.¹⁶ DIV's investment in Sanergy, a start-up company in Nairobi, is piloting their network of pay-per-use latrines in urban slums. The sanitation centers are franchised to local entrepreneurs, who earn income through usage fees, membership plans, and sales of complementary products. The company collects the waste daily to process as commercial-grade fertilizer and biogas, which can be sold for a profit.

Election fraud: Researchers from the University of California, San Diego, used funding from DIV to evaluate how Afghan candidates and polling officials reacted to the knowledge that their vote counts would be photographed and compared to the final vote tallies in the capital. The results showed a 25% reduction of votes for the candidate most likely to influence the count and a 60%

14 "ACOG Practice Bulletin: Clinical Management Guidelines for Obstetrician-Gynecologists Number 76, October 2006: Postpartum Hemorrhage," *Obstetrics and Gynecology* 108, no. 4 (October 2006), 1039–1047.

15 C. Georgiou, "Balloon Tamponade in the Management of Postpartum Haemorrhage: a Review," *BJOG: An International Journal of Obstetrics & Gynaecology* 116, no. 6 (May 1, 2009): 748–757.

16 *Diarrhoea: Why Children Are Still Dying and What Can Be Done* (Geneva: United Nations Children's Fund/World Health Organization, 2009).

reduction in the theft of vote tallies and other election materials.¹⁷ Following the evidence of the approach's success in Afghanistan, a second trial of the technology in Uganda met with similar success, and a private global telecommunications firm plans to expand the approach to some upcoming high-profile elections.

Road safety: Worldwide, road accidents are the leading cause of death for young adults, claiming the lives of more than a million people each year. Traffic and road safety enforcement in developing countries is often corrupt and

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inefficient. Commercial minibuses account for a large share of traffic and accidents in many of the poorest countries. Putting small stickers in minibuses encouraging passengers to “Stand up! Speak up!” against reckless driving reduced insurance claims by more than 50% in a pilot in Kenya.¹⁸ With DIV funding, the researchers will expand the pilot to reach approximately 10,000

17 Michael Callen and James Long, “Institutional Corruption and Election Fraud: Evidence from a Field Experiment in Afghanistan,” University of California Institute on Global Conflict and Cooperation, 2011.

18 James Habyarimana and William Jack, “Heckle and Chide: Results of a Randomized Road Safety Intervention in Kenya,” *Journal of Public Economics* 95, no. 11–12 (December 2011), 1438–1446.

Indian residents collect drinking water from a tanker supplied by the municipal water works in Bolkapur Colony of Hyderabad on May 6, 2009. More than 250 people in Bolakpur Colony fell sick when sewage contaminated the local drinking water pipeline, and five died. | AFP Photo: Noah Seelam

minibuses in Kenya and rigorously evaluate the program to determine how messages can be most effective in reducing accidents.

Evidence-based innovation offers—and DIV is designed to assist with—the iterative process of seeking and adapting to lessons learned. DIV’s staged financing approach allocates resources in lockstep with the amount of evidence of impact demonstrated by a solution and helps scale only the ones that are proven to work. By supporting breakthrough innovation while prioritizing evidence, DIV has the potential to change millions of lives at a fraction of the usual cost and be an important development innovation in the field.

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The views expressed in this essay are their own, and do not necessarily represent the views of the United States Agency for International Development or the United States Government.