The Urgent Need for Evidence in Agriculture

Agriculture provides the largest source of income and jobs for the world's rural poor. The Sustainable Development Goals (SDGs) urge the international community to make the investments needed to double agricultural incomes of small-scale food producers.[1] However, current yield trends suggest a need for path-breaking innovations to come to the rain-fed areas of the world to meet this target. Astonishingly little evidence exists to rigorously inform the investments needed to meet this urgent goal.

Agricultural development is crucial not only for poverty reduction, but for many other SDGs as well. Ending hunger and improving nutrition for the hungry 13 percent of the developing world requires restructuring the agricultural value-chain: from farmers who grow food all the way to retailers who sell it to consumers. As a sector that both generates and captures carbon emissions and is uniquely susceptible to climate and extreme weather, agricultural innovations will need to address climate change through both mitigation and adaptation. DIME's agriculture portfolio produces rigorous evidence on the innovations that best address these complex and overlapping challenges.

Agriculture program

The agriculture portfolio includes 29 impact evaluations (IEs) in 17 countries across Africa, South Asia, and Latin America and the Caribbean. The evaluations focus on understudied issues relevant to agricultural policy to advance knowledge to improve productivity in the sector. The program has already generated rigorous research on how to adjust extension programs to optimize knowledge diffusion, the relationship between land rights and investment decisions, and the role of gender in technology diffusion.

Policy-driven evaluation design

DIME's research influences policy directly through intensive interaction with partners from governments and multinationals and changes the way that agriculture programs operate throughout every stage of the impact evaluation. For example, in Malawi, impact evaluation results showed that demonstrations from typical farmers were a more effective way to increase adoption of new technologies than traditional extension services. This finding prompted further tests of decentralized demonstration and "learning-by-doing" in Bangladesh and Rwanda. For an irrigation project in Mozambique, DIME developed a transparent system to identify farmers who were cultivating small areas of land and therefore likely to be poor. This allowed the project to roll out a structured selection process, improving the inclusion of poor farmers as prioritized by the project when compared to a traditional community selection process.

The agriculture portfolio is based on three main pillars:

- DIME's **programmatic approach** identifies key classes of interventions and builds complementary evaluations across country contexts. The program currently covers five knowledge gaps, which are highlighted in table 1. One example of this approach is pursuing coordinated evaluations in Mozambique and Haiti that are focused on leveraging private sector investment to stimulate commercialization of small-scale and medium-scale farmers.

[1] http://databank.worldbank.org/data/source/world-development-indicators

TABLE 1. Five knowledge gaps

Knowledge Gap	Example IE results	Active IEs in this Area
Commercialization What are the public investments needed to ensure that farmers have access to markets and receive fair prices for their products?	**Brazil:** Providing rural organizations with matching grants to invest in machinery and marketing increased farmers' likelihood of participating in commercial activities, increasing overall sales value by 86%.	Haiti, Brazil, Liberia
Financial Constraints How do financial barriers and institutional constraints prevent farmers from making profitable investments? What are the simple interventions that can overcome these constraints?	**Haiti:** A subsidy for fertilizer caused farmers' rice yields to decrease by 30%. This counterintuitive result occurred because most farmers were already purchasing fertilizer. Because subsidized fertilizer was delivered late, farmers eligible for the subsidy applied fertilizer at the wrong time and experienced lower yields than farmers who paid full price but were able to use fertilizer at the right time. In the future, the government will shift away from fertilizer subsidies and toward promotion of agroforestry.	Rwanda, Benin, Haiti, Uganda
Rural Infrastructure Are large infrastructure investments always profitable? Beyond construction, how can we ensure sustainability of investments by building effective users groups to manage infrastructure?	**Rwanda roads:** Households in remote villages are typically the poorest. These households see the largest benefits from road rehabilitation. When roads are completed, remote households' income increases more than 20%, enough to catch them up to the initially more-connected villages.	Rwanda, Mozambique, Kenya, Nepal
Information Are farmers aware of the productivity gains to be realized from adopting new technologies and methods? If not, what are the most efficient ways to help them learn about these opportunities?	**Bangladesh:** Allowing farmers to experiment with new technologies on their own farms increases adoption more than traditional technology demonstrations. The adoption gains are driven both by "learning-by-doing" and learning from others. The important role for learning by doing implies that this mechanism should be incorporated into the design of extension programs.	Bangladesh, Mozambique, Malawi, Rwanda, Nepal
Natural Resource Management How can we encourage rural communities to manage and protect natural resources such as forests, clean water, and soil, while supporting livelihoods that rely on these resources?	**Ghana:** Small payments to farmers can incentivize farmers to adopt tree crops that are costly in the short run but profitable in the long run and have environmental benefits. Payments of less than $100 can increase participation in tree-crop cultivation from 28% to 88%. Behavioral nudges are being tested to ensure that participating farmers keep their trees alive.	Ghana, Burkina Faso

- **Country partnerships** are intense sector-wide engagements covering issues ranging from extension to transport to commercialization. This enables the team to identify complementarities in inputs and market conditions that can promote the transformation of the rural economy. The partnership in Rwanda is the most mature example of this type of engagement, and the model is relatively advanced in Mozambique, where four evaluations are completed and at least two others are planned or ongoing.
- **Integrated data systems** are a core element of this research program. Through such systems, increasingly large-scale data frames link to more traditional farming household surveys, opening up new and innovative methods. This includes remote sensing and administrative data on roads, markets, land transactions, use of infrastructure, and so on, thus allowing for a broader understanding of the roles of different market forces in the process of rural transformation.

Results coming out of the program are consolidated into policy lessons targeted to a wide audience. A key goal of the process is to ensure that findings are disseminated to client governments across the portfolio, to the wider development community, as well as published in peer-reviewed journals (see table 2).

For instance, over a five-year research engagement, the government of Haiti piloted the use of vouchers to subsidize fertilizer on a large scale. A DIME impact evaluation found that this strategy was not an effective approach to improving farmers' income and productivity. Before starting a new fertilizer project, a representative of Haiti's Ministry of Agriculture attended an event in 2017 at the World Bank to discuss these findings, along with representatives from an evaluation in Mozambique, where fertilizer subsidies had yielded positive impacts, and one in Tanzania, where results had been mixed. After reflecting on these findings, Haiti decided that the next round of investments would not support fertilizer subsidies for staple crops, and instead chose to support the promotion of agroforestry practices.

DIME agriculture team

Name	Title	Areas of Focus
Florence Kondylis	Senior Economist	Program Lead
Serge Adjognon	Economist	Natural Resource Management
Paul Christian	Economist	Agriculture
Maria Jones	Survey Specialist	Data Analytics
Saahil Karpe	Research Analyst	Research Management
Astrid Zwager	Research Analyst	Research Management

Going forward

Focusing on emerging priority areas. In consultation with the World Bank Agriculture Global Practice, DIME's agriculture team has identified areas where additional research is needed. One example is understanding complementary investments in agricultural programs, particularly those related to nutrition, social protection, and climate change. An ongoing evaluation in Nepal seeks to document the role of nutrition and social protection measures in enhancing the impact of efforts to enhance agricultural productivity. Another area of expansion is around value chain development. Newly launched projects in Senegal and the Democratic Republic of Congo will focus on value-chain interventions, warehousing, and marketing as channels to translate gains in agricultural productivity into increases in income.

TABLE 2. Recent publications

Title	Findings	Country	Authors	Link to Paper
"Rural Non-farm Employment and Household Welfare: Evidence from Malawi"	Non-farm wage employment and non-farm self-employment improve welfare and reduce poverty. Targeted interventions that improve poor households' access to high-return non-farm opportunities are likely to lead to bigger successes in curbing rural poverty.	Malawi	Serge Adjognon (DIME), Saweda Liverpool-Tasie (MSU), Alejandro De La Fuente (World Bank), and Rui Benfica (IFAD)	World Bank working paper
"Agriculture Input Credit in Sub-Saharan Africa: Telling Myth from Facts"	Contrary to conventional wisdom, the paper shows that use of traditional credit, formal or informal, to acquire modern inputs is extremely low. Instead, farmers primarily finance modern input purchases with cash from nonfarm activities and crop sales.	Multiple	Serge Adjognon (DIME), Saweda Liverpool-Tasie (MSU), and Thomas Reardon (MSU)	*Food Policy*
"Revisiting the Effect of Food Aid on Conflict: A Methodological Caution"	Methods used to causally link food aid to conflict through cross- country regressions may be vulnerable to misinterpretation. Results from a seminal study arguing that food aid causes conflict in recipient countries are shown to be consistent with the opposite conclusion, that food aid reduces conflict.	Multiple	Christopher Barrett (Cornell University), Paul Christian (DIME)	World Bank working paper
"The Processes of Structural Transformation of African Agriculture and Rural Spaces"	This article provides an overview of empirical approaches that leverage new data sources to understand the process of change in livelihood strategies in rural Africa.	Multiple	Christopher Barrett (Cornell University), Paul Christian (DIME), and Abebe Shimeles (AfDB)	*World Development*
"The Structural Transformation of African Agriculture and Rural Spaces: introduction to a Special Section of *Agricultural Economics*"	This article provides an overview of a special issue on the structural transformation of African agriculture and rural spaces. The section draws on household-level microdata to explore important aspects of the salient changes taking place on the world's most agrarian and poorest continent.	Multiple	Christopher Barrett (Cornell University), Paul Christian (DIME), and Bekele Shiferaw (World Bank)	*Agricultural Economics*
"Social Learning and Communication"	Providing incentives for farmers to teach their peers is a more cost-effective method of promoting technology than traditional extension models in Malawi.	Malawi	Ariel BenYishay (College of William & Mary) and Ahmed Mushfiq Mobarak (Yale School of Management)	*Review of Economic Studies*
"Are Gender Differences in Performance Innate or Socially Mediated?"	Female village-level extension partners are just as able as men to learn and apply new information, but gender bias impedes their performance. Farmers are less likely to adopt methods advocated by the female extension workers, even though farmers who do learn from them achieve higher yields.	Malawi	Ariel BenYishay (College of William & Mary), Maria Jones (DIME), Florence Kondylis (DIME), and Ahmed Mushfiq Mobarak (Yale School of Management)	World Bank working paper
"The Distributional Consequences of Group Procurement"	Allowing groups of potential beneficiaries to choose which type of rice to purchase in their local market using subsidized public funds causes the consumption impacts to be concentrated among the wealthiest beneficiaries because communities often select high quality, expensive rice.	India	Paul Christian (DIME)	World Bank working paper
"Growing and Learning When Consumption Is Seasonal: Long-term Evidence from Tanzania"	Greater variance in childhood food consumption during childhood associated with seasonal agriculture patterns is associated with reduced height and education in adulthood. A policy that reduced consumption variability by 10 percent would have the same impact as one that increased the level of food consumption by 3 percent.	Tanzania	Paul Christian (DIME) and Brian Dillon (Cornell University)	*Demography*

Title	Findings	Country	Authors	Link to Paper
"Safety Nets and Natural Disaster Mitigation: Evidence from Cyclone Phailin in Odisha"	A rural livelihoods program mitigates reductions in household nonfood expenditure and women's consumption that result from a cyclone in rural India. Similar livelihood interventions can be a part of climate change adaptation strategy.	India	Paul Christian (DIME), Eeshani Kandpal (DECPI), Nethra Palaniswamy (World Bank), and Vijayendra Rao (DECPI)	World Bank working paper
"Water When It Counts: Reducing Scarcity through Irrigation Monitoring in Central Mozambique"	Farmers sharing irrigation infrastructure in Mozambique overuse water by following inefficient irrigation rules. Simple reminders eliminate approximately half of the observed water scarcity.	Mozambique	Paul Christian (DIME), Florence Kondylis (DIME) , Valerie Mueller (IFPRI) , Astrid Zwager (DIME), and Tobias Siegfried (Hydrosolutions Ltd.),	WB working paper
"Protecting the Environment for Love or Money? The Role of Motivation and Incentives in Shaping Demand for Payments for Environmental Services Programs"	Offering payments for environmental services can crowd out intrinsic motivation to conserve land among people with baseline pro-environment motivations in Brazil.	Brazil	Samantha De Martino (University of Sussex), Florence Kondylis (DIME), and Astrid Zwager (DIME)	*Public Finance Review*
"Formalization without Certification? Experimental Evidence on Property Rights and Investment"	The first large scale randomized control trial of a land formalization program revealed that improvement in perceived tenure security led to increased long-term agricultural investment, especially on women-owned agricultural plots.	Benin	Markus Goldstein (World Bank), Kenneth Houngbedji (Paris School of Economics), Florence Kondylis (DIME), Michael O'Sullivan (World Bank), and Harris Selod (World Bank)	*Journal of Development Economics*
"Does Feedback Matter? Evidence from Agricultural Services"	When farmers groups are offered simple systems to provide feedback to extension workers, dropout rates are cut in half and new members are more likely to sign up.	Rwanda	Maria Jones (DIME) and Florence Kondylis (DIME)	*Journal of Development Economics*
"Learning by Doing: Evidence from a Field Experiment in Bangladesh"	This study compares a traditional demonstration model to two alternative models in which the resources to cultivate a demonstration plot are instead divided among multiple farmers, who cultivate smaller experimental plots on their own farms. Self-demonstration triggers a higher rate of adoption than more traditional extension approaches.	Bangladesh	Maria Jones (DIME), Florence Kondylis (DIME), Ahmed Mushfiq Mobarak (Yale School of Management), and Daniel Stein (IDinsight)	Forthcoming
"Mental Accounting and Commitment Savings: Experimental Evidence from Rwanda"	The introduction of savings models that allow farmers to overcome issues related to timing of savings with respect to inputs leads to large, short-term increases in agricultural investment.	Rwanda	Maria Jones (DIME), Florence Kondylis (DIME), Marcela Mello (DIME), and Daniel Stein (IDinsight)	Forthcoming
"Do Female Instructors Reduce Gender Bias in Diffusion of Sustainable Land Management Techniques? Experimental Evidence From Mozambique"	Using female extension agents instead of male agents increases women's knowledge of new farming methods by 9 percent and adoption by 5 percent.	Mozambique	Florence Kondylis (DIME), Valerie Mueller (IFPRI), Glenn Sheriff (EPA), and Siyao Zhu (University of Wisconsin-Madison)	*World Development*
"Seeing is Believing? Evidence from an Extension Network Experiment"	Directly training local contact farmers to fill the role of centralized extension agents leads to large gains in information diffusion and adoption.	Mozambique	Florence Kondylis (DIME), Valerie Mueller (IFPRI), and Siyao Zhu (University of Wisconsin-Madison)	*Journal of Development Economics*
"Measuring Agricultural Knowledge and Adoption"	Standard survey modules overestimate technology adoption, compared to objective measures of knowledge and field verification of adoption.	Mozambique	Florence Kondylis (DIME), Valerie Mueller (IFPRI), and Siyao Zhu (University of Wisconsin-Madison)	*Agricultural Economics*

Note: AfDB = African Development Bank; DECPI = Development Economics Research Group – Poverty and Inequality; EPA = U.S. Environmental Protection Agency; IFAD = International Fund for Agriculture; IFPRI = International Food Policy Research Institute; MSU = Michigan State University.