



INTERNATIONAL  
FOOD POLICY  
RESEARCH  
INSTITUTE

IFPRI

AUGUST 2025

**INDEPENDENT IMPACT ASSESSMENT REPORT No. 47**

**FINAL REPORT**

# **External Assessment of Outcomes from IFPRI's Causal Impact Evaluation Research 2012–2022**

**Sarah K. Lowder <sup>1</sup>**

---

<sup>1</sup> sarahklowder@gmail.com



---

## TABLE OF CONTENTS

<b>Acknowledgments</b> .....	<b>v</b>
<b>Acronyms and Abbreviations</b> .....	<b>vi</b>
<b>Introduction</b> .....	<b>1</b>
<b>Previous Assessments</b> .....	<b>2</b>
<b>Citations Analysis</b> .....	<b>5</b>
<b>Interviews of IFPRI Staff and External Stakeholders</b> .....	<b>6</b>
<b>Impact Evaluations for Which Outcomes Were Observed</b> .....	<b>8</b>
Agriculture.....	8
Bt Brinjal in Bangladesh Impact Assessment.....	8
Cereal Systems Initiative for South Asia—Laser Land Levelling Project (India) ...	8
Tilapia Seed Project in Ghana .....	9
Developing Local Extension Capacity in Ethiopia and Uganda .....	10
Impact Evaluation of Picture-Based Insurance (India, Kenya, Ethiopia, and Bolivia).....	11
Risk-Contingent Credit Product in Kenya .....	12
Enhancing Agency and Empowerment in Agricultural Development Projects: A Synthesis of Mixed Methods Impact Evaluations from the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2) (9 countries in South Asia and sub-Saharan Africa).....	13
Agriculture and Nutrition .....	13
The Agriculture, Nutrition and Gender Linkages (ANGEL) Project in Bangladesh .....	13
HarvestPlus Reaching End Users (REU) (Uganda and Mozambique) .....	15
Nutrition .....	16
Assessing the Feasibility of Integrating Maternal Nutrition Interventions into an Existing Maternal, Newborn, and Child Health Platform in Bangladesh .....	16
Innovative Approaches for the Prevention of Childhood Malnutrition (PROMIS) (West Africa) .....	17

Mitigating Aflatoxin Exposure to Improve Children’s Growth in Eastern Kenya ..	18
More Milk Project in Kenya .....	19
Preventing Malnutrition in Children under Two Years of Age (PM2A) in Guatemala and Burundi.....	20
Governance .....	21
The Baraza Program Impact Evaluation in Uganda.....	21
Social Protection .....	23
Strengthen Productive Safety Net Program Institutions and Resilience (SPIR) in Ethiopia .....	23
Takaful Impact Evaluation in Egypt.....	24
Transfer Modality Research Initiative (TMRI) in Bangladesh.....	24
Using Preschools as Platforms for Behaviour Change in Malawi to Improve Diets and Nutrition Outcomes (NEEPIE) .....	25
<b>Impact Evaluations for Which No Outcomes Have Yet Been Identified .....</b>	<b>26</b>
Agriculture.....	26
Africa Research in Sustainable Intensification for the Next Generation (Africa RISING).....	26
Digital Innovation in Uganda.....	27
Exporting Fomento to Africa (Malawi and Senegal).....	27
Farm and Family Balance Project in Uganda .....	27
Impacts of Solar-Powered Cold Storage in Nigeria .....	28
Soutenir l’Exploitation Familiale pour Lancer l’Élevage des Volailles et Valoriser l’Économie Rurale (SELEVER) Phase I in Burkina Faso (Agriculture)—Evaluation of the Project on Women’s Empowerment.....	28
Nutrition .....	29
Enhancing Gender and Nutrition Impacts in the Agricultural Development Support Project in Myanmar.....	29
Evaluation of the WINGS Project in India .....	29
<b>Conclusions.....</b>	<b>30</b>

<b>References .....</b>	<b>33</b>
<b>Appendix A: Terms of Reference .....</b>	<b>36</b>
<b>Appendix B: Impact Evaluations Conducted by IFPRI.....</b>	<b>38</b>
<b>Appendix C: Interview of IFPRI Staff Working on Impact Evaluations .....</b>	<b>46</b>
<b>Appendix D: Interview of Stakeholders Outside of IFPRI .....</b>	<b>49</b>
<b>Appendix E: Persons Interviewed or Responding to Questionnaire .....</b>	<b>51</b>

## ACKNOWLEDGMENTS

This work was undertaken from April 2024 through August 2024. Although the review is independent, the assistance of IFPRI staff is gratefully acknowledged. The author would like to thank Frank Place, Alan de Brauw, and Indira Yerramareddy as well as other IFPRI staff for suggestions and data for this paper. Also gratefully acknowledged are all interviewees (both IFPRI staff and external stakeholders) as well as questionnaire respondents for providing their time and insights.

## ACRONYMS AND ABBREVIATIONS

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
BCC	Behavior change communication
BMGF	Bill & Melinda Gates Foundation
CIAT	International Center for Tropical Agriculture
CIE	Causal impact evaluation
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
DFID	United Kingdom Department for International Development
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FCDO	United Kingdom Foreign, Commonwealth and Development Office
HKI	Helen Keller International
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
NGO	Nongovernmental organization
RCT	Randomized controlled trial
TOR	Terms of reference
USAID	United States Agency for International Development

## INTRODUCTION

This report describes methods and findings from an assessment of the International Food Policy Research Institute’s (IFPRI) causal impact evaluation (CIE) research over the period 2012–2022. CIE research is recognized within IFPRI as one of its primary means for contributing to informed policy and program decisions and thus forms a key part of one of its impact pathways. Appendix A contains the terms of reference (TOR) for the study. The main goal was to examine how the outputs of this research were used by stakeholders to make decisions. Many of the impact evaluations considered were conducted in partnership with donors and implementing organizations eager to know the effectiveness of their programs and interventions.

CIE refers to a class of methods that attempt to understand causality by explicitly quantifying the outcomes of policies, programs, or other interventions against a counterfactual. Ideally, a CIE is designed at the same time as the policy, program, or intervention—that is, before changes in outcomes occur (a prospective design)—so the counterfactual can be created through randomized assignment. Where feasible, a randomized controlled trial (RCT) is used, but IFPRI researchers have also conducted quasi-experimental evaluations. A main challenge to the latter type of CIE is in demonstrating that results should be considered causal. Nonetheless, whether an RCT or a quasi-experimental evaluation, well designed CIEs can help promote various types of learning including, most importantly, about the most cost-effective ways to move products or programs to scale.

This report represents the first comprehensive assessment of outcomes from nearly all of IFPRI’s 2012–2022 impact evaluations for projects related to agriculture and/or nutrition, social protection, and governance. For the purposes of this study, an outcome is defined as “a change in knowledge, skills, attitudes and/or relationships, manifest as a change in behavior, to which research outputs and related activities have contributed” (CGIAR MELCoP 2018). Outcomes from policy-oriented research are often changes in strategies, policies, programs, or investments. The recognition or use of outputs by partners in decision-making or capacity strengthening can also be considered an outcome.

Outcomes can be designated as early or mature. An “early outcome” is defined as an initial use of research work by decision-makers to consider the strategy or policies of their government or organization. For instance, in Bangladesh the government and the World Bank considered funding continuation of the ANGEL project, but changes in administration and management, coupled with changing priorities due to the COVID-19 pandemic, prevented it. Changes in administration or senior management often prevent

“mature outcomes,” ones that show evidence of actual implementation of a change in strategy, policy, or other decision as a result of using such research.

This study used a variety of methods, including: (1) analysis of downloads and citations of references; and (2) analysis of existing outcomes from IFPRI’s CIEs, identified through (a) interviews of researchers engaged in the evaluations, and (b) stakeholders participating in or learning from the evaluations. More specifically, the methods used included:

- ▶ Desk reviews of IFPRI’s CIE outputs (see Appendix B).
- ▶ Reviews of reports of outcomes from such evaluations (reports are frequently made to funders and to CGIAR).
- ▶ Bibliometric analysis of impact assessment publications and datasets.
- ▶ Interviews with select IFPRI staff and other external stakeholders.
- ▶ Use of analytical tools to trace the influence of research recommendations on decisions taken in relation to policies, programs, investments, and other actions.

The report proceeds as follows. First, it describes previous assessments of IFPRI’s work. Next, it presents the results of a bibliometric citation analysis using Altmetric and Google Scholar citation searches for references detailing IFPRI’s impact evaluations. The report then describes outcomes identified by IFPRI staff involved with the impact evaluation; in some instances, the staff interview is complemented by an interview with an external stakeholder. These are supplemented by a few outcome stories taken from IFPRI reports or presentations. It concludes with some general findings.

## PREVIOUS ASSESSMENTS

Numerous assessments have considered outcomes resulting from IFPRI’s work, but not its CIEs specifically. Assessments have considered the impact of IFPRI’s policy research generally or of specific types of research conducted by the organization. For instance, Hazell and Slade (2016) evaluate the impact of IFPRI’s policy research from 1995 to 2015; their work includes a mixture of citations analysis and interviews of key researchers as well as stakeholders. Works by Lowder and Regmi (2020) and Lowder (2018a, 2018b) use similar methods to examine the impact of specific research programs (Foresight modeling, SPEED, and ASTI<sup>2</sup>). An evaluation by Pardey and

---

<sup>2</sup> SPEED stands for Statistics on Public Expenditures for Economic Development, a collection of annual national-level expenditure data, which IFPRI regularly updates for use by researchers and policy analysts. ASTI stands for Agriculture Science and Technology Indicators, covering human resources and investment in national agricultural research systems. Outputs included data and analyses of those data.

Christian (2002) presents detailed information on IFPRI's impact measured using bibliometric information only. These previous evaluations helped to inform the methods used in this study. The methods were also adjusted to be more relevant to the questions posed in the TOR for this assignment.

There is likewise a history behind IFPRI's use of Causal Impact Evaluations; here we describe that history as related to research on nutrition.<sup>3</sup> In the 1980s and through the mid-1990s, IFPRI did not conduct what are now considered CIEs. In the late 1990s this changed: IFPRI's research on nutrition—including evaluation of nutrition programs and of the impacts of agriculture or other development investments (for example, social protection programs) on a range of development outcomes (including poverty, food security, income, productivity, child malnutrition, and women's empowerment)—broadened to include RCTs. Nutritionists led some of the RCTs but multidisciplinary teams were also created to run large multisectoral RCTs (for example, to evaluate the PROGRESA social protection program in Mexico), bringing together IFPRI economists, sociologists, gender specialists, and nutritionists. The RCT skills of IFPRI's nutritionists nicely complemented the economic modeling skills of its economists and RCTs became the preferred rigorous evaluation design used by researchers in IFPRI's Poverty, Health, and Nutrition Division. The use of RCT methodology specifically but impact evaluation more broadly then spread to IFPRI's other research divisions, following the adoption of RCTs as a main method of analysis in development economics and agricultural economics that began in the early 2000s.

One example of an RCT led by IFPRI nutritionists in the early 2000s is the evaluation mandated by the United States Agency for International Development's (USAID) Food For Peace program to determine whether blanket targeting of food aid to all children 6–24 months of age (prevention) was more effective at reducing child undernutrition than providing food aid to children once they have been identified as being malnourished (treatment). IFPRI's RCT showed that prevention was better than treatment to reduce community-level child malnutrition; the paper was published in the *Lancet* (Ruel, Menon, and Habicht 2008) as a complementary paper to the first Maternal and Child Undernutrition Series (2008), which highlighted the importance of preventing child undernutrition early in life. These results—combined with other new evidence of the importance of targeting mothers and children during the first 1,000 days—were incorporated in USAID's new Multisectoral Nutrition Strategy 2014–2025. This work also informed USAID's call for proposals for additional research on designing and shaping

---

<sup>3</sup> This section draws largely from a conversation with an IFPRI staff member, a former head of IFPRI's Poverty, Health, and Nutrition division.

food aid programs to maximize their cost-effectiveness, which IFPRI was selected to carry out (PM2A research project).

In addition to demonstrating the need to emphasize the prevention of malnutrition, IFPRI's CIEs of nutrition-related projects have influenced the global debate in other ways. For instance, work by Ruel and Alderman (2013) introduced an operational definition and guidance on the design and evaluation of nutrition-sensitive programming to the global nutrition community (paper #3 of the second Lancet Maternal and Child Undernutrition Series 2013). IFPRI built a strong portfolio of evaluation research (using CIEs) on a variety of nutrition-sensitive programs in health, social protection, education, and agriculture. Based partly on the results of this work, members of the IFPRI nutrition team contributed to publication of a paper in the Lancet Series on the Double Burden of Malnutrition that proposed the use of "double duty actions" to address the multiple burdens of malnutrition (for example, the coexistence of undernutrition and overnutrition in the same individual, household, community, country), a new reality for most low-income countries today (Hawkes et al. 2020).

## CITATIONS ANALYSIS

This assessment identified 81 projects related to agriculture, social protection, or nutrition carried out by IFPRI from 2012 to 2022 for which an impact evaluation was undertaken (Appendix B). A total of 244 publications related to those projects were identified.

Google Scholar helped our understanding of how references were used by the academic community. This website provided information on citations for 235 of the publications; the most widely cited references were publications in scholarly journals. Forty-five of the publications had more than 50 citations; of these, all except one were external publications in scholarly journals. The articles published by IFPRI in scholarly journals were far more widely cited than its internal publications (project notes, discussion papers, etc.): scholarly journal articles averaged 55 citations, with a median of 22 and a maximum of 567 citations on Google Scholar, whereas internal publications had an average of 7 citations, with a median of 3 and a maximum of 53 citations.

**Table 1: Citation statistics for IFPRI’s internal and external publications, 2012–2022**

Publication type	Number of citations			
	Mean	Median	Min	Max
IFPRI internal publication	7	3	0	53
External publication (e.g., journal article)	55	22	0	567

Source: Google Scholar.

The 10 most widely cited studies (cited more than 200 times, according to Google Scholar) are articles appearing in top scholarly journals. Two were published in *World Development*, two in *Economic Development and Cultural Change*, and two in the *Journal of Development Studies*. One article was published in each of the following journals: the *Journal of Development Economics*, the *Journal of Nutrition*, the *American Economic Journal: Applied Economics*, and the *British Journal of Nutrition*.

## INTERVIEWS OF IFPRI STAFF AND EXTERNAL STAKEHOLDERS

This report considers 72 impact evaluations conducted by IFPRI staff from 2012 onward. Those impact evaluations were led by 36 different IFPRI staff members, each of whom led at least one impact evaluation. Each of the CIE lead scientists was contacted for an interview or asked to fill out a survey. In addition, a former head of the IFPRI Poverty, Health, and Nutrition division for many years was interviewed.

From May to early July 2024, IFPRI documents were reviewed and interviews conducted with lead authors of IFPRI's impact evaluations related to agriculture, nutrition, agriculture and nutrition (combined), social protection, and governance. A list of questions for interviews was developed based upon previous evaluations as well as the TOR for this assignment and consultation with IFPRI staff; the questions aim to help identify outcomes attributable to IFPRI impact assessments. Appendix C contains the list of questions for IFPRI staff. A key question concerned their recommendations of external stakeholders who might provide information on outcomes related to the impact evaluation. Those persons identified were interviewed when possible, using questions listed in Appendix D. Appendix E provides the complete list of persons interviewed.

Staff members were asked to focus on the project they felt had the most significant outcome and also, if relevant, to consider more briefly a project for which they did not observe an outcome. Emails were sent to all IFPRI staff requesting that they undergo an interview or fill out a questionnaire. As a result, information was obtained for 27 projects from 20 of the project lead staff (10 video interviews were conducted and 10 questionnaires were received). Interviews were likewise conducted with external partners who were able to validate the information for nine projects.

The results of consultations (interviews and questionnaires) as well as the review of documents related to the selected project for each staff member are summarized below. The interviews and questionnaires identified the partners involved in each project, a brief description of the impact evaluation and methods used, the project's contribution to the global debate, how it involved local stakeholders, and what outcomes may be at least partly attributed to it.

The majority of the 27 CIEs considered have led to identifiable outcomes (Table 2). Nineteen mature outcomes were identified for 12 of the projects; some of these 12 projects also led to early outcomes, but those are not reported here. Typical outcomes included national government or donors (often the Bill & Melinda Gates Foundation [BMGF] or the World Bank) upscaling projects or funding a second phase. An additional five projects had early but not mature outcomes.

No outcomes were observed for eight projects, attributed by interviewees to one or more of the following:

- ▶ The impact evaluation concluded too recently to expect outcomes
- ▶ The results of the impact evaluation were null
- ▶ The national government was little involved
- ▶ Administration of the national government changed
- ▶ Key ministers changed
- ▶ Political factors intervened
- ▶ Management of partner organizations changed
- ▶ An unforeseen shock occurred, such as the COVID-19 pandemic.

**Table 2: Outcomes from 27 of IFPRI’s CIEs by outcome type and stakeholder to which the outcome is attributed**

Stakeholder	Early outcome (5 projects)	Mature outcome (14 projects)	No outcome observed (8 projects)
Government	3	6	NA
Government and donor	1	1	NA
Donor	0	7	NA
NGO	0	4	NA
Private sector	0	1	NA
CGIAR	1	0	NA
IFPRI	0	1	NA
<b>Total</b>	<b>5</b>	<b>20</b>	<b>8</b>

The rest of this report summarizes the results of the consultations.

# IMPACT EVALUATIONS FOR WHICH OUTCOMES WERE OBSERVED

## Agriculture

### *Bt Brinjal in Bangladesh Impact Assessment*

A grant from the USAID funded Cornell University and the Bangladesh Agricultural Research Institute's development of Bt brinjal, a genetically modified (GM) eggplant resistant to the fruit and shoot borer (FSB) pest. USAID asked IFPRI to conduct the evaluation. The eggplant showed good results for farmers who adopted it and the government did consider the results of IFPRI's impact evaluation (early outcome). The brinjal was not taken up by farmers at a large scale because the government did not provide the GM seed. The Minister of Agriculture was interested at the time, but was replaced by a new Minister. Furthermore, widespread adoption was discouraged by anti-GMO and pesticide companies, which lobbied against its uptake.

### *Cereal Systems Initiative for South Asia—Laser Land Levelling Project (India)*

The evaluation of laser land levelling (LLL) in eastern Uttar Pradesh (UP) (part of the Cereal Systems Initiative for South Asia [CSISA]) gained much attention. CSISA, established in 2009, is currently led by the [International Maize and Wheat Improvement Center \(CIMMYT\)](#) and implemented jointly with [IFPRI](#), the [International Rice Research Institute \(IRRI\)](#), and other CGIAR centers. CSISA works to increase the adoption of resource-conserving technologies and practices by farmers in the rice-wheat system of the Indo-Gangetic plain, and supports the research priorities of the national agricultural research systems in Bangladesh, India, and Nepal. The market for LLL, a precursor technology for minimum tillage production systems, was the subject of a field experiment led by IFPRI and set up in 2011. The experiment aimed to assess the willingness to pay for and impact of LLL, including low-till agriculture. Results, measured in terms of water savings and irrigation cost savings, were consistent with findings from research station trials, although they also showed that adoption at scale among small-scale, resource-poor farmers would require significant levels of public subsidies or other price interventions to reduce the costs of custom hiring of LLL services.

Publications in high-profile scholarly journals resulted from the work and much of the attention paid to it was both topical and methodological. The experiment combined a binding auction to assess willingness to pay with an RCT (a “selective trial”); the experimental design and participant survey also allowed for causal evaluation of social network effects on adoption. The experiment was conducted in consultation with CSISA staff on the ground, including CSISA hub staff in eastern UP, and the study results were

shared with a wide range of partners, including the Agriculture Departments of the Governments of UP and Bihar, the Indian Council for Agricultural Research, and research and extension centers (KVKs) in the study locality. The research design and findings were also shared with Jawaharlal Nehru University, 3ie, and the Indian Statistical Institute, with staff, faculty, and students providing feedback via research seminars. In terms of (early) policy impact, CIMMYT and IFPRI used the findings to advocate for support (including subsidies) from state authorities for resource-saving technologies such as LLL. Policy engagement on these topics continues as part of CSISA, as does the growth of markets for other resource-saving technologies, products, and services in the CSISA program area.

### ***Tilapia Seed Project in Ghana***

Evaluation of a tilapia seed project in Ghana assessed the impact of aquaculture training on farmers' productivity and income, the result of the Government of Ghana's (Fisheries Commission and research body, the Water Resources Institute [WRI]) agreement with IFPRI about the usefulness of such an evaluation. Funding was sought from the Government of Netherlands in response to its call for proposals for research projects. IFPRI was one of seven successful applicants that received funding (out of 50 applicants).

Both the project and the evaluation were gender-sensitive. Some of the project interventions were gender-specific: an effort was made to have women enumerators and gender-disaggregated data were collected. Local partners were engaged in the evaluation, with University of Ghana Master's students serving as enumerators and using the dataset for their theses; one such student was also on the staff at WRI; he was valedictorian of his class and promoted at WRI for his high-quality thesis on the tilapia work.

The impact assessment was publicized through blogs, policy notes, and policy briefs and results were presented at the International Conference of Agricultural Economists, IFPRI seminars, and workshops at country level. The evaluation resulted in numerous citations and much uptake. It is, however, still early, having ended in 2022, so most outcomes are preliminary. The Fisheries Commission cites the work in its reports (early outcome). The commission appreciated that the effect of trainings was quantified through an impact evaluation and consequently increased investments in such trainings (mature outcome).

A representative from the government Council for Scientific and Industrial Research-Water Research Institute, Fisheries and Aquaculture Division explained that results of the impact evaluation have been used to inform three policies currently being developed or updated: the Aquatic/Animal Health Policy; the Ghana National Aquaculture

Development Plan; and the Guidelines on the Introduction of Alien Species (early outcome).

### *Developing Local Extension Capacity in Ethiopia and Uganda*

#### **Ethiopia**

In Ethiopia, the Developing Local Extension Capacity (DLEC) project had a significant outcome. The project originated when the founder of Digital Green met an IFPRI staff member and together with the Ministry of Agriculture (MoA) started the project. The evaluation of Digital Green's video-mediated extension innovation was funded by BMGF. The video innovation was added to the basket of tools for use by the extension system and was found to improve rates of adoption of some technologies.

The results of the study were presented to the State Minister of Agriculture in a small seminar. As a result, video extension was incorporated into the syllabus of universities that teach agricultural extension (mature outcome). Furthermore, the results were used by BMGF and the government to fund a US\$20 million follow-up project on digital agricultural advisory services (mature outcome). Follow-up to learn more about this case with Digital Green, BMGF, and the MoA would be useful. Since the inception of this project, IFPRI's work on digital extension has expanded, but that cannot be directly attributed to this work.

#### **Uganda**

A collaboration with Digital Green in Uganda as part of the DLEC project did not initially lead to policy change. The impact evaluation was innovative for numerous reasons. The topic is innovative for the country; conventional extension targets men, but this study targeted their spouses as well. Further innovations of the study were that it used a novel experimental design and it included a marginal cost-effectiveness analysis.

Both the project and the impact evaluation had a strong gender component: they tested the impacts of video extension advice (1) delivered by women compared to men, and (2) on women compared to men as recipients. Local partners were involved in the evaluation through a local staff member hired by the IFPRI country office and trained in data collection.

The evaluation may have led to a changes in Digital Green's approach, a point that needs to be verified, but there is no evidence that it changed policies, investments, or decisions at the government level. Although IFPRI staff have no evidence of an outcome from this project, some of its publications were highly cited; this may not be surprising given its novelty and that it was more of a research project by nature.

## ***Impact Evaluation of Picture-Based Insurance (India, Kenya, Ethiopia, and Bolivia)***

Picture-based crop insurance (PBI) was an idea developed by IFPRI in 2015–2016 based on the overall challenges presented by index insurance, as discussed in the literature and as experienced in previous IFPRI projects on insurance. In particular, PBI was an attempt to address the high levels of basis risk and limited demand for index insurance among smallholder farmers. PBI involves farmers' use of a smartphone app to upload photos of their crops throughout the season. If a loss is suffered, they can upload a photo as evidence and submit a claim for damages.

A 2016–2017 pilot impact evaluation of PBI in India was financed through a 3ie Phase I grant, and the initial promising results, described in Ceballos, Kramer, and Robles (2019), led to a full impact evaluation through a 3ie Phase II grant, with additional funding provided by the CGIAR Research Programs on Climate Change, Agriculture and Food Security (CCAFS) and Policies, Institutions, and Markets (PIM), the CGIAR platform for Big Data in Agriculture, and the United Kingdom's Natural Environmental Research Council.

The initial PBI evaluation (Ceballos, Kramer, and Robles 2019) and the general PBI idea informed the global debate, cited in various types of documents (for example, review papers on agricultural insurance, CGIAR documents, state-of-the-art in agricultural insurance reports, etc.). The final impact evaluation results have not been published yet.

The PBI project received a lot of initial interest from policymakers and one might consider such developments as early outcomes. Project staff met with numerous high-level policymakers in India at both the state (Haryana, Odisha, Tamil Nadu) and national level (Mahalanobis National Crop Forecast Centre). The Food and Agriculture Organization of the United Nations (FAO) invited IFPRI to present the PBI concept in three large regional meetings with FAO staff and country policymakers.

The project resulted in mature outcomes in the following cases:

- ▶ The work in Haryana resulted in a partnership with Dvara E-Registry, a social enterprise that is now using this solution in its operations in Odisha. In Odisha, the evaluation showed that a bundled PBI-credit solution increased financial inclusion, agricultural investments, productivity and incomes, women's empowerment, and women's mental health. Dvara E-Registry now provides this type of insurance alongside its credit solution.
- ▶ In Kenya, PBI increased demand for insurance, especially among women and farmers in arid and semi-arid lands (ASALs). Among men in ASAL regions, having

insurance coverage increased fertilizer use. However, women may have faced barriers to using fertilizers in ASAL regions, limiting the impacts of PBI on their technology adoption. Even after the project ended, the insurance intermediary Agriculture and Climate Risk Enterprise Africa continued providing PBI to manage basis risk in its soil moisture index-based insurance products.

- ▶ Pula Advisors, a major agricultural insurance provider working in several countries across Africa, is currently testing the solution in a pro-poor insurance scheme in Ethiopia with the Government of Ethiopia (specifically, the Agricultural Transformation Agency [ATA], where insurance is being bundled with fertilizer subsidies).

In Bolivia, the PBI team engaged with the national insurance scheme (INSA) to implement the PBI idea, among other innovations, to curtail high levels of fraud and make damage estimation more efficient. However, and despite the strong interest from INSA, this work has not taken off due to lack of funding.

Part of the reason for the low uptake of PBI by policymakers and the private sector in Bolivia and other contexts may be that it is complicated to implement. It requires setting up a digital infrastructure, ensuring that farmers have access to smartphones as well as an app where they can provide pictures. Furthermore, it requires a back-end structure where incoming pictures are processed and reviewed by experts. While still potentially cost-effective, such a high entry cost may discourage public and private sector actors from investing. Finally, setting up the insurance side usually involves regulatory hurdles, since this product is not typical in national insurance environments.

### ***Risk-Contingent Credit Product in Kenya***

IFPRI piloted a market-based, innovative risk management solution known as risk-contingent credit (RCC). RCC is a loan that includes insurance against agricultural shocks; when a sufficient shock occurs, the borrower needs only to repay part of the original loan or nothing at all. The RCC innovation was tested through an RCT method in Kenya beginning in 2016. Following promising results, several banks agreed to offer the product to farmers (mature outcome). Over 3,000 farmers applied for the RCC product in Kenya through Family Bank, Equity Bank, and APA Insurance Limited, with 547 farmers confirmed to receive RCC in the latest 2023–2024 round. The initiative focused on learning, training, and providing credit services to farmers in Machakos and Mbeere counties in Kenya to strengthen their resilience to drought. It not only allowed farmers' specific credit needs to be addressed, but also provided valuable insights into crop cycles, RCC demand, and farmers' perceptions of drought. This information was instrumental in refining the product for wider adoption in Kenya (CGIAR 2023). Similar loans were made to 444 farmers in Ethiopia through Awash Bank and Oromia Insurance

Company; this provided an understanding of farmers' credit needs, crop cycles, demand for RCC, and farmers' perceptions about drought, which helped improve the product for its wider adoption in Ethiopia.

***Enhancing Agency and Empowerment in Agricultural Development Projects: A Synthesis of Mixed Methods Impact Evaluations from the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2) (9 countries in South Asia and sub-Saharan Africa)***

Evaluations were carried out for a portfolio of 13 agricultural development projects in nine countries in South Asia and Africa. The project was an extension of the Phase 1 project, funded by BMGF, that focused on the impact of agricultural development projects on the gender asset gap. Learnings from GAAP1 influenced development of the Women's Empowerment in Agriculture Index (WEAI). Since its launch in 2012, many agricultural development projects had used the WEAI, but found that it did not adequately capture aspects of empowerment that projects deemed important for their success. BMGF and USAID, which funded the WEAI's original development, funded the second phase of the project. Projects had to apply to be part of the GAAP2 portfolio. GAAP2 included development and testing of the project-level WEAI (pro-WEAI), qualitative protocols for impact evaluations, and use of these methods in partner projects' impact evaluations. The use of a common empowerment metric across a project portfolio meant that the results were comparable across different types of projects. Findings have influenced the global debate.

Findings from the portfolio impact evaluation were cited in the *State of Women in Agrifood Systems*, a high-level FAO publication (early outcome) (FAO 2023). Findings from the portfolio are also included in 3ie's rapid evidence assessment of food security and nutrition interventions' impact on men and women (Lwamba et al. 2024).

## **Agriculture and Nutrition**

***The Agriculture, Nutrition and Gender Linkages (ANGEL) Project in Bangladesh***

The ANGEL project ran as a pilot from 2015–2018, implemented by Bangladesh's Ministry of Agriculture (MoA). It was partially funded by USAID and the IFPRI-led CGIAR Research Program on Agriculture for Nutrition and Health (A4NH), with technical assistance from IFPRI's Bangladesh Policy Research and Strategy Support Program (PRSSP) and Helen Keller International (HKI). The project aimed to identify interventions that can improve nutrition through agriculture and also improve women's empowerment.

The ANGEL project included gender-sensitization activities by using a tool that fosters communication, negotiation skills, mutual respect, and appreciation within families. The tool even addressed topics such as domestic violence and child marriage, and how they can be harmful to overall family health.

The impetus for this evaluation was an IFPRI analysis of the Bangladesh Integrated Household Survey (BIHS) that demonstrated the linkage between agriculture, nutrition, and gender in the country. IFPRI solicited USAID funding for a project that would introduce training of households in agricultural production, nutrition, and gender sensitization. IFPRI presented the idea to the Minister of Agriculture; representatives of USAID also attended at the invitation of the government. Involvement of the government, including costs being borne by the MoA, made it more likely that the pilot project could scale up. The impact evaluation was notable in that it was the first RCT implemented by the Government of Bangladesh that aimed to improve nutrition-sensitive agriculture.

The evaluation helped to inform Transforming Agrifood Systems in South Asia (TAFSSA), one of the CGIAR initiatives running from 2022–24, co-led by IFPRI. TAFSSA conducted a trial for adoption of interventions similar to those in the ANGEL project.

The impact evaluation and project were cited in high-level fora. For example, at the Second International Conference on Nutrition in Rome in 2014, Bangladesh's Minister of Agriculture cited government support for ANGEL; on other occasions that same minister stated how little research existed on that topic before the project. The ANGEL project was recognized as important at the 66th session of the Commission on the Status of Women in 2022 and the Nutrition for Growth Summit in Japan in 2022. The project also influenced the national food system transformation pathway document prepared for the United Nations Food Systems Summit, which incorporates gender, including the empowerment of women in agriculture.

An interview with a government counterpart confirmed that Bangladesh began efforts to scale up, with the MoA approving a phased approach: in phase 1 the work would be rolled out to 60 of 400 subdistricts in the country, while phase 2 would cover the entire country. This was approved by the Ministry of Planning and later by the Ministry of Finance. Ultimately, the government did not proceed because of (1) a change in priorities resulting from COVID-19, and (2) changes in leadership at the MoA and at the World Bank in Bangladesh (early outcome).

The World Bank was approached and agreed to provide a US\$500 million loan to the MoA that would be supplemented by US\$43 million from the International Fund for Agricultural Development (IFAD) for the Project for Agricultural and Rural Transformation for Nutrition, Entrepreneurship, and Resilience (PARTNER). Scaling up

ANGEL was to be included as one of the activities in the project. This was followed by changes in World Bank leadership in Bangladesh as well as leadership in the MoA. The ANGEL work was then dropped from the World Bank document. Although ANGEL was removed from the project, the project document and plans incorporated nutrition and involvement of women more than had been done in the past, possibly attributable to the findings of the ANGEL project.

### ***HarvestPlus Reaching End Users (REU) (Uganda and Mozambique)***

The International Potato Center (CIP) had conducted research in Mozambique on orange sweet potatoes and HarvestPlus was trying to develop orange sweet potato with (1) higher vitamin A content, (2) yields at least as high as those of more traditional sweet potatoes, and (3) a taste that consumers liked. A small project conducted prior to the Reaching End Users (REU) project showed that an integrated approach (production and behavior change communication [BCC]) on dissemination of orange sweet potatoes led to improved nutrition among children, exhibited through increased serum retinol in blood, suggesting reduced vitamin A deficiency. BMGF had funded that research so, eager for more rigorous evidence, commissioned RCTs in Uganda and Mozambique. The RCTs took an integrated approach, including breeding and dissemination of seeds, nutrition education, and marketing components. The evaluation was conducted for three groups: those receiving sweet potato vines and light nutrition education; those receiving vines as well as more rigorous nutrition education; and a control group. The decision was made to not conduct analysis of serum retinol in Mozambique due to lack of necessary infrastructure and because it had been done in the previous project; serum retinol was, however, tested in Uganda. Socioeconomic and nutrition knowledge surveys were also conducted. Finally, dietary intake surveys gathered information on micronutrient deficiency. BMGF and the European Commission (EC) funded follow-up work to demonstrate post-REU impacts.

Results of the impact evaluation showed that introduction of the orange sweet potato could increase intake of vitamin A among children. These findings were cited in flagship publications such as the *State of Food and Agriculture 2013: Food Systems for Better Nutrition* (FAO 2013), as well as numerous editions of the *Global Nutrition Report*. Indeed, orange sweet potatoes are touted as one of the greatest successes in international agricultural development, perhaps partly due to the rigorous evidence produced by the IFPRI evaluation.

The robust results of the impact evaluation have influenced donors' decisions. For example, BMGF invested hundreds of millions of dollars in HarvestPlus for work on various types of micronutrient-rich crops (mature outcome). The results also helped influence the design of a USAID Feed the Future project on orange sweet potatoes in Senegal (mature outcome).

Furthermore, the evaluation influenced various parts of the CGIAR system (mature outcome). It helped CIP in its fundraising, making it possible to continue with additional work on the orange sweet potato. IFPRI, CIMMYT, IRRI, CIP, the International Center for Tropical Agriculture (CIAT), and other breeding centers within CGIAR have become more amenable to collecting and using evidence on the adoption and use of crop varieties rather than focusing solely on yields as they had in the past. Finally, this type of impact evaluation has promoted collaboration between IFPRI and the crop-specific research centers.

## Nutrition

### *Assessing the Feasibility of Integrating Maternal Nutrition Interventions into an Existing Maternal, Newborn, and Child Health Platform in Bangladesh*

Given the challenges of inadequate maternal nutrition globally and in Bangladesh, IFPRI collaborated with Alive & Thrive (A&T), a program led by FHI360, to evaluate the use of nutrition-focused BCC in the existing Maternal, Neonatal, and Child Health program. The project used a cluster RCT design across 20 subdistricts, with baseline and endline surveys conducted in 2015 and 2016, respectively. Results showed significant improvements in maternal nutrition practices, including increased use of supplements, improved dietary diversity, and better breastfeeding practices in areas where interventions were intensified. The findings underscored the effectiveness of integrating nutrition interventions into health systems and recommended scaling up of similar models in comparable contexts.

The impact evaluation has informed the global debate. It was cited in a *Lancet* article that considers how to achieve global maternal and child undernutrition targets and in the Sustainable Development Goals (Heidkamp et al. 2021). It has also been cited in systematic reviews on nutritional interventions in low- and middle-income countries (Lassi et al. 2021; Jeong, Sullivan, and McCann 2023).

Stakeholders such as the Government of Bangladesh and international organizations have actively used the findings from the impact evaluation to guide their policy and programmatic decisions in the fields of health, nutrition, and social welfare.

The evaluation findings were disseminated through various channels, such as:

- ▶ **Presentations and reports:** IFPRI and A&T partners presented the findings in stakeholder meetings, workshops, and conferences attended by policymakers from relevant ministries and agencies in Bangladesh, as well as by global audiences.
- ▶ **Direct engagement:** IFPRI and its partners through A&T have directly engaged with key decision-makers within the Ministry of Health and Family Welfare, Ministry of

Women and Children Affairs, and other departments involved in health and nutrition policymaking.

Decision-makers who used the findings of the evaluation included: (1) officials from the Ministry of Health and Family Welfare responsible for healthcare delivery and policy formulation; (2) representatives from the Ministry of Women and Children Affairs involved in social welfare programs and policies affecting maternal and child health; and (3) other relevant government departments and agencies overseeing nutrition, education, and social protection programs.

The Government of Bangladesh and implementing partners are integrating the guidelines into their Maternal Nutrition and Childhood Health programs (Alive and Thrive 2017). More specifically, mature outcomes include:

- ▶ **Integration into primary healthcare:** Maternal nutrition components such as counseling, weight gain tracking, and iron-folic acid supplementation were integrated into routine antenatal care services at primary healthcare facilities.
- ▶ **World Bank-funded project inclusions:** Maternal nutrition indicators were incorporated into the World Bank-funded Health Sector Support Project, leading to strengthened capacity among community healthcare providers to deliver and monitor maternal nutrition services.
- ▶ **Development of national guidelines:** Guidelines for Maternal, Infant, and Young Child Nutrition (MIYCN) were developed and implemented in Bangladesh, standardizing practices across healthcare facilities.
- ▶ **Social protection integration:** Maternal nutrition interventions were integrated into social protection programs like the Improved Maternity and Lactating Mother Allowance (IMLMA), supported by structured social behavior change communication (SBCC) strategies.

### ***Innovative Approaches for the Prevention of Childhood Malnutrition (PROMIS) (West Africa)***

The Innovative Approaches for the Prevention of Childhood Malnutrition (PROMIS) program sought to overcome key barriers to the effectiveness of community-based management of acute malnutrition (CMAM) by incorporating two interventions into screenings for acute malnutrition: (1) BCC on how to improve children's nutrition and health; and (2) provision of a small-quantity lipid-based nutrient supplement (SQ-LNS) to all children.

The program was implemented by HKI in Burkina Faso, Mali, and Senegal between 2014 and 2017. HKI engaged IFPRI to conduct a cluster-randomized trial in Burkina

Faso and Mali to assess the program's impact. Previous research on screening for and treatment of wasting had shown that few children returned for screening and that preventative treatment was needed. The evaluation aimed to test how the new supplement could be used both as an incentive and for prevention.

Both the topic and method of the evaluation were innovative. First, the use of a new supplement (SQ-LNS) for the dual objective of prevention and incentivizing caregivers to visit a platform where more prevention and screening services would be delivered was novel. The method of cohorts with monthly data collection for incidence measurement was also new.

Gender played a role in the impact evaluation. Some women's empowerment indicators were assessed as covariates, and reporting to the donor included disaggregation of indicators by gender. It also involved local partners. There was a strong partnership with HKI at headquarters, regional, and country level. HKI was in charge of implementation in collaboration with the Ministry of Health in each country. An arrangement formed with a local association for data collection also evolved over 10 years into a strong partnership for data collection on other projects and eventually into a research relationship.

Results of the impact evaluation were publicized through communications materials and presented in conferences/meetings, including:

- ▶ National dissemination workshops organized by implementing partners with key nutrition stakeholders (including government, nongovernmental organizations [NGOs], the United Nations)
- ▶ Large international nutrition conferences (International Union of Nutritional Sciences International Congress of Nutrition [IUNS-ICN])

On request to key stakeholders and key partners (for example, UNICEF, USAID, etc.).

Results were used in World Bank documents (for example, see Lufumpa et al. 2023 on the prevention of undernutrition among children in the Sahel). A mature outcome was that the NGO ALIMA used PROMIS results in designing a project to incentivize caregivers to vaccinate children. The results have also influenced evaluation work undertaken in partnership with UNICEF (early outcome), including the IRAM project (2020–2023, US\$2.4 million; see Huybregts et al. 2023).

### ***Mitigating Aflatoxin Exposure to Improve Children's Growth in Eastern Kenya***

IFPRI undertook an impact assessment of aflatoxins on children's growth in Kenya. Both the method and topic of the evaluation were innovative, given it was the first RCT on that topic. The work was jointly commissioned by BMGF and the United Kingdom's

Department for International Development (DFID), both of which wanted to inform their policies on aflatoxins. Carried out over a period of two years, the study tested the effect of three different interventions: information; postharvest technology (drying sheets); and a premium price offered based on aflatoxin levels. The study was gender-responsive, following women and children. Furthermore, women enumerators were used. Local partners were engaged through the involvement of Innovations for Poverty Action and CARITAS, Kenya.

Because the findings were unable to establish a benefit to children's health as a result of removing grain containing aflatoxin, it did not build a strong case for continued work on aflatoxins. Follow-up interviews must be conducted with BMGF and DFID to determine whether the findings impacted their policies on aflatoxins. IFPRI's food safety work has shifted focus to other food safety hazards that have better-established detrimental health impacts.

The interim director of BMGF's Nutrition, Gender and Climate Division, Agricultural Development Team explained that as a result of the CIE in Kenya, BMGF funded an impact evaluation of aflatoxin prevention in Tanzania; this also failed to identify statistically significant positive results from the intervention. As a result of the impact evaluations in both Kenya and Tanzania, BMGF did not increase its investments in aflatoxins (mature outcome). They approach aflatoxins as one small part of the larger food safety work undertaken by the organization. This is consistent with a World Health Organization study carried out on the global burden of foodborne disease that treats aflatoxins as one small part of the larger problem of food safety.

### ***More Milk Project in Kenya***

The More Milk project came about when the International Livestock Research Institute (ILRI) applied to an open call from BMGF for nutrition-sensitive agriculture interventions. A BMGF representative stated that funding from BMGF and the United Kingdom's Foreign, Commonwealth and Development Office (FCDO, formerly DFID) was used to engage IFPRI and ILRI to evaluate an intervention carried out with informal dairy vendors (mostly women) in part of one town in Kenya. The work showed that the intervention led to improved storage and handling of milk and increased consumption of milk by households. No effect was found on milk safety. The findings demonstrated that interventions at the market level could positively impact households. As a result, a second phase of the project was funded to upscale the work to three counties (mature outcome). Another major policy impact resulting from the evaluation is that the Kenya Dairy Board is now developing, in collaboration with ILRI and funded by the Gates Foundation, a strategy to strengthen and empower the informal dairy sector; this is a shift in the Board's focus.

A compliance officer at the Kenya Dairy Board confirmed the above and added that the work also led to mature outcomes, including:

- ▶ Training of informal dairy business operators on dairy quality and safety requirements, thereby enhancing their compliance with food safety regulations;
- ▶ A review of Dairy Industry Regulations, 2021, that resulted in a restructuring of permit fees to promote participation by informal vendors;
- ▶ Changes to the regulatory framework that made it easier for informal sector vendors to register and comply with safety requirements; and
- ▶ Support for the Dairy Traders Association in registering, sensitizing, and conducting outreach to informal dairy business operators.

### ***Preventing Malnutrition in Children under Two Years of Age (PM2A) in Guatemala and Burundi***

The PM2A studies were a follow-up to an earlier study conducted by IFPRI in Haiti that demonstrated that preventing undernutrition was more effective than treating it. AED (now FHI360) contacted IFPRI to conduct the impact evaluation with funding from FANTA, USAID's flagship nutrition program at the time.

The study was an RCT of two food-assisted maternal and child health programs targeting pregnant women and children during their first 1,000 days (from pregnancy to two years old). Interventions were different combinations of family and individual rations, each of which varied in size and length of time carried out. Findings were as follows. First, providing smaller rations or rations for shorter durations is less expensive per beneficiary, but often insufficient to improve (biological) outcomes. Second, effective programs carried out for longer periods of time can lead to cost savings because they decrease start-up costs and lengthen peak operating capacity.

The findings were disseminated widely through scientific publications, and also at USAID-organized events, NGO events, blogs, and research briefs. The work appeared in numerous high-profile reports, thereby informing the global debate; these included reports by UNICEF, the World Bank, and others (see UNICEF 2023 and Gentilini 2022, for example).

The studies in Guatemala and Burundi were part of a series of other nutrition-sensitive studies (in health, agriculture, education, and social protection) undertaken by an IFPRI team. The results of the PM2A work, together with other work by IFPRI on nutrition-sensitive programming, had a cumulative effect and influenced donors like the World Bank, UN agencies, and governments (for example, Bangladesh) to endorse such programming.

The PM2A projects contributed in a variety of ways. A few examples are:

- ▶ Evidence for USAID on the effectiveness of their Food for Peace programs led to changes in their programming (mature outcome).
- ▶ The Guatemala study provided rigorous evidence of a desirable impact on children’s linear growth and an undesirable impact on women’s weight. These findings were key in development of the concept of “double duty actions.”
- ▶ The costing study formally demonstrated the limitations of cost-effectiveness analyses for complex interventions designed to improve a wide range of outcomes.

## Governance

### *The Baraza Program Impact Evaluation in Uganda*

Uganda’s Baraza Program—a government-led initiative that aims to improve public service delivery by engaging beneficiaries in monitoring through an advocacy forum (in the form of town hall-style meetings called barazas)—began in 2009. An initiative of the President of Uganda, the program is implemented by the Office of the Prime Minister (OPM), which engaged 3ie to conduct an impact evaluation. 3ie awarded the contract to IFPRI, which implemented the evaluation between 2015 and 2020. Its design was innovative, differentiating between provision of information to the baraza, discussion among participants at baraza meetings, and both. It was also innovative because it was an evaluation of a large government program that covered multiple sectors. Evaluation of a multisectoral program is more useful for policy than a single-sector evaluation, but is more challenging.

Follow-up by OPM shows that in FY2015/16, at the beginning of the impact evaluation, the government was responding to 25 percent of baraza actions. After adoption of the study recommendations, 52 percent of baraza recommendations were prioritized for implementation in FY2017/18 by the responsible ministries, departments, agencies, and local governments and 61 percent in FY2022/23.

Gender played a role in the evaluation in that some of the monitored outcomes were more relevant for women. The OPM implemented the treatment while IFPRI designed the study and oversaw the collection of data using local enumerators. The study was publicized through communications materials (for example, a blog in *The Conversation*; policy briefs) and was presented to policymakers in country as well as at an event organized by 3ie, the funder. Journal articles were also published about the impact of the Baraza Program.

OPM documentation shows it considered the findings of this evaluation in its planning and program design (early outcome). Conversations with policymakers at OPM

revealed numerous mature outcomes from the Baraza Program evaluation. One representative clarified that changes in policy would not have been made without the evidence provided by the IFPRI/3ie evaluation. For example, the evaluation encouraged the following outcomes:

- ▶ The United Nations Development Programme adopted preliminary concepts from the impact evaluation's baseline survey report in FY2017/18 and supported a rigorous baraza monitoring and follow-up activity in different subregions of the country (mature outcome).
- ▶ In 2018, the European Union (EU) became interested in the newly recommended modality for implementing barazas. They supported the program's activities in the northern region of Uganda, where the 11th European Development Fund programs were being implemented. The baraza was used as one of the monitoring and evaluation tools for EU-supported programs in northern Uganda (mature outcome).
- ▶ Government ministers and Members of Parliament adopted the baraza model as a tool for effective oversight of local implementation and feedback from their constituents (mature outcome).
- ▶ Various stakeholders from other countries and organizations across Africa and beyond have expressed overwhelming interest in the current baraza model. Immediately after the impact study was completed, the Government of Uganda hosted delegations from Senegal, Burkina Faso, Yemen, South Africa, Benin, and India that came to learn about the Baraza Program (early outcome).
- ▶ A paper presented on the current baraza model at the 11th African Evaluation Association (AfrEA) conference in March 2024 generated significant debate and interest from various African countries (for example, Ethiopia, Ghana, and Kenya) in replicating the model. Additionally, engagements have begun with South Africa to jointly design a hybrid model that combines barazas (Uganda) and imbizos (South Africa) as a continentwide model.

Other evaluations of the Baraza Program have been carried out since the IFPRI/3ie evaluation, but the methods used were less sophisticated and did not measure impact. Those evaluations were typically targeted and carried out by sector-specific ministries within the government (rather than multisectoral and comprehensive like the IFPRI/ 3ie evaluation). Now that nearly 10 years have passed since the impact evaluation baseline, the OPM recognizes the need for a new evaluation.

## Social Protection

### *Strengthen Productive Safety Net Program Institutions and Resilience (SPIR) in Ethiopia*

IFPRI undertook a study to assess interventions aimed at helping Productive Safety Net Program (PSNP) households graduate out of the program.<sup>4</sup> The Strengthen Productive Safety Net Program Institutions and Resilience (SPIR) was a five-year project (2016–2021) aimed at enhancing livelihoods, increasing resilience to shocks, and improving food security and nutrition for rural households vulnerable to food insecurity in Ethiopia. Funded by USAID’s Bureau of Humanitarian Assistance in collaboration with the Government of Ethiopia, implementation of SPIR is led by World Vision together with the Organization for Rehabilitation and Development in Amhara (ORDA) and CARE. The impact evaluation assessed nearly 500,000 PSNP4 beneficiaries in 13 of the most vulnerable woredas (districts) in the Amhara and Oromia regions of Ethiopia. The impact evaluation came about because USAID wanted evidence of the intervention’s effectiveness. World Vision reached out to IFPRI to join it in a proposal to USAID’s Development Food Security Activity for evaluating the intervention, with IFPRI as the lead learning partner.

Both the SPIR project and the evaluation of the project were innovative. SPIR uses a graduation model of social protection and is multisectoral. It focuses on a broad set of outcomes including nutrition impacts and mental health, the latter of which is a new topic in the development literature.

The safety net program has gender-responsive components, with programming designed to improve women’s wellbeing. The evaluation looked at the impact on variables such as women’s savings, their asset ownership, and intimate partner violence, and it involved local stakeholders. First, ORDA, an Ethiopian organization, is one of the implementing partners. Second, IFPRI worked with two local universities in the first phase. Finally, in the second phase IFPRI collaborated closely with local researchers (coauthors) and funded six local research teams, with teams submitting proposals in a competitive process.

World Vision, CARE, and ORDA have used the impact evaluation to inform their work. Through in-country workshops, results were disseminated to USAID and local

---

<sup>4</sup> IFPRI’s evaluative research of the PSNP program began in 2006 and has continued ever since. Early studies, relying on difference-in-difference methods, discovered targeting problems in early implementation of the program and calculated that households with access to multiple components of the program benefited significantly more than others. These led to operational changes in the PSNP that were estimated to be substantial, given that about 7 million beneficiaries participated in the program in the early years (Renkow and Slade 2013). Since then, continued causal studies have provided the government and funders with high-quality results that have informed investment decisions.

academics as well as local NGOs. Few national government policymakers have seen the results of the evaluation, but more of an impact has been made with district and subdistrict government staff. Follow-up interviews (especially with the Chief of Party) will be necessary to determine whether outcomes are early or mature.

### ***Takaful Impact Evaluation in Egypt***

Takaful is the Egyptian government's program for distributing cash to poor families whose children are studying at any level from kindergarten to secondary school. FCDO funded a World Bank call for proposals for an impact evaluation of the Takaful program in Egypt; IFPRI applied and was successful.

The results of the impact evaluation were presented to the Ministry of Social Solidarity, which is responsible for the Takaful program. The head of the Takaful program was promoted to Minister of Social Solidarity, so IFPRI was afforded greater opportunities to share the evaluation results. One conclusion from the impact evaluation was that giving cash is not sufficient to change intrahousehold dynamics; the government therefore decided to focus more on complementary programming.

The Minister cited IFPRI outputs to justify expanding the program as well as changing the program design. The Ministry of Social Solidarity used the impact evaluation findings to advocate for additional funding from the World Bank and the Ministry of Finance. The impact evaluation was referenced by the World Bank in its Project Appraisal document, which recommended a US\$500 million increase in funding for the program; it was also an important factor in the Ministry of Finance's decision to increase the budget for the Takaful program (mature outcomes) (CGIAR PIM 2021). The evaluation led to changes in program design that included adding more complementary programming focused on women's empowerment and increasing outreach and communication campaigns (CGIAR 2021; IFPRI 2020).

### ***Transfer Modality Research Initiative (TMRI) in Bangladesh***

IFPRI and the World Food Programme evaluated a pilot initiative in Bangladesh called the Transfer Modality Research Initiative (TMRI) that involved the transfer of benefits to 4,000 ultra-poor women and 21,600 of their family members over the period 2012 to 2014 (Akhter and Roy 2017). The research team evaluated the impact of four different types of transfers on beneficiaries' income, food security, and child nutrition. The researchers found robust evidence that all transfer modalities improved income and food security, but only cash transfers linked to nutrition-related BCC improved children's nutritional status.

The study contributed to the government's decision to add nutrition BCC to the Vulnerable Group Development Program, the largest social protection program for poor

rural women in Bangladesh; it reached over 1 million beneficiaries (mature outcome). The results also helped lead to the inclusion of nutrition BCC in programs implemented by the Ministry of Agriculture and the Ministry of Local Government, Rural Development and Cooperatives (mature outcome). Furthermore, the 2015 monitoring report of Bangladesh's National Food Policy Plan of Action as well as the Country Investment Plan (Government of Bangladesh 2016) included a review of the TMRI study findings; it found them highly relevant for implementation of the National Social Protection Strategy (early outcome). Finally, the findings have received mainstream press coverage, including in Vox and NPR, as well as in the Financial Express in Bangladesh. They have also informed global guidance to policymakers on prevention of violence against women.

### ***Using Preschools as Platforms for Behaviour Change in Malawi to Improve Diets and Nutrition Outcomes (NEEPIE)***

The NEEPIE project came about when staff at Save the Children Malawi suggested to IFPRI that local communities' provision of meals at community-based childcare centers (preschools) might be a useful area for research. IFPRI obtained funding through an FCDO (formerly DFID) grant and the A4NH program; IFPRI staff also spent time with the Government of Malawi to get its buy-in and to understand what research inquiry would be most helpful. The government helped guide research questions and encouraged the involvement of a co-principal investigator (co-PI) from the University of Malawi.

The evaluation was set up with a government program as a control group and a treatment group that was largely the same, except members were served more nutritious food. The evaluation was innovative both in terms of topic and method; most work had been done on meals in primary schools, not in preschools, and this evaluation looked at both the effectiveness and costs to estimate returns on investment. The evaluation found that children benefited from more nutritious meals and that, in short, the program had a positive return on investment.

A few factors were key in achieving the project's impressive outcomes. By working with a professor from the University of Malawi who served as co-PI, the evaluation gained the government's buy-in. In addition, the results were impressive and the timing was good in that the results were presented at an international conference on nutrition where the World Bank was in attendance. At that time, the World Bank was looking to invest in children's programming in Malawi. As a result, the project was taken to scale in about 10 districts in Malawi. In 2018, the Government of Malawi and the World Bank decided to scale up the work with a second phase (2022–2025). This decision was based largely on evidence gathered by the IFPRI evaluation. Indeed, the World Bank's Project Appraisal document (World Bank 2018) cites Gelli et al. (2017) to show the

effectiveness of feeding programs delivered at community-based childcare services. The project's second phase involves both a food and cash transfer and is valued at US\$10 million; of that US\$1 million will be allocated for impact evaluation (mature outcome).

A Save the Children Malawi representative confirmed these results, adding that NEEPIE inspired the design of a another Save the Children-led project known as MAZIKO (mature outcome) (Save the Children, Give Directly, and IFPRI 2023).

## IMPACT EVALUATIONS FOR WHICH NO OUTCOMES HAVE YET BEEN IDENTIFIED

### Agriculture

#### *Africa Research in Sustainable Intensification for the Next Generation (Africa RISING)*

Africa RISING was part of USAID's Feed the Future initiative. It comprised three research-in-development projects and was carried out over two phases: phase I, from 2012 to 2016; and phase II, from 2017 to 2022. It aimed to help smallholder farm households move out of hunger and poverty through sustainably intensified farming systems that conserved or enhanced the natural resource base. The three regional projects were led by the International Institute of Tropical Agriculture (in West, East, and Southern Africa) and ILRI (in the Ethiopian highlands). IFPRI was in charge of monitoring, evaluation, and impact assessment.

The impact evaluation for Africa RISING generated much interest in terms of highly cited journal articles and frequently downloaded datasets. The baseline and follow-up household and community survey data collected for the Africa RISING project are available on Dataverse on a dedicated webpage. The numbers of downloads of Africa RISING Evaluation Survey data are very high, particularly the baselines, which have been in circulation for many more years (Ghana: 8,288 for the baseline and 1,245 for the follow-up; Tanzania: 19,070 for the baseline and 727 for the follow-up; Malawi: 9,848 for the baseline and 325 for the follow-up; Mali: 7,572 for the baseline and 675 for the follow-up). This may be attributed to the great interest in this program and the communication material produced to disseminate the results (also through a dedicated IFPRI webpage). As of August 30, 2023, Africa RISING's Sustainable Agricultural Intensification: Handbook for Southern and East Africa was one of CABI's most popular e-books, with over 6,000 downloads from the CABI Digital Library. The IFPRI team recently completed a series of impact evaluation studies, one for each focus country and a consolidated cross-country report (Haile, Boukaka, and Azzarri 2024).

Although the program generated much interest, outcomes manifested in policy changes have not yet been identified. This is not surprising given the program concluded in 2022 and it is too early to identify outcomes based on the evaluation.

### ***Digital Innovation in Uganda***

An IFPRI researcher posited that while the impact evaluation of digital innovation work has been well received in Uganda, its influence on the national agricultural extension system is limited. This is primarily because, for political reasons, extension in Uganda is now the responsibility of Operation Wealth Creation (<https://owc.go.ug/>), which pursues a different set of priorities and tactics than previous extension programs in Uganda.

### ***Exporting Fomento to Africa (Malawi and Senegal)***

According to an IFPRI researcher, the Exporting Fomento to Africa project, funded by DFID-Brazil, did not lead to outcomes largely due to changes in administrations. The essence of the project was to test whether improved extension advice coupled with financial resources to implement the advice (the Fomento approach) could increase uptake and impact of agricultural technologies in two African countries. IFPRI organized implementation, through local NGOs, in both countries. The Government of Brazil initially suggested interest in an evaluation of the Fomento program, but an administration change in Brazil led to a change in personnel in the Brazil Ministry of Social Development, and a concurrent change in priorities. IFPRI also applied for funding from Development Innovation Ventures (DIV) to conduct further research in Malawi, but DIV funding was paused soon after the proposal was submitted, effectively ending researchers' efforts to follow up on this project. In short, change within two government administrations prevented the success and scale-up of the Fomento approach in Africa.

### ***Farm and Family Balance Project in Uganda***

IFPRI undertook a study in Uganda to examine the impacts of transferring economic and market control of a cash crop (sugar) from men to women within the household. Partners and funding were sought to support the study, which was adapted as needed to fit the key collaborating partner's requirements (Kakira Sugar Ltd). Although the study had important and useful results, it was a proof of concept. Additional work would be needed to build a body of results that could impact policy. At a smaller scale, the project could have impacted the partner's policies, but two factors prevented that: (1) the partner organization's management changed during project completion; and (2) the COVID-19 pandemic prevented IFPRI's plans to visit and conduct further outreach with the partner and in the area.

### ***Impacts of Solar-Powered Cold Storage in Nigeria***

IFPRI proposed this project to the Government of Japan (GoJ) to be funded under the Supplementary Budget the GoJ disburses in response to emergency crises (COVID-19 in this instance). The intervention design (use of Japanese-manufactured solar panels) and locations (northeast Nigeria) were selected to meet the funding requirements of the GoJ, the donor.

Seven cold storages were installed in seven horticulture markets in northeast Nigeria between December 2020 and January 2021. For the impact evaluation, a preintervention survey was conducted in November 2020 and a postintervention survey in March 2021. The evaluation considered the effect of cold storage on volumes of horticultural sales and revenue; it found that the revenue generated was sufficient to absorb technology and operating costs.

The evaluation was conducted and results were published very recently. It is therefore not surprising that the IFPRI staff member has no evidence of it informing the global debate nor of it resulting in outcomes from policymakers or other external stakeholders. Furthermore, local governments in Nigeria continue to struggle with limited budgets for the agriculture sector, and despite the significant net expected returns, the intervention requires significant up-front investments in cold storage facilities. It is nevertheless expected that the project's findings will be of interest among policymakers and donors. The local collaborator on this project ([ColdHubs](#)) continues its work and maintains a high profile within Nigeria, including with local governments; its work and results from the impact evaluation may also result in future outcomes.

### ***Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale (SELEVER) Phase I in Burkina Faso (Agriculture)—Evaluation of the Project on Women's Empowerment***

IFPRI collaborated with Tanager International (the implementer) to evaluate the impacts of its integrated approach to develop the poultry value chain in Burkina Faso. SELEVER provided an integrated agriculture-nutrition intervention package (including poultry value chain development; women's empowerment activities; and a BCC strategy to promote improved diets and feeding, care, and hygiene practices) in an effort to improve the diets, health, and nutritional status of women and children in Burkina Faso. A first set of results showed that farming households did invest more in poultry inputs and services, though those investments have not yet paid off in terms of profits. Those results, along with other assessments by Tanager, led to a second phase of the project aiming to scale up the intervention. Other results focused on the impacts on women's empowerment found that the intervention did not have an effect. The SELEVER evaluation was commissioned by BMGF, which also funded the SELEVER project and, according to a BMGF official, the null results of the evaluation are a factor explaining the lack of

noticeable outcomes from that analysis. Additionally, as the implementer was not well-connected with the government, there was no clear pathway for the results to inform government programming.

## **Nutrition**

### ***Enhancing Gender and Nutrition Impacts in the Agricultural Development Support Project in Myanmar***

An impact evaluation on the gender and nutrition impacts of the Agricultural Development Support Project in Myanmar has not yet resulted in outcomes. This may be attributed to the country's political situation: the project would likely have been scaled up had the coup of 2021 not occurred. Despite the lack of outcomes, the work has yielded publications in scholarly journals that have generated a large number of citations.

### ***Evaluation of the WINGS Project in India***

The Women Improving Nutrition through Group-based Strategies (WINGS) was a BMGF-funded project in India carried out from 2015 to 2019. WINGS studied the pathways through which self-help groups improved nutrition in India by examining interventions implemented by PRADAN and the Public Health Resource Society (PHRS).

The impact evaluation was innovative in terms of its strong collaboration with the implementing partners. The continuous cycle of developing survey tools and sharing and coming to a joint understanding of the findings was helpful. As a result, the partners decided to adjust the intervention strategy as a mid-term course correction. Gender issues were central to the project and to the evaluation. Women's empowerment was measured and many of the associated publications address gender issues. The results of the evaluation were presented in important forums and in numerous publications in high-level journals, although they have not been widely cited or frequently downloaded.

The evaluation found no clear outcomes apart from the improved research-development learning approach that occurred within the evaluation itself; this is likely because the evaluation found null impacts, which the partners appreciated. The conclusions were cautionary about the use of women's groups as delivery platforms. They recommended getting a deeper understanding of the workings of such groups, building their capacity, and providing sufficient incentives before using them as delivery platforms. The government or donor may not have been ready to hear or propagate this nuanced finding.

## CONCLUSIONS

IFPRI has undertaken a large number of CIEs across all major thematic areas its research covers. This study considered citations of articles and working papers on such CIEs. First, it found that citations of publications from impact evaluation projects are higher those in journals than in IFPRI's Discussion Paper series. Second, the topic of a journal article is key in gaining citations, as is the methodology jointly with the topic. For instance, an RCT evaluation of a project on an under-researched topic for which no RCT has previously been conducted promises to yield a large number of citations. While not assessed, it may be of interest for IFPRI to analyze whether studies from certain countries are more widely cited than others (for example, from high-population countries or from countries that are rarely studied).

For the more in-depth portion of this review, 27 different IFPRI CIE projects related to agriculture, nutrition, social protection, and/ or governance were considered. This part of the study relied on a review of documents as well as nearly 30 interviews with and/or questionnaires from 20 staff members and 9 external partners. Twelve of the projects had mature outcomes; this was often in addition to early outcomes. Five of the projects had early but not mature outcomes. Although this study was unable to identify or validate outcomes for all CIEs undertaken between 2012 and 2022,<sup>5</sup> it found that the majority of those evaluations have informed important decisions and other outcomes.

IFPRI's CIEs have been funded by BMGF, the Government of the Netherlands, 3ie, FCDO (formerly DFID), the EU, and the US government, as well as, in some instances, by the CG system (for example, A4NH, CCAFS, and PIM). They have informed the decision-making of multilateral organizations, donors, and NGOs, including ALIMA, BMGF, CARE, the EU, FCDO, IFPRI itself and other parts of the CGIAR system, ORCA, the US government, the United Nations Development Programme, the World Bank, and World Vision. They have also informed decisions of national governments, including those of Bangladesh, Egypt, Ethiopia, Ghana, Kenya, India, Malawi, and Uganda.

Typical mature outcomes include national governments or donors scaling up programs, funding a next phase of a program, or redesigning an intervention or program. IFPRI's evaluations have also shaped its own work. For instance, results of the PROMIS evaluation (which examined prevention of childhood malnutrition) were used to expand

---

<sup>5</sup> The study's inability to identify outcomes may be due to failure to reach external stakeholders for an interview, evaluations having been conducted too recently for an outcome to have occurred, changes in government personnel following the evaluation, or unforeseen shifts in policies or shocks like COVID-19.

IFPRI's research portfolio on wasting, secure funding for future research, and inform the design of its interventions.

IFPRI has conducted numerous impact evaluations designed at the request of a government or an organization; these inevitably inform that entity's decision-making. The pathway to outcomes is more challenging when the evaluation arises mostly from researchers' own initiative. On the other hand, supply-driven CIEs are often methodologically superior and more objective than demand-driven CIEs, which sometimes risk being an exercise in justifying a program. Inclusion of stakeholders in the design of CIEs is critical, but different stakeholders (policymakers, NGOs, implementers, other CG centers, donors) have different perspectives that may affect the objectivity of the study. Going forward, it could be useful to undertake analysis to better understand the costs and benefits associated with conducting demand- versus supply-driven impact assessments.

Regardless of the origin of the CIE, factors that help ensure that an outcome results from a CIE include: its rigor and timing; how convincing its results are; its publication in a high-profile journal and the timing of that publication; and purposeful dissemination of results at the right venues.

A BMGF source explained that IFPRI excels in conducting research at the intersection of agriculture, nutrition, climate change, and gender. This source reports that IFPRI's researchers conduct excellent literature reviews and publish in high-profile journals as well internally and through the organization's annual Global Food Policy report. The quality of their impact evaluations is evident through their engagement in a project at the University of Washington's Evans School Policy Analysis and Research Group (EPAR), which is partnered with BMGF's Agricultural Development Team (AgDev). The project hires numerous vendors to conduct impact evaluations, but only about 8–10 of them conduct RCTs. IFPRI, one of those vendors, produces among if not the highest quality RCT impact evaluations. Despite IFPRI's strength in CIE, areas for improvement remain, according to the interviewee. First, there is room to improve staff members' ability to work with government partners as well as their ability to develop in-country capacity. Second, IPFRI's CIEs are often quite costly, so lower costs could increase the number of CIEs that funders are willing to support.

In summary, IFPRI's body of CIE work has been highly influential. As such, strong support exists for maintaining the importance IFPRI places on CIEs as one of its four core impact pathways.



## REFERENCES

- Akhter, A., and S. Roy. 2017 “Strengthening Resilience of Rural Households through Improved Social Protection.” PIM Outcome Note. International Food Policy Research Institute (IFPRI), Washington, DC. <https://hdl.handle.net/10568/148300>
- Alive & Thrive. 2017. *How to Scale Up Maternal Nutrition*. [USAID](#).
- Ceballos, F., Kramer, B. and M. Robles. 2019. “The Feasibility of Picture-Based Insurance (PBI): Smartphone Pictures for Affordable Crop Insurance.” *Development Engineering* 4: 100042. <https://doi.org/10.1016/j.deveng.2019.100042>
- CGIAR. 2023. CGIAR Results Dashboard 2022–2030. <https://www.cgiar.org/food-security-impact/results-dashboard/>
- CGIAR MELCoP. 2018. *Monitoring, Evaluation, Learning and Impact Assessment Glossary*. The Monitoring, Evaluation and Learning Community of Practice of the CGIAR. [https://docs.google.com/spreadsheets/d/1il\\_zvFXCijPRCWnprtYvtq4uXbbri\\_bTfKztrc\\_5Ss/edit#gid=781492945](https://docs.google.com/spreadsheets/d/1il_zvFXCijPRCWnprtYvtq4uXbbri_bTfKztrc_5Ss/edit#gid=781492945).
- CGIAR Research Program on Policies, Institutions, and Markets (PIM). 2021. “Supporting Egypt’s Safety Net Programs for Better Nutrition and Food Security, Inclusiveness, and Effectiveness.” PIM Outcome Note July 2021. Washington, DC: IFPRI. <https://hdl.handle.net/10568/143971>
- FAO (Food and Agriculture Organization of the United Nations). 2013. *State of Food and Agriculture 2013: Food Systems for Better Nutrition*. Rome. <https://www.fao.org/4/i3300e/i3300e.pdf>
- FAO. 2023. *State of Women in Agrifood Systems*. Rome. <https://www.fao.org/gender/the-status-of-women-in-agrifood-systems>.
- Gelli, A., A. Margolies, M. Santacroce, N. Roschnik, A. Twalibu, M. Katundu, H. Moestue, H. Alderman, and M. Ruel. 2017. “Using a Community-Based Early Childhood Development Center as a Platform to Promote Production and Consumption Diversity Increases Children’s Dietary Intake and Reduces Stunting in Malawi: A Cluster-Randomized Trial.” *Journal of Nutrition* 148 (10): 1587–1597). <https://doi.org/10.1093/jn/nxy148>
- Gentilini, U., ed. 2022. *Social Protection, Food Security and Nutrition: An Update of Concepts, Evidence and Select Practices in South Asia and Beyond*. Washington, DC: World Bank. <http://hdl.handle.net/10986/38210>
- Government of the People’s Republic of Bangladesh. 2016. *Bangladesh Second Country Investment Plan: Nutrition Sensitive Food Systems: 2016–2020*. Ministry of Food. Dhaka. <https://faolex.fao.org/docs/pdf/bgd191142.pdf>
- Haile, B., S.A. Boukaka, and C. Azzarri. 2024. *Africa RISING Impact Assessment Report*. Washington, DC: IFPRI. <https://hdl.handle.net/10568/148737>
- Hawkes, C., M. T. Ruel, L. Salm, B. Sinclair, and F. Branca. 2020. “Double-Duty Actions: Seizing Programme and Policy Opportunities to Address Malnutrition in All Its Forms.” *Lancet* 395 (10218): 142–155. [https://doi.org/10.1016/S0140-6736\(19\)32506-1](https://doi.org/10.1016/S0140-6736(19)32506-1)

- Hazell, P., and R. Slade. 2016. *Taking Stock: Impacts of 40 Years of Policy Research at IFPRI*. Independent Impact Assessment Report 42. Washington, DC: IFPRI. <https://hdl.handle.net/10568/148363>
- Heidkamp, R.A., E. Piwoz, S. Gillespie, et al. 2021. "Mobilising Evidence, Data, and Resources to Achieve Global Maternal and Child Undernutrition Targets and the Sustainable Development Goals: An Agenda for Action." *Lancet* 397 (10282): 1400–1418. [https://doi.org/10.1016/S0140-6736\(21\)00568-7](https://doi.org/10.1016/S0140-6736(21)00568-7)
- Huybregts, L., L. Diop, A. Diatta, T. Fall, M. Ouedraogo, F. Barba, A. Sawadogo, and E. Becquey. 2023. "Reducing Child Wasting through Integrated Prevention and Treatment in Mali." IFPRI Policy Note. Washington, DC: IFPRI. <https://hdl.handle.net/10568/139052>
- IFPRI. 2020. *IFPRI Making a Difference*. Washington, DC. <https://hdl.handle.net/10568/143005>
- Jeong, J., E.F. Sullivan, and J.K. McCann. 2023. "Effectiveness of Father-Inclusive Interventions on Maternal, Paternal, Couples, and Early Child Outcomes in Low- and Middle-Income Countries: A Systematic Review." *Social Science and Medicine*: 115971. <https://doi.org/10.1016/j.socscimed.2023.115971>
- Lassi, Z.S., Z.A. Padhani, A. Rabbani, F. Rind, R.A. Salam, and Z.A. Bhutta. 2021. "Effects of Nutritional Interventions During Pregnancy on Birth, Child Health and Development Outcomes: A Systematic Review of Evidence from Low- and Middle-Income Countries." *Campbell Systematic Reviews* 17 (2): e1150. <https://doi.org/10.1002/cl2.1150>
- Lowder, S.K. 2018a. *Agricultural Science and Technology Indicators (ASTI): Evaluation of Outcomes Based on the Use of ASTI, 2008–2018*. Independent Review. Washington, DC: IFPRI. <https://hdl.handle.net/10568/147375>
- Lowder, S.K. 2018b. *Statistics on Public Expenditures for Economic Development (SPEED): Evaluation of Outcomes Based on the Use of the SPEED Database, 2008–2018*. Independent Review. Washington, DC: IFPRI. <https://hdl.handle.net/10568/144858>
- Lowder, S.K., and A. Regmi. 2020. *Assessment of Outcomes Based on the Use of PIM-Supported Foresight Modeling Work, 2012–2018*. Independent Review. Washington, DC: IFPRI. <https://doi.org/10.2499/p15738coll2.133608>.
- Lufumpa, N., A. Hilger, O. Ng, and B. De La Brière. 2023. *Preventing Early Childhood Undernutrition in the Sahel Region: Recommendations for Small-Quantity Lipid-Based Nutrient Supplement Interventions*. Washington, DC: World Bank Group. <http://documents.worldbank.org/curated/en/099701107062331180/IDU037f1de090e3c70406a0a14803d1c64a182c0>
- Lwamba, E., K. Basak, A. Nabi, P. Marion, and I. Storhaug. 2024. "Assessing the Effectiveness of Food Security and Nutrition Interventions on Gender Transformative Outcomes." 3ie blog, April 16. <https://www.3ieimpact.org/blogs/assessing-effectiveness-food-security-and-nutrition-interventions-gender-transformative>.
- Pardey, P.G., and J.E. Christian. 2002. "The Production and Diffusion of Policy Knowledge: A Bibliometric Evaluation of the International Food Policy Research Institute." *Impact*

Assessment Discussion Paper No.14. Washington, DC: IFPRI.

<https://hdl.handle.net/10568/156643>

Renkow, M., and R. Slade. 2013. *An Assessment of IFPRI's Work in Ethiopia 1995–2010: Ideology, Influence, and Idiosyncrasy*. Independent Impact Assessment Report 36.

Washington, DC: IFPRI. <https://hdl.handle.net/10568/153566>

Ruel, M.T., and H. Alderman. 2013. “Nutrition-Sensitive Interventions and Programmes: How Can They Help to Accelerate Progress in Improving Maternal and Child Nutrition?” *Lancet* 382 (9891): 536–551. [https://doi.org/10.1016/S0140-6736\(13\)60843-0](https://doi.org/10.1016/S0140-6736(13)60843-0)

Ruel, M., P. Menon, and J.-P. Habicht. 2008. “Age-Based Preventive Targeting of Food Assistance and Behaviour Change and Communication for Reduction of Childhood Undernutrition in Haiti: A Cluster Randomised Trial.” *Lancet* 371: 588–595.

[https://doi.org/10.1016/S0140-6736\(08\)60271-8](https://doi.org/10.1016/S0140-6736(08)60271-8)

Save the Children, Give Directly, and IFPRI. 2023. MAZIKO–Integrated Maternal and Child Cash Grant Project. <https://massp.ifpri.info/2023/10/06/maziko-malawi-integrated-maternal-and-child-grant-project/>

UNICEF. 2023. *Undernourished and Overlooked: A Global Nutrition Crisis in Adolescent Girls and Women*. UNICEF Child Nutrition Report Series, 2022. New York.

[https://www.unicef.org/media/136876/file/Full%20report%20\(English\).pdf](https://www.unicef.org/media/136876/file/Full%20report%20(English).pdf)

World Bank. 2018. “Project Appraisal Document on a Proposed Grant to the Republic of Malawi for an Investing in Early Years for Growth and Productivity in Malawi Project.” Washington, DC. <http://documents.worldbank.org/curated/en/172701545534083794>

## APPENDIX A: TERMS OF REFERENCE

### ***Terms of Reference for Consultant on the Influence and Impacts of IFPRI Causal Impact Evaluation Research***

The International Food Policy Research Institute (IFPRI) wishes to commission a consultant to carry out an impact assessment study of IFPRI's causal impact evaluation research over the period 2012–2022. Causal impact evaluations refer to the use of rigorous methods able to infer causality of a 'treatment' effect on specified outcomes. Randomized controlled trials are a gold standard, but other methods such as discontinuity and difference in differences analyses. This type of research program has long antecedents at IFPRI, notably in evaluation of social protection programs, but IFPRI's causal impact evaluation research has broadened into many thematic areas: (a) agriculture and natural resource management, (b) markets and agricultural value chains, (c) health and nutrition, (d) education, (e) governance mechanisms, and (f) social protection.

Many of the evaluations were conceived in partnership with funders and implementing organizations who sought to know if and how innovations, programs, or other interventions were beneficial and worthy of continued or increased investment. Case study evidence has already found that some of these studies were highly impactful, but there has been no comprehensive review across the many studies undertaken.

The impact assessment study should include the following types of analyses:

- ▶ An assessment of the overall contributions of causal impact evaluation research in terms of the relevance and quality of its research, research capacity building, communications activities, and outputs and thematic area.
- ▶ Identification of challenges in achieving impacts and factors that may be associated with higher likelihood of contributing to impacts.
- ▶ Validate and/or identify impacts from 2–3 case studies selected on the basis of likelihood of having significant impacts.
- ▶ Where feasible, explore the use of IFPRI's causal impact evaluations in replication studies, systematic reviews, literature reviews, and teaching.
- ▶ Examine the process by which IFPRI causal impact evaluations are designed and executed, including IRB review, study registrations, science and research quality assessments, partnership strategies, etc.

It is expected that the methods used to produce those outputs will include:

- ▶ Desk reviews of IFPRI causal impact evaluation outputs, IFPRI impact materials, as well as reporting of contributions to outcomes to funders and the CGIAR.
- ▶ Consultations with scientists and selected partners.
- ▶ In-depth case studies of selected causal impact evaluations and their influence.
- ▶ Use of analytical tools to trace through influences of research recommendations on decisions taken in relation to policies, programs, investments, and other actions.

The consultant will lead the impact assessment study and take direct responsibility for the final report. IFPRI staff will help provide necessary background documents and assist with the organization of the case studies. The background studies will include several project evaluation and impact assessment studies that have already been conducted of IFPRI's causal impact evaluation research. IFPRI will also provide the consultant with a list of all the outputs from this body of research between 2012 and 2022, together with relevant use (e.g., download) and citations statistics from internal websites.

After an initial review of background materials, the consultant will be expected to visit IFPRI to meet with relevant staff and develop an agreed work plan and budget with IFPRI. The consultant will prepare a methodology paper which outlines the analytical approach. This will be followed by agreement on the case studies selected for a deeper analysis. A draft report will be submitted 90 days following the signing of the contract. It will be peer-reviewed and subsequently published as an IFPRI independent Impact Assessment Report.

## APPENDIX B: IMPACT EVALUATIONS CONDUCTED BY IFPRI

Table of projects evaluated

Project Name	Country (Countries)	Evaluation Method	Years of Publications
Testing Innovations in Extension	Cambodia	Randomized controlled trial (RCT)	2019
m-Nutrition for Agriculture	Ghana	Randomized encouragement design	2020
Bangladesh AVC Project	Bangladesh	RCT	2019
Role of Information in Agricultural Technology Adoption	Uganda	RCT	2021
Uganda Coffee Agronomy Training	Uganda	Cluster- and individually-randomized controlled trial	2019; 2023
Developing Local Extension Capacity	Ethiopia, Uganda	RCT	2019–2023
HarvestPlus Reaching End Users	Mozambique, Uganda	Cluster RCT	2012–2020
Exporting <i>Fomento</i> to Africa	Malawi, Senegal	RCT	2018;2020
Nutrition Dairy value chain	Senegal	RCT	2017; 2019
Agricultural Transformation Agency's wheat initiative	Ethiopia	RCT	2018

Table of projects (cont.)

Project Name	Country (Countries)	Evaluation Method	Years of Publications
<b>Ghana Tilapia Seed Project</b>	Ghana	Cluster RCT and quasi-experimental design	2022
<b>Farm and Family Balance project</b>	Uganda	RCT	2021
<b>Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale (SELEVER)</b>	Burkina Faso	RCT	2022–2023
<b>Strengthen Productive Safety Net Program Institutions and Resilience (SPIR)</b>	Ethiopia	RCT	2022–2024
<b>Developing agricultural value chains</b>	Ghana	Quasi-experimental design	2022
<b>Pluralistic agricultural extension in Malawi</b>	Malawi	Quasi-experimental design	2018-2022
<b>Integration of small farmers into modern value chains with food safety standards in Kenya</b>	Kenya	RCT	2022
<b>Africa RISING</b>	Ethiopia, Ghana, Mali, Malawi, Tanzania	Quasi-experimental design	2017–2021
<b>The Impact of E-verification on Counterfeit Agricultural Inputs and Technology Adoption in Uganda</b>	Uganda	Randomized encouragement design	2019
<b>Cereal Systems Initiative for South Asia</b>	Bangladesh, India, Nepal	Selectivity trials; RCTs	2013–2019

Table of projects (cont.)

Project Name	Country (Countries)	Evaluation Method	Years of Publications
<b>Impact evaluation of Ethiopia's fiscal and administrative decentralization of service delivery on agricultural services and social services</b>	Ethiopia	Spatial regression discontinuity design	2020
<b>Impact evaluation of Tanzania's community-based conditional cash transfer program</b>	Tanzania	RCT	2014–2023
<b>Does Relative Deprivation Condition the Effects of Social Protection Programs on Political Support? Experimental Evidence from Pakistan</b>	Pakistan	Regression discontinuity design	2023
<b>Impact evaluation of Pakistan's national citizen's damage compensation program</b>	Pakistan	Quasi-experimental design	2017
<b>Improving accountability in schools project</b>	Pakistan	RCT	2020
<b>Baraza impact evaluation</b>	Uganda	RCT	2020
<b>Impact evaluation of land privatization in Kyrgyzstan</b>	Kyrgyzstan	Difference-in-difference	2024
<b>Feed the Future Innovation Lab for Small-Scale Irrigation</b>	Ethiopia, Ghana, Tanzania	Difference-in-difference; matching	2018–2023
<b>Impact evaluation of randomized variation in gender composition of groups addressing deforestation on women's voice and influence in decision-making</b>	Malawi	RCT	2023
<b>Mitigating aflatoxin exposure to improve child growth in Eastern Kenya</b>	Kenya	Cluster- and individually-randomized controlled trial	2015–2019

Table of Projects (cont.)

Project Name	Country (Countries)	Evaluation Method	Years of Publications
Information technology and market incentives for aflatoxin control in Ghana	Ghana	RCT	2019
Hybrid index insurance evaluation	Bangladesh	Project Name	2019
Impact Evaluation of FTF ACCESO	Honduras	Quasi-experimental design	2016
Impact evaluation of picture-based crop insurance in India	India	Cluster RCT	2019; 2023
Impact Evaluation of INVOAGRO II	Mozambique	Quasi-experimental design	2019; 2022
Impact Evaluation of the Landscape Programs in Ethiopia	Ethiopia	Quasi-experimental design	2022
Can We Relax Liquidity Constraints in Micro-Insurance Demand? Piloting an Innovative Design for Agricultural Insurance	China	RCT	2016; 2020
SARD-SC	Ethiopia	RCT	2017
Research for Ethiopian Agricultural Policy (REAP)	Ethiopia	Quasi-experimental design	2021
TNS Sidama Coffee Program	Ethiopia	Quasi-experimental design	2021
Demand and supply factors constraining the emergence and sustainability of an efficient seed system—three experiments in Uganda	Uganda	RCT	2023

Table of Projects (cont.)

<b>Uganda coffee certification schemes</b>	Uganda	Quasi-experimental design	2017
<b>Impacts of solar-powered cold storage in Nigeria</b>	Nigeria	Quasi-experimental design	2023
<b>Preventing Malnutrition in Children under Two Years of Age (PM2A)</b>	Burundi	Cluster RCT	2016–2020
<b>Implementation and Impacts of India's National Rural Employment Guarantee Scheme</b>	India	Quasi-experimental design	2019–2021
<b>Enhancing Gender and Nutrition Impacts in the Agricultural Development Support Project</b>	Myanmar	Cluster RCT	2021
<b>MoreMilk</b>	Kenya	Cluster RCT	2023
<b>PROMIS</b>	Burkina Faso, Mali	Cluster RCT	2019; 2024
<b>NEEPIE—Using preschools as platforms for behaviour change to improve diets and nutrition outcomes</b>	Malawi	Cluster RCT	2018–2022
<b>Impact evaluation of a maternal and child cash transfer intervention, integrated with nutrition, early childhood development and agriculture (MAZIKO-IE)</b>	Malawi	Cluster RCT	2024
<b>Validation, feasibility and effectiveness of AI-assisted diagnostics and behaviour change</b>	Ghana, Vietnam	RCT	2022–2023
<b>Impact Evaluation Associated with the SHARPE Program</b>	Ethiopia	Matching, RCTs	2023

Table of Projects (cont.)

Project Name	Country (Countries)	Evaluation Method	Years of Publications
<b>Evaluate a Feasibility Study of Integrating Maternal Nutrition Interventions in Existing Reproductive, Maternal, Newborn and Child Health Services in Uttar Pradesh, India: A cluster-randomized evaluation</b>	India	Cluster RCT	2021–2022
<b>Impact Evaluation of Behavior Change Communication Interventions on Infant and Young Children Feeding Practices and Childhood Stunting in Ethiopia (Alive &amp; Thrive)</b>	Ethiopia	Pre-post adequacy design	2015–2016
<b>Assessing the Feasibility of Integrating a Package of Maternal Nutrition Interventions into Antenatal Care Services in Burkina Faso (Alive &amp; Thrive)</b>	Burkina Faso	Cluster RCT	2023
<b>Impact Evaluation of the Pakistan BISP Program</b>	Pakistan	Regression discontinuity design	2024
<b>Improving Student Nutrition in Vietnam</b>	Vietnam	RCT	2021–2022
<b>Video Based Consumption Behavior Change</b>	Ethiopia	RCT	2022–2023
<b>How social protection design and complementary programs can help women mitigate and adapt to effects of climate change</b>	Ethiopia, Mali, Bangladesh	RCT	2023
<b>Teacher Pay for Percentile</b>	Uganda	RCT	2022
<b>School feeding experiment in IDP camps</b>	Uganda	RCT	2012; 2019
<b>Impact evaluation of the Productive Safety Net Program</b>	Ethiopia	Matching	2014; 2023

Table of Projects (cont.)

Project Name	Country (Countries)	Evaluation Method	Years of Publications
<b>Cooking Contests</b>	Bangladesh	Cluster RCT	2017
<b>Tangible Information and Citizen Empowerment: Identification Cards and Food Subsidy Programs in Indonesia</b>	Indonesia	RCT	2018
<b>JP RWEE synthesis</b>	Ethiopia, Niger, Nepal, Kyrgyzstan	Portfolio project (4 quasi-experimental studies); IFPRI's role was for standardizing using common metrics and synthesis	2023
<b>Impact evaluation of Egypt's Takaful cash transfer program</b>	Egypt	Regression Discontinuity Design	2023
<b>Bolsa Familia impact evaluation</b>	Brazil	Matching	2014–2015
<b>Women Improving Nutrition through Group-based Strategies (WINGS)</b>	India	Difference-in-difference; matching	2022–2023
<b>Evaluation of the JEEViKA Multisectoral Convergence Pilot</b>	India	RCT	2019; 2023
<b>An evaluation of the Food Friendly Program in Bangladesh</b>	Bangladesh	Pre-post adequacy design	2021–2024
<b>Warrantage experiment</b>	Burkina Faso	RCT	2023
<b>Onion Certification Experiment</b>	Senegal	RCT	2017
<b>Transfer Modality Research Initiative (TMRI)</b>	Bangladesh	RCT	2019; 2024

Table of projects (cont.)

Project Name	Country (Countries)	Evaluation Method	Years of Publications
<b>Gender, Agriculture, and Assets Project Phase 2 (GAAP2)</b>	Bangladesh, India, Nepal, Burkina Faso, Ethiopia, Ghana, Kenya, Mali, Tanzania	Portfolio project (6 RCTs, 5 quasi-experimental); IFPRI's role was for convening, using common metrics, and synthesis	2022
<b>Private Outsourcing and Competition: Subsidized Food Distribution in Indonesia</b>	Indonesia	RCT	2019
<b>Agriculture, Nutrition, and Gender Linkages (ANGEL)</b>	Bangladesh	RCT	2021–2023
<b>Bt brinjal impact assessment</b>	Bangladesh	RCT	2019; 2021
<b>Educating Children Together (ECT) 3</b>	Mozambique	RCT	2023
<b>WFP cash, food and vouchers</b>	Ecuador, Niger, Uganda, Yemen	RCT	2014–2021
<b>Ethiopia Social Cash Transfers</b>	Ethiopia	Matching	2020

Notes: Table may not be exhaustive. Methodology listed is given by the researchers in the project, and years of publication list either the year any publications went into the public domain, the two years (if two publications of different years), or the range of years (if three or more publications). Projects took place earlier than the years that are listed.

## APPENDIX C: INTERVIEW OF IFPRI STAFF WORKING ON IMPACT EVALUATIONS

Name of interviewee:

Date of interview:

### ***Questions regarding your impact evaluation work***

We are contacting you because you have played a leading role in one or more of IFPRI's causal impact evaluations. We would like to gain your insights on IFPRI's evaluations and how they have or may have not led to outcomes. Thank you in advance for taking the time to fill this out.

These questions are part of an assessment intended to identify outcomes of IFPRI's causal impact evaluations. An early outcome refers to the use of outputs by partners in decision-making or capacity strengthening. Mature outcomes are changes in strategies, policies, programs, or investments.

According to our records you have taken a leading role in the impact evaluations listed below.

<insert name(s) of evaluation(s)>

If we have identified only one impact evaluation that you have worked on, please answer all questions in relation to that impact evaluation only. If we have identified more than 1 impact evaluation that you have worked on, please choose 1 project for us to consider for which the impact evaluation had an outcome or more interest. Please also choose (if available) one project for which you can not identify an outcome or for which there seemed to be little interest.

Name of impact evaluation with outcome or more interest:

Name of impact evaluation for which no outcome or little interest identified:

### ***Description of the impact evaluation with outcome***

Can you describe to me the step-by-step process by which this IFPRI project (the one that has shown an outcome or for which there is more interest) and its related causal impact evaluations was designed and executed? This would include how the studies came into being. Were they from an external request by a funder, government or other organization? Was there a particular decision to be made that this study would feed into? Or was the project more of an exercise taken out of IFPRI's own initiative?

### ***Informing global debate***

1. Has the impact evaluation been cited in high level policy documents, flagship publications or international research initiatives? Please provide the reference information or name of the research initiative.

### ***Outcomes through the work of non IFPRI, non-CG stakeholders***

2. Are you aware of stakeholders outside of IFPRI or the CGIAR, such as government officials or international organizations, using the impact evaluation to inform their own work activities (eg. research, projects or advocacy) or decisions regarding policies, programs, strategies and/ or expenditures? If no, skip to question 8. If yes, please answer questions 4 - 7.
3. How did the evaluation come to the attention of policy makers?
4. Who was the decision maker/ stakeholder (or set of decision makers/stakeholders) that used it? Can you provide their email/contact information or contact information of someone who might validate and further explain this outcome? This may be a colleague or collaborator of yours or a decision maker. Please provide name, e-mail, title and affiliation.
5. What visible/ tangible outcomes (e.g. changes in behavior, policy or investment decisions) resulted from the impact evaluation? Again an outcome may be defined as use of IFPRI outputs by partners in their decision making or capacity building. It may be more advanced and involve a change in strategy, policy, program or investment.
6. Please provide any available written evidence documenting the outcome such as a study, citation, interview, etc. Has IFPRI released any publications describing outcomes from the use of such impact assessments? Skip to question 9.

7. If you answered no to question 3, why do you think there have been no noticeable outcomes as a result of such impact evaluations? What future outcomes, if any, might be anticipated as a result of such activities or decisions?
8. If you listed a second impact evaluation for which you have not observed an outcome, why do you think there have been no noticeable outcomes as a result of that impact evaluation? What future outcomes, if any, might be anticipated as a result of such activities or decisions?

***Outcomes within the CG or IFPRI***

9. Are you aware of IFPRI or other parts of CG system using any of these impact evaluations to inform their work activities (for example, research, projects or advocacy) or decisions regarding policies, programs, strategies and/ or expenditures? Which impact evaluation was used and what decision did it affect?

## APPENDIX D: INTERVIEW OF STAKEHOLDERS OUTSIDE OF IFPRI

Name of interviewee:

Date:

<Insert name of project>

1. What is your affiliation and title?
2. Have you used impact evaluations of the above project to inform your own work activities (for example, research, projects or advocacy) or decisions regarding policies, programs, strategies and/ or expenditures?
3. How did it come to your attention or to the attention of policy makers (eg. you were involved with it from the beginning; it was recommended by a colleague; IFPRI newsletter; Media; at a conference or workshop; other)?
4. What activity or decision was influenced by the IFPRI impact evaluation?
5. Have there been any visible/ tangible outcomes (eg. mature outcome such as changes in behavior, policy or investment decisions) as a result of such activities or decisions? If no, skip to question 7.
6. Please describe the visible/ tangible outcomes resulting from such activities or decisions and provide any available written evidence such as a study, citation, interview, etc. Skip to question 8.
7. Why do you think there have been no visible/ tangible impacts as a result of such activities or decisions?
8. What future impacts might be anticipated as a result of such activities or decisions? Please describe.
9. Are you aware of stakeholders outside of your own organization, such as government officials or staff of international organizations, using the impact evaluation to inform their own work activities (e.g., research, projects or advocacy) or decisions regarding policies, programs, strategies and/ or expenditures? If so:
  1. Who was the decision maker/ stakeholder that used it and how can we reach them (i.e., email)?
  2. What activity or decision was influenced by the IFPRI impact evaluation?

3. Is there anyone we should speak to who might validate and help us further understand how this and other outcome(s) came about? This may be a colleague or collaborator of yours or a decision maker. If so, please provide name, e-mail and, if available, title and affiliation.
4. Validate – do you agree with the following statements – would you suggest any rewording – do you have any updates?

<insert summary description from report that details the IE and outcomes>

## APPENDIX E: PERSONS INTERVIEWED OR RESPONDING TO QUESTIONNAIRE

Interviewed	
<b>Agnes Quisumbing</b>	IFPRI staff
<b>Akhter Ahmed</b>	IFPRI staff
<b>Alan de Brauw</b>	IFPRI staff
<b>Aulo Gelli</b>	IFPRI staff
<b>Bjorn Van Campenhout</b>	IFPRI staff
<b>Catherine Ragasa</b>	IFPRI staff
<b>Daniel Gilligan</b>	IFPRI staff
<b>David Spielman</b>	IFPRI staff
<b>Dr. Md. Ruhul Amin Talukder</b>	Formerly an official in the Ministry of Agriculture
<b>Gashaw T Abate</b>	IFPRI staff
<b>Joseph Musero</b>	Ministry of Agriculture
<b>Marie Ruel</b>	IFPRI staff
<b>Natalie Roschnik</b>	Save the Children
<b>Ruby Asmah</b>	Government Council for Scientific and Industrial Research
<b>Shelly Sundberg</b>	Gates Foundation
<b>Vivian Hoffmann</b>	IFPRI staff
Reviewed information or answered questionnaire	
<b>Carlo Azzarri</b>	IFPRI staff

<b>Deanna Olney</b>	IFPRI staff
<b>Elodie Becquey</b>	IFPRI staff
<b>Francisco Ceballos</b>	IFPRI staff
<b>Hiroyuki Takeshima</b>	IFPRI staff
<b>Jef Leroy</b>	IFPRI staff
<b>Jordan Kyle</b>	IFPRI staff
<b>Kate Ambler</b>	IFPRI staff
<b>Mr. Kebede</b>	Digital Green, Ethiopia
<b>Neha Kumar</b>	IFPRI staff
<b>Phuong Nguyen</b>	IFPRI staff
<b>Sikandra Kurdi</b>	IFPRI staff

---

## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

*A world free of hunger and malnutrition*

**IFPRI is a CGIAR Research Center**

1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org) | [www.ifpri.org](http://www.ifpri.org) | [www.ifpri.info](http://www.ifpri.info)

© 2025 International Food Policy Research Institute (IFPRI). This publication is licensed for use under a Creative Commons Attribution 4.0 International License (CC BY 4.0). To view this license, visit <https://creativecommons.org/licenses/by/4.0>.