

A Global Value Chain of Knowledge to End Hunger Sustainably

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Societies endure based on their ability to protect their populations' well-being, especially by keeping them free from hunger, disease, and war. In September 2015, the UN member states adopted the 2030 Agenda for Sustainable Development, with 17 ambitious Sustainable Development Goals, commonly known as the SDGs (UN General Assembly, 2015). The SDG agenda is complex and integrated. It is an aspirational view of future societies that are able to secure a decent life for everyone on a thriving planet. Crises such as the COVID-19 pandemic test this vision. To emerge successfully from a crisis, societies need the capacity to address the short-term health and economic challenges posed by COVID-19 while continuing to prepare for slower-acting challenges (such as climate change) and continuing to build toward the 2030 Agenda. The COVID-19 pandemic has been an abrupt and painful reminder that crises are an ever-present hazard. If anything, however, COVID-19 underlines only more clearly the necessity of realizing the aspirations of the SDGs. Both the disease itself and the measures taken by governments to contain it have shone a stark light on the deep existing inequalities among and within societies. Those inequalities pose significant barriers to achieving sustainable development. This is an introduction to the research tools that can be used by governments and donors to decide how much and where to spend scarce resources to solve the multiple and complex global challenges to sustainable development.

In the first years since the UN adopted the SDGs, governments have focused on translating the 2030 Agenda into national strategies, setting out policies and programs to achieve these strategies, and developing indicators to monitor progress.¹ A significant gap in governments' ability to implement the SDGs is a lack of tools to assess options and trade-offs and to consider different possible sets of interventions to achieve their goals (Machingura & Lally, 2017). Now the pandemic has sharpened the challenge, reminding decision-makers that they cannot focus just on 2030 because COVID-19 and its consequences have put the significant recent gains in human development in jeopardy. Those gains need to be

¹ The UN has a website for the national voluntary review database, available here <https://sustainabledevelopment.un.org/vnrs/>

protected even as governments continue to make the necessary investments to meet the goals set for 10 years hence. To protect and restore while promoting positive change demands a framework that allows governments to draw on the best available evidence and to evaluate the necessary trade-offs to achieve a good outcome among competing priorities.

The UN 2030 Agenda commits governments to evidence-based decision-making (UN General Assembly, 2015). This approach requires efforts to find and catalogue the evidence, then developing methods to analyze and synthesize it. It also means understanding the feasibility of whichever interventions the government identifies, taking into account the policy landscape in which the decision-maker operates. Policy interventions require political support among competing interests in the context of meeting both short- and long-term objectives.

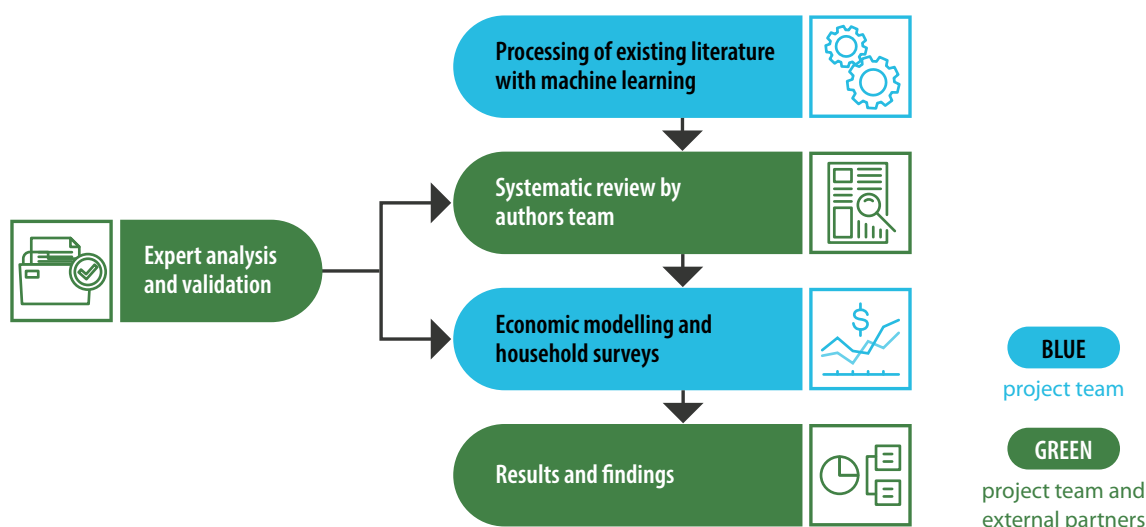
Motivated by the need to support tools for evidence-based policy-making, three partner organizations—Cornell University, the International Food Policy Research Institute (IFPRI) and the International Institute for Sustainable Development (IISD)—formed a three-year partnership in 2018 called Ceres2030: Sustainable Solutions to End Hunger. The project is designed to support global development donors to increase the amount and improve the efficacy of their investment of public funds in improving food security and sustainability outcomes. The primary focus is on SDG 2. The project addresses two linked questions:

1. What will it cost to end hunger sustainably as defined by SDG 2?
2. What are the most effective public interventions to end hunger sustainably based on the available evidence?

A series of sub-goals in SDG 2 define what ending hunger means: an end to calorie deficits, improved nutritional status, doubling the productivity of small-scale food producers, and reducing the burden food systems place on the environment, including biological diversity (UN General Assembly, 2015). SDG 2 is a comprehensive statement about food systems and the importance of understanding food security and nutrition in a systems framework (High Level Panel of Experts on Food Security and Nutrition, 2017).

The project team has developed tools for researchers, donors, and policy-makers to use when they allocate public resources to interventions designed to achieve complex goals. The two primary tools consist of an economic cost model and a method for evidence reviews that uses expert knowledge and artificial intelligence to synthesize a large body of published evidence. In addition, members of the project team are in dialogue with decision-makers, official development assistance donors, and experts engaged in evidence gathering and analysis who work in academia and intergovernmental organizations. The team has likened the result to a global value chain of knowledge: the project is systematically finding, agglomerating, and refining evidence. By gathering, processing, and synthesizing knowledge with an interdisciplinary focus, validating it through formal practices (in particular evidence synthesis and peer review), and then applying that knowledge in the context of an economic model, the project adds value along a process that ultimately ensures the result is relevant to decision-makers (see Figure 1). The value chain is global in scope because it uses data and expertise from around the world, including in the composition of evidence synthesis. The results offer a global estimate of the public investment needed to make the SDG 2 goals a reality.

FIGURE 1. THE GLOBAL VALUE CHAIN OF KNOWLEDGE



As the project prepares its findings for public release later in 2020, there are three essential lessons the team has derived from the work to date.

1. THE RELEVANCE OF RESEARCH TO POLICY INCREASES BY KNOWING THE COST OF AN INTERVENTION, UPFRONT AND OVER ITS LIFETIME.

There is fierce competition for public funds in the wake of the COVID-19 pandemic, which has made vast demands on government budgets. The scale of the economic recession triggered by the measures taken to limit the spread of the disease is still only being guessed at, but it will be huge—and global (World Bank, 2020). Inevitably, this will affect how much public money will be available to invest in the UN 2030 Agenda. Given there was not enough being invested in the SDGs even before the advent of COVID-19, making decisions about where to direct public spending now more than ever requires information on costs, target populations, and the likely effectiveness and interactions of possible sets of interventions. Economic cost models demonstrate the relationships among interventions along with their combined effects. They can also forecast their effects over time.

The economic model assumes an omniscient decision-maker who must spend all available money (but not a penny more). In the dynamic computable general equilibrium (CGE) model used by the Ceres2030 team, spending is calculated in three dimensions: i) geographical space, with a focus on 11 developing countries; ii) time, looking at the decade 2020–2030; and, iii) a set of 20 interventions, chosen for their effectiveness in realizing SDG 2 and its sub-goals. Of course, real-life decision-makers are not omnipotent—but neither are they helpless. They can create economic incentives, for example introducing a stimulus package to help a faltering economy, paying for public goods, or redistributing income and endowments. The economic model generates an idea of how much money the decision-maker needs to invest and which set of policy interventions offers maximum benefit.

The economic model uses household surveys to form a disaggregated picture of how to allocate public funds most efficiently. In the Ceres2030 project, this data is complemented with peer-reviewed evidence syntheses. The eight synthesis teams, which together comprised over 70 researchers and librarians from around the globe, developed data-

gathering templates with the economic modellers so as to harmonize the evidence captured during the evidence synthesis for integration into the model's equations.

This approach of integrating evidence synthesis into cost assessments is an important contribution to policies intended to support the development of agricultural and food systems. However, the information available in academic literature on the effectiveness of agricultural interventions and their costs is limited. This was one of the shared findings of the eight global interdisciplinary research teams: The researchers looked at more than 100,000 papers culled from major scholarly databases and agency and organizational repositories but found fewer than 3,000 papers had original data that could support the authors' analysis.


Call to action: Researchers should present evidence of costs of specific interventions to increase their relevance to decision-makers. The finding is a wake-up call for the research community. Documenting the costs of interventions provides an important perspective on their usefulness and enables modellers to use the research to estimate the cost of a set of policy interventions.

2. TO SOLVE COMPLEX PROBLEMS, USE RIGOROUS INTERDISCIPLINARY RESEARCH METHODS AND COLLABORATION.

Interdisciplinary research study allows for the synthesis of ideas and findings from diverse sources. Each SDG touches on a series of complex systemic issues, none of which is rooted in a single academic domain. Food insecurity, for instance, cannot be solved by increased food production alone; the problem has deep roots in economic and social exclusion, including poverty and gender discrimination (Kumar & Quisumbing, 2013; Maxwell, 1996). It is also linked to natural resource depletion, climate shocks, and conflict (FAO, 2017). Solutions to such complex problems require practitioners to work with researchers with expertise from across many disciplines.

Universities and donor agencies seek to catalyze interdisciplinary research through the use of multi-million dollar research grants for collaborative work. A 2017 survey of 3,500 policy-makers in 26 countries made clear that demand exists: the survey results showed that decision-makers wanted more evidence gap maps and systematic reviews because they valued these tools for their ability to synthesize global knowledge from relevant disciplines while offering context-specific solutions (Masaki et al., 2017). However, although the benefits are widely acknowledged, relatively few processes exist to encourage more interdisciplinary collaboration. Importantly, it takes thought and planning to ensure an independent and productive interdisciplinary outcome.

Ceres2030 pioneered such a process for food systems research. Using a common methodological blueprint, the teams' first task was to create a model protocol that set out the kind of evidence synthesis a team looking at agricultural interventions might attempt (some of the different kinds are systematic reviews, scoping reviews, evidence gap maps, and meta-analyses). They created and piloted the use of an *a priori* generic protocol (Porciello & Ghezzi-Kopel, 2020). The novelty lay in finding a way to include the variety of disciplines that generate knowledge for agriculture. The generic template was based on the international PRISMA-P protocols that have long been in use in health and medicine (Moher et al., 2009). Each team then developed its own specific protocol that included the team's research question (and any sub-questions) and explained the rationale behind the question. The protocol also sets out common definitions, the study design, and the decision-making criteria for which articles will be included in the study. The protocol is a stand-alone document that is published and made publicly available on a designated website before the research begins. The method is intended to limit bias, maximize transparency, and ensure replicability in the retrieval and review of data (Gurevitch et al., 2018).



Involving an independent peer-reviewed journal created an important level of quality assurance for the project products. By working with *Nature* journals, the project created a bridge between academic publishers and researchers, on the one hand, and the world of policy-makers on the other. The result is a contribution to policy-relevant research that offers decision-makers new, relevant, and high-quality content.

Call to action: Scientific publishers and funding agencies have already expressed their desire for interdisciplinary policy-relevant research. Protocols proved highly effective in the research conducted as part of the Ceres2030 process. They increased the transparency of research and were a low-cost and effective way to construct effective interdisciplinary research teams. They should be considered in more research settings.

3. ADVANCED AND ROBUST TOOLS ARE NEEDED TO SUPPORT EVIDENCE-BASED DECISION-MAKING.

One of the challenges of evidence-based decision-making is how best to use so-called “grey literature.” Grey literature is a term used to refer to publications that are not published by established commercial or academic publishers. It covers a wide range of literature, including agency and organization reports that provide crucial evidence for policy-makers—crucial because they are accessible, timely, and reactive. Yet there are few aggregators of grey literature of the kind that exist for scientific journals, such as Scopus or Web of Science. Existing aggregators do not index most grey literature because the grey literature does not have the metadata indexing systems that the aggregators depend on. Without these features, it becomes prohibitively time-consuming to bring together large summaries from grey literature repositories to use in evidence synthesis.

The Ceres2030 team addressed this challenge by using computer science and machine-learning to increase the comprehensiveness of what the research teams could examine in their reviews. Data scientists performed web-scraping from nearly 50 agency websites so as to provide the research teams with a summary version of the available grey literature to include in their evidence syntheses. This expanded the total dataset by more than 25% compared to looking just at scientific journals. It also has the benefit of including in the results some of the literature most relied upon by decision-makers.

The project team designed a machine-learning model that could perform repetitive tasks, such as the classification of thousands of text-based materials quickly and accurately (Porciello et al 2020, forthcoming; Gil et al., 2014). A powerful attribute of machine-learning is its ability to synthesize and create an analytical framework that can bring together information independent of its institutional home. This process saved researchers valuable time overall; the average evidence synthesis takes between 18 and 36 months to complete (Haddaway & Westgate, 2019). Our global and distributed teams completed their reviews in less than one year.

Call to action: Agencies should update their platform with simple features to make the inclusion of their research more accessible to researchers. Donors in research and development should prioritize funding models and tools that facilitate the collection and inclusion of grey literature and research that can be integrated with existing commercial platforms so as to provide communities with timely and valuable data and analysis.

CONCLUSIONS

The Ceres2030 project came about at a unique moment in time. The project was designed to increase donors' understanding of the costs and opportunities available to them to support the realization of the SDGs. The Ceres2030 team was not funded to do blue-sky research, yet the team was given a blue-sky goal, coupled with an unusual level of access to a highly political process. We were forced to think concretely about how to operationalize the project, working with existing processes and tools, and how to situate ourselves in a large and complex space. Innovating along the way has both delivered on an ambitious project agenda and pushed the boundaries of how multi-institutional interdisciplinary teams can work with evidence and modelling to inform the public policy debate. Just as Ceres2030 benefited enormously from a range of data scientists, academic researchers, economic modellers, and public policy experts, so too will the iterations to come find themselves on a still stronger foundation.

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Ceres2030
Sustainable Solutions to End Hunger



ABOUT CERES2030

Ceres2030 brings together three institutions who share a common vision: a world without hunger, where small-scale producers enjoy greater agricultural incomes and productivity, in a way that supports sustainable food systems. Our mission is to provide the donor community with a menu of policy options for directing their investments, backed by the best available evidence and economic models.

The partnership brings together Cornell University, the International Food Policy Research Institute (IFPRI) and the International Institute for Sustainable Development (IISD). Funding support comes from Germany's Federal Ministry of Economic Cooperation and Development (BMZ) and the Bill & Melinda Gates Foundation (BMGF).

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