Scientists Without Borders
MOBILIZING SCIENCE, IMPROVING LIVES

Dairy Data Challenge

Scientists Without Borders, in partnership with the Bill & Melinda Gates Foundation (Gates Foundation) and The Sackler Institute for Nutrition Science at the New York Academy of Sciences (Sackler Institute), is issuing this $7,500 open innovation challenge to students across the globe in an effort to understand the role of better data in advancing the human health and nutrition outcomes and economic benefits resulting from smallholder dairy farming in developing countries. ***Specifically, we are seeking bold, innovative, feasible, and scalable ideas that will leapfrog existing approaches to significantly improve the collection, reporting, aggregation, and sharing of data associated with dairy production and consumption all along the smallholder[1] dairy production value chain in, but not limited to, Sub-Saharan Africa and South Asia.***

Currently, a highly fragmented, incomplete data picture of milk production, consumption, and pricing patterns associated with smallholder farmer production undermines the ability of producers, researchers, and policymakers to comprehensively identify and implement strategies that increase dairy production, improve the quality of the milk produced, and innovate and scale successes. This challenge will allow us develop tools to better understand the role of improving data availability and sharing in increasing milk production and sales, and future studies to evaluate how to better augment at-home consumption of milk by smallholder farmers and their families, as well as their incomes and livelihood. Past studies have shown promising results in linking rising incomes to increased consumption of other nutrient-rich, animal-sourced foods.[2]

Background and Context

This challenge is the third part of a novel three-stage initiative developed by Scientists Without Borders, in partnership with the Gates Foundation and The Sackler Institute, to identify pathbreaking ideas from the intersection of animal, veterinary, and human health and nutrition science that have the potential to significantly improve maternal and child nutrition in the developing world. In spite of the many overlaps between the disciplines, they have become siloed, and this project was conceived of to surface opportunities in the discovery-development-delivery spectrum for knowledge and practices in one field to accelerate progress in the other.

In the first stage of the project, Scientists Without Borders conducted a 45-day crowdsourcing exercise on its free and open platform which solicited ideas and discussion from leaders from each of the three fields, as well as from numerous other disciplines and across sectors, to unearth promising and out-of-the-box research, collaboration, and translation ideas and pathways across animal, veterinary, and human nutrition science.

We next convened a small group of high-level global stakeholders from academia, government, NGOs, foundations, and multinational corporations to discuss the insights that emerged from

[1] Small-holder farmers - defined as those marginal and sub-marginal farm households that own or/and cultivate less than 2.0 hectare of land. Source: Food and Agricultural Organization. Smallholder farmers in India: Food Security and agricultural policy. Why the Small-Holder Farmer? http://www.fao.org/docrep/005/ac484e/ac484e04.htm

[2] Daphna K. Dror and Lindsay H. Allen. The importance of milk and other animal-source foods for children in low-income countries. Food and Nutrition Bulletin, vol. 32, no. 3, 2011.

the crowdsourcing and to collaboratively workshop and build on these and other new ideas. Through the crowdsourcing and stakeholder convening, it became clear that innovation across the dairy value chain[3] in low-resource environments in developing countries presents both a critical need and a huge opportunity.

Milk is a rich source of energy, protein, and micronutrients, and stimulates weight gain and linear-growth in childhood and adolescence.[4] Unfortunately, milk consumption (like other animal-sourced foods) is highly income elastic.[5] In low-resource settings, milk and other animal-source foods provide less than 5% of total energy intake in many countries of Sub-Saharan Africa and only 5% to 10% in most other African countries and Southern Asia.[6] Furthermore, milk production is significantly lower in the developing world: globally, the mean dairy herd size is around two cows, and unlike cows in the US which produce an average yield of nearly 50 liters per farm per day, cattle in India and Sub-Sahahan Africa provide a meager average yield of between 5 to 2 liters per farm per day (respectively).[7] Despite comparatively low production, smallholder dairy farming is a very significant source of livelihood and economic value across the globe. An estimated 12% to14% of the world population (or 750-900 million people) live on dairy farms or within dairy farming households and contribute to the production of 1 million liters of milk per year on small-scale dairy farms.[8] Improving the production and quality of milk could not only improve smallholder incomes by making more available for sale, it has also been shown to increase home consumption (and therefore nutritional outcomes) among women and children. Better studies, however, are needed to understand the impact pathways linking dairy production and consumption in vulnerable households.

In particular, a crucial gap toward improving access to milk identified through the first two stages of this project was the lack of reliable, comprehensive, or aggregated data about basic aspects of production at all levels in the dairy value chain associated with smallholder farmers. For example, current stakeholders – who range from the smallholder farmers themselves, distributors and processors, sales and distribution entities, NGOs, researchers, and policymakers - do not have a comprehensive information picture about basic milk production at the household level that would yield reliable market data across the board in the relevant geographies. This information includes:

- What is the source of the milk across relevant geographies? Cow, buffalo, goat?
- How much milk is being produced at the household level by the smallholder farmers? How much is used for at-home consumption or shared with neighbors? How much is reserved to take to market or sold?

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[3] Value Chain: A supply chain in which value is added to the product as it moves through the chain. It is described by a series of activities and actors along the supply chain, and what and where value is added in the chain for and by these activities and actors. Source: Corinna Hawkes and Marie T. Ruel. Value Chains for Nutrition. 2020 Conference Paper 4 Updated June 2011. IFPRI 2020 International Conference. http://www.ifpri.org/sites/default/files/publications/2020anhconfpaper04.pdf.

[4] Dror and Allen. The importance of milk. 2011.

[5] Ibid.

[6] Ibid.

[7] Small-scale dairy production: a way out of poverty. New study assesses global perspectives for smallholder milk production. Food and Agricultural Organization of the United Nations (FAO), http://www.fao.org/news/story/en/item/44582/. April 18, 2013 and Agricultural Development: Livestock Overview and Strategy. Bill & Melinda Gates Foundation April 2012. www.gatesfoundation.org/agriculturaldevelopment/Documents/agricultural-development-strategy-overview.pdf.

[8] Status and Prospects for Smallholder Milk Production A Global Perspective. Torsten Hemme and Joachim Otte. FAO June 2010. http://www.fao.org/docrep/012/i1522e/i1522e.pdf.

- Who is buying the milk in both the formal and informal sectors?[9]
- What is the nutritious quality of the milk produced (e.g.: the proportion of butterfat, protein, micronutrients)?

At present, this information, if collected at all, remains fragmented and highly localized. As a result, smallholder farmers, and the entities working with them, lack data that could help them increase the productivity of their animals to generate more milk for consumption and sale.

The lack of good-quality and accessible data also impedes the ability of local added-value producers who use milk produced by smallholder dairy farmers as an input, , to have a clear picture of local milk production as they develop their own business models. In extreme cases, this lack of market information about production, quality, and consumption patterns across communities and geographies can lead to pervasive market failure with milk being sold at prices that are too low, too high, or not at all. It can also result in erratic quality and production patterns at the local level.

There is similarly fragmented, unavailable, and unreliable research and policy data that would help improve the health and output of livestock and, consequently, the health of milk and milk product consumers, and the livelihood of smallholders. For example, currently smallholder farmers and researchers lack access to data on:

- Animal health, genetics, and prevalence (i.e., data about breeds, cross-breeding, average number of animals per smallholder household)
- Kind, variety, and source of fodder and feed inputs and the relationship to potential productivity of the animals
- Disease prevalence among the animals and the geographic spread of various diseases
- Relevant migratory patterns of the smallholder farmers and their animals, and the relationship of these migratory patterns to fodder, disease, output, land-titling, predation, and access to markets

Without this data, smallholders, researchers, and policymakers lack a comprehensive information picture that can aid them, respectively, in identifying, implementing, and tracking key conditions and interventions to improve animal intake and productivity, milk quality, and human nutritional intake. Nor can they effectively identify key producers and market leaders to scale effective approaches, and to determine effective and efficient resource allocation and policies.

In sum, the prevailing severe data fragmentation and gaps undermine opportunities to improve human health and nutritional intake related to dairy consumption and the economic well-being of smallholder farmers related to dairy production.

[9] Formal Sector: comprising regulated economic units and protected workers. DESA Working Paper No. 46. Martha Alter Chen. Rethinking the Informal Economy: Linkages with the Formal Economy and the Formal Regulatory Environment. July 2007. http://www.un.org/esa/desa/papers/2007/wp46_2007.pdf. and Informal sector: The informal economy refers to activities and income that are partially or fully outside government regulation, taxation, and observation. Source: The World Bank. Labor Markets. Workers in the Informal Economy. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALPROTECTION/EXTLM/0,,contentMDK:20224904~menuPK:584866~pagePK:148956~piPK:216618~theSitePK:390615,00.html

Barriers to Effective Data Collection

The data gaps and fragmentation described above are the result of a number of barriers and constraints:

- It is extremely costly to collect data from individual smallholder producers since they are dispersed across wide geographies and may be difficult to reach via connection technologies such as mobile or Internet. Data collectors must traverse expansive terrains with erratic transportation systems.
- Similarly, it is costly to adequately train individuals engaged in data collection and where there is inadequate training, there are high costs associated with human error such as not knowing how to use data collection tools.
- Even when data collectors reach smallholder producers, or if the farmers self-report, it can still be difficult to gather and process the data as a result of the absence of a common and shared platform or set of standardized, systemic, and agreed-upon, meaningful and measurable data points or metrics.

Our Challenge

Against this backdrop, it is clear that this is an area in urgent need of innovation. Lack of reliable data at the smallholder farmer and household level not only undermines the efficacy of existing interventions, but it impedes potential advances across the dairy value chain that could contribute to better animal health, human nutrition and health, and improved livelihoods for the smallholder farmers. Moreover, it also hinders efficient and effective resource allocation and policymaking that could help accelerate these improved outcomes.

Hence, Scientists Without Borders, in partnership with the Gates Foundation and The Sackler Institute is offering up to $7,500 in prize money to student solvers who provide the best:

Bold, innovative, feasible, and scalable ideas to leapfrog existing approaches and significantly improve the collection, reporting, aggregation, and sharing of data associated with dairy production and consumption all along the smallholder dairy production value chain in, but not limited to, Sub-Saharan Africa and South Asia.

We are specifically targeting students in order to access nontraditional creative minds and passionate problem-solvers and we encourage students to form teams or other models of collaboration to engage as many different perspectives as possible. Below, we offer guidance and provide criteria that solvers must address, as well as those that will be accorded a preference.

We are seeking ideas that will appropriately and successfully combine and integrate technology-based approaches and innovations with social and cultural factors, rather than focusing on any one approach in isolation. Additionally, we seek ideas that provide a clear model of sustainability - meaning an identified and measurable pathway to scale and adoption of the idea proposed - and platform or program models that are open and shared, can piggyback or integrate with existing technology or program initiatives, and that can accommodate additional functionality as needs evolve. Finally, solvers must be cognizant when proposing a solution of the resource constraints and technology limitations operating at the household or smallholder farmer level in the relevant geographies.

Criteria for Evaluation of Winning Ideas:

- A successful idea must propose a solution or approach that can be implemented or used at the smallholder farmer household level.
- A successful idea must mitigate the cost per farmer reached for data collection.
- A successful idea must propose a solution that enables the data sought to be captured at the household or smallholder level to be easily understood and input, even given varying agricultural practices, languages, degrees of education and literacy, and will provide a systematized and standard framework for the data capture and entry.[10]
- A successful idea must enable the data captured to be easily uploaded to a common or shared platform, and the platform must have the tools and capacity to aggregate and process the data and enable the variety of stakeholders to access, understand, analyze, and share it in a meaningful way.
- Where a technology tool, or suite of tools, is proposed, a successful idea must propose a solution that is open and interoperable across a variety of platforms and device interfaces and that can accommodate the development of additional functionality to capture other kinds of data or piggyback on existing tools, platforms, or interventions.
- A successful idea must propose a solution that also addresses and considers users (particularly smallholder farmers') incentives to adopt the tools or approaches proposed, their price sensitivity or other potential barriers to adoption, and should creatively approach incentives for communities and target populations to avail themselves of the innovation (e.g., gamification, community organizing, peer-to-peer spread).

Additional Considerations

- A successful idea must propose a solution that has the capacity to capture regional and national data. In other words, the idea proposed will not simply focus on a micro picture of household or smallholder farmer data, but will describe mechanisms to provide a macro picture across regions and geographies. In this same vein, a successful idea will be able to integrate and accommodate inclusion of existing data sets that stakeholders may wish to include.[11]
- A successful idea will also consider and address constraints of access to and reliability of mobile and other connection technologies.
- A successful idea will propose a solution that opens up and enables channels of communication and information exchange between smallholder dairy farmers, researchers, and policymakers across geographies.

[10] Examples of data to be captured at the household level, or by smallholder farmers includes, but need not be limited to, geographic location, migration pattern, species and breed of animal, cross-breeding information, health of the animals, fodder, seasonal information such as weather, inputs, or migration patterns, quantity and quality of milk produced, quality and quantity of milk consumed at the household level, quantity and quality of milk sold, milking time of day, container and storage practices, transport to market, price at market.

[11] Examples of existing data sets that might be relevant include International Livestock Research Institute, the Food and Agriculture Organization of the UN, G8's Platform for Agricultural Risk Management, and the Zanzibar Livestock Report.