HIGHER EDUCATION SOLUTIONS NETWORK - ANNUAL REPORT (FY 2013)

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Acronyms

CEGA	Center for Effective Global Action
DevEng	Development Engineering
DIL	Development Impact Lab
HESN	Higher Education Solutions Network
ICT	Information and Communication Technologly
IIT-B	Indian Institute of Technology, Bombay
JU	Jadavpur University
LBNL	Lawrence Berkeley National Lab
M&E	Monitoring and Evaluation
MAC	Management Advisory Committee
MAK	Makerere University
MDP	Microgrids Development Project
NGO	Non-Governmental Organization
ODK	Open Data Kit
PAC	Project Advisory Committee
PSU	Portland State University
R&D	Research and Development
RCT	Randomized Controlled Trial
SDS	Sustainable Design Solutions
UC	University of California
UCB	University of California, Berkeley
UCSD	University of California, San Diego
UCSF	University of California, San Francisco
UM	University of Michigan
USAID	United States Agency for International Development
UW	University of Washington
VBTS	Village Base Transceiver Station

Executive Summary

The Development Impact Lab (DIL) is an international consortium of universities and research institutes, non-governmental organizations (NGOs), and industry partners addressing global poverty through advances in science and engineering. Headquartered at the University of California (UC) Berkeley, and launched with support from the US Agency for International Development (USAID), the Lab designs "development solutions" that couple innovative social and market interventions with cutting edge technological advances. These solutions are then rigorously evaluated in the field, with proven solutions transferred to partners for scale-up and dissemination.

This annual report highlights the Lab's first year of activities. In 2012-13, as part of the USAID Higher Education Solutions Network (HESN), we have piloted and evaluated 10 novel solutions for clean water, energy, and health care in low-income settings. We have convened hundreds of academic and development leaders, in the US and abroad, to identify development research priorities and promising areas of inquiry. We have established new channels for university students to engage in innovation for poverty action. And we have built an enduring foundation for future innovation: the Lab is led by two physical centers on the Berkeley campus: the Blum Center for Developing Economies and the Center for Effective Global Action (CEGA). Together, these units have created a vibrant hub for the broader DIL network.

Other key partners in the DIL consortium include the Technology and Infrastructure for Emerging Regions (TIER) Group at UC Berkeley, which is developing a platform for real-time measurement of development outcomes (along with colleagues at University of Washington, University of Michigan, and Portland State University); and the Policy Design and Evaluation Lab (PDEL) at UC San Diego, which oversees DIL's work on governance-related Information and Community Technologies (ICTs). In addition, the LBNL Institute for Globally Transformative Technology (LIGTT) is leading a forecasting effort, analyzing the 50 technological breakthroughs with greatest promise to rapidly advance global development.

Our strongest link to other HESN Labs is through Makerere University, which is both a sister HESN Development Lab and a core university partner for DIL. We have also worked closely with NGOs like BRAC, the Aga Khan Development Network, and IDEO.

Part 1: Major Milestones and Events Completed

DIL's mission is to channel world-class science, engineering and economics research into the design, evaluation, and scale-up of promising solutions for international development. The Lab is organized into four pillars, each sponsoring innovative research, translation, and training activities. Major milestones for the first year are outlined below, by pillar.

1.1. Milestones

Pillar1: Portfolio of Demonstration Projects

In the last year, DIL has established a portfolio of 10 promising development solutions, each at a different stage in the innovation pipeline. The portfolio spans multiple problem areas—from clean energy and water to point-of-use diagnostics and mobile services. Projects are led by university researchers working alongside government, NGO, and private sector partners. The portfolio is closely monitored to enable rapid identification of successes and failures; this reduces the risk for follow-on investors as projects mature toward scale-up.

Pillar 2: Pipeline of Development Innovations

DIL has launched 3 research and development (R&D) competitions this year, to incite further innovation within our network. Each competition targets ideas at different stages of maturity—from exploratory work, to field pilots, to the design and testing of new solutions. In the coming months, the Lab will award funding to nearly 20 new projects sourced through these competitions, using a review mechanism that incorporates input from veteran innovators as well as international development practitioners.

Pillar 3: Data Toolkit

Alongside investment in targeted solutions, the Lab is creating an open-source toolkit to help innovators everywhere measure the social and economic impacts of new solutions. To date, Lab researchers have piloted an array of sensors and other wireless devices to collect real-time data in field settings. These pilots are informing development of Mezuri, an end-to-end platform for field data storage, analysis, visualization, and sharing. The pilots will also inform revisions of Mezuri component technologies like Open Data Kit, a open source tool for electronic surveying.

Pillar 4: Ecosystem for Development Engineering

To cultivate a rich network of development innovators, DIL supports annual scientific conferences, USAID-university staff exchanges, and other activities that meaningfully engage academia in international development. This year, the Lab ran 2 "ideas" contests, hosted 9 seminars and workshops, appointed 5 visiting fellows, and initiated graduate-level training in the nascent field of Development Engineering, which integrates methods from development economics with engineering disciplines. Also in 2013, the Lab's website and media strategy launched.

1.2. Events

Scientific convenings and seminars present an opportunity for researchers and practitioners to exchange ideas, receive feedback, and identify new directions. We hosted 9 meetings on the Berkeley campus this year. In addition, the Lab sponsored multiple small meetings among research collaborators in India, Indonesia, Kenya, and other developing countries.

Development Engineering Seminar Series (Fall 2012)

The new "DevEng" seminar series, launched at UC Berkeley in 2012, provides a forum for PhD students and faculty from science and engineering to share results from research with developing country partners.

Monday Oct 15, 2012 – 3:00 to 4:00 pm – 330 Blum Hall

"Design & Impact of Rural Solar Microgrids in India and Kenya," Javier Rosa (PhD student, Computer Science) and Ken Lee (PhD student, Agricultural and Resource Economics), UC Berkeley and "Piloting Low-Cost, Village-scale Cell Towers in Papua, Indonesia," Kurtis Heimerl (PhD student, Computer Science) and Kashif Ali (Postdoc, Computer Science), UC Berkeley

Monday Dec 10, 2012 – 11:30 am to 12:30 pm – 330 Blum Hall

"The challenge of providing safe water with intermittent piped water supply in India," Emily Kumpel and John Erickson (PhD candidates, Civil and Environmental Engineering) UC Berkeley

Gadgil Lab, Jadavpur University, 2012

Development Engineering Seminar Series (Spring 2013)

Friday April 12, 2013 – 12:00 to 1:00pm – B100 Blum Hall
"Black Powder, Red Soil, More Crops: Biochar, technology adoption, and carbon sequestration in Western Kenya," Andrew Crane-Droesch (PhD candidate, Energy and Resources Group), UC Berkeley

Wednesday April 17, 2013 – 12:00 to 1:00pm – B100 Blum Hall
"Technology Adoption in Difficult Environments: Evidence from mobile payments in Afghanistan," Tarek Ghani (PhD candidate, Business) UC Berkeley

Monday April 22, 2013 – 12:00 to 1:00 pm – 210 South Hall
"Building and managing low cost, low power wireless networks in developing regions," Bhaskaran Raman, PhD (Associate Professor, Department of Computer Science and Engineering), IIT Bombay

Thursday May 9, 2013 – 12:00 to 1:00pm – B100 Blum Hall
"Addressing the Water Energy Nexus in Rural Mountains: A remote sensing feasibility assessment of in-line hydropower," Marc Muller (PhD candidate, Civil & Environmental Engineering), UC Berkeley

Monday May 13, 2013 – 2:00 to 3:00pm – B100 Blum Hall
"Low-cost automated chlorine dosers in urban Dhaka, Bangladesh: balancing tech development, rigorous evaluation, and financial sustainability," Amy Pickering, PhD (Postdoc, Civil & Environmental Engineering), Stanford University

DIL Launch Workshop
Friday March 1, 2013 – 9:00 am to 6:00 pm – 100 Blum Hall
The Lab officially launched in March 2013 with a workshop connecting more than 10 consortium partners for a day of brainstorming, planning, and relationship building. Two representatives from USAID attended the meeting and participated in research design discussions and working groups. Materials from the event are available online at http://cega.berkeley.edu/events/dil-launch

Mobile Money, Berkeley, 2013

Mobile Money: Technology to Transform Transactions
September 20-21, 2013 – 9:00 am to 5:00 pm – Berkeley Shattuck Hotel
This year DIL co-hosted a major scientific convening on "Mobile Money: Technology to Transform Transactions." Attended by nearly 100 mobile service providers, banks, researchers and development practitioners, the event created a forum for identifying the tools needed to reach the 4 billion people who currently lack access to formal financial services. The blog Nextbillion.net reported on the event, and follow-up conversations will be tracked through a LinkedIn group. Kay McGowan from USAID attended the meeting, and members of the USAID Mobile Solutions team provided input on content.

1.3. Publications

In the last year, DIL has released a USAID-branded series of short communications highlighting key Lab activities; in the coming months, we will add a Working Paper series. In addition to these publications, the Lab and its researchers have received media coverage through mainstream outlets, such as the Wall Street Journal and CNN, and through blogs and scientific publications.

DIL Publications

UC Berkeley Graduate Students and USAID Focus on Catalyzing Student-Global Engagement
http://dil.berkeley.edu/wp-content/uploads/GSR-USAID-DIL.pdf

Big Ideas@Berkeley Contest and USAID: Student Engagement and Collaboration for Development
http://dil.berkeley.edu/wp-content/uploads/BigIdeas-USAID.pdf

UC Berkeley's Development Impact Lab: "Greater than the Sum of Its Parts"
http://dil.berkeley.edu/wp-content/uploads/DILConference.pdf

Dil is Launching a New Ph.D. Curriculum in Development Engineering
http://dil.berkeley.edu/wp-content/uploads/DIL-_DE2.pdf

Media Coverage of DIL

CNN Heroes 2013: Laura Stachel, We Care Solar (December 2013)
http://www.cnn.com/SPECIALS/cnn.heroes/2013.heroes/laura.stachel.html

A Carbon-Map to Development, Shankar Sastry, Daily Cal (October 15, 2013)
Link: http://www.dailycal.org/2013/10/15/carbon-map-development-2/

Why Your iPhone Upgrade Is Good for the Poor, Wall Street Journal (Sept 20, 2013)
http://online.wsj.com/news/articles/SB10001424127887324492604579083762147495666

Mobile Money: Technology to Transform Transactions, NextBillion (August 29, 2013)
http://nextbillion.net/blogpost.aspx?blogid=3504 and http://nextbillion.net/blogpost.aspx?blogid=3512

Science for All, Pallava Bagla and Richard Stone, Science Magazine (31 May 2013). DIL on page 1033.
http://www.sciencemag.org/content/340/6136/1032.full.pdf?sid=ace47049-7ba9-4063-80b0-9b8ab178219c

USAID invests up to $20 million in UC Berkeley's global development initiatives, Sarah Yang, UC Berkeley News Center. (November 11, 2012)
http://newscenter.berkeley.edu/2012/11/08/usaid-gives-20m-for-global-development-initiatives-at-uc-berkeley/

USAID chief lauds Blum Center as model in search for global solutions, Kathleen Maclay, UC Berkeley News Center. (October 11, 2012)
Link: http://newscenter.berkeley.edu/2012/10/11/usaid-chief-lauds-blum-center-as-a-model-in-search-for-global-solutions/

1.4. Communications

Cultivating the ecosystem for development innovation requires building social networks, fostering new institutions, and establishing productive partnerships. Toward this end, DIL has developed a robust communications and outreach strategy, including newsletters, web, and a social media presence.

Newsletters

In 2013 we launched a weekly Berkeley campus e-newsletter, *DIL Connect*, to advertise programs, build the local innovator community, and engage students. Sign-ups for this newsletter and a "State of the Lab" bulletin are online at http://dil.berkeley.edu/about-us/get-involved/. Sample content is below.

Join the DIL Idea Team

The DIL Idea Team is a creative leadership team that designs and implements new ways to engage the UC Berkeley community in global development challenges. We are seeking an interdisciplinary group of grad students to help shape the campus dialogue about science and tech for global good while receiving previews to internship and collaboration opportunities. Open to graduate students from all departments. To apply visit dil.berkeley.edu/wp-content/uploads/DIL-Idea-Team1.pdf

Receive Support for Novel Development Approaches

- Due Oct 1: DIL Explore mini-grants offer $5,000 for international travel to develop early-stage research ideas and partnerships. 500-word application form online: dil.berkeley.edu/technology-portfolio/competitions-incentives/fall-2013-explore/
- Due Oct 30: DIL Innovate grants offer $75,000 to $200,000 for design, piloting and evaluation of innovative solutions for development. dil.berkeley.edu/technology-portfolio/competitions-incentives/fall-2013-rfa/

Water e-Internship Opportunity

Apply for an exclusive opportunity to work with USAID as a Grand Challenge Analyst e-Intern for the $15M *Securing Water for Food* Grand Challenge for Development. Analyst e-Interns will complete first-round analysis and scoring of concept notes from development innovators worldwide. USAID has reserved 5 of these competitive nationwide positions exclusively for graduate students at UC Berkeley. E-internships run Jan-March, 2014.

Tech4Dev Discussions led by Innovation Experts

DIL Salons are in-depth, informal conversations with leaders in technology and development, ranging from social start-up founders, to project scale-up specialists, to high level policy-makers. OCTOBER 30th: David Green, serial social entrepreneur with a focus on high-quality, low-cost medical devices, moderates a discussion of "How to Distribute Risk during the Path of Least Resistance to Commercialization." dil.berkeley.edu/development-engineering-network/support-for-innovation/

Website
The DIL website was launched Spring 2013 and features an overview of each of pillar, as well as the Lab's broader vision, plans, and news. The site is updated continuously with materials relevant to a range of audiences. For example, it features snapshots from the current portfolio of research projects, as well as profiles of visiting scholars, USAID Fellows, and recipients of DIL grants. Content from multiple channels is integrated into the site: it connects with the Lab's twitter feed (featured on the landing page) and links to the e-newsletter (which is excerpted on the site's News section).

Social Media
DIL's twitter presence aims to expand the Lab's network while also promoting our partners. We track effectiveness by the numbers of retweets and followers we collect. Each day, the Lab issues one original tweet plus two tweets focusing on partner institutions. Original tweets include quotes from affiliated practitioners, students, visiting scholars and staff, as well as promotion of events (including photos or posters where applicable). Retweets typically promote HESN centers and Labs, USAID projects, and others in our networks. We promote unity amongst tweets with the consistent use of hashtags (e.g., #developmentengineering #HESN #deveng) and uniform formats.

Part 2: Description of Key Activities

2.1. Annual Objectives

In our first year of operation, DIL's mandate has been to establish each of the four pillars. Within each area of activity, we set out specific objectives, with progress and outcomes reported in Table A, below.

Table A. Objectives for Year 1 of the Development Impact Lab

Pillar	Objectives	Outcomes
1: Portfolio of Demonstration Projects	• Continued support for 3 existing demonstration projects • Up to 6 new innovations identified for DIL support	• Portfolio of 10 demonstration projects has been established
	• Comprehensive strategy for managing the DIL portfolio	• Management strategy includes quarterly project meetings, bimonthly progress updates, DIL Salon and Practitioner-in-Residence initiatives, and mentor matchmaking
2: Pipeline for Development Innovation	• At least one contest or other innovation incentive implemented	• 3 competitions launched: DIL Explore, DIL Pilots, and DIL Innovate
	• 3-5 new projects launched (selected through competitions)	• Through these competitions, up to 20 new awards will be made in 2013
	• Strategy for piloting and evaluating future incentives	• New ideas for incentives and payments are being documented
3: Toolkit for Development Data	• Co-deployment of partner technologies at multiple test field sites	• Four co-deployments launched, each using wireless technology to measure development outcomes
	• Identification of data platform infrastructure options and use cases	• Development of prototype of Mezuri cloud-based data platform begun
	• Prototypes for online resources designed and developed	• Online resources outlined for further development
4: Ecosystem for Development Engineering	• USAID-university engagement programs (pilots and evaluation)	• Pilots include Masters thesis projects, USAID Fellows, e-Internship
	• "Big Ideas" toolkit and 2 USAID-themed contests	• "Big Ideas" toolkit launched and all HESN partners engaged in contest
	• 2 Postdoctoral fellows appointed • Design for PhD training program	• 2 postdoctoral fellows appointed • DevEng PhD seminar established
	• "State of the Science" conference • Multiple White Papers released	• Mobile Money conference convened • 2 white papers drafted: Revealing Demand & Development Engineering
	• DIL website and media strategy	• DIL website, twitter launched
	• Business case for DevEng journal	• Journal concept note for Elsevier

2.2. Summary of Key Activities and Outcomes

Portfolio of Demonstration Projects (Pillar 1)
At DIL's core is a new way of innovating for international development. We seek to change the way universities design solutions for the challenges of poverty. This includes closer collaboration with development professionals, speedier translation of proven interventions to partner organizations, and extensive learning across projects. Here we highlight the 10 demonstration projects currently in DIL's portfolio; these serve as exemplars of the Lab's work overall. Each project falls at a different stage in the innovation pipeline, and receives up to three years of funding (with annual awards of $125,000 to $300,000 per projects). All projects are contributing to the establishment of the emerging field of *development engineering.* The key activities from DIL's other three pillars are highlighted in subsequent sections of this report.

Village Base Transceiver Station (VBTS)
Partners: UC Berkeley, Indonesian NGOs
Personnel: Kurtis Heimerl (PhD student), Yael ben David (PhD student)

The VBTS project is developing a low-cost, lower-power cellular network hardware and software for use in remote places without coverage by mobile network operators. This GSM "network in a box" is built on OpenBTS, an open source Unix application. VBTS makes it possible to install and operate community cellular networks at a fraction of the cost and power consumption of traditional telecomm infrastructure. The technology is being piloted in Papua, Indonesia and the Philippines.

Rural Electrification and Power Project (REPP)
Partners: UC Berkeley, Gram Power, Kenya Rural Electrification Authority, IPA, J-PAL
Personnel: Kenneth Lee, Javier Rosa, Achintya Madduri, Carson Christiano, Matt Podolsky

REPP is testing new mechanisms for providing electricity to the rural poor. The project works with government and private sector partners in India and Kenya to integrate "smart" metering technology and sustainable (pay-as-you-go) business models into grid and off-grid power installations. The project generates real-time data on household power consumption and willingness to pay and is also rigorously measuring the social and economic impacts of electrification.

CellScope
Partners: UC Berkeley, UCSF, NIH, Uganda National Tuberculosis Reference Laboratory, Hanoi Lung Hospital
Personnel: Mike D'Ambrosio, Frank Meyers

CellScope is a mobile digital microscope for diagnosis of disease in remote settings, by non-expert health workers. This easy-to-use device can rapidly capture images in blood, sputum, and other patient samples, using the mobile phone's computational power to analyze images, automatically render a diagnosis at the point-of-care, and wirelessly transmit data to clinical centers. Two applications are being piloted with DIL's support: one for diagnosis of *tuberculosis* in Vietnam, and another for diagnosis of *loiasis* in Congo.

Electrochemical Arsenic Remediation (ECAR)
Partners: UC Berkeley, Jadavpur University
Personnel: Susan Amrose, Caroline Delaire

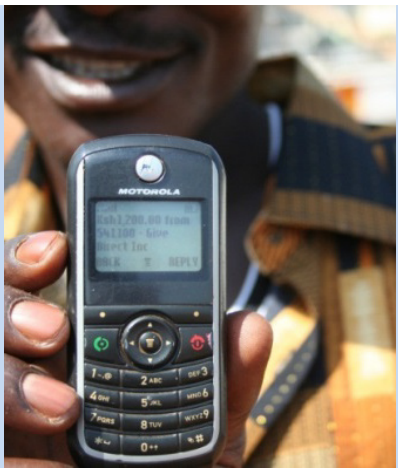
More than 70 million people are poisoned by arsenic in drinking water in India and Bangladesh. Electro Chemical Arsenic Remediation (ECAR) is a novel technology producing arsenic-safe water in a sustainable and scalable manner. The innovation applies an electric charge across steel plates, which precipitates arsenic as rust particles, allowing for effective filtration. It is being piloted in West Bengal, India in rural areas with almost no tech support.

We Care Solar
Partners: We Care Solar (US NGO), UC Berkeley
Personnel: Laura Stachel

Nearly 300,000 women die each year from pregnancy complications and millions of infants die primarily in regions lacking energy resources for basic obstetric care. The Women's Emergency Communication and Reliable Electricity (We Care) Solar Suitcase is an economical, portable power unit that provides off-grid health workers and clinics with efficient medical lighting and power for communication and medical devices. Experiences from early pilots of the technology are being analyzed to inform a redesign.

Optimizing Fieldwork for the Mobile Era
Partners: UC San Diego, GiveDirectly (US NGO), IPA

This project tests the effectiveness of using mobile phones to collect data for randomized control trials (RCT). It builds on a mobile-based cash transfer program for poor households in Kenya. Innovations implemented and tested on a mobile-based survey platform include long-term follow-ups, high-frequency data collection to assess treatment effects over time, flexible addition of questions (as new evidence emerges), automated surveying and SMS-based thought diaries.



Collective Assessment and Feedback Engine (CAFÉ)
Partners: UC Berkeley

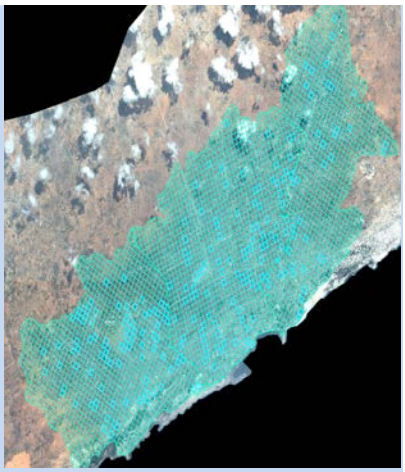
Traditional polling and survey instruments offer limited opportunity for citizen participation and public discourse. CAFÉ addresses these shortcomings via an online platform that provides users with dynamic visual feedback about their position on key issues, relative to other community members. It is being developed and will be piloted as part of an ongoing study that seeks to understand citizen engagement in key public decision-making processes.

Mobile Monitoring for Elections
Partners: UC San Diego

This project empowers citizens to hold politicians accountable through free and fair elections. The team has developed a smartphone application first used in elections in Uganda and Afghanistan. The modified technology was then used for citizen monitoring of the 2013 Kenyan national elections in real-time, using digital image collection and cloud computing. The project is also measuring the effect of citizen monitoring on election outcomes, using randomized trial design.

Distance Mobile Survey Project (DMSP)
Partners: UC San Diego, FieldPulse Research

This project uses mobile and satellite technology to maintain contact with households in a research study over a one-year period in conflict-ridden Mogadishu, Somalia. The aim of the project is to determine whether long-distance surveys can be conducted in near-real time, with meaningful results. Remote surveys enable more effective iteration between the piloting and evaluation of development interventions. This is particularly important in post-conflict and conflict settings, where in-person follow-up with households is risky.



M-Pasandaaz
Partners: UC San Diego, UC Berkeley, U Washington, Roshan

This project develops and pilots an interface to enable Afghan mobile subscribers to deposit and accumulate balances in a phone-based savings account. Pilot users comprise 1,200 employees at Roshan, Afghanistan's largest mobile network operator. Rigorous testing of variants of this interface through randomized control trials (RCTs) will establish drivers of low levels of formal savings and be used to refine the design to allow quick scale up and release to the general public.

Each of DIL's demonstration projects builds on an existing body of research. Lab resources are used to introduce the new partners, technologies, and talent needed to translate promising pilots into sustainable social impact. Taken together, these projects will articulate (or demonstrate) the Development Engineering (DevEng) approach. Key elements of the approach include:

- Multidisciplinary teams that integrate engineering with the quantitative social sciences, to diagnose and address development challenges in a holistic manner;
- Successive and iterative phases of designing, piloting, and evaluating new solutions, to ensure impact and sustainability (in tandem with scale up); and
- The use of advanced technologies and methods to accurately measure the demand for new products and services, and quantify their social impacts.

Each demonstration project is designed around the context, opportunities, and constraints of developing economies—where missing infrastructure and market failures can limit the use of traditional design and assessment tools. The projects will provide rich learning experiences for DIL. We are distilling and formalizing the lessons learned through case studies and teaching materials, which will be used to transform scientific norms and practices across the network.

DIL Grant Competitions (Pillar 2)
Beyond the advanced demonstration projects supported by DIL, three consortium-wide competitions were launched in summer 2013. Grants awarded through the competition will fund a pipeline of promising "development solutions" at different stages of the innovation cycle—from discovery, to design and piloting, to rigorous evaluation and translation.

The first competition, "DIL Explore," opened in June 2013 offering small grants of $5,000. The awards are intended to support preliminary or exploratory research, as well as international travel to develop a new idea or partnership. Two rounds of competition were held, with eligibility limited to members of the DIL consortium. The first round had a rolling deadline, resulting in just 6 applications (with 4 awards). A second round with a fixed deadline (concluding on September 30) resulted in 34 additional proposals, of which just 8 were funded. The clear lesson from this experience is that fixed deadlines, rather than rolling deadlines, yield more applications and more competitive awards.

DIL released two additional funding opportunities in late August 2013. These two competitions—awarding $75,000 pilot awards and $200,000 full project grants, respectively—were folded into a single Request for Applications (RFA) titled "DIL Innovate." We highlighted two research tracks in the RFA. Track 1, "Development Solutions," focuses on the design, evaluation, and translation of holistic development solutions that incorporate technological, economic, and social innovations. Track 2, "Measurement Solutions," focuses on the design and validation of technologies (e.g. wireless sensors, meters, data analytics) for monitoring the impacts of development interventions.

The "DIL Innovate" RFA outlines the theory and concepts underlying DevEng, including the role that the quantitative social sciences play in the design of technologies for development. The deadline for submissions is October 30th, and awards will be made at the end of the calendar year.

In addition to demonstration projects and competitions, DIL has supported several activities to improve the sourcing of development innovations. These include an analysis of the technologies with greatest promise to reduce poverty at scale, and a review of incentives and other tools for encouraging high quality academic research and development for priorities identified by USAID and other development actors.

50 Breakthroughs
The aim of the 50 "breakthrough" technologies analysis is to coalesce and catalyze the global ecosystem of innovators to identify how science and technology can be used to alleviate global poverty and related social ills. The analysis has been broken into multiple components, each focused on a different sector or theme within human development. The health component of the analysis was drafted in Year 1 and is currently under review; it includes sub-sections on malaria and other infections diseases, maternal and neonatal health, water quality and diarrheal diseases, cardiovascular disease, diabetes, and diagnostics. Incorporation of feedback for this component (as well as harmonization with reporting standards) is ongoing. Another section that was drafted this year, on food security and agriculture, is currently in review. The entire package of reports will be released in early 2014.

Working group on incentives for global development innovation
Over the last year, DIL has designed competitions that incentivize researchers and their implementing partners to generate new ideas, devices, and services to accelerate development. Ideas and learnings from this year have been captured in a brief working paper on investment in development R&D. To formalize this work, the Lab will convene a working group in 2014 to review research investment

mechanisms used by the public and private sectors. The team will then identify adaptations that might improve DIL's ability to source promising innovations from academia and the broader development engineering landscape.

Journal of Development Engineering

As DIL cultivates a network of academic researchers involved in development innovation, it is important to create appropriate outlets for sharing results and lessons learned. Toward this end, the Lab engaged Elsevier, a global leader in academic publishing, to discuss the creation of an open access Journal of Development Engineering. The publisher has responded positively to an initial concept note, outlining the potential readership, users, and contributors to such a journal. Preliminary plans are to build an vet the proposal with leading researchers in engineering and development economics, form an editorial committee, and solicit content—all within the early part of 2014. The journal will ideally be launched in Spring 2015.

Part 3: High Value Areas of Collaboration [HVAC] (Lab-to-Lab)

DIL's collaboration with other HESN Labs has focused on the sourcing of solutions through competitions and on student engagement.

3.1. Data

Some Lab-to-Lab interaction has been achieved through the HESN Data Working Group (convened by OST) and the informal HESN Monitoring & Evaluation (M&E) working group (convened by staff at Texas A&M). We expect that, as Labs begin to collect and share data, our interaction in this area will expand.

3.2. Solutions (Creation, Testing, Scaling)

Uncovering potential solutions to development challenges has been a strong focus for DIL's partnership with our partner universities—including Makerere University, home to the HESN Resilience African Network. We have sought out new solutions through a series of 3 competitions open to all members of the DIL consortium. RAN is the sole HESN Lab eligible for these competitions, as a member of the DIL network. Their participation is highlighted in Table B.

Table B. Involvement of Makerere University's HESN Lab in DIL Competitions. Makerere was heavily recruited to compete in Big Ideas and other contests, through phone and email outreach, scheduling of Google Hangouts, and discussions with the leaders of multiple schools and colleges within the university.

Competition	# of RAN Submissions
DIL Explore ($5,000)	0 of 40
DIL Pilot ($75,000)	1 of 8
DIL Innovate ($200,000)	6 of 40

An additional example of Lab-to-Lab collaboration has been the joint support of WeCare Solar, a maternal health innovation, by DIL and the Duke HESN affiliate. Both Labs have provided advising and funding for WeCare researchers as they advance from prototype to scale.

3.3 Student Engagement

Managed by the Blum Center, Big Ideas@Berkeley is an annual innovation contest aimed at providing funding, support, and encouragement to students who have creative solutions to challenges facing our

campus, community or world. This competition has formed the most substantive basis for DIL collaboration with other HESN Labs.

In broad strokes, the goals of the Big Ideas contest are to:

- Challenge students to step outside of their traditional academic boundaries and empower them to conceive creative solutions to social problems;
- Provide critical resources to support students in thinking about the design, implementation, and impact of their projects; and
- Harness the power of student innovation into scalable and sustainable social ventures with real world impact.

The 2012-13 Contest launched in August 2012, and during the 2012-13 Contest cycle, over 160 teams submitted pre-proposals. The teams represented over 500 students, from 75 majors, and 5 UC campuses. After a preliminary review, 54 teams across nine categories were selected to compete in the final round. Finalists were paired with mentors and given two months to fine-tune their proposals. Applicants submitted final round proposals in March 2013. Ultimately, 37 proposals were selected for awards totaling nearly $225,000.

Categories Inspired by USAID Grand Challenges

Inspired by the USAID Grand Challenges for Development initiative, and with support from USAID, two new categories were offered to students in the 2012-2013 Big Ideas Contest. Eligibility for these two categories, as well as the Global Poverty Alleviation Category (first offered in the 2007 Big Ideas Contest), was expanded to include all ten campuses in the UC system.

Promoting Human Rights: This new catergory seeks innovative ideas that address the causes or consequences of corruption and/or promote the protection of individuals' essential human rights. It was inspired by USAID's Grand Challenges category, "Atrocity Prevention" and developed with support and guidance from experts at USAID and UC Berkeley faculty with the Human Rights Center and Data & Democracy Initiative. Nine proposals were initially received in this category, four of which obtained some level of funding to enable them to implement their projects.

Maternal & Child Health: This category was inspired by USAID's Grand Challenges category, "Saving Lives at Birth." It seeks innovative solutions to safeguard the health of expectant mothers and young children. It was developed with support and guidance from experts at USAID, UC Berkeley faculty in the School of Public Health, and the Bixby Center for Population, Health & Sustainability. Ten proposals were initially received in this category, three of which obtained some level of funding to enable them to implement their projects.

In addition to the design of contest categories, USAID has been integrally involved in the reviewing proposals submitted to Big Ideas. Three of the agency's development experts (Karen Clune, Maurice Kent, Marion Adeney) served as judges for the 2012-2013 contest. In addition, two representatives of

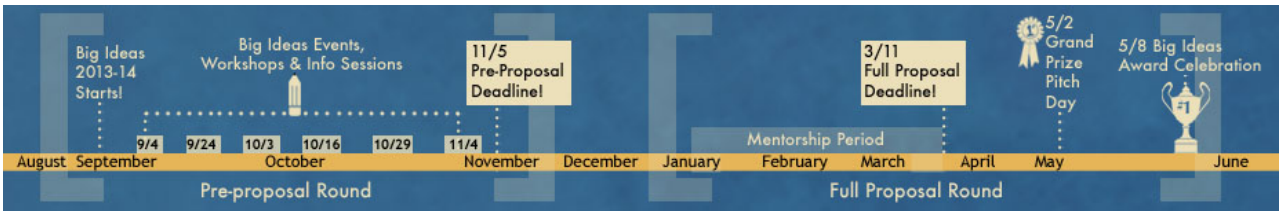
USAID's Office of Science and Technology (David Ferguson and Marion Adeney) participated as judges in the second annual "Grand Prize Pitch" day (for the Global Impact Pitch Round). The pitch day invited six of the top teams from this year's Contest to compete against each other, with a total of $18,000 in funding split among the teams. In concert with the Pitch day, USAID judges were convened to meet and brainstorm with several other award winning Big Ideas teams.

Above, Left to Right: Pachamama Project, 1st Place Winner, Promoting Human Rights category; FlowBit, 1st Place Winner, Global Poverty Alleviation category; Emmunify, 1st Place Winner, Maternal & Child health Category

Development of the "Big Ideas Toolkit"

To share the Blum Center's strategies for running an early-stage, student-led, social innovation competition, DIL released the Big Ideas Toolkit in summer 2013. The Toolkit was developed as both an on-line resource (http://bigideas.berkeley.edu/toolkit/) and as a print document. Along with an overview of how the Contest is managed, the Toolkit contains an appendix of the tools that are used each Contest year (e.g., student application requirements, recruitment emails to judges, judging scorecards, evaluation surveys) that can be replicated or adapted to fit the needs of Big Ideas Contests at other colleges and universities.

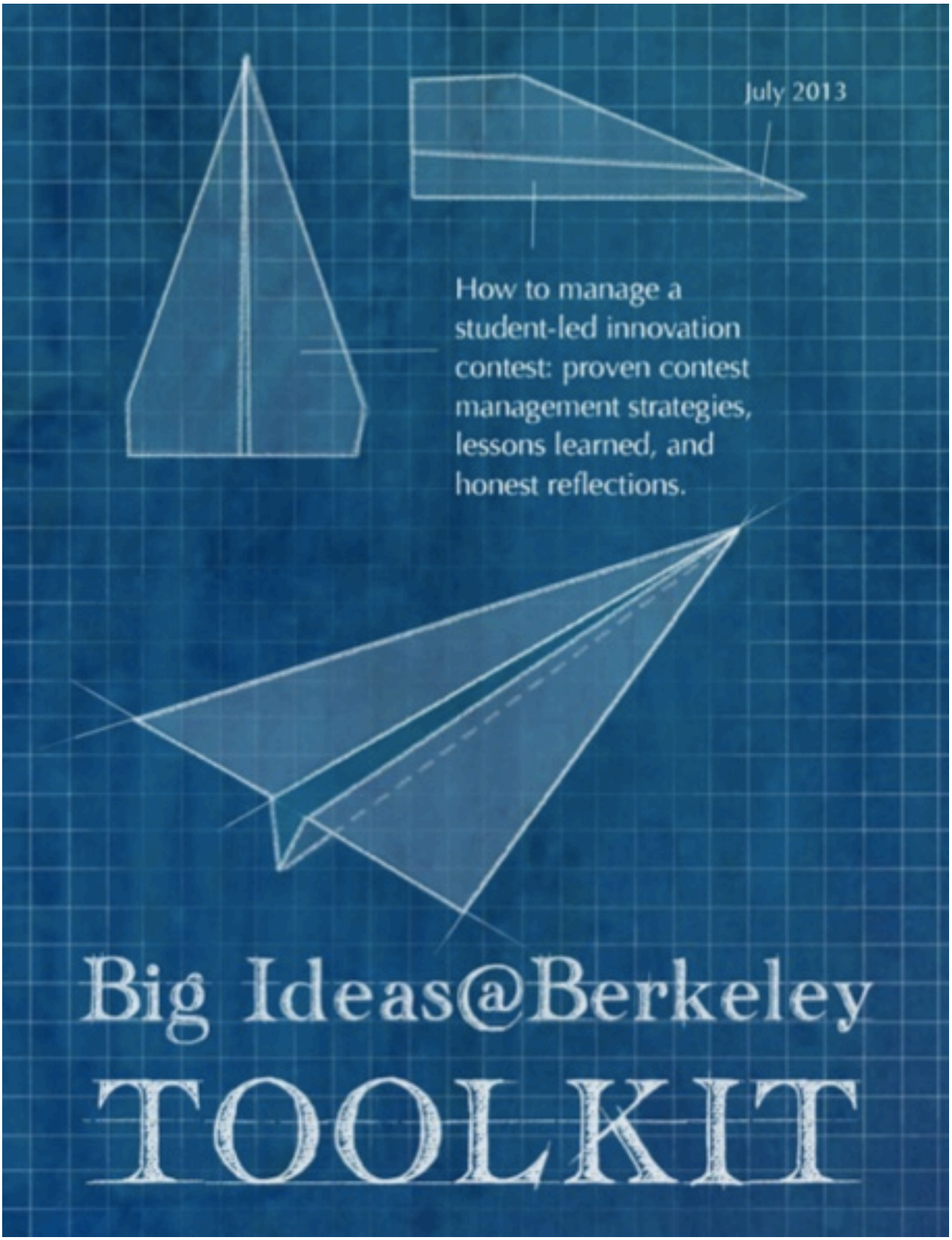
In September 2013 we reached out to contacts at each HESN Lab and invited them to access the Big Ideas Toolkit. All six Labs acknowledged receiving and reviewing the Toolkit. Follow up conversations, to solicit feedback from each partner, will be used to inform future updates.



2013-2014 Big Ideas Timeline

New Category: "Open Data," Developed with William & Mary

For the 2013-2014 Big Ideas Contest, DIL has begun working in close partnership with AidData at the College of William and Mary to create a new Big Ideas category, on "Open Data." It will challenge students to develop a plan that leverages publicly available datasets to generate innovative solutions that address important social challenges. Potential projects areas include mapping visualizations, transparency and accountability feedback loops, crowd-sourcing tools, monitoring and evaluation applications, spatial analysis and others. This jointly funded category will be open to all HESN campuses.


July 2013
How to manage a student-led innovation contest: proven contest management strategies, lessons learned, and honest reflections.
Big Ideas@Berkeley
TOOLKIT

3.4. Co-Location of Resources

Several categories in the 2013-14 Big Ideas Contest have been opened to prime universities within the HESN (including Duke, Michigan State, Massachusetts Institute of Technology, Texas A&M, The College of William & Mary, and Makerere University in Uganda). These include *Global Poverty Alleviation* (focused on action-oriented projects); *Promoting Human Rights* (combating the causes or consequences of corruption); and the *Open Data* challenge, described earlier.

To invite broader collaboration in the 2013-2014 Contest, DIL's staff reached out to designated contacts at each HESN Lab. Under the proposed model, the Big Ideas team at Berkeley will administer the entire contest, provide marketing materials, and facilitate student outreach at partner campuses. DIL will also offer biweekly phone calls and host information sessions and writing workshops for students at other campuses via Google+ Hangouts.

In exchange, HESN partners agreed to market the Contest on their campus, garner proposal submissions for each of the three categories, and help identify at least three judges and three mentors in each of the three HESN-eligible categories.

These activities have generated particularly strong relationships with three HESN Development Labs: the Texas A&M Conflict & Development Center, AidData at William & Mary, and Makerere University's RAN. The other HESN Development Labs—Duke (SEAD), Michigan State (GFSI) and MIT (CITE)—will be more closely engaged in future years.

Indeed, in the preliminary round of proposals, Duke and Texas A&M submitted 8 proposals, William & Mary submitted 13, and Makerere submitted 15 proposals. In all, the BigIdeas contest categories received more than 180 proposals from students throughout the UC and HESN campuses.

Part 4: Intra-Development Lab/ University Engagement

4.1. Interdisciplinary Collaboration

The Mezuri Data Platform project is an excellent example of how DIL is networking and collaborating across academic disciplines, partners, and sectors. Mezuri is a collaborative effort led by Eric Brewer and the TIER group (UC Berkeley) plus research groups led by Prabal Dutta (University of Michigan), Evan Thomas (Portland State University, SweetLab), and Gaetano Borriello (University of Washington, Change Group). The team's goal is enabling the secure collection and analysis of data from development interventions, including high frequency field measurements gathered by constituent Mezuri technologies (including UW's ODK Android phone- and tablet-based surveys and PSU's SWEETData sensor platform). Mezuri will also provide cloud-based tools for the storage, analysis, visualization, and sharing of the collected data. Below are some collaboration highlights from this effort.

The DIL Launch Conference was held on March 1, 2013, and produced two key opportunities for collaboration. First, it was an opportunity to share knowledge and challenges between a multi-campus network of social scientists and technologists, including from staff from USAID. Second, it was the first in-person gathering of the entire Mezuri core team, which provided the opportunity to discuss each team member's constituent technologies and areas of expertise, begin outlining Mezuri's architecture, and capture input from other disciplines about the features that will best serve intervention implementation and evaluation needs.

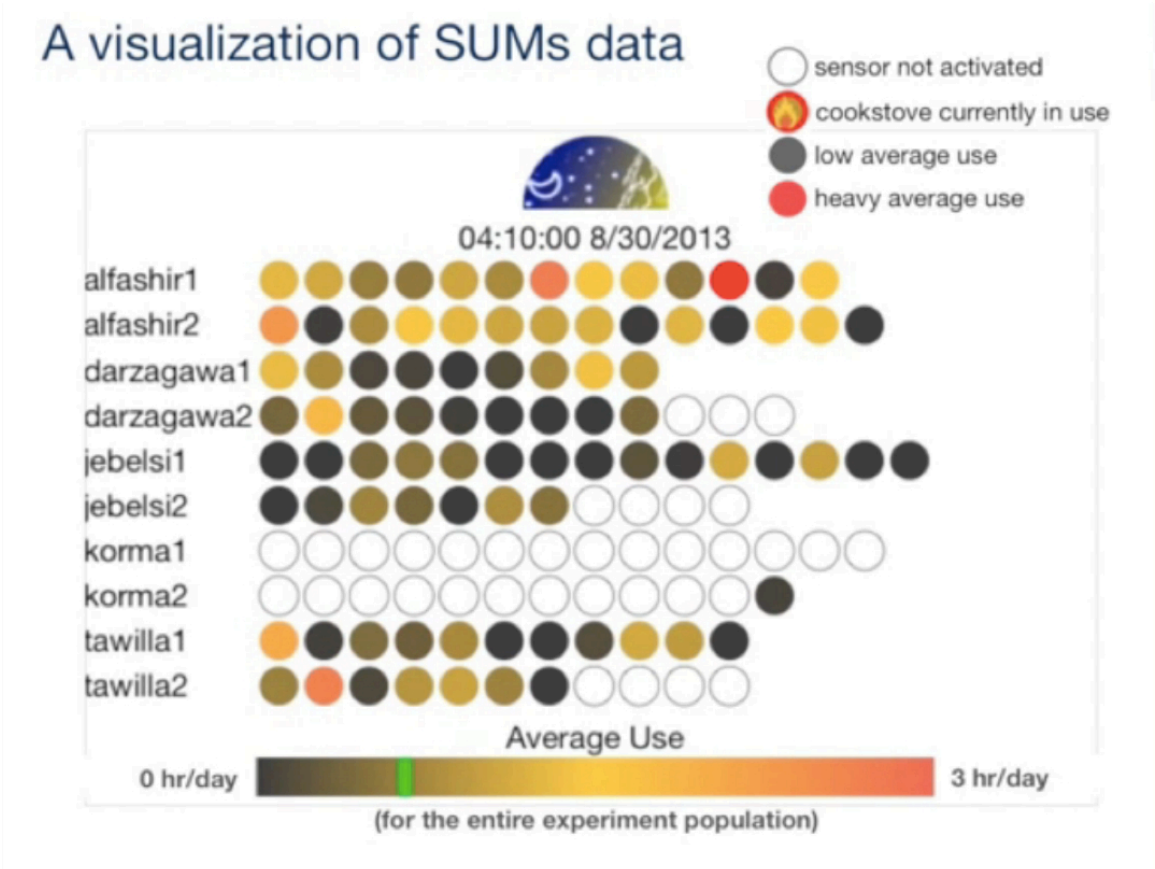
DIL Launch at UC Berkeley, March 2013.

Since then, the Mezuri group has led more than 4 joint field deployments, which are playing a key role in the platform's development. These have required both multidisciplinary collaborations within each campus as well as cross-campus efforts. These co-deployments include:

The TIER group has collaborated extensively with economists from CEGA on the Rural Electric Power Project (REPP). Together, they are performing randomized control trials to evaluate grid connection subsidies in Kenya and solar-powered microgrids in India. The Mezuri team has co-deployed a number of technologies in this project, including ODK for survey data collection in both countries; the incorporation of UW's Bluetooth module schematics into TIER's voltage monitor (which enables ODK Sensor-based monitoring of grid power quality and availability); and the analysis of public tweets to the Kenyan national power utility's twitter account, to measure power outages. The team is also working with microgrid implementing partner Gram Power, in India, to feed electricity consumption data from their smart meters into the Mezuri platform.

In addition, TIER has collaborated with the group at Michigan to develop "Grid Watch," a smartphone-based tool that enables visualization of power grid performance using inexpensive, crowdsourced data—in a manner independent of utilities. Grid Watch software on iOS and Android phones smartphones can detect power outages by monitoring changes to each phone's own power state, locally verifying these outages using a variety of already-present sensors, and corroborating the data with other phones through cloud services.

Another co-deployment has been led by the SweetLab team from PSU; they are working with Living Water International to instrument 200+ hand pumps in Rwanda with SWEETSense™ sensors. They are also using DoForms, a tool built on top of UW's ODK, to collect survey data. The SweetLab is deploying a similar combination of Mezuri component technologies with a Del Agua water filtration project in Rwanda.



Visualizations of data from field deployments of new technologies are essential for understand how and why something works. The Mezuri prototype is collecting data on cook-stove usage using temperature sensors attached to each unit. This project is led by UCB students in Mechanical Engineering and Agriculture and Resource Economics. Above is a snapshot of an animated "heat map" showing cookstove usage over time, using "SUMS" (Stove Use Monitoring Sensors"). Each circle in the figure is a household with a stove, and the color of the circle changes over time to correspond with frequency of cookstove use.

Finally, TIER has worked with Berkeley students in Agriculture and Resource Economics and Mechanical Engineering to deploy Mezuri technologies within two different cookstoves projects. The team has added stove monitoring sensors and UW's ODK survey technology to cookstove deployments in Ethiopia and Sudan. See Figure above for details.

The team has also begun discussions with members of MIT's HESN CITE effort about using the Mezuri platform and its sensors to inform their evaluations of development technologies. The SweetLab first met with members of CITE during a visit to MIT in September 2013, and Eric Brewer and TIER

researchers followed up with multiple meetings with CITE leadership during an October 2013 visit to UCB.

Both audio and video Conferences have helped foster cross-discipline and cross-partner collaborations within the Mezuri team. Over the last year, regular monthly conferences have been held among developer teams at the four partner universities, first starting with audio-only but quickly transitioning to Internet video. In particular, communications between the Michigan and Berkeley Mezuri teams have been key to furthering the overall platform's development and architecting and documenting the Grid Watch project; and regular video conferences between TIER and UW's Change group (begun in September 2013) have fostered planning of ODK 2.0, its integration into Mezuri, and support for the sensor and survey needs of projects in the DIL portfolio.

Beyond the Mezuri group, several conference have also included demonstration project partners—including CEGA economists at Berkeley and in-country field implementers (JPAL-India and IPA-Kenya)—who have provided invaluable feedback based on field experiences, including suggestions for new features.

4.2. Partner Engagement

Visiting Scholars
DIL is committed to cultivating equitable collaboration among its developing country university partners. To this end, the DIL Visiting Scholars program is helping demonstration project teams host visits by collaborators from low- and middle-income countries. The initiative aims to strengthen existing partnerships and build new ones, through joint research, publication, and curriculum development.

In DIL's first year, visiting scholars have visited Berkeley from DIL partner Jadavpur Unviersity (Kolkata, India). Each scholar is already involved in a demonstration project supported by DIL; their visits enable hands-on collaboration as well as meetings with a range of faculty members at Berkeley and across the UC network.

Debalina Chakravarty
PhD Student, Economics, Jadavpur University, India

Hosts (University of California, Berkeley):
Eric Brewer, Computer Science
Catherine Wolfram, Haas School of Business
Meredith Fowlie, Agriculture and Resource Economics

Debalina Chakravarty is a Fall 2013 DIL Visiting Student Researcher focusing on economics and climate change. She spent the semester working with Berkeley faculty Eric Brewer, Catherine Wolfram, Meredith Fowlie, and their research team on the Rural Electric Power Project (REPP) – an evaluation of solar microgrids in India. Debalina comes to DIL from Jadavpur University in India, where she is pursuing a PhD in Economics with a focus on climate change and the rebound effect. Her dissertation, entitled "Rebound Effect: Empirical Evidence from the Indian Economy," focuses on the impact of energy efficiency and climate change mitigation policies on consumer behavior in the energy sector. Debalina received her M.Phil. in Economics from Jadavpur University and has published her work in peer reviewed books and journals.

Amit Dutta and Anupam Debsarkar
Professors, Civil Engineering, Jadavpur University, India

Hosts (University of California, Berkeley):
Ashok Gadgil, Civil and Environmental Engineering and LBNL
Susan Amrose, Indoor Environment Group, LBNL

Dr. Amit Dutta and Dr. Anupam Debsarkar, both professors in the Department of Civil Engineering of Jadavpur University in Kolkata, West Bengal, India, focus their research on Environmental Engineering, particularly on water purification technologies. They plan to spend their time in Berkeley gathering information and hands-on experience with new mechanisms for Arsenic Remediation, Flouride Remediation of groundwater, and other water purification methods. Additionally they seek to explore cost-effective desalination processes in an effort to ease the world's increasing water shortages. During their time at Berkeley both Dr. Dutta and Dr. Debsarkar laid the foundation for the expansion of future collaborative research opportunities between researchers from Jadavpur University and UC Berkeley and other Bay Area water purification specialists.

Practitioners-in-Residence
In addition to the Visiting Scholars initiative, DIL has initiated a Practitioners in Residence program, providing student social entrepreneurs and innovators with one-on-one consulting and mentorship from a experts in industry, non-profits, government, and social enterprises. Most are drawn from the local Silicon Valley community. The program is open to all undergraduate and graduate students, across all departments and disciplines.

Practitioners in Residence
a Blum Center program

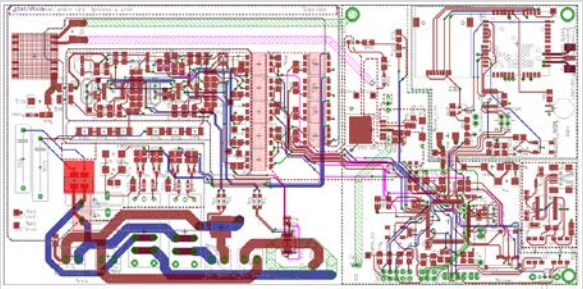
Our first Practitioner in Residence, Elliot Anderson, serves as CEO of Sanku Fortification, a for-profit social enterprise working to reduce hidden hunger in the developing world. As a consultant with the Monitor Group, he has also served as an advisor, strategist, and consultant to multiple foreign governments and NGOs on economic development initiatives, including USAID, the World Bank, IFC, and foreign Ministries in El Salvador, the Dominican Republic, and Brazil. Elliot previously served as the President of a packaging manufacturing company, co-founder of a tech start-up, development director for 2 non-profits, and principal of his own consulting practice.

Research Partner Engagement
Through DIL's portfolio demonstration projects (Pillar 1), several existing and new partners have been engaged. A snapshot of how these projects have attracted new partners into the DIL network is highlighted in the following boxes.

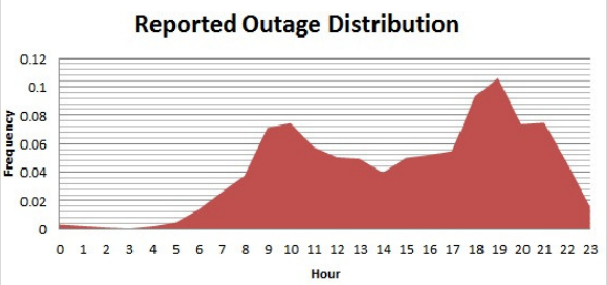
Rural Electrification & Power Project *(Sep'2013)*

This year, the REPP evaluation team mapped several sites in Western Kenya, all of which have a working transformer and < 10% connected households. IPA-Kenya will begin baseline survey data collection in January. Meanwhile, REPP is exploring a partnership with the **World Bank**, which would allow them to drastically expand the size of their study. In India, REPP is working closely with Gram Power to identify eligible sites for 40 new solar microgrids, to be subsidized by USAID's DIV program and the **Government of Rajasthan**. Research plans are finalizing with J-PAL South Asia, and baseline data collection will begin in January.

On the engineering side, TIER microgrid metering boards have been integrated with UW's ODK Sensor technology by including Bluetooth wireless communications on board the meters themselves. Layout is complete and the next step is prototype manufacturing and driver development. The FoneAstra Bluetooth communications backend has been added to the latest revision of the TIER metering board, for use both with the microgrids and with the grid, as a power quality measurement device. In Kenya, publicly available tweets identifying grid power outages are being analyzed. These data are providing preliminary information on the health of the Kenyan grid, to inform the deployments Mezuri's Grid Monitoring Hardware (currently under development).



FoneAstra Bluetooth Communication Backend



Analysis of Kenyan Grid

Electro Chemical Arsenic Removal (*Sep'2013)*

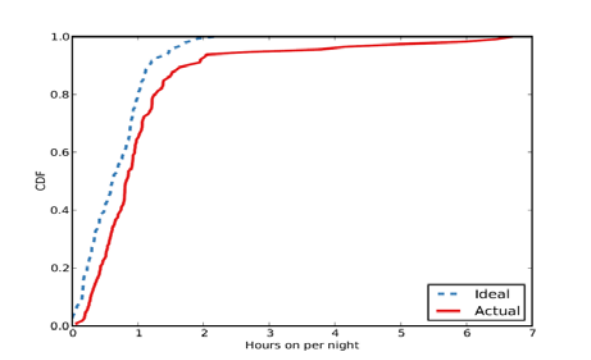
Earlier this year, the ECAR team presented at the WEDC Conference, the largest international water conference for developing economies. There, they met with HESN affiliates from MIT. As noted above, two professors from Jadavpur University visited Berkeley for six weeks, meeting with over 20 scientists to generate new ideas and expand research capacity. The ECAR project's Indian field trial supervisor also visited Berkeley to build capacity and collaborate with the scientific team to solve minor rust-buildup challenges uncovered during our last field trial. The team recently won the silver prize in the prestigious "Reed Elsevier Environmental Challenge", with the winners announced at the Stockholm World Water Week, and is a finalist in the Siemens-Stiftung "Empowering People Challenge", whose winners will be announced next month at Nairobi, Kenya. This has fostered new links with **Elsevier**, a leading publisher of academic research.

Indian field trial supervisor, Siva Rama Satyam Bandaru, visits Berkeley.

Village Base Transceiver Station (*Sep'2013)*

This year, a VBTS paper detailing power savings analysis in the Papua deployment was accepted for publication in ACM DEV4. A second paper, accepted at ICTD, has been prepared for publication; and a third paper (detailing design decisions available for small-scale rural telephony network operators) was submitted to CHI. The latter was coauthored with new partners from the **Rhizomatica project** in Mexico. The VBTS team has recently fabricated their first custom radio and demonstrated new power saving techniques with the Universal Software Radio Peripheral (USRP). Finally, the team has met with Anant Sahai (Berkeley EECS faculty) about a new collaboration in defining GSM White Space (a technique for allowing small-scale networks to share spectrum with established carriers).

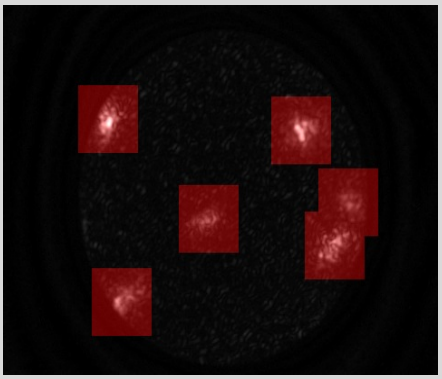
The radio fabricated by VBTS



The graph (Cumulative Distribution Function) shows how much longer the Base Station was "on" each night, relative to the ideal minimum level. The clear conclusion is that VBTS is operating with near-minimum power consumption.

CELL SCOPE – *Recent Developments (as of Sep'2013)*

The DIL CellScope team recently developed a new version of their iPhone-based *Loa Loa* diagnostic microscope, which avoids many of the costly optical components of the first version. As such, it could be substantially cheaper to produce. They have sent an early prototype of this device to new collaborators at the **National Institutes of Health**, where it received positive feedback. This device is currently undergoing validation studies, and design modifications will be incorporated based on feedback. The DIL team has also revised the *Loa* counting algorithm to improve linearity up to 60 mf/ml (twice the treatment threshold). NIH will be sending 3 microscopes to Cameroon at the end of October for field testing (with blood smear data for comparison).



Loa Loa in human blood, Cameroon

4.3. Student Engagement

One of DIL's student engagement highlights was a Spring 2013 pilot connecting students directly with USAID professionals, through one-time student analysis projects. To date, six UC Berkeley students have completed Master's level analysis for USAID missions and Washington staff on topics related to science and technology.

Berkeley Graduate Students and USAID Focus on Catalyzing Student-Global Engagement
By Luis Flores, Blum Center Student Writer

Together with three other Master of Public Policy students, Evan Axelrad (far left) is evaluating technologies for charging cell phones in rural Mozambique, in support of a USAID pilot project to financially empower farmers.

BERKELEY – The adage that "great ideas are everywhere, opportunity is not" holds true in many places, even within top universities. UC Berkeley has 30,000 students with great skills and ideas, but even with the existing array of clubs, courses and faculty-led research positions, there remains a strong student demand for novel opportunities to tackle real-world challenges. Eight UC Berkeley graduate researchers are working with the Blum Center's Development Impact Lab (DIL) to expand the avenues available for students from all departments to directly apply their ideas to pressing technology challenges in global development and sustainability.

Collaborating with USAID, the federal agency for foreign assistance, the DIL students are laying the foundations for new approaches to efficiently connect UC Berkeley's existing technological innovations, policy and economic analysis, with the expertise, experience and on-the-ground implementations of one of the world's largest civilian aid organizations. In the Blum Center's current pilot study, the graduate student researchers are providing actionable analysis and recommendations that support USAID initiatives. The students and the Blum Center will then use the lessons from this test program to further develop and expand opportunities for student global action.

"By initiating and facilitating Berkeley-based projects with international USAID locations as well as DC bureaus, DIL makes it easy for students to develop actionable solutions to real-world problems," explains Erica Schlesinger, DIL student project manager and a Ph.D. student in the Joint Bioengineering Group at UC Berkeley and UCSF. "Students are not only learning technical skills, but they also have the opportunity to gain valuable project experience and developing global networks."

Charlotte Jourdain (MPP 2013) is providing research and analysis to USAID's Development Innovation Ventures, an initiative that funds, evaluates, and scales breakthrough solutions to global challenges.

One of the researchers is Evan Axelrad, a first-year Master of Public Policy student at the Goldman School of Public Policy (GSPP). He is working with DIL as part of GSPP's first year capstone requirement, in which students produce an introductory policy analysis for an NGO or company client. For Axelrad, who has previously worked for USDA and conducted research as a Fulbright Scholar, the DIL evaluation project is an exciting challenge.

Sarah Salter (MPP 2013) is also creating novel program recommendations for USAID's DIV initiative.

Axelrad is working in a small student team to evaluate technologies for charging cell phones in rural Mozambique. Countless development programs aim to leverage the availability of cell phones, but lack of electricity remains a widespread and critical bottleneck, including for initiatives run by USAID Mozambique and its partner organizations. Axelrad explains that while cell phone distribution in Mozambique continues to grow, access to electricity remains very low, reaching only 10 percent of the population.

"We seek to find technologies which give the most 'bang for the buck' in terms of small-scale, rural power generation, and which are also the best fit specifically for charging cell phones in this context," explains Axelrad. The team hopes that their student-led approach can become a new model for connecting university expertise, including both policy assessment and technology design, to critical development problems.

Ashley Clark (MPP 2014) reviewed the emerging role of technology in integrating vulnerable populations into post conflict resolution, for USAID in Colombia.

While the research projects are just a few weeks old, DIL is committed to using this pilot program as a stepping stone to developing a larger student initiative that also includes undergraduates. "We're really excited about these dynamic pilot projects," says Schlesinger. "We are still developing new projects and partnerships, and we look forward to partnering with more departments, groups, and courses at Berkeley to connect students with meaningful, real-world initiatives."

Development Engineering" PhD Emphasis

Beyond individual projects linking students with USAID, DIL is spearheading the creation of a new graduate program, the Designated Emphasis in Development Engineering (DE2). Meetings of faculty from Berkeley, MIT, and other campuses have generated both faculty commitment to the program and new ideas for curriculum and practice. Two new courses and a wide range of multi-disciplinary electives will make up the content of the program.

While multi-department enthusiasm for the initiative has been foundational, the complicated bureaucratic process of securing teaching time for faculty to participate within the program – a prerequisite to formally proposing the program to administration - has proven to be a longer process than was initially anticipated. Our goal is now to submit the program proposal to the Graduate Division during the spring term of 2014 (approximately February 2014). This will allow the program to formally launch in fall term of 2014. In an effort to increase student and faculty interest in the development engineering as we lead up to the full program launch, a Development Engineering Research Seminar will be offered during spring term 2014.

4.4. Student Highlights

New Course for Graduate Students: Cooperative Innovation
The new Development Engineering course supported by DIL this year forms interdisciplinary teams of students to solve problems identified by outside clients. Through the course of a semester, students frame the problem, undertake rapid prototyping, and then iterate with immediate feedback. Class projects include an entrepreneurial sanitation initiative for urban slums in Kenya, a low cost roofing tile business for slum houses in Ahmedabad, India and a community driven solid waste reduction solution in Guatemala City, Guatemala. Course members are from varied backgrounds, including business, energy and resources, public policy, public health, nutrition, civil and environmental engineering, chemical engineering, chemistry, physics, architecture, and medicine.

Postdoctoral Fellows
This year, two postdoctoral scholars were selected as the first recipients of the "Global Poverty & Practice" DIL Fellows award. The program is designed with two primary objectives: to inspire and train the next generation of academic scholars and teachers in global poverty studies and development practice, and to engage DIL researchers with USAID, HESN, and the broader international development community in finding solutions to global development challenges. The two selected Fellows, Dr. S. Imran Ali and Dr. Kweku Opoku-agyemang, will each advance research projects under faculty mentorship during their two-year appointments at UC Berkeley. Both will also teach courses within the Blum Center's Global Poverty & Practice Minor. The fellowship opportunity was publicized internationally, with 80 scholars applying from six continents. A short biography on each post doctoral scholar follows.

Dr. S. Imran Ali – environmental engineer (Ph.D., University of Guelph, 2012)

Dr. Ali was born and raised in Toronto, Canada. Most recently, he was in South Sudan working with Doctors Without Borders (Médecins Sans Frontières, MSF) as a water and sanitation specialist in the Jamam refugee camp. This was his second emergency response with MSF, the first having been during the Indus River floods in Pakistan in 2010. During his graduate career, he established and ran an international research collaboration between three Canadian and Indian universities on water, environment, and public health in low-income, marginalized urban/peri-urban communities in South Asia. The primary objectives of Dr. Ali's proposed research project are: 1) improving existing safe water practices in acute emergencies by generating evidence-based guidance on free residual chlorine and the optimization of the safe water chain, and 2) evaluating and catalyzing novel improvements to best practices for emergency safe water supply through the application of point-of-use water treatment technologies. The research will build the presently-limited evidential base underlying safe water supply in humanitarian operations; in doing so, it aims to improve best practices for responding to population displacements the world over.

Dr. Kweku Opoku-Agyemang – economist (Ph.D., University of Wisconsin-Madison, 2012)

Dr. Opoku-Agyemang received his Ph.D. in Development Studies, with a concentration in economics, at the University of Wisconsin-Madison, where he has been an Honorary Fellow at the Agricultural and Applied Economics Department. He holds an M.A. in Economics from Ohio University, and a B.A. in Economics with Geography and Resource Development from the University of Ghana. Prior to graduate studies, Dr. Opoku-Agyemang was a National Service Person for the Government of Ghana.
Dr. Opoku-Agyemang's main research interest is the political economy of development: how the interface between economic and political science can help us understand important policy issues. He is also interested in behavioral economics, social entrepreneurship and the political impacts of mobile and open-source technologies. Dr. Opoku-Agyemang's research project seeks to understand why entrepreneurial Ghanaians are constrained in their ability to push for political accountability and the potential role of mobile technology in breaking through these constraints.

Part 5: USAID Engagement and Travel

5.1. USAID/Washington Interactions

DIL benefits from close collaboration with USAID bureau and technical staff, as well as contacts in the agency's missions. Interaction with Washington staff are highlighted in the table below.

USAID Office	DIL Linkage
Office of Science and Technology (OST)	DIL has participated in weekly phone calls with HESN staff and monthly working groups with the OST Data Team. In addition, the Lab has liaised with numerous OST staff regarding USAID's Grand Challenges
IDEA	Staff from IDEA (Dave Ferguson) have contributed to Big Ideas contests in both 2012-13 and 2013-14. They have also hosted a Masters student analysis project and have provided input on the 2014 DIL Conference (on revealing the demand for new technologies in developing countries).
Global Health (BGH)	
E3	DIL demonstration project teams spoke with staff at E3 both about REPP (and, more broadly, about rural electrification). These conversations have also included the USAID Grand Challenge on Powering Agriculture.
GBI	The VBTS demonstration project has spoken on several occasions with staff from USAID's Global Broadband Initiative, exploring opportunities for collaboration.
BGH	The Big Ideas team at Berkeley has discussed student contest categories with USAID staff from the Bureau for Global Health—primarily for the 2012-13 contest.

In addition to these specialized interactions, the 50 Breakthrough Technologies project has held consultations with multiple USAID staff.

5.2. USAID Mission Interactions

Interaction with USAID missions provides valuable feedback and connections for DIL portfolio projects. In addition, Master's students have worked with individual missions (Colombia, Mozambique) to provide policy analysis on priority science and technology topics. More on these projects can be found in the Publications (section 1.3) and Student Highlights (section 4.4) portions of this report.

Vietnam

Activity: Dr. Lina Nilsson worked on location with Vietnamese medical doctors to roll out the study and introduce 15 CellScopes to point-of-care clinics, and connected with the Mission during this field study coordinated by UCB/UCSF/Vietnam National Tuberculosis Program.
Visit/virtual: Two in-person meetings, one with USAID S&T Office calling in.
Mission response/engagement: has provided the CellScope team with connections to other TB initiatives in northern Vietnam.

Colombia

Activity: to explore how University projects can best directly interact in-country with USAID and its local partners. We also explored how students could directly support missions.
Visit/virtual: In-person meeting, with USAID S&T Office calling in.

Mission response/engagement: The mission worked with DIL to have a master's student from the UC Berkeley Goldman School of Public Policy complete an Advanced Policy Analysis (equivalent of a theses) on behalf of the Mission. Follow up engagement through this project.

Indonesia
Activity: 1) The team spoke with Indonesia mission staff to explore how University projects can best directly interact in-country with USAID and its local partners. 2): Students, faculty and staff deploying the Village Base Station in Indonesia interacted with USAID contacts.
Virtual: Call with Mission that linked us with other UC researchers funded by the agency
Mission response/engagement: These contacts helped identify channels for importing equipment into the country. In addition, at the recommendation of mission staff, VBTS has connected with a cabinet-level telecommunications executive in the Indonesia Office of the Prime Minister, who has expressed interest in a partnership to bring rural broadband coverage to island habitations.

Mozambique
Activity: to explore how University projects can best directly interact in-country with USAID and its local partners. In addition, we are evaluating how students could directly support missions.
Visit/virtual: Conference call, with USAID S&T Office also calling in.
Mission response/engagement: After follow up, worked with DIL to have a group of master's students from the UC Berkeley Goldman School of Public Policy complete an Intermediate Policy Analysis brief on behalf of the mission. Follow up engagement through this project.

Kenya
Activity: to discuss how DIL projects in Kenya (specifically the Rural Electrification Project) can inform in-country decision-making, particularly related to the U.S. Government's Powering Africa initiative.
Visit/virtual: Visit with USAID Nairobi Office.

India
Activity: to discuss how DIL projects in India (specifically ECAR) are progressing, and to identify opportunities to leverage HESN for mission priorities.
Visit/virtual: Visit with Sheila Desai and Nilesh Shah (State Department), Delhi.

5.3. Travel

The following travel (domestic and international) using HESN funding occurred during the past fiscal year:

Location (City and Country)	Number of Travelers	Partner(s) Engaged (If applicable)	USAID Engagement (If applicable)	Outcome(s) & Next Steps
Kolkata, India	2	Jadavpur University	N/A	Advanced collaboration.
Nairobi, Kenya	2	Kenya REA, IPA	Meetings with USAID mission staff	Advanced collaboration.
Papua, Indonesia	2	Yasumat	N/A	Advanced collaboration.
Oaxaca, Mexico	3	Rhizomatica	N/A	Began co-development of a shared platform for future community cellular networks

Part 6: Monitoring & Evaluation

6.1. Progress Narrative

As of summer 2013 DIL began implementing a monitoring and evaluation (M&E) plan to identify, collect and analyze key performance data. The M&E plan tracks progress toward DIL's pre-specified goals, objectives and results; it also informs DIL's management and innovation agenda moving forward. The DIL team collaborated with USAID staff to generate an appropriate and comprehensive set of indicators, including the assignment of roles and responsibilities for data collection.

In order to ensure the quality, depth and breadth of the reported data (including the accessibility and navigability of the final product for DIL, USAID, and HESN partners) we have invested significant time to develop an appropriate data collection strategy, building on input from a diverse set of stakeholders including tenured faculty, university staff, graduate students, university-based academic centers and NGO partners. DIL has experimented with a variety of software solutions, including Microsoft Access and Google Forms, Docs and Sites.

In future, DIL will hire an M&E consultant with superior knowledge of monitoring, process evaluation, and administrative data collection—including experience with quantitative and qualitative research methods and experience working with USAID. This will ensure effective reporting, data collection, and monitoring systems are in place over the next four years. DIL will advertise widely for this position, including on Devex.com.

6.2. Monitoring & Evaluation Issues

DIL is continuing to iterate on its M&E plan. Based on requests from USAID, we have proposed a large number of indicators with ambitious targets. To ensure that the data collected are of high quality—and to limit the administrative burden on DIL faculty and student innovators—the Lab's staff will need to streamline data collection methods. Of concern, data collection related to the Big Ideas@Berkeley competition has become difficult, given the rapidly growing number of applicants. This will become an increasingly challenging exercise as the competition expands, and may require investment in specialized software to track applicant characteristics.

The Big Ideas@Berkeley now includes three categories open to all seven Higher Education Solutions Network universities. DIL is working to set up systems to ensure data is collected for all submissions to the competition as well as for all other aspects of the program. Due to the increasing size and scope of the 2013-14 Big Ideas@Berkeley competition, the program will include a minimum of 120 judges and 500-1,000 students. Collecting data on these judges (for IR 2.3.2, etc.), students (IR 3.3.4, etc.) and projects (IR 2.1.1, IR 3.4.2, etc.) will require more bandwidth and resources than originally anticipated. The Big Ideas competition also rewards projects in their earliest ideation phase rather than rewarding "transformative innovations" at the pilot, evaluation or scale-up stage, so ensuring the competition fits properly within the larger M&E framework has required some definitional adjustments.

Finally, additional data collection required on 1) DIL-related student travel for USAID's Global Research & Innovation Fellowship Network (GRIFN) and 2) DIL-related visiting scholars for USAID's Exchange Visitors program (via the TraiNet Web system) must be integrated into staff work plans going forward.

6.3. Update on Performance Indicators

Below are the updates on the performance indicators for Year 1. A full M&E report was submitted along with this Annual Report to document the full set of performance indicators as detailed in the M&E Plan.

Lab Ref.	Performance Indicator	FY12 Baseline	FY13 Target	FY 13 Actual	FY14 Target	FY15 Target	FY16 Target	FY17 Target
G1	Value of leverage and cost-share	Cost-share: $1 million Leverage: 0	Cost-share: $200,000 Leverage: $800,000	TBD (financials pending)	Cost-share: $1,400,000 Leverage: $1 million	Cost-share: $1,600,000 Leverage: $3 million	Cost-share: $1,800,000 Leverage: $3 million	Cost-share: $1,500,000 Leverage: $3 million
G2	# of innovations developed (i.e. faculty-led projects)	SDS only: 3 DIL/SDS: 3	SDS only: 3 DIL/SDS: 5	SDS only: 3 DIL/SDS: 9	SDS only: 5 SDS/DIL: 15	SDS only: 5 SDS/DIL: 15	SDS only: 5 SDS/DIL: 15	SDS only: 5 SDS/DIL: 15
G3	# of innovations piloted	SDS only: 4 DIL/SDS: 4	SDS only: 4 DIL/SDS: 5	SDS only: 4 DIL/SDS: 10	SDS only: 5 DIL/SDS: 12	SDS only: 5 DIL/SDS: 15	SDS only: 5 DIL/SDS: 15	SDS only: 5 DIL/SDS: 15
G6	# of innovations evaluated	SDS only: 2 DIL/SDS: 2	SDS only: 2 DIL/SDS: 2	SDS only: 2 DIL/SDS: 4	SDS only: 2 DIL/SDS: 4	SDS only: 2 DIL/SDS: 5	SDS only: 2 DIL/SDS: 6	SDS only: 2 DIL/SDS: 7
G7	# of student fellows	SDS only: 0 DIL/SDS: 0	SDS only: 3 DIL/SDS: 3	SDS only: 3 DIL/SDS: 7	SDS only: 3 DIL/SDS: 10	SDS only: 3 DIL/SDS: 12	SDS only: 3 DIL/SDS: 12	SDS only: 3 DIL/SDS: 12
O1.1	# of new tools	0	1 (DIL)	8 (DIL)	4	4	4	4
O1.2	# of new data sets	0	0	0	2	2	2	2
O1.3	# analyses/consultations	2 (SDS only)	5 (SDS/DIL)	8 (SDS/DIL)	8	10	12	14
O2.1	# months required to innovate at each stage in pipeline	N/A	36 mo.	TBD	36 mo.	36 mo.	36 mo.	36 mo.
O2.2	Change in targeted development indicators	0	0	0	TBD	TBD	TBD	TBD
O2.3	# of transformative innovations sourced (including student-led projects, e.g. BigIdeas)	SDS only: 31 SDS/DIL: 31	SDS only: 3 SDS/DIL: 50	SDS only: 3 SDS/DIL: 46	SDS only: 3 SDS/DIL: 50	SDS only: 3 SDS/DIL: 50	SDS only: 3 SDS/DIL: 50	SDS only: 3 SDS/DIL: 50
O3.2	# of courses created	0	1	1	2	2	2	2
O3.3	# of disciplines created	0	1	1	0	0	0	0
O3.4	# of faculty and students involved in new courses/disciplines	Faculty: 3 Students: 4	Faculty: 10 Students: 50	Faculty: 18 Students: 136	Faculty: 20 Students: 150	Faculty: 30 Students: 180	Faculty: 40 Students: 200	Faculty: 50 Students: 250

Note: Items marked DIL/SDS include those which are SDS-only, those jointly supported by SDS and DIL, and those supported exclusively by DIL. This represents the Lab-wide total.

Part 7: Lessons Learned / Good Practices

DIL focused its first year on building up the Lab's internal infrastructure, including the organizational and reporting frameworks, staff responsibilities, and institutional networks needed to ensure efficiency over the life of the project.

As part of this work, DIL interacted closely with USAID staff within the Office of Science and Technology, and beyond. Year one's many, high quality collaborations with USAID reinforced the pivotal role both communication and linkages with USAID will hold for the success of the novel technologies that serve as the foundation of DIL. DIL will continue to work to establish carefully constructed, mutually beneficial relationships with USAID offices, bureaus and staff, both in Washington, DC and in multiple USAID Missions. This system will benefit DIL as a whole and will serve particularly important for the "scaling up" DIL-supported technologies and approaches.

Additionally, DIL dedicated much of the first year to fostering the growth of the "development engineering" ecosystem, including designing and building awareness around a DIL brand. DIL partook in a range of marketing-related activities, from launching its website to undertaking social media campaigns on Twitter. DIL has found that the more aware university faculty, postdocs, graduate students and staff are of the Lab, the more successful the series of competitions it plans to hold will be.