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I. Executive Summary

The [Development Impact Lab](#) (DIL) is an international consortium of universities and research institutes working with partners to advance global development through science and engineering. Headquartered at the [University of California Berkeley](#) (UCB), DIL was launched in 2012 with support from [the US Agency for International Development](#) (USAID). DIL leverages the innovation capacity of world-class universities to design and evaluate a new class of “development solutions” that couple technological advances with the economic and behavioral interventions needed for large-scale social change. DIL is formalizing this approach by launching a new academic discipline, *development engineering* (*Dev Eng*).

In the last two quarters, DIL has supported a coordinated portfolio of development solutions, including over 90 projects in 30 countries. DIL sources these innovations and ideas through competitions for travel awards, project grants, and prizes (like [Big Ideas@Berkeley](#)). Priority is given to projects that demonstrate embody or exemplify the *Dev Eng* approach. In the current year, DIL has also focused on accelerating a few key demonstration projects, including Mezuri, a cloud-based computing platform that integrates data (from wireless sensors, mobile networks, and other ICTs) to track the performance of development interventions in the field.

Along with its growing portfolio of innovations, DIL supports an ecosystem for *Dev Eng* researchers. For example, DIL has established a cross-disciplinary *Dev Eng* [minor for PhD students](#) at UCB. Other campuses in the DIL consortium (e.g. UC San Diego, University of Washington) are launching similar programs. We have established an open-access, peer-reviewed journal, [Development Engineering: The Journal of Engineering in Development Economics](#), which showcases influential work across engineering and the social sciences. Published by Elsevier, the journal also features a unique [co-mentorship program](#) to encourage authorship by developing country researchers.

In the current period, DIL has also continued to strengthen its partnerships with USAID’s Higher Education Solutions Network (HESN). In November 2014, we hosted the 2nd annual HESN Technical Convening ([TechCon 2014](#)) with more than 350 student innovators, faculty researchers, development experts, investors, and thought leaders. The event provided a venue for discussing creative approaches to solution ideation, testing, and scaling. A new report by the DIL consortium, titled [50 Breakthroughs: Critical scientific and technological advances needed for sustainable global development](#) was officially launched at TechCon.

2. Major Milestones and Events Completed

DIL is a five-year initiative, and in the first two years we invested heavily in sourcing new innovations and ideas. As we enter Year 3, DIL has begun to focus on strengthening the existing portfolio of innovations and accelerating those projects that best demonstrate the principles of *Dev Eng*. One major milestone has been the use of DIL research by policy-makers. This year, a data set on electricity access in Kenya was used to inform decision-making by Kenya's national power company. A device that turns a smartphone into a microscope is now being used by the US [National Institutes of Health](#) to detect parasite infections in West Africa. Each of these solutions will reach tens of thousands of people in 2015. Both projects were among the earliest in DIL's portfolio, and they have now matured to achieve impact at scale. We attribute these achievements, in part, to the unique approach embodied by DIL, as well as the excellent field partners we are able to attract.

A second milestone has been the implementation of a Lab-wide self-assessment, marking the midpoint of our award from USAID. We have undertaken a comprehensive portfolio review to identify which of our projects and activities are most likely to achieve scale. As part of this process, 20 of the largest research grants in DIL's portfolio were invited to articulate their long-term goals and pathways to achieving social impact. These and other assessments will be used in the coming months to reflect, evaluate, and identify opportunities for pruning and growth. An additional outcome will be the discovery of research pivots and failures that can be shared with the broader community, to ensure that future innovations transition more smoothly from the lab to the field.

The 2014-15 academic year marked the first year of the *Dev Eng* [minor for PhD students](#) at UCB. As discussed earlier, *Dev Eng* is a new field of research intended to accelerate development in low-income communities, by integrating insights from engineering and the social sciences along the entire arc of innovation: from idea, to evaluation, to manufacture at scale. In its first year, the program enrolled students from multiple engineering units, economics, social welfare, and other disciplines. Fifty percent of enrollees are female, and more than 20 faculty members are participating in the Graduate Group guiding this program.

This year also marked the launch of a new open access peer-reviewed journal, [Development Engineering](#), to be published by Elsevier. The journal opened for submissions in March 2015. It aims to foster academic recognition for faculty and students engaging in high-impact development innovation. To date, more than 50 manuscripts have been submitted for the first issue.

A final milestone has been the unprecedented growth of our student contest, [Big Ideas@Berkeley](#). This prize for social innovation was founded on the Berkeley campus in 2005. With USAID support, it is now open to students at 18 universities and has attracted additional funding from 5 partners around the world. In the current year, nearly 180 student teams submitted applications for the prize, in areas like food security, global health, conflict, and open data.

3. Key Activities

Objective 1: Improve data quality, access and analytics to advance evidence-based development decision-making

DIL invests in data generation and analytics through two activities: our portfolio of innovations, many of which generate data and rigorous evidence for decision-makers; and the Mezuri platform, a cloud-based infrastructure for aggregating and analyzing digital data from interventions in the field. Each of these activities is intended to improve the quality and use of data by development actors.

Portfolio Innovations: A diverse universe of data are generated by research teams in DIL's portfolio. Each team is expected to partner with at least one field-based development actor, typically an organization that pilots the solution and/or assists in implementation at scale. While field partners provide operational expertise, university researchers contribute skills in technology innovation, intervention design, evaluation, and rapid iteration. More than half of DIL's projects utilize wireless, distributed measurement technologies to track performance, use, and consumer satisfaction with new solutions. Data generated by these projects are shared with implementing partners and, once cleaned and documented, can be made openly available to the public. The preliminary data generated by seed grants and travel awards are intended to provide initial inferences and foundations for future research paths while larger investments in DIL's portfolio should both produce data and demonstrate policy-maker demand for results.

Mezuri: Beyond the data produced by DIL's portfolio of innovations, DIL has also invested in the design of a cloud-based software platform for the broader *Dev Eng* community, called Mezuri. This product, led by the [TIER](#) group at UCB, will allow researchers and practitioners throughout the world to upload raw data from sensors, satellites, mobile phones, and other Information and Communication Technologies (ICTs). The team's goal is to enable the routine, secure analysis and sharing of data from field interventions, including high frequency measurements gathered by the platform's constituent technologies (i.e. the [Open Data Kit](#) (ODK) from [University of Washington](#), the [SWEETSense](#) data management technology developed by the [SWEETLab](#) at [Portland State University](#), and a series of sensor data platforms developed by [Lab I I](#) at [University of Michigan](#)).

In the current period, the Mezuri team at UCB has begun implementing a unique data provenance tracking algorithm to ensure that original data sets remain accessible even after analyses have been performed. They have also generated sensor data from field deployments in Kenya, India, Ethiopia, and Sudan. The resulting data, which include sensor readings from instrumented cookstoves and microgrids plus electronic surveys, are informing the architectural design and feature set of Mezuri.

In collaboration with University of Michigan, the UCB group also developed GridWatch, a system that detects electricity grid conditions using only mobile phones. It has been piloted in Kenya and was demonstrated at TechCon. The platform can provide regulators, researchers, and customers with an independent source of power outage data. University of Michigan designed a second technology in this period, called Opo. This system of sensors tracks face-to-face human interactions between people, allowing researchers to reconstruct the physical social network graph. Such information is useful for studying the spread of infectious diseases through human interactions, which are known to vary across

cultures and geographies. Data captured from both GridWatch and Opo sensor technologies will feed into the Mezuri Platform.

In 2014 and 2015, SWEETLab has continued to feed sensor data from field deployments in Rwanda into the Mezuri platform. This includes data from the deployment of 200 sensors on water handpumps, as well as 125 sensors on household water filters and 100 sensors on cookstoves. Additional text data describing the operation and maintenance of the devices are being captured using ODK. These deployments leverage investments by partners DelAgua, the London School of Hygiene and Tropical Medicine, and the UK Department for International Development.

Over this period, the ODK team continued development of its version 2.0 tools, including:

- Childhood pneumonia screening application that includes a digitized Integrated Management of Childhood Illness (IMCI) protocol plus USB pulse-oximeter (piloted in partnership with [PATH](#))
- ODK Tables customization for the HOPE Study, which evaluates HIV discordance among couples in Kenya who are visited repeatedly by healthcare workers
- Low cost human milk bank pasteurization process in South Africa, in cooperation with PATH
- ODK Scan deployment in Malawi, collecting data for maternal and neonatal health programs with the NGO Village Reach

In addition to ODK 2.0 development, the team also worked with UCB to create an alpha prototype implementation of the Mezuri platform. The exercise helped the team understand the design challenges of integrating sensing and survey data from 3 different pre-existing systems. This is the first step in designing a full system that is sufficiently generic to handle real-time input from multiple types of information systems.

Objective 2: Accelerate the creation, testing, and scaling up of transformative innovations, technologies and approaches in development solutions

Since the beginning, DIL has sponsored competitions within its network of researchers, to source innovations for the *Dev Eng* pipeline. DIL uses small amounts of money to derisk new ideas for subsequent investment by larger donors like USAID's [Development Innovation Ventures](#) and the [Global Innovation Fund](#). In 2015, we implemented two small competitions to seed new projects. We are currently finalizing awards for these competitions, and outcomes will be shared in our next report.

Of note, we continue to incentivize interdisciplinary collaboration through our competitions. Priority is given to projects that demonstrate substantial contributions from quantitative social scientists as well as engineers or natural scientists. DIL's philosophy is that innovations are substantially more likely to iterate quickly, fail early, and meet user demand if they involve an interdisciplinary team from the start. We encourage all funded teams to incorporate intellectual contributions from complementary disciplines, mimicking the private sector product pipeline (which typically involves business intelligence, product design and management, demand generation and marketing, supply chain development, and user support).

Objective 3: Catalyze a global interdisciplinary ecosystem of individuals & individuals that shares knowledge, promotes learning, & builds mutual capacity

To transform the innovation ecosystem at Berkeley and beyond, DIL supports events, student prizes, fellowships, training. In the current period, our major event was the 2nd annual HESN Technical Convening (TechCon) in November 2014. The event, held in the San Francisco Bay Area, showcased work by HESN grantees and the broader community, including local private sector actors like [Planet Labs](#) and [Autodesk](#). At TechCon, we launched the [50 Breakthroughs](#) report, authored by LIGTT. The report serves as a blueprint for the development community, providing an analysis of technologies and innovations that - if developed and scaled - could accelerate economic growth for the poor. It was widely covered in mainstream press, including the Guardian and NPR. As a knowledge sharing tool, 50 Breakthroughs could inspire further innovation beyond the DIL network.

To generate a career trajectory in *Dev Eng*, DIL has provided ongoing support for two postdoctoral fellows. In the current year, each fellow has taught a course on poverty at UC Berkeley, and they have contributed to the *Dev Eng* seminar as guest speakers. Dr. Opoku-Agyemang studies mobile technologies and poverty and hunger in Ghana. In 2015, he presented his research at University of Oxford's Economic Development in Africa conference, the Pacific Development Economics conference at UC San Diego, and the American Economic Association meeting. He is co-authoring a book chapter entitled "Modeling Poverty," in *Encountering Poverty* (Co-Editors: Ananya Roy, Genevieve Negron-Gonzalez, Kweku Opoku-Agyemang, Clare Talwalker). Dr. Imran Ali conducts research on chlorine technologies in refugee camps. He has presented his research at the 2015 Humanitarian Technology conference and the 2014 Reproductive Health in Humanitarian Settings conference. He has submitted a paper for publication describing his work in a South Sudan refugee camp.

While postdoctoral fellowships are one mechanism for creating career trajectories, DIL also supports research training for students, through the *Dev Eng* minor and a series of workshops. In the current year, we sponsored workshops on the Institutional Review Board (IRB) process and another on video-documenting field research. These provide students with on-demand technical skills to prepare them for work in the field. We have also invited external experts to provide feedback and mentorship to students on field research. During this period, we hosted 9 Practitioners-in-Residence at Berkeley, ranging from impact investors and international development consultants, to global water specialists. Each practitioner provides an afternoon of office hours for one-on-one meetings with students. DIL also hosted a series of Salons, which are informal small group conversations led by leaders across the technology and development fields. Salons provide a space for students to request candid feedback from peers and external experts. Topics in this period include "Broadband in Developing Countries" (moderated by Bruce Baikie, Executive Director of Inveneo) and "Launching and scaling new innovative product and businesses that improve lives" (moderated by Vishal Vasishth, co-founder of Better Ventures).

To advise on student engagement at Berkeley, DIL convened together a group of 9 graduate students in Fall 2014 (from a range of disciplines including Landscape Architecture, Development Practice, Civil and Environmental Engineering, Mechanical Engineering, Energy and Resources, Information Management and Systems, and Computer Science). Called the "DIL Idea Team", this group is tasked with designing and implementing creative ways to engage the community in global development challenges. The Team

hosted its second annual Innovation Crawl in November 2014; this is a campus-wide tour of labs and incubator spaces supporting research in international development. The event brought in over 25 students and faculty. In March 2015, the Team hosted a series of “Failure” events, including a Fail Salon, to encourage the sharing of experiences.

Finally, DIL has invested heavily in communications and social media. DIL issues biweekly email newsletters, a biannual "State of the Lab" report, web publications highlighting new work, and opinion pieces in high profile news outlets. In addition, researchers and students in our network have been covered in Forbes, IEEE Spectrum, Smithsonian, SciDevNet, and the BBC, among others. We disseminate these articles through social media, emails, and web.

4. Engagement of Partners and Other Actors

4.1.1. Interdisciplinary Collaboration

Interdisciplinary collaboration is at the core of DIL’s work. This is exemplified by the *Dev Eng* minor for PhD students, which offered its first course in Fall 2014. *DevEng 200*: “Design, Evaluate, and Scale Technologies” was oversubscribed from the start. The faculty members co-teaching the class (Alice Agogino, Mechanical Engineering and David Levine, Business School) reported positive feedback from participants, including suggestions for evolving the class as it moves forward. In particular, students seek more hands-on field work experience.

In Spring 2015, Agogino led a seminar course to further build community among *Dev Eng* students at UCB. In this course, students were encouraged to share their work, discuss experiences in the field, and learn from practitioners about real-world applications of technologies to poverty alleviation. The minor has the potential to inspire and equip the next generation of scientists and engineers to create integrated, sustainable solutions for communities living in poverty. But it requires commitment from a range of faculty members in different disciplines.

To this end, a *Dev Eng* Graduate Group has been formed to oversee the minor. It includes over 20 faculty across the campus. Represented disciplines include Agricultural and Resource Economics, Bioengineering, Civil & Environmental Engineering, Economics, Energy and Resources Graduate Group (ERG), Graduate School of Education, Goldman School of Public Policy, Gender & Women’s Studies, Haas School of Business, Mechanical Engineering, Studies in Engineering Science & Math Education, School of Public Health, and Architecture.

4.1.2. Partner Engagement

The portfolio of DIL innovations involves more than 100 partner organizations - from governments and nonprofit organizations to private sector firms and other universities. This has created a rich network of development actors that are directly engaged in research and development. Presenting these research projects to the public has forged new partnerships, for example with the Inter-American Development Bank, the Innovation Hangar in San Francisco, ACM-DEV 2014, and the US-India Tech Summit. Members of Mezuri team have also fostered new collaborations with industry, as a result of their research. For

example, the team is partnering with San Francisco startup [Premise Data Corp](#) and the Alameda Municipal Power to implement an extension of GridWatch.

In addition to engaging partners directly through research, DIL has taken advantage of the unique network and partnerships provided as a part of the [Global Development Lab](#) (Lab). During this reporting period, two USAID Cornerstone Partners served as Practitioners in Residence: CARE and Catholic Relief Services. We also reinstated our USAID Fellows Program, this time inviting an expert from Cornerstone Partner Microsoft to visit UC Berkeley for 2-4 weeks. James Bernard, Senior Director for Global Strategic Partnerships with Microsoft Education, served as a Fellow in March 2015. He attended several on campus events, held office hours for students, met with faculty and staff, wrote a blog piece for the DIL website, and guest lectured in *Dev Eng* courses.

4.2. Summary of Collaboration Across HESN

This year, DIL has linked with HESN peer institutions through two major activities. First and foremost, TechCon 2014 created a unique opportunity for DIL to connect HESN faculty, staff and students with international development leaders from Silicon Valley and the San Francisco Bay Area. Each HESN lab contributed to the event, in the form of panels, discussion sessions, or demonstrations. Pre-conference meetings among HESN partners took place at UCB a day before the conference.

Second, the Big Ideas@Berkeley competition was opened to campuses across the HESN in 2014-15. Categories open to the HESN network included: Global Health, Food Systems Innovation (joint with Michigan State University), Mobiles for Reading, Conflict and Development (joint with Texas A&M), and Open Data for Development (joint with William and Mary). In addition to an increase in HESN student participation, there were over 45 judges and mentors from the HESN network. DIL recently signed an MOU with Michigan State to support the 2015-16 contest collaboration; they expect to disburse up to 15 prizes to students in the Food Systems Innovation category.

Of note, Big Ideas@Berkeley and the GLD also piloted the "Blind Spots in International Development" Essay Contest, which was open to researchers and students in HESN, the RI Fellows Program, the PEER Program, and to USAID Mission Staff. This was the first ever contest which sought input from a diverse group of students, practitioners, faculty, and implementers with a range of experience and perspectives. The contest sought to identify development challenges and issues not widely recognized but are hindering programs and initiatives. For example, a community launched a new program to integrate new farming techniques for small scale farming families with a communal sales center. This new model guaranteed the community set their prices together and benefited from the increased income from the excess crops. After three years, several farms were indeed using the new techniques, producing excess crops and using the communal model to sell those crops to larger distributors. However, the net income of those families did not increase to the amount it should. Blind spot: Local laws allowed the village chiefs, and primary brokers between the farmers and the distributor, to take a percentage of the crop sales per farmer family. Despite the sound theory behind the novel farming approach, unionizing the farmers did not ensure that they were the primary beneficiaries of the newly liberated capital. First and second place winners from Duke University were recognized at TechCon 2014.

4.2.1. Data

DIL-supported research projects are beginning to generate data for sharing with the HESN community. The Collective Assessment and Feedback Engine (CAFE) project, in particular, has recently made data available to the public, as part of its pilot [Digital Report Card](#) for local governments.

Members of the DIL management team have continuously participated in the HESN Data Working Group, joining monthly conference calls, providing information about ongoing data generation, and feedback on data policies. The team has completed surveys and email requests and is committed to helping align open data requirements with the realities of university research. DIL seeks to be a leader of the development community's move toward transparency.

4.2.2. Solutions (Creation, Testing, Scaling)

In March 2015, DIL staff member Heather Lofthouse (with expertise in public health and social franchising) participated in the annual summit of the Social Entrepreneur Accelerator at Duke (SEAD). This three-day workshop is designed to provide insights and experiences that will help global health organizations in their efforts to scale. The workshop included structured peer learning sessions, 1:1 meetings with members of the SEAD team and other subject-matter experts, and facilitated workshops in areas such as strategic planning, fundraising, and monitoring and evaluation. Senior leaders from each of the 25 SEAD innovators were the main attendees. Lofthouse served as a visiting subject matter expert at the Summit and held one-on-one meetings with five of the SEAD-supported innovators in attendance.

4.2.3. Student Engagement

In previous years, Big Ideas@Berkeley was the primary means through which DIL engages students at other HESN labs. However, with USAID's support we have been able to connect our students with peers across the world. At TechCon, we invited several DIL students to showcase innovations and present research findings to a wide audience. Five students in the DIL network participated in the Innovation Marketplace, the two DIL postdoctoral fellows and a Masters student, Asim Fayaz, participated in panels throughout the weekend.

In addition, in February 2015 the HESN Communications team connected DIL with Dan Shine, formerly with USAID and now the curator of The Innovation Hangar in San Francisco, a unique social innovation space that facilitates connections, ideas and investments in a way that simply cannot happen in the virtual world. Dan invited several DIL students to showcase their work at the 100th Anniversary of the Panama Pacific Exposition in San Francisco. Three DIL graduate teams presented their research, including an online platform to facilitate public discourse (CAFE); the Gridwatch app, which maps blackouts with smart phones; and a low-cost sensor to measure the adoption of clean cookstoves.

6. Monitoring & Evaluation

6.1. M&E Updates

DIL is on track to meet its FY 2015 monitoring and evaluation (M&E) targets at fiscal year end. DIL's staff continues to actively integrate lessons into calls for grant applications, award letters, and onboarding activities for affiliated researchers. We continue to participate in monthly M&E specialist

calls with HESN labs to share knowledge and discuss shared challenges. In winter 2015 Sarah White presented DIL's internal M&E strategies and processes for data collection and reporting as well as additional activities DIL has pursued to operationalize DIL M&E data both for internal strategy and external communications. DIL has experienced minor disruptions to its existing M&E collection tools with the introduction of DevResults and continues to iterate and improve upon data collection tools and systems with each reporting round.

6.2. Deviance from M&E Targets

Not Applicable

7. Lessons Learned / Best Practices

With the support offered by USAID, DIL is building the capacity of the University of California, at Berkeley and beyond, to engage more in field work in developing countries – through institutional reform, operational trainings, and staff support. DIL has been documenting, studying and publishing on the delays, pivots, and changes in study design that are intrinsic to the research process, but are also often downplayed in place of clear successes. DIL is increasingly aware of the fact that field research requires universities to be especially flexible. DIL will continue to discuss these important nuances in public fora, including blogs, op-eds, grey literature such as self-published two-pagers, and peer-reviewed articles.

Field Delays and Pivots: Unforeseen challenges are inevitable in international development collaborations. As we bring researchers into the field, they often discover the need to change research designs or interventions. We see this as a part of the iterative innovation process. One example is a team conducting a randomized evaluation in Bangalore. Upon arriving in the field to conduct a baseline survey of beneficiaries, they realized that targeting individual households would result in unobserved community-level effects. They shifted their study design, which minor delays requiring administrative flexibility.

Research Administration Delays (e.g. IRB approvals, subawards and contracts): Necessary but time-consuming research administration sometimes delays project timelines. DIL has offered trainings and staff support to help accelerate these processes. That said, delays happen; DIL tries to exhibit flexibility to project timeline and milestone deadlines.

Operational Challenges: There is a push and pull between academic incentives and programmatic objectives. Projects that are guided only by faculty and students may struggle with the applied nature of development work. Staff scientists can help to bridge this gap, by providing the technical expertise needed to push the work along while escaping some of the academic pressures to publish.

8. Future Activities

DIL intends to undertake a critical self-assessment and forecast exercise during the next reporting period to inform future programming and, specifically, to help determine which DIL-supported projects are most likely to scale. The process will review 20 projects within the DIL portfolio, with a focus on those that have received more than \$25,000 in funding. It will also cover courses in the *Dev Eng* PhD minor, the innovator support activities, and student engagement efforts. We hope to gain new insights about projects' visions and practical trajectories for achieving social impact. The process will also begin to uncover more specific pivots and failures which the university innovation community at large can learn from to ensure more novel technologies go from lab bench to community. Candid inputs will also allow DIL staff to improve management in areas such as grant administration, partner management, student support, and innovator support to ensure that projects are accelerating the translation of their research outside of the university.

In summer 2015, DIL will embark on an intensive team retreat to reflect on years one, two and three, and thoughtfully plan for years four and five. The meeting will further foster a collective team vision and specifically serve to craft a strategy for the upcoming 2015-2016 academic year. This retreat will also be informed by outcomes of the internal self-assessment and scale forecast exercise.

9. Environmental Monitoring

The DIL completed an Initial Examination (IEE) in coordination with USAID's Bureau Environmental Officer in early 2015 and continues to work with USAID to ensure relevant and needed mitigation strategies are in place for new and ongoing work.