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Evidence
Gap Map
Report 26

Agriculture-led Growth in Low- and Middle-income Countries
An Evidence Gap Map

June 2023

Agriculture, fishing, and forestry

3ie International Initiative for Impact Evaluation

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The evidence gap map reports provide all the supporting documentation for the maps, including the background information for the theme of the map, the methods and results, protocols, and the analysis of results.

About this evidence gap map report

This report presents the results of systematic searches to identify and map the available evidence base of impact evaluations and systematic reviews to support decision-making in global agricultural development. The evidence gap map was developed by 3ie with generous support from the United States Agency for International Development (USAID)'s Bureau for Resilience and Food Security (RFS), via a partnership with D-Lab at the Massachusetts Institute of Technology (MIT). The content of this report is the sole responsibility of the authors and does not represent the opinions of 3ie, its donors, or its Board of Commissioners. Any errors and omissions are also the sole responsibility of the authors. Please direct any comments or queries to the corresponding author, Mark Engelbert at mengelbert@3ieimpact.org.

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Agriculture-led Growth in Low- and Middle-income Countries: An Evidence Gap Map

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Acknowledgments

Abstract

The economies of many low- and middle-income countries are dominated by agriculture, making development of the agricultural sector key to economic growth and prosperity in these countries. The design and implementation of effective policies for agriculture-led growth will require high-quality evidence on the impact of different interventions. This report presents the results of a systematic mapping exercise to determine the availability of rigorous evidence, in the form of impact evaluations and systematic reviews, on the impact of interventions in the agricultural sector in low- and middle-income countries.

The results suggest that there are large quantities of evidence on the impact of interventions designed to disseminate technologies and knowledge to farmers, increase access to financial and insurance services, and establish formal land rights. However, there is limited availability of evidence on interventions designed to strengthen agricultural markets, particularly those targeting non-producer actors in these markets.

There is a need for impact evaluation research to remedy these gaps. The reliability of evidence from systematic reviews in this sector is limited, and the field may benefit from up to date, high-quality syntheses of evidence on such topics as land rights reform and access to financial and insurance services.

Summary

Background and scope

Agriculture plays a large role in the economies of many low- and middle-income countries. Recognizing this, numerous agencies working in international development have made agricultural development a key priority and have dedicated substantial resources to programming in this area.

This evidence gap map provides an overview of the availability of impact evaluations and systematic reviews to support evidence-based decision-making in global agricultural development. The scope of the map is broad, seeking to capture interventions ranging from national-level policies to locally implemented programs targeting smallholder farmers and other actors in local agricultural markets. We also map coverage of key intermediate and final outcomes in the evaluation literature.

Our framework includes three broad intervention domains and seven outcome domains. These are listed in the table below.

Intervention domains	Outcome domains
1. Dissemination and delivery of innovations, including knowledge, technologies, and practices 2. Improving markets for efficiency, information flow, and accessibility 3. Supporting efficient, stable, and transparent regulatory and business environments	1. Farmer adoption of productivity-related technologies and practices 2. Quantity/quality of farm output 3. Economic (micro) 4. Environment and sustainability 5. Empowerment and access for vulnerable groups 6. Economic (macro) 7. Allocation and investment in the agricultural sector

Objectives

1. To identify, describe and summarize evidence on the effects of agriculture-focused interventions on economic and welfare outcomes in many low- and middle-income countries;
2. To facilitate identification of equity dimensions in this evidence base; and
3. To identify potential primary and synthesis evidence gaps.

Methods

We conducted a broad literature search covering 13 scholarly databases and 9 additional sources of gray literature. We screened search results with the aid of a machine learning classifier to identify eligible studies. Once eligible studies were identified, we extracted descriptive data including country, study design, interventions, outcomes, and attention to gender and/or equity. For systematic reviews, we conducted critical appraisals and assigned each review a confidence rating of high, medium, or low.

We created an online, interactive map with our matrix of interventions and outcomes, populated with the impact evaluations and systematic reviews we identified. Drawing on our extraction of descriptive data, the map can be filtered using criteria such as country, study design, and population targeted.

Main findings

Our search retrieved 292,461 records. After removing duplicates, we manually screened 43,197 abstracts and excluded the remaining records using the machine learning model. After abstract screening, we retrieved 5,108 documents for full-text review. From these, we included 1,605 completed impact evaluations, 61 completed systematic reviews, 29 ongoing impact evaluations, and 2 ongoing systematic reviews.

In general, there has been a steady upward trend in the number of impact evaluations published per year since 2000, though publication of systematic reviews has been more inconsistent. The most common study designs for impact evaluations are matching methods (36%), fixed effects estimation/difference-in-differences (28%), and randomized controlled trials (23%).

Of the 61 included systematic reviews, 38 (62%) were assessed as low confidence, 9 (15%) as medium confidence, and 14 (23%) as high confidence.

Geographically, evidence is heavily concentrated in Sub-Saharan Africa: we identified 832 impact evaluations from this region, more than all other regions combined. Within Sub-Saharan Africa, evidence is highly concentrated in East Africa, particularly Ethiopia and Kenya (145 and 117 impact evaluations, respectively). Outside of East Africa, the next highest regional total is that of India (114 impact evaluations). China has been the site of the most impact evaluations (162) of any country.

Among interventions, there is a substantial evidence base for those that provide training and seek to disseminate agricultural innovations to farmers. Among the most frequently evaluated interventions are trainings that disseminate productivity information to farmers (250), promotion of improved inputs (157), land rights reform (120), and forest conservation schemes (119).

Interventions that combine multiple components are common: we identified 390 primary studies evaluating multi-component interventions. These most commonly combine components from the "training and innovations" and "markets" domains (160 evaluations), or multiple components from within the "markets" and "training and innovations" domains (44 and 42 evaluations, respectively).

In general, we identified little evidence on market-oriented interventions, particularly those targeting non-producer actors in agricultural markets. There are also gaps regarding some policy interventions, as we did not identify any evaluations of the impact of financial sector reform on outcomes in the agricultural sector, and only one evaluation of the impact of migration policy. Areas with high and low concentrations of systematic reviews mirror those of impact evaluations.

With regard to outcomes, there are large numbers of both impact evaluations and systematic reviews that measure many key outcomes, including farm productivity and income, food security, and poverty among farming households. A comparatively small number of studies examine empowerment outcomes. However, the starkest gaps in outcome measurement include (non-producer) agribusiness performance, and public and private investment in the agricultural sector.

There are several potential synthesis gaps – i.e., areas with a cluster of impact evaluations but no recent, high-confidence systematic reviews. These include land rights reform, access to financial and insurance services, and multi-component interventions combining productivity-related training for farmers with access to productivity-enhancing technologies.

Very few studies have noted consideration of gender or equity in their research: 80% of both impact evaluations and systematic reviews do not address gender or equity at all. Among studies that do, the most common approaches are measuring effects on inequality outcomes (8% of impact evaluations and 2% of systematic reviews) and subgroup analysis by sex (5% of impact evaluations and 3% of systematic reviews).

Conclusions and implications

Implications for policy makers and practitioners
Rigorous systematic reviews are generally the best source of information about intervention effectiveness. There are a number of high-confidence reviews in the literature on agriculture-led growth, which can guide decision makers on whether and how to pursue certain types of interventions. These high-confidence reviews mainly cover interventions that provide training and/or access to improved inputs.

Where there are no high-confidence reviews to serve as guides, decision makers may consult medium- or low-confidence reviews with appropriate caution, or even individual impact evaluations (though it is advisable not to place too much weight on any one study). These reviews and evaluations may be valuable sources of information about implementation, even if there are limitations to their conclusions about effectiveness.

Some of the interventions for which there are "absolute evidence gaps" – lacking both impact evaluations and systematic reviews – are likely to be promising in certain contexts. A lack of evidence does not mean that an intervention should not be implemented; indeed, when a decision is made to proceed with such an intervention, it presents a valuable opportunity to incorporate an impact evaluation into the policy or program implementation.

Implications for researchers and research commissioners
There are several types of interventions related to agriculture-led growth for which there is little effectiveness evidence, and these should be priorities for future research. Valuable insights would likely emerge from high-quality and up to date syntheses of the evaluation evidence on topics such as land rights reform, access to financial and/or insurance services, and combined training and technology interventions.

With respect to both interventions and outcomes, non-producer actors in agricultural markets are understudied. There is a need for additional evidence on the impact of interventions that aim to improve the efficiency of markets by targeting input suppliers, purchasers, processors, and other agribusinesses. The field may also benefit from additional research on policies affecting the financial sector and migration, though opportunities to evaluate such policies using counterfactual-based methods may be more limited.

There are substantial bodies of evidence on the effects of interventions targeting constraints on farmers' knowledge and access to inputs. Before embarking on further evaluation research on these topics, researchers and commissioners may wish to consult the available evidence base to ensure they are addressing unresolved questions and building on existing knowledge.

Contents

List of figures and tables

List of abbreviations and acronyms

EGM   Evidence gap map

IE   Impact evaluation

L&MICs   Low- and middle-income countries

RCT   Randomized controlled trial

RFS   Bureau for Resilience and Food Security

R&D   Research and development

SR   Systematic review

USAID   United States Agency for International Development

1. Introduction

The International Initiative for Impact Evaluation (3ie), the Massachusetts Institute of Technology (MIT), and the University of Notre Dame were commissioned by the US Agency for International Development's Bureau for Resilience and Food Security (RFS) in 2021 to support enhanced intersectoral and bureau-wide use of evidence for programmatic decision-making. RFS is the Agency's home for resilience and food security programming; it coordinates the U.S. Government's global strategies in food security and water, as well as the Agency's multi-sectoral nutrition strategy.

RFS comprises three offices and four technical centers which bring together programmatic and technical expertise in agriculture-led growth; water security, sanitation and hygiene; nutrition; and resilience. The RFS Evidence Aggregation for Programmatic Approaches (REAPER) project was designed to serve two primary aims. The first, is to present a systematic evidence gap map (EGM) underlying the bureau's strategic approaches in its four technical areas and cross-cutting areas on inclusive development and policy. The second is to explore and incorporate machine learning and automation methods to aggregate and accelerate the production of EGMs. This goal is in service to the primary aim of mapping and presenting findings on the evidence base.

This EGM report presents the findings of a systematic search, screening, and machine learning-assisted process to identify and map the evidence base of impact evaluations (IEs) and systematic reviews (SRs) of interventions in the agricultural sector that aim to promote inclusive economic growth.

1.1 Structure of this report

This report is organized as follows:
- Section 2 presents the subject background.
- Section 3 presents the scope of the EGM.
- Section 4 presents a brief discussion of EGM methods. More information can be found in the appendices.
- Section 5 presents the EGM's findings.
- Section 6 concludes and provides a set of considerations for future policy and research.

2. Background

2.1 Development problem being addressed

World Bank data indicate that, as of 2019, large proportions of the population in low- and middle-income countries (L&MICs) are employed in agriculture and allied sectors (World Bank 2019). Crops, livestock, forestry, fisheries, and aquaculture provide direct livelihoods to over 1.3 billion people, and their dependents produce food for the world's growing population and national economies (Karttunen et al. 2017). While the agriculture, fishing and forestry sectors account for approximately 4 per cent of the global gross domestic product, in some L&MICs these sectors can account for more than 25 per cent. They employ 60 per cent of the population in low-income countries and 32 per cent in middle-income countries (World Bank 2019). They also support the livelihoods of more than 75 per cent of people living in poverty (Castañeda et al. 2016; World Bank 2022).

Emphasis on the agricultural sector is expected to help attain several UN Sustainable Development Goals. For instance, agriculture is the focal point of Goal 2, which seeks to achieve zero hunger. However, the agricultural sector is also instrumental in realizing other goals including Goals 12 (responsible consumption and production), 13 (climate action), and 14–15 (related to conserving aquatic and terrestrial life). The multi-stakeholder Farming First coalition, which was conceived to promote sustainable development, argues that "agriculture is the common thread which holds the 17 Sustainable Development Goals together" (Farming First 2013).

Despite the importance of agriculture for sustainable growth, the sector faces several significant challenges. Chief among these are: low productivity among smallholder farmers, limited access to credit (especially among small and medium enterprises [SMEs]), and inadequate linkages between producers and output markets.

2.2 Policy responses

The World Bank highlights an urgent need to invest in the agricultural sector. Due to the high dependence on agriculture in many countries, the Bank argues that governments worldwide should take substantive measures to grow the sector, and suggests that at least $80 billion in annual investment will be needed to achieve the required growth (World Bank 2014).

Several development organizations are working towards improving agricultural productivity and resilience. The US Agency for International Development (USAID), for instance, believes that growth in the agricultural sector "from farm to fork" is up to four times as effective in reducing poverty as growth in other sectors (USAID 2022). USAID seeks to integrate investments targeting agricultural sector growth with those targeting food security. Food insecurity, which is often directly associated with poverty, leads to prolonged undernourishment, vulnerability to diseases, and stunted development. The objective of these programs is to create, strengthen, and maintain capacity in key areas of agriculture – such as research, policy analysis, and support for the generation of essential skills required to create and run farmer associations and agribusinesses.

2.3 Contribution to the literature

There is a large body of literature that aims to assess the impact of agricultural interventions, and this map seeks to increase the accessibility and use of this evidence while also identifying key gaps in the evidence base. Indicating the scale of the literature on agriculture-led growth, prior to this EGM the 3ie Development Evidence Portal contained over 1,100 IEs and 51 SRs of potentially relevant interventions.

Previous mapping exercises have captured some aspects of this literature. For instance, 3ie produced an EGM on agricultural innovations that included studies related to knowledge dissemination, finance, institutional arrangements, and inputs and practices (Lopez-Avila et al. 2017). However, this map focused narrowly on smallholder productivity and excluded interventions targeting market mechanisms and linkages. More recently, Cornell University produced an EGM on "Agriculture in the Digital Age," which included studies related to agriculture-led economic growth outcomes, such as income, yield, practice change, and market efficiency (Porciello et al. 2022). However, this map excluded studies that do not have agricultural services or farmers as their primary focus.

Thus, it provides an incomplete picture of the evidence regarding interventions targeting other actors in agricultural value chains.

To build on these previous maps, this EGM maps the evidence from IEs and SRs across interventions throughout the agricultural and food systems. The map will be able to inform future research investments and provide stakeholders in the international community with easier access to the information needed to make evidence-informed decisions regarding agriculture-led growth programming.

2.4 Study objectives and questions

The centrality of agriculture to global food security and poverty reduction – and the substantial global investments in agriculture- and food system-related interventions – highlight the importance of grounding policy and programming decisions in the sector in the best available evidence. This demands a broad and high-quality evidence base. The aim of this EGM is to describe the characteristics of the current evidence base in the form of IEs and SRs. The scope of the EGM is broad, aiming to capture an expansive range of interventions across the agricultural sector, rather than targeting particular subsectors or intervention types.

This EGM has the following three specific objectives:
1. To identify, describe and summarize evidence on the effects of agriculture-focused interventions on economic and welfare outcomes in L&MICs;
2. To facilitate the identification of equity dimensions in this evidence base; and
3. To identify potential primary and synthesis evidence gaps.

Research questions that are addressed by this study are presented in Table 1.

Table 1: EGM research questions

Research Question	Type
1. What is the extent and what are the characteristics of empirical evidence on the effects of interventions aiming to achieve agriculture-led growth in L&MICS?	Coverage
2. What are the major primary and synthesis evidence gaps in the literature?	Gaps
3. What intervention/outcome areas should be prioritized for primary research and/or evidence synthesis?	Research needs

3. Scope

3.1 Conceptual framework

We have developed the framework for this research by consulting the relevant literature cited in Section 2. We have received feedback on this framework from stakeholders within the USAID Center for Agriculture-led Growth and an external advisory group.

This map focuses on studies assessing the effectiveness of interventions related to agriculture-led growth. Agriculture-led growth is a long-term approach to address socioeconomic issues such as poverty, malnutrition, and hunger, by focusing on growth and stability in the agricultural sector. The map will consider the impacts of interventions that reflect the programmatic and strategic approaches to agriculture-led growth of the USAID RFS Center for Agriculture-led Growth.

It is important to note, however, that not all aspects of a strategic approach to agriculture-led growth are reflected in this EGM. In particular, funding and/or capacity-building in L&MICs for research to develop, adapt, and test improved agricultural technologies – such as climate-resilient seed varieties, improved agricultural practices, or bundles of these – is an early-stage component of many interventions in the sector, particularly those that ultimately provide farmers with access to productivity-related training or improved inputs.

However, research and development (R&D) often take place significantly upstream of, and on a longer time scale than, activities that directly involve wide-scale dissemination to farmers. As a result, project-based IEs that measure impacts on farmers are typically unable to capture the development and testing of research investments (outside of research validation studies that measure the performance of new technologies under tightly controlled conditions, which are not included in the EGM), or many of the upstream activities to disseminate these technologies to farmer populations.

In addition, R&D activities are difficult to evaluate using methods that rely on counterfactuals (i.e., the methods included in this EGM). Unlike, for example, interventions that target individual farmers (where a control group of untreated farmers can be identified), R&D efforts typically take place at an institutional level. It is therefore difficult to model what would have happened in the absence of particular R&D activities. For example, it is difficult to rule out the possibility that, had a particular R&D investment not been made, someone else would have made a similar investment and developed a similar technology.

Given these considerations, our framework does not include institution-level interventions to support R&D.[1] However, this does not mean that the literature is entirely devoid of evidence regarding the impact of such activities. Though rare, counterfactual-based evaluations of R&D do exist, such as a study by Alene and Coulibaly (2009) that

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[1] An earlier version of our framework included these interventions, and our literature search was designed to capture any IEs and SRs assessing their effectiveness. Although we found a small number of potentially eligible studies on these interventions, we decided to eliminate these from our framework to avoid the appearance of an "evidence gap" in a domain where we would not expect to find much evidence of the type covered in this map.

assessed the impact of agricultural research using instrumental variables. There is also a body of literature attempting to assess the impact of agricultural R&D using alternative methods (e.g., Evenson 2001; Evenson and Gollin 2003). Mapping this type of research is beyond the scope of this EGM, but may be a useful area to explore in future research mapping exercises.

3.1.1 Definitions

The agricultural sector here encompasses the "practice of food, feed, and fiber production (including forestry, wildlife, fisheries, aquaculture, and floriculture) and its relationships to natural resources, processing, marketing, distribution, utilization (including nutrition), and trade" (USAID 2018).

According to the US Government Global Food Security Strategy 2022–2026, agriculture and food systems are:

> the intact or whole unit made up of interrelated components of people, behaviors, relationships, and resources that interact in the production, processing, packaging, transporting, trade, marketing, consumption, and use of food, feed, fiber, and other outputs through aquaculture, farming, wild fisheries, forestry, and pastoralism. The food and agriculture system operates within and is influenced by social, political, economic, and environmental contexts — USAID 2022.

In turn, we define agriculture-led growth as a broad-based approach to strengthening the agricultural sector through investment in agricultural infrastructure and programs to boost resource productivity and, in turn, socioeconomic status (Taylor 1992).

3.1.2 Strategic and programmatic approaches

Agriculture-led growth encompasses a broad swath of approaches covering dissemination of new technologies; strengthening markets and distribution networks; mitigating risks and increasing resilience to shocks; strengthening the enabling environment; increasing the safety and nutritive value of foods; and promoting sustainable farming practices.

Given this broad scope, our conceptual framework is informed by the strategic and programmatic approaches developed by the RFS Center for Agriculture-led Growth (Figure 1). These approaches capture a range of activities spanning development and dissemination of technologies to enhance productivity and sustainability, to strengthen and expand access to markets, and to promote public and private investment in the agricultural sector.

Figure 1: Strategic and programmatic approaches, center for agriculture-led growth

Strategic Approach 1: Foster sustainable agricultural productivity (PAs 1-7)	• Data and science-based evidence are generated and used to optimize inclusive agricultural productivity growth • Capacity of national partners is strengthened to carry out and support research and development, and to detect, prevent, and manage shocks and stresses • Research and development generates innovations relevant to the needs of all agriculture producers and enterprises, including consumers, women, youth, and other marginalized persons • Demand driven and appropriate information, training and innovations are disseminated, accessed, and adopted through public and private channels • On-farm productivity is increased, and production risks, including climate-related, are reduced • Natural resources are sustainably managed • The policy, regulatory, and enabling environment ensures quality standards and facilitates access and safe use of innovations
Strategic Approach 2: Facilitate inclusive and competitive agri-food system markets and trade (PAs 8-14)	• Equitable access to high quality market infrastructure and quality products and services is increased for all actors • Market efficiency is improved and entry barriers reduced • Efficiency, stability, and transparency of domestic and cross-border trade is increased • Informed and inclusive policy making processes are supported • Market demand for productivity- and adaptivity-enhancing products and services is increased • Market linkages between actors in the agri-food system are strengthened • Firm profitability, growth, and resilience is increased
Strategic Approach 3: Expand public and private investment in agri-food systems (PAs 15-20)	• Evidence regarding agri-food system growth is generated and influences policies and investment • Evidence-based public and inclusive private sector investment is increased • Financial sector is governed within a legal and regulatory framework that facilitates equitable access and protections to consumer segments • An inclusive, resilient, and competitive financial sector creates sustainable services that address the financial needs of individuals and SMEs • Innovative, tailored financial products and services and loan guarantees decreases risk and increases return by lenders • Individuals and SMEs are able to access and successfully use varied financial services from formal and informal sources, including to manage risk

Note: PAs = programmatic approaches.
Source: USAID documents shared with 3ie

Our framework is also informed by the results framework of the US Government Global Food Security Strategy (USAID 2022) (Figure 2) – particularly the intermediate results tied to Objectives 1 and 2. These results are changes that are expected to result from USAID's strategic initiatives to promote resilience and food security. They cover increased sustainable productivity, better market access and trade, and improved risk management and resilience.

The results framework emphasizes the need for interventions that will increase farmers' access to technological innovations and to markets, and will enable better trade practices on a macro scale. As a result, investment in the sector will expand, productivity will increase, and markets will function efficiently and inclusively. In turn, these effects will lead to more sustainable and inclusive growth in the agricultural sector, accompanied by reduced hunger, malnutrition, and poverty throughout the world.

Figure 2: Results framework, US Government Global Food Security Strategy 2022–2026

Goal: Sustainably reduce global poverty, hunger and malnutrition

Objective 1
Inclusive and sustainable agriculture-led economic growth

Objective 2
Strengthened resilience among people and systems

Objective 3
A well-nourished population especially among women and children

Inclusion, equality and equity are essential to achieving these objectives.

Intermediate Results (IR)

IR 1	IR 2	IR 3	IR 4	IR 5	IR 6	IR 7	IR 8	IR 9
Strengthened inclusive food and agriculture systems that are productive and profitable	Strengthened and expanded access to markets and trade	Increased employment and entrepreneurship	Increased sustainable productivity	Improved proactive risk reduction, mitigation and management	Improved adaptation to and recovery from shocks and stresses	Increased consumption of safe and nutritious foods	Increased use of direct nutrition interventions and services	More hygienic household and community environments

Cross-Cutting Intermediate Results (IR)

CC IR 1	CC IR 2	CC IR 3	CC IR 4	CC IR 5	CC IR 6	CC IR 7	CC IR 8	CC IR 9	CC IR 10
Strengthened global commitment to investing in food security	Increased gender equality and female empowerment	Increased youth empowerment and livelihoods	Enhanced climate change adaptation and mitigation	Improved natural resource management	Improved water resources management	More effective governance, policy and institutions	Improved human, organizational and system performance	Enhanced integration of conflict sensitivity, peacebuilding and social cohesion	Enhanced integration of digital technologies

Complementary Results

Long-term food security efforts benefit from and contribute to complementary work streams that promote:

Economic growth in complementary sectors	Healthy ecosystems and biodiversity	Stable, democratic societies that respect human rights and the rule of law	A reduced impact of disease	Well-educated populations

Source: USAID (2022)

In Appendix A, we summarize the volume of evidence we found for the intermediate results tied to Objectives 1 and 2 (i.e., intermediate results 1–6).

3.2 Interventions and outcomes covered by the EGM

The tables below present our framework of interventions and outcomes. The interventions fall into three broad categories, related to disseminating agricultural innovations, improving the efficiency and equitability of markets, and creating a regulatory and business environment that promotes efficiency and transparency. For each intervention domain, we list the corresponding programmatic approaches.

Intervention domain	Domain definition	Intervention category	Intervention definition
1. Dissemination and delivery of innovations, including knowledge, technologies, and practices PAs: 4, 5, 6, 12	Interventions such as extension and training to support productivity, soil health, business/marketing, and establishment of demonstration plots for dissemination of information, innovations, and capacity-enhancement through public and private channels	1.1. Disseminating productivity/sustainability-focused crop/livestock/ fisheries information	Interventions that disseminate information for best practices in managing crops (including planting techniques, soil fertility, pest management, etc.) or livestock (including feeding, parasite and disease control, breeding, etc.). This includes disseminating information via SMS or voice messages.
		1.2. Promoting access to and application of improved inputs	Interventions that introduce new inputs (e.g., seed varieties, fertilizers) with improved properties (e.g., varieties with higher yields, drought tolerance, pest and disease resistance, etc.)
		1.3. Introduction of irrigation systems	Interventions that introduce irrigation systems, including those with energy-efficient equipment and designs
		1.4. Building the capacity of extension systems and non-producer private sector actors	Interventions that build the capacity of agricultural extension systems and (non-producer) private sector actors in the agriculture system (including both SMEs and larger firms), to improve the quality and availability of services
		1.5. Facilitating access to productivity-enhancing technologies	Interventions that increase access to productivity enhancing technologies for actors in the agriculture system (e.g., mechanization or greenhouses for farmers, or digital technologies for SMEs. This includes direct transfers of assets or cash.[2] This does not include improved agricultural inputs (seed, fertilizers—often referred to as "technologies"), which are covered in a separate category above.
		1.6. Forest conservation schemes	Schemes intended to shift land use in ways that preserve or restore forest cover, including protected areas, community forest management, and payments for ecosystem services.
		1.7. Multi-component training & innovations	Interventions with multiple components, all focused on training and innovations

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[2] We included cash transfer interventions when these were specifically targeted to actors in agricultural systems (primarily smallholder farmers). These are classified as facilitating access to productivity-enhancing technologies, on the assumption that the targeting of these interventions to farmers meant that their main purpose was to allow farmers to invest in such technologies.

Intervention domain	Domain definition	Intervention category	Intervention definition
2. Improving markets for efficiency, information flow, and accessibility PAs 5, 8, 9, 12, 13, 14, 18, 19, 20	Interventions related to improving the functioning and accessibility of markets through a better flow of information, better linkages among actors, and better infrastructure.	2.1. Women's empowerment/ engagement of women and other marginalized actors in the ag sector	Interventions that promote equality for women and other marginalized actors in the agricultural system by involving them in production or marketing activities, establishing self-help groups or co-ops, and/or changing attitudes through gender-transformative approaches. This includes interventions that specifically target such groups and have addressing barriers specific to those groups as part of their theories of change. It does not include studies with subgroup analysis for interventions targeting the general population.
		2.2. Disseminating information on marketing/business skills	Provision of entrepreneurship training focused on how to start or manage a business, which can include developing a business plan, day-to-day management of the small enterprise, bookkeeping, financial planning, etc.
		2.3. Disseminating combined productivity and marketing information	Interventions that simultaneously provide information *both* on improved farming techniques *and* on how to market products.
		2.4. Agricultural market information	Interventions that increase farmers' access to information on conditions and dynamics of agricultural markets (e.g., prices, supply, etc.)
		2.5. Weather information systems for farmers	Interventions to promote and implement weather information systems as tools to help farmers to make weather-related decisions.
		2.6. Market information systems for (non-producer) SMEs	Interventions that provide market information (e.g., supply, demand, prices) to small and medium enterprises that have non-producer roles in the agriculture sector (e.g., processing raw ag products). It can also be known as market intelligence systems.
		2.7. Producer/marketing group formation/capacity building	Interventions that facilitate the establishment or strengthening of organizations, groups, collectives, and cooperatives of agriculture-sector actors—for purposes such as price-setting and negotiation—other than those directly targeting women or other marginalized actors (which are covered in a separate category above)
		2.8. Linking farmers to purchasers/processors	Interventions that create or strengthen linkages between agricultural producers and those who buy or process raw agricultural goods. This includes contract farming interventions and outgrower schemes.

		2.9. Building business-to-business and business-to-government linkages	Interventions to promote building linkages between businesses and between business and government. E.g., linking food processors with restaurants/retail.
		2.10. Facilitating farmer access to innovative and/or existing insurance products	Interventions that help farmers access government and private insurance products for agriculture, either by promoting take-up of existing products or by working with insurance providers to improve the quality and relevance of insurance products available to farmers
		2.11. Facilitating farmer access to financial products (incl. credit)	Interventions that help farmers access financial products such as credit facilities or loans, either by promoting take-up of existing products or by working with formal financial institutions (such as banks) to improve the quality and relevance of financial products available to farmers
		2.12. Building relationships with private sector investors	Interventions that promote building partnerships between private-sector investors and other actors in the agriculture system, including farmers, SMEs, and larger agribusinesses
		2.13. Government loan guarantees	Schemes in which the government assumes some of lenders' risk by guaranteeing to fully or partially reimburse lenders in the event of default
		2.14. Building/maintaining rural transportation infrastructure	Building or maintaining/improving roads, bridges, and other transportation infrastructure in largely agricultural areas
		2.15. Building/maintaining agricultural storage facilities	Interventions pertaining to development and/or maintenance of storage facilities of agricultural products
		2.16. Rural electrical/telecommunications infrastructure	Interventions that improve the quantity or quality of access to electricity and/or telecommunications (including mobile networks and Internet) in rural areas, including linking to national grids or networks and/or establishing small/local grids or networks. Note that for telecommunications infrastructure interventions, the "Digital technologies" cross-cutting theme should also be coded "Yes".
		2.17. Multi-component market interventions	Interventions with multiple components, all focused on agricultural markets

Intervention domain	Domain definition	Intervention category	Intervention definition
3. Supporting efficient, stable, and transparent regulatory and business environment PAs 7, 10, 11, 14, 15, 17, 18	Interventions that facilitate fair and efficient agriculture and food system regulations, and policies to support a good environment for agricultural production and trade.	3.1. Enacting/enforcing legislation to promote competitiveness (incl. antitrust)	Legislative/policy interventions that help to make the market run in a competitive manner
		3.2. Trade policy	Changes to trade policies (including tariffs and import quotas) that affect agricultural markets
		3.3. Price regulations (incl. subsidies)	Government schemes that allow farmers to determine in advance a fixed price at which they can sell their product. Subsidies to farmers such as crop subsidies, export subsidies, equipment subsidies, input subsidies
		3.4. Land rights reform	Interventions that establish formal rights for land ownership or use to traditional occupants
		3.5. Financial sector reform	Interventions pertaining to the legal framework of the finance system in a country, which aim to reform business practices and de-risk lending
		3.6. Agricultural practice recommendations	Formal recommendations issued by governments (e.g., ag ministries) or private actors (e.g., trade groups) on agricultural practice, such as fertilizer blend recommendations. This also covers certification schemes such as fair trade, organic, sustainable, etc.
		3.7. Migration policy/programs	Policies and programs that promote/incentivize or discourage/disincentivize migration, whether across national borders or regional/seasonal migration within countries. This includes changes to standing immigration policy, one-off programs to promote migration to a particular area, and NGO programs that encourage seasonal migration.
		3.8. Multi-component regulatory environment	Interventions with multiple components, all related to the regulatory and business environment
Cross-domain multi-component	Programs with multiple components delivered as a package, where the components fall into different domains in the framework	Cross-domain multi-component	Programs with multiple components delivered as a package, where the components fall into different domains in the framework

Outcome domain	Domain definition	Outcome category	Outcome definition
1. Farmer adoption of productivity-related technologies and practices	Outcomes measuring farmers' adoption of productivity-related practices.	1.1. Recommended inputs	Adoption of improved or recommended use of inputs, including new crop varieties/cultivars, fertilizers, and pesticides. For fertilizers and pesticides, this can be the adoption of new products or adherence to recommended usages (quantities, timings, etc.).
		1.2. Soil, land, and water management	Adoption of productivity-enhancing practices for managing soil (e.g., integration of crop residues), land (e.g., allocation of hectarage amongst crops, crop rotation), or water (e.g., irrigation and drainage systems). This category includes integrated soil fertility management. Fertilizer adoption is related to soil management but should be classified under "inputs" above, rather than in this category.
		1.3. Livestock management	Adoption of improved livestock management practices.
		1.4. Farmer investment (non-inputs)	Farmers' level of financial investment in their enterprise, including investments in land, equipment, and training/information. Farmers' investments in inputs should be classified under "inputs" above, rather than in this category. This includes farmers' decisions to access credit.
		1.5. Farmer adoption of recommended post-harvest practices, including storage	Farmers' adoption of post-harvest practices that promote product quality or profitability. Includes practices for moving products from the field, access to/use of storage facilities, duration of storage, etc.
		1.6. Adoption of productivity-enhancing processing practices	Adoption of improved technologies or practices by those who process agricultural goods, including SMEs and larger firms. This can include, e.g., using improved mechanical equipment, adopting digital technologies, or modifying labor allocation across tasks.
2. Quantity/quality of farm output	Outcomes measuring productivity/output of agricultural production.	2.1. Soil fertility	Measures of soil fertility ability to sustain plant growth by providing essential plant nutrients and favorable chemical, physical, and biological characteristics as a habitat for plant growth.
		2.2. Product volume/yield	Measures of the amount of product harvested. Includes both measures of raw volume and measures of yield (volume per unit land area).
		2.3. Nutrient content/ bioavailability	Measures of the nutrient content or bioavailability of agricultural produce. This can be measured through laboratory testing or visual inspection.
		2.4. Post-harvest losses	Measures of the loss of crops attributed to inefficient practices for harvesting, storage, and transport of raw agricultural goods.

Outcome domain	Domain definition	Outcome category	Outcome definition
		2.5. Production of processed ag products	The volume of processed agricultural products derived from basic inputs to increase value-added
3. Economic (micro)	Outcomes related to the profitability of agricultural activities and returns to factors of production for local actors in agricultural markets.	3.1. Farmer income (gross)	Gross income of farming households from any form of agricultural production. This includes measures of farmgate prices farmers receive for their products.
		3.2. Farmer income (net/ profitability)	Net income or profits of farming households from all forms of agricultural production
		3.3. Food security & household poverty	Any measure of poverty (other than gross or net income) or food security among members of farming households. This can include measures (including indexes) of wealth, assets, or consumption for poverty. Food security includes measures of dietary diversity, caloric intake, frequency of skipped meals, and anxiety about food; these can be measured at the individual or household level.
		3.4. Health and well-being	Any measure of physical or mental health of actors in the agriculture sector, including measures of life satisfaction, etc.
		3.5. Agribusiness income (gross)	Gross income of non-farmer actors (processers, wholesalers, etc.) from activities in the agriculture value chain.
		3.6. Agribusiness income (net/ profitability)	Net income or profits of non-farmer actors (processers, wholesalers, etc.) from activities in the agriculture value chain
4. Environment	Outcomes focused on the natural resource base that supports agriculture (e.g., soil, water), the environmental services directly affected by agricultural practices (e.g., habitat, water-holding capacity), and the level of pollution resulting from agriculture (e.g., pesticides, greenhouse gases).	4.1. Ag runoff/nonpoint source pollution	Quantity or composition of nonpoint source pollution resulting from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification caused by rainfall or snowmelt moving over and through the ground
		4.2. Water availability/ quality	Availability of water and/or water quality for all forms of agricultural production
		4.3. Landscape change (incl. deforestation) and soil loss	Changes to topography and/or vegetative cover of an area, and resultant soil loss/erosion
		4.4. Greenhouse gasses (incl. emissions and sequestration)	The quantity and type of emissions of greenhouse gasses (CO_2, methane, etc.), or sequestration potential (e.g., through re-forestation)

Outcome domain	Domain definition	Outcome category	Outcome definition
5. Empowerment & access for vulnerable groups	Outcomes related to social interactions: equitable relationships across gender within the household, equitable relationships across social groups in a community or landscape, the level of collective action, and the ability to resolve conflicts related to agriculture and natural resource management.	5.1. Decisions about agricultural production	An individual's level of input or control regarding agricultural production, such as which farming techniques to use; allocation of resources of land, labor and capital among the alternatives; investment; marketing, etc.
		5.2. Access to/ decision-making about productive resources	An individual's access to and level of input or control over decisions about productive resources, such as access to financial services (credit, savings, loans, insurance, etc.), ownership over assets, local and export markets, infrastructure (including access to water, fuel, etc.)
		5.3. Control of the use of income	An individual's level of control of the use of income from all forms of agricultural production
		5.6. Leadership in the community	An individual's standing and leadership in the community, including status as a community leader and contributions to rural community development processes. Includes membership in producer or marketing groups (aka "self-help groups"), comfort/willingness to speak in public, etc.
		5.7. Time allocation	The allocation of an individual's time across different activities, including agricultural and non-agricultural labor (including wage-earning and non-wage-earning labor), domestic labor, and leisure.
6. Economic (macro)	Outcomes related to the overall health of local, regional, and national markets as a result of interventions in the ag sector	6.1. Profitability of non-agribusiness market actors	The profitability of actors/activities in the market that are not directly part of agricultural value chains. It may be measured, e.g., as knock-on effects on total economic productivity in an area, etc.
		6.2. Price stability	Stability of prices for unprocessed and processed agricultural goods
		6.3. Product availability	Availability of processed and unprocessed agricultural products, including crops, livestock, and livestock. Examples include field crops, fruits, vegetables, horticultural specialties, cattle, sheep, hogs, goats, horses, poultry, furbearing animals, milk, eggs, and furs, etc.
		6.4. Market health/ efficiency/competitiveness	Measures of the health, efficiency, and competitiveness of markets, including consumer or producer surpluses, labor supply (surpluses or shortages), migration, transaction costs, and deadweight loss. Also includes overall measures of the state of agricultural and other markets, such as GDP or AgGDP+. Note that price stability and product availability measures should be classified under the codes for those outcomes, even when authors characterize them as economic efficiency measures.

Outcome domain	Domain definition	Outcome category	Outcome definition
7. Allocation and investment	Outcomes focused on allocating funds for the agricultural sector to enhance productivity, education, and research.	7.1. Govt. allocation/ spending on ag-related education & research	Govt. funds allocated to/spent on ag education and research, in coordination with scientists and researchers across the federal government and university and private partners.
		7.2. Govt. allocation/ spending on ag extension	Govt. funds allocated/spent to ag extension providing technical advice inputs, or other services to farmers
		7.3. Overall govt. investment in the ag sector	Total govt. funds invested in the ag sector, including research/education, extension, and other investments.
		7.4. Private sector investment in ag	Private sector funds invested in ag., including both "operationalized" investment (where funds have actually been disbursed) and "committed" Investment (where funds are formally committed but not yet disbursed)
Additional filters	These filters capture additional features of studies that are not interventions or outcomes per se but may provide useful insights about the evidence base.	Digital technologies/ICTs	Coded as "yes" when the study looks at digital technologies (e.g., tablets or mobile phones for information access or mobile banking) or information and communications technologies (such as broadband access).
		Climate change	Coded as "yes" when the study looks at any aspect of climate change mitigation, impacts, or adaptation
		Cost data/ analysis	We very often find that the vast majority of studies include no-cost information. It is useful to capture this to (a) demonstrate when there is a critical lack of cost information in the evidence base and (b) easily direct users to those studies that do provide cost information.

Note: Pas = programmatic approaches; AgGDP+ = agri-food system gross domestic product.

4. Methods

An EGM is a thematic collection of evidence on the effects of development policies and programs in a particular sector or thematic area (Snilstveit et al. 2017). EGMs are designed around a framework of interventions and associated outcomes, and are developed through a review of academic and policy literature as well as consultation with experts and stakeholders. Systematic search strategies are used to identify, review, and categorize relevant IEs and SRs from an expansive list of databases, websites, and gray literature. Included studies are mapped onto the intervention-outcome framework, creating a visualization that presents existing evidence, clusters, and gaps.

An EGM is a mapping and visualization of the evidence landscape, so it does not provide interpretation, analysis, or synthesis of what the evidence says. It also does not focus on implementation considerations such as how to effectively deliver the intervention, whom to target, or how to scale. However, it is an important entry point for understanding where evidence exists, including whether there is evidence on how the intervention affects different populations, and where more evidence may be needed.

To develop this EGM, we followed standards and methods for EGMs developed by 3ie (Snilstveit et al., 2016, 2017). The following evidence standards define the 3ie approach:
- Transparent and explicit population, interventions, comparator, outcomes, and study design inclusion criteria;
- Consultations with advisory groups within USAID RFS and missions and with external sectoral experts;
- Systematic search, screening, and data extraction procedures; and
- Critical appraisal of SRs using a standardized tool to assess how reviews have searched for, identified, and analyzed evidence.

Our search for studies covered three categories of sources. The first is 3ie's Development Evidence Portal (DEP), an online database of IEs and SRs. These studies have already been screened according to 3ie's criteria and coded according to sector, country, interventions, and outcomes. The second type of source is scholarly databases containing mostly peer-reviewed literature. Finally, we searched websites of relevant institutions that may publish research not indexed in scholarly databases, and reviewed the reference lists of included studies to identify additional papers not retrieved through our other searches. We then removed duplicates from the search results and used a screening process, aided by machine learning models, to identify eligible studies.

Given the broad scope of this EGM and our available resources, it was feasible to screen only a relatively small percentage of the abstracts retrieved through our search. We employed machine learning models to help us identify as many relevant papers as possible with the available resources. However, given that these models are not 100 per cent accurate in mimicking the screening decisions of human reviewers, it is inevitable that our screening process did not identify every eligible study in the literature. Thus, the studies included in this EGM should be considered a large and representative sample of the available evidence, rather than a fully comprehensive list of all relevant publications.

For a more comprehensive description of the methods, including additional details on the search, screening, and coding processes, see Appendixes B and C.

4.1 Analysis and reporting

To answer Research Question 1 regarding the extent and characteristics of the evidence base, we present the distribution of studies by date of publication, intervention(s) studied, outcomes reported, and population considered, including regions, countries, and specific population groups (the data extraction codebook is provided in Appendix D). For the medium- and high-confidence SRs included, we further extracted summaries of the key findings for policy implications.

To answer Research Question 2 regarding gaps in the evidence, we combined knowledge of the evidence distribution with sectoral knowledge to determine meaningful primary evidence gaps (where no IEs exist), and synthesis gaps (where no up to date or medium- or high-confidence SRs exist, despite a cluster of IE evidence).

To answer Research Question 3 regarding which evidence and synthesis gaps should be prioritized, we shared the draft findings with stakeholders at USAID and the advisory group, and solicited input on policymaker and practitioner priorities for future research.

Using 3ie's EGM software, we created an online, interactive matrix that maps all included studies according to the interventions evaluated and the outcomes reported. This provides a visual display of the volume of evidence for intervention-outcome combination, the type of evidence (IEs, SRs, completed or ongoing), and a confidence rating for SRs. The platform provides additional filters so that users can further explore the available evidence, for example by global regions, income levels, or population. The EGM can be viewed online.

This report serves as an accompaniment to the interactive map. In this report, we address the key research questions through analysis of the characteristics of the available evidence and key trends (i.e., number of IEs published over time, geography, focus on interventions and outcomes, targeted audiences).

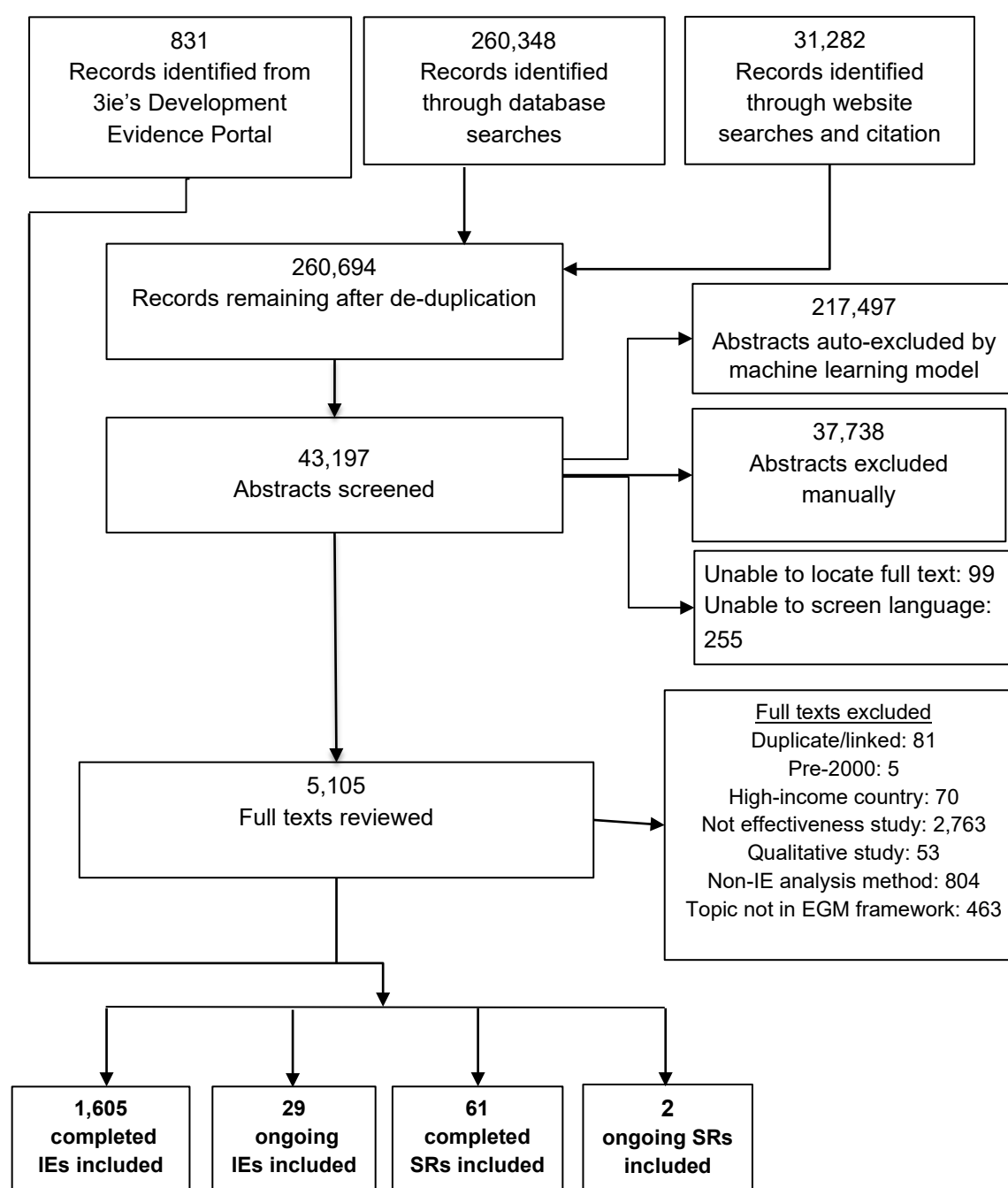Additional detail on our analysis methods can be found in Appendix B.

5. Findings

5.1 Volume of the evidence

Our search of academic databases retrieved 260,348 results (Figure 3). We identified another 31,282 items through manual searches of relevant websites and citation tracking. After removing duplicates, we manually screened 43,197 abstracts and excluded the remaining 217,497 using the machine learning classifier. We estimate that our machine-aided screening process captured about 80 per cent of all eligible studies among our search results.[3]

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[3] See model accuracy and potential for missed studies in Appendix B for additional detail on the potential for missed papers. It is worth noting that we deliberately adopted a very sensitive search strategy that was designed to capture as many relevant studies as possible, at the cost of also retrieving large numbers of irrelevant items. Compared with a more precise search strategy (i.e., one that retrieved fewer numbers of both relevant and irrelevant items), our approach to search and screening may have reduced the percentage of eligible studies we identified relative to our

Figure 3: Search and screening process

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┌─────────────────────┐  ┌─────────────────────┐  ┌─────────────────────┐
│        831          │  │      260,348        │  │      31,282         │
│ Records identified  │  │ Records identified  │  │ Records identified  │
│  from 3ie's         │  │ through database    │  │ through website     │
│  Development        │  │ searches            │  │ searches and        │
│  Evidence Portal    │  │                     │  │ citation            │
└─────────────────────┘  └─────────────────────┘  └─────────────────────┘
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┌─────────────────────────────────────┐      ┌─────────────────────────┐
│            260,694                   │      │       217,497           │
│ Records remaining after             │      │ Abstracts auto-excluded │
│ de-duplication                      │      │ by machine learning     │
│                                     │      │ model                   │
└─────────────────────────────────────┘      └─────────────────────────┘
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┌─────────────────────────────────────┐      ┌─────────────────────────┐
│            43,197                    │      │       37,738            │
│ Abstracts screened                  │      │ Abstracts excluded      │
│                                     │      │ manually                │
└─────────────────────────────────────┘      └─────────────────────────┘
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                                              ┌─────────────────────────┐
                                              │ Unable to locate full   │
                                              │ text: 99                │
                                              │ Unable to screen        │
                                              │ language: 255           │
                                              └─────────────────────────┘
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┌─────────────────────────────────────┐      ┌─────────────────────────┐
│            5,105                     │      │ Full texts excluded     │
│ Full texts reviewed                 │      │ Duplicate/linked: 81    │
│                                     │      │ Pre-2000: 5             │
│                                     │      │ High-income country: 70 │
│                                     │      │ Not effectiveness study:│
│                                     │      │ 2,763                   │
│                                     │      │ Qualitative study: 53   │
│                                     │      │ Non-IE analysis method: │
│                                     │      │ 804                     │
│                                     │      │ Topic not in EGM        │
│                                     │      │ framework: 463          │
└─────────────────────────────────────┘      └─────────────────────────┘
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┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│   1,605      │  │     29       │  │     61       │  │      2       │
│ completed    │  │  ongoing     │  │ completed    │  │  ongoing SRs │
│ IEs included │  │ IEs included │  │ SRs included │  │  included    │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
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Looking at the trend in publications over time, we observe a fairly consistent upward trend in the number of IEs published since 2000, with the rate accelerating beginning in about 2008 (Figure 4). The figure shows a decline in publications in 2021 and 2022. However, this does not necessarily mean a decline in evidence production. The database search was run in March 2022, so more recent publications are not captured. In addition, some studies published in 2021 may not yet have been indexed in the databases we searched.

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search results, while increasing the percentage of eligible studies identified relative to the entire literature.

Figure 4: Publication of impact evaluations and systematic reviews over time
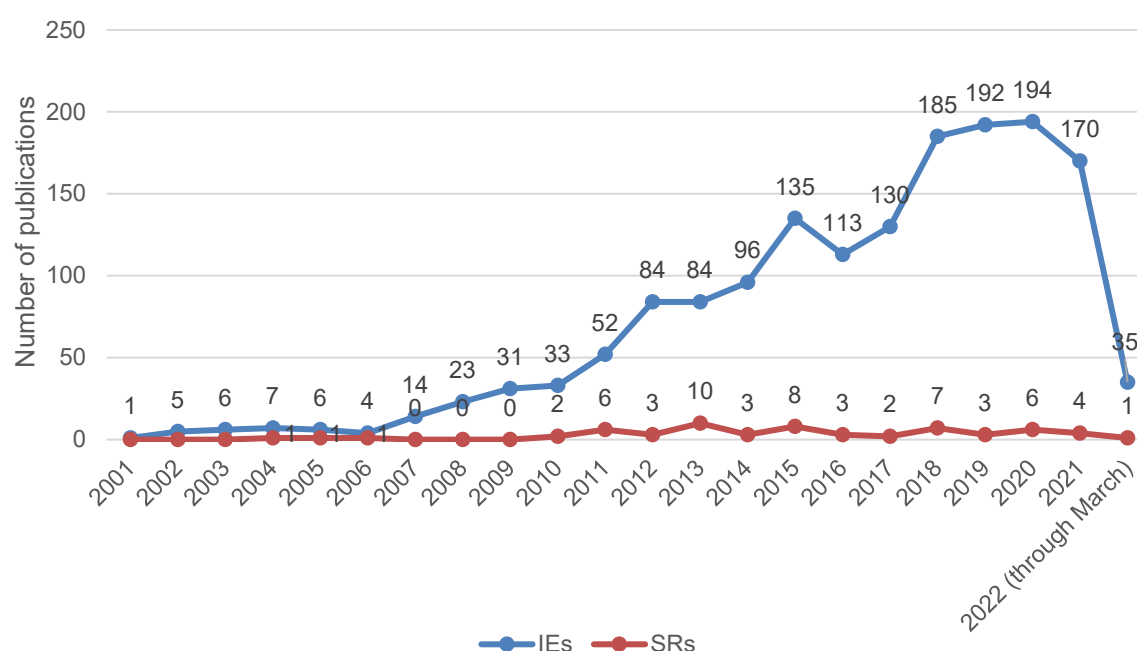
Note: Some studies have generated multiple publications over multiple years (e.g., a working paper and a journal article). This figure reflects only one date per study (the date of each study's "primary" publication).[4]

## 5.2 Characteristics of the evidence base

5.2.1 Impact evaluation methods

Just over one third of IEs in the map employ statistical matching methods (Figure 5). Randomized controlled trials (RCTs) and fixed-effects estimation (including difference-in-differences) are also common, each accounting for about a quarter of evaluations in the map. Other methods, such as instrumental variables and regression discontinuity, are less frequently used (accounting for less than 10 per cent of included studies). The predominance of matching methods contrasts with trends across the field of impact evaluation in international development, where RCTs account for about 40 per cent, and matching methods only 10 per cent.[5]

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[4] For more information on "linked" and "primary" publications, see Appendix B.

[5] Based on data from 3ie's Development Evidence Portal.

Figure 5: Breakdown of analysis methods for impact evaluations
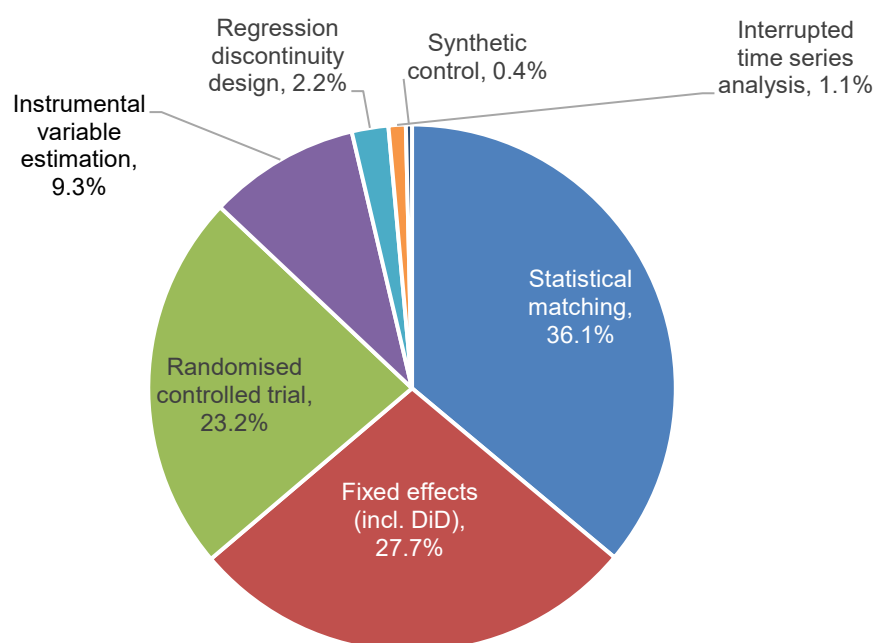
Note: DiD = difference-in-differences.

Looking at trends in the use of these methods over time, we observe a "boom" in the use of matching methods beginning around 2011, and this remained the most popular evaluation method for several years (Figure 6). Following a dip in statistical matching papers published in 2016, the gap between matching and the other most common methods (RCTs and fixed effects/difference-in-differences) appears to be closing, as these methods account for a higher proportion of the literature.

Figure 6: Use of impact evaluation methods over time
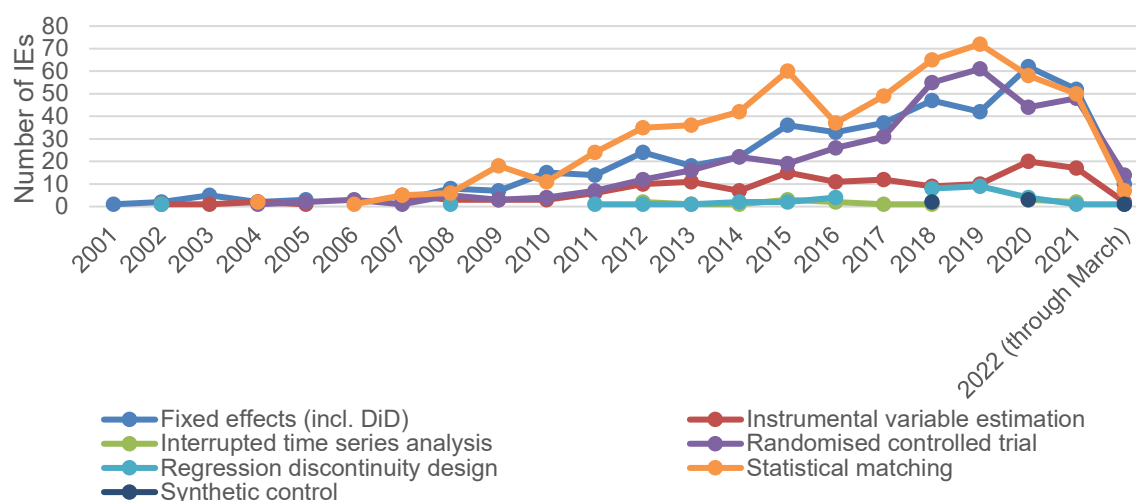
Note: DiD = difference-in-differences.

5.2.2 Confidence in findings of systematic reviews

3ie performs comprehensive critical appraisals of all SRs included in an EGM, and assigns each review a confidence rating of high, medium, or low (the critical appraisal tool is provided in Appendix E). We have generally low confidence in the SRs available

in this sector. Of the 61 completed SRs in this EGM, over half (38 reviews; 62%) received low confidence ratings (Figure 7). Only 14 reviews (23%) are high confidence, while the remaining 9 (15%) are medium confidence.

Figure 7: Confidence in findings of systematic reviews
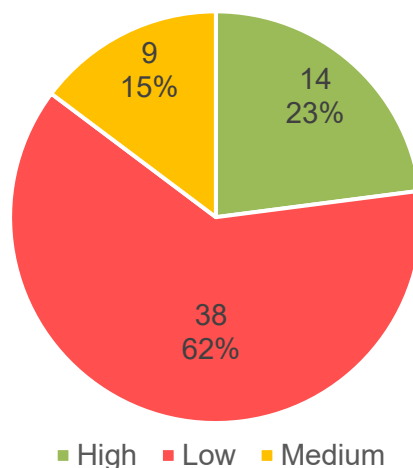
5.2.3 Geographic coverage

Evidence is unevenly distributed across countries and regions. As shown in Figure 8, there are more evaluations from Sub-Saharan Africa (n = 832) than from all other regions combined. The East Asia and Pacific and South Asia regions both have upwards of 200 IEs, with Latin America and the Caribbean just under this threshold. Evaluations are rare in Europe and Central Asia (n = 34) and in the Middle East and North Africa (n = 10). Fifteen studies evaluate interventions spanning multiple regions.

Figure 8: Impact evaluations by region
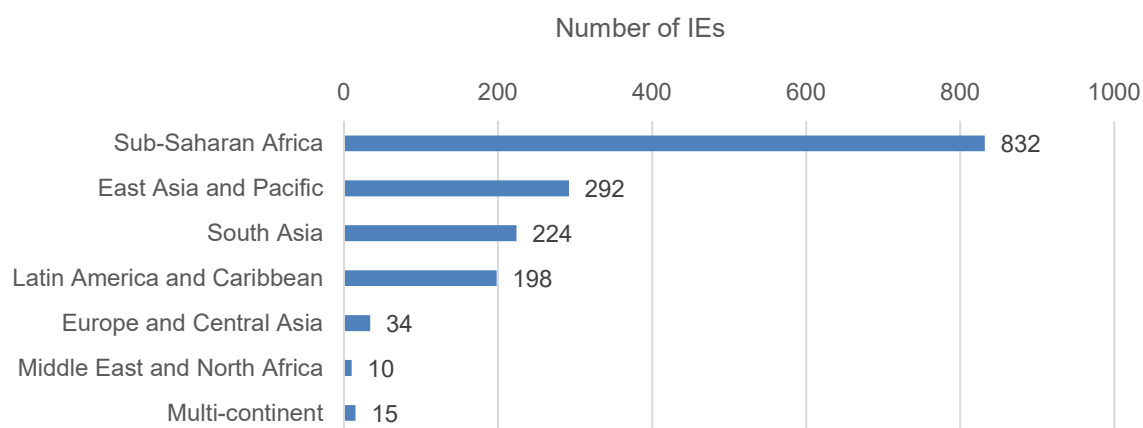
With regard to specific countries, evidence is concentrated in several countries of East Africa, along with large countries elsewhere with significant agricultural sectors, including China (n = 161), India (n = 114), Nigeria (n = 79), and Brazil (n = 48) (Figure 9). Distribution of evidence elsewhere in Sub-Saharan Africa is inconsistent, with some countries such as Mali having moderately sized evidence bases (n = 15), and countries such as Somalia and Angola having almost none (n = 1 each).

Figure 9: Geographic distribution of impact evaluations
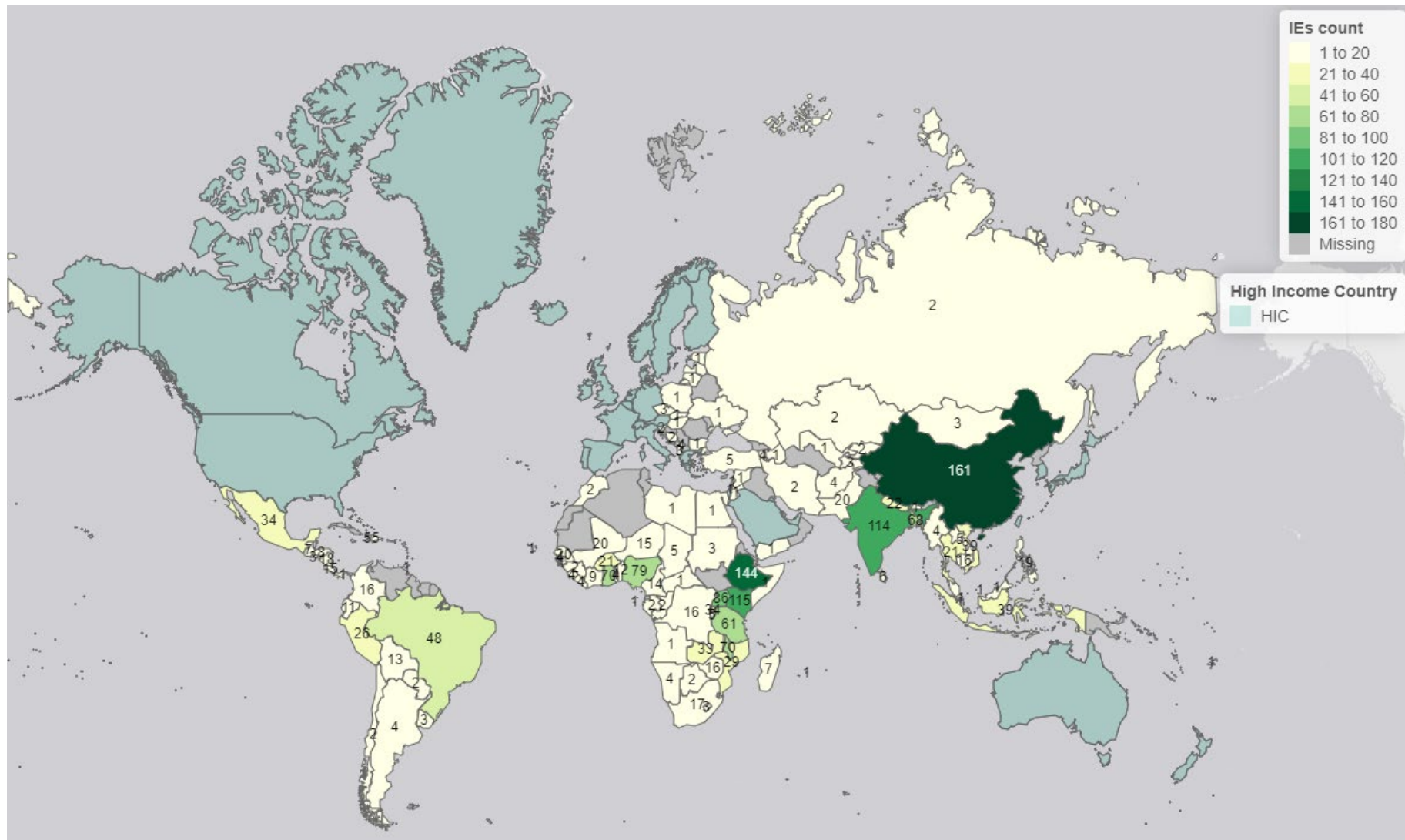
5.2.4 Intervention coverage

We find that interventions focused on disseminating productivity-related information and innovations are commonly evaluated (Figure 10). Nearly all intervention types in this category have substantial bodies of evidence, with numbers of IEs ranging from 40 (extension and private-sector capacity building) to 250 (disseminating productivity-related information).

Within the other domains of interventions, coverage is inconsistent. Among market-focused interventions, those that promote access to financial products (n = 76) or insurance (n = 53) are very frequently evaluated. Substantial evidence bases also exist for interventions that strengthen producer or marketing groups (n = 34), disseminate information on effective marketing practices and current market conditions (n = 22), and promote women's engagement and empowerment in the sector (n = 24).

However, other market-oriented interventions are infrequent subjects of evaluations. We identified very few IEs on efforts to build business-to-business and business-to-government linkages (n = 1), loan guarantees (n = 3), weather information systems (n = 3), or market information systems for non-producer actors in the agricultural value chain (n = 0).

Figure 10: Evidence by intervention (impact evaluations)
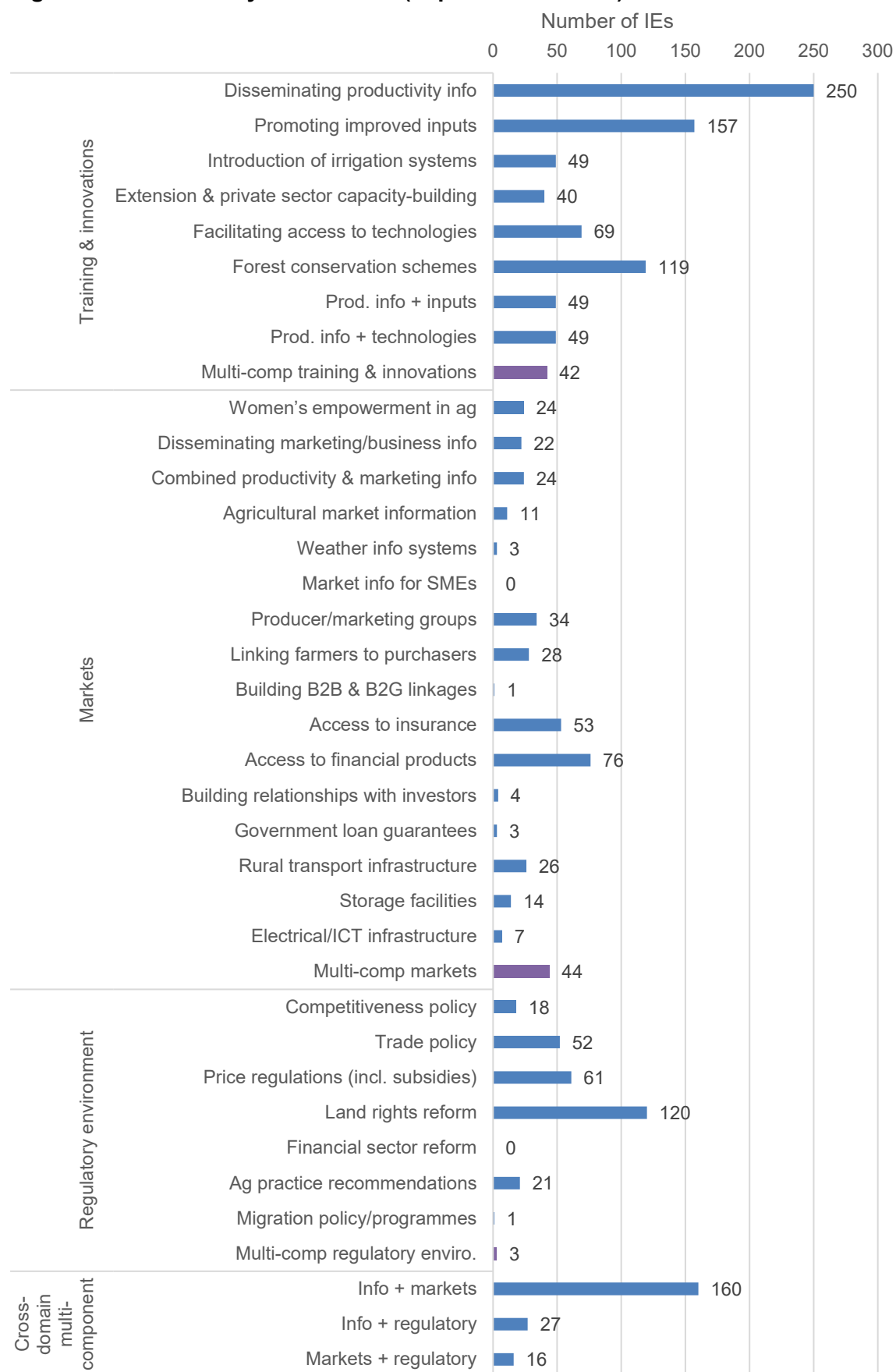
Note: B2B = business to business; B2G = business to government.

Evidence for interventions targeting the regulatory and business environment is also inconsistent. Broad evidence bases exist for land rights reform (n = 120), price regulations (61), and trade policies (n = 52); policies to promote competitiveness are also fairly well-covered (n = 18). However, we identified scant evidence on the effects of financial-sector reform or migration policy.

Multi-component interventions are common: about a quarter of IEs (n = 390) assess a multi-component intervention. When we found specific combinations of intervention components that appeared in more than 10 evaluations, we created new intervention categories for these interventions. This led to the creation of two additional categories, corresponding to interventions that combined training with improved access to inputs (n = 49), or with access to other technologies (n = 49).

For other multi-component combinations, we grouped them according to the domain or combination of domains in the framework from which the components came. Interventions that combine a training and innovations component with a market-focused component are commonly evaluated (n = 160), as are interventions that combine multiple training and innovations components (n = 42).

For SRs, we find similar patterns of coverage across intervention categories, and the majority of reviews across categories have been assessed as "low confidence" (Figure 11). As with IEs, we find a significant concentration in the training and innovations domain. The most assessed interventions in included reviews are dissemination of productivity-related information and forest conservation schemes (14 and 13 reviews, respectively). For productivity information interventions, five of these reviews are of high or medium confidence, while there are three high- or medium-confidence reviews on forest conservation schemes. However, we find no reviews investigating extension and private-sector capacity-building interventions. Most reviews in this domain have low confidence ratings, though almost a quarter are high confidence.

# Figure 11: Evidence by intervention (systematic reviews)
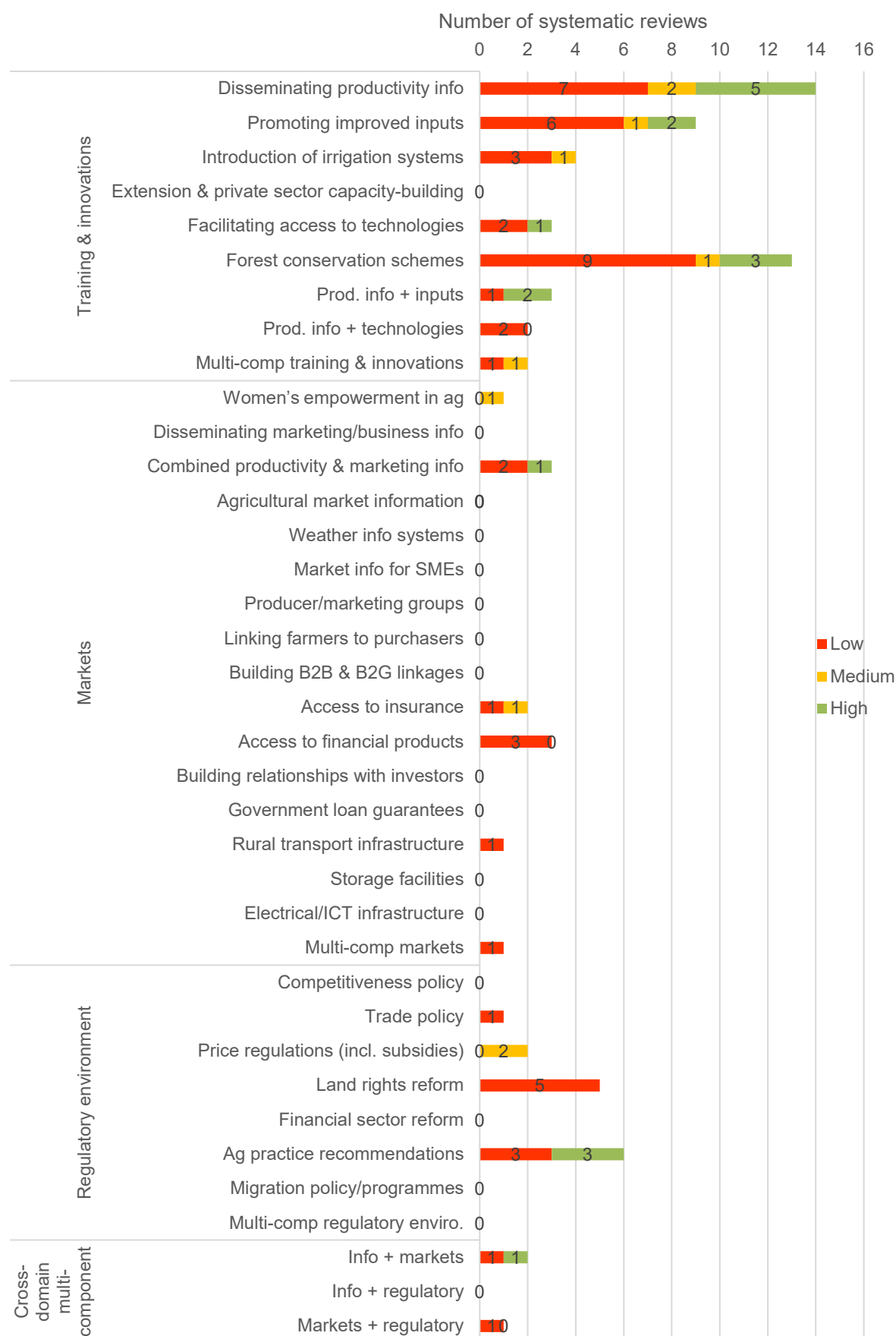
Note: B2B = business to business; B2G = business to government.

The domains focused on markets and the regulatory environment each have moderate representation in SRs (n = 11 and n = 14, respectively). Among market-focused interventions, the most reviewed is access to financial products (n = 3; all low confidence) and interventions that disseminate information on effective marketing practices and current market conditions (n = 3; 1 high confidence and 1 low confidence). Among interventions targeting the regulatory environment, the most frequently assessed SRs are agricultural practice recommendations (n = 6; 3 high confidence and 3 low confidence) and land rights reform (n = 5; all low confidence).

We also looked at the distribution of evaluations covering our intervention domains across regions (Figure 12). This distribution is broadly consistent with patterns elsewhere, with training/innovations interventions dominating in each region. However, it is notable that there is much greater attention to interventions targeting the regulatory environment in East Asia and the Pacific than in Sub-Saharan Africa. Although there are more than twice as many evaluations overall in the latter region as in the former, there are nearly as many studies on the regulatory environment in East Asia and the Pacific (n = 88) as there are in Sub-Saharan Africa (n = 102).

Figure 12: Intervention domain coverage, by region
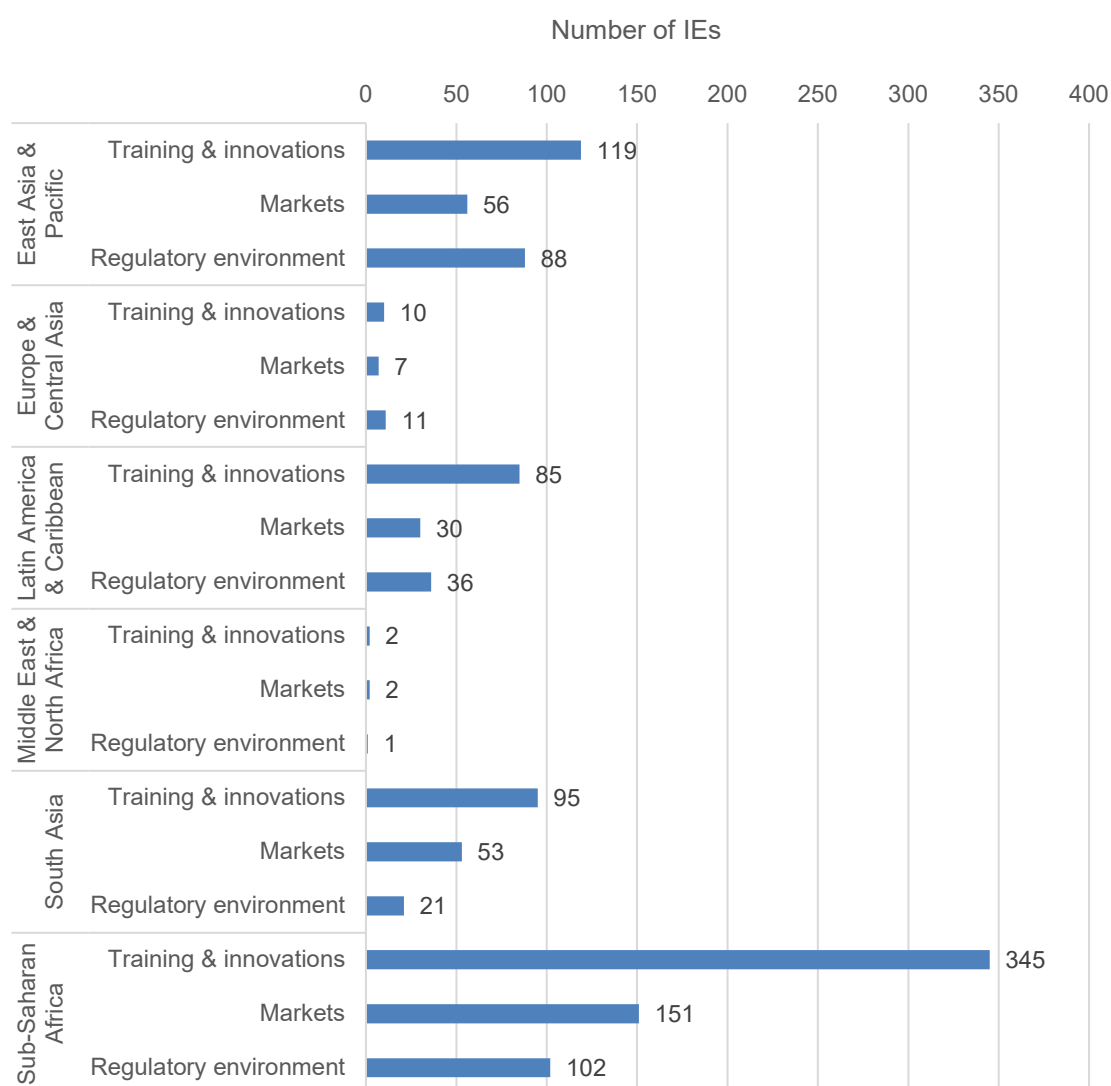
5.2.5 Outcome coverage

The included studies most frequently measure outcomes related to agricultural production and household-level impacts (Figure 13). Product volume/yield is the most frequently measured outcome among IEs (n = 591), followed by household poverty and income (n = 479 and n = 470, respectively), and farmers' input adoption (n = 377).

Figure 13: Evidence by outcome
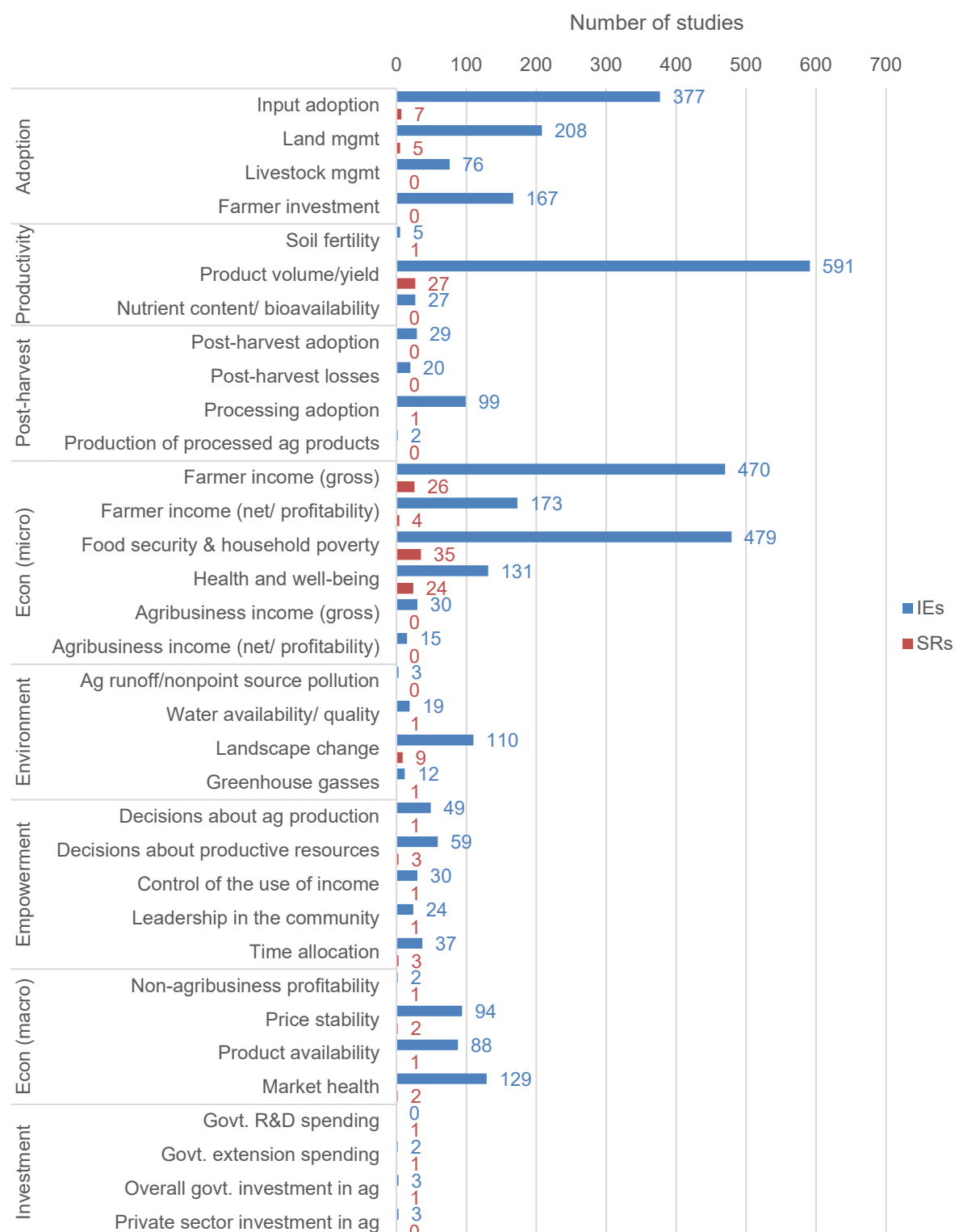
While adoption measures are generally common, we identified only two evaluations (and no reviews) that measure farmers' adoption of recommended post-harvest practices (including storage). Among outcomes related to farm outputs, most are well covered in the literature, with the exception that there are very few studies measuring production volumes of processed agricultural goods (n = 2).

There are notable gaps with respect to environmental outcomes (except landscape change, measured in 111 studies) and outcomes related to investment in the agricultural sector.

5.2.6 Ongoing studies
We identified 29 ongoing IEs and 2 ongoing SRs (Figure 14). The IEs are focused on three broad categories from our framework: training and innovations (n = 4), markets (n = 11), and the regulatory environment (n = 2). In addition, six evaluations focus on multi-component interventions that combine a training and innovations component with a market-focused component. The two ongoing SRs are split between the training/innovations and markets domains.

Figure 14: Intervention domains of ongoing studies
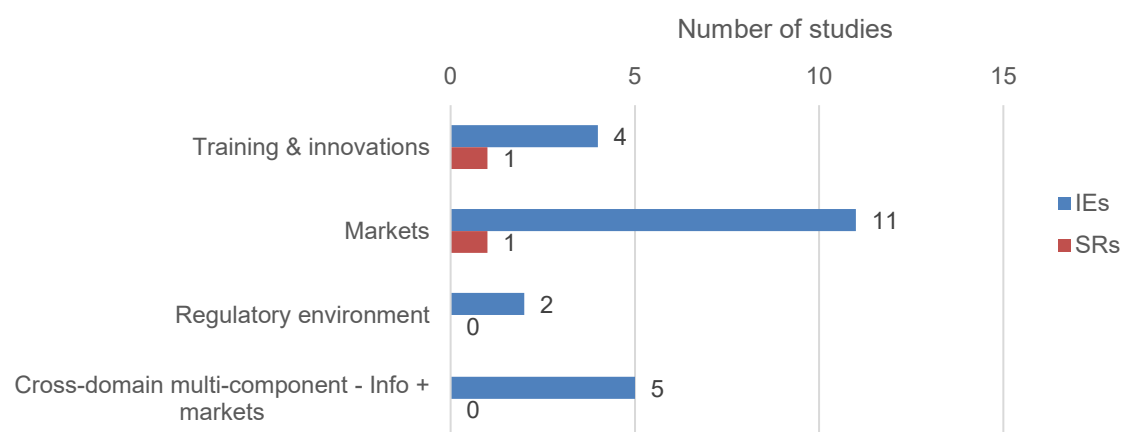
5.2.7 Implementers and funders
For each included study, we captured the following information whenever it was reported:
   (a) The agency or organization that implemented the program or policy being evaluated;
   (b) The source of funding for the evaluated program; and
   (c) The source of funding for the IE.

These data provide a picture of the agencies and organizations that are investing most heavily in evaluation research on agricultural development interventions.

Among studies in which the agency implementing the intervention is identified (n = 881), most (n = 506) are implemented by the governments of the countries where the interventions take place (Figure 15). Non-profit organizations are also frequent implementers of evaluated programs (n = 159), while evaluations of interventions implemented by other types of agencies, such as international aid agencies, for-profit firms, or academic institutions are rarer. Of the 10 most frequent implementers of evaluated programs, 6 are country governments (Figure 16).

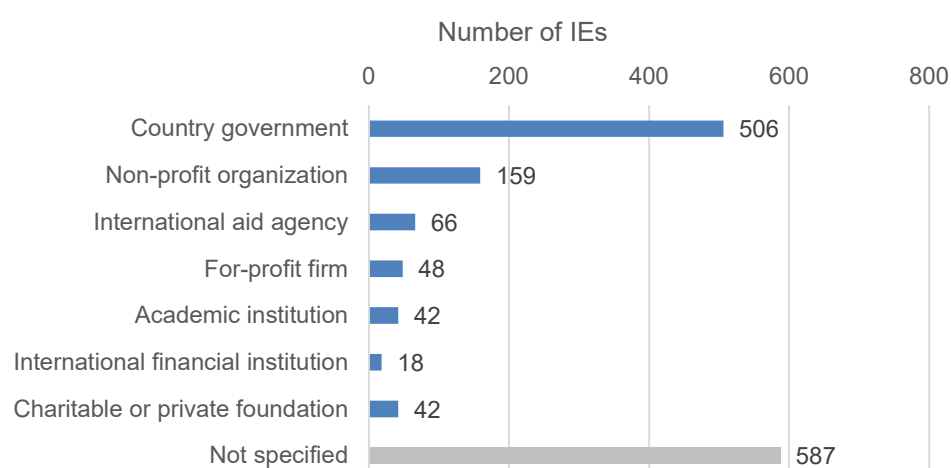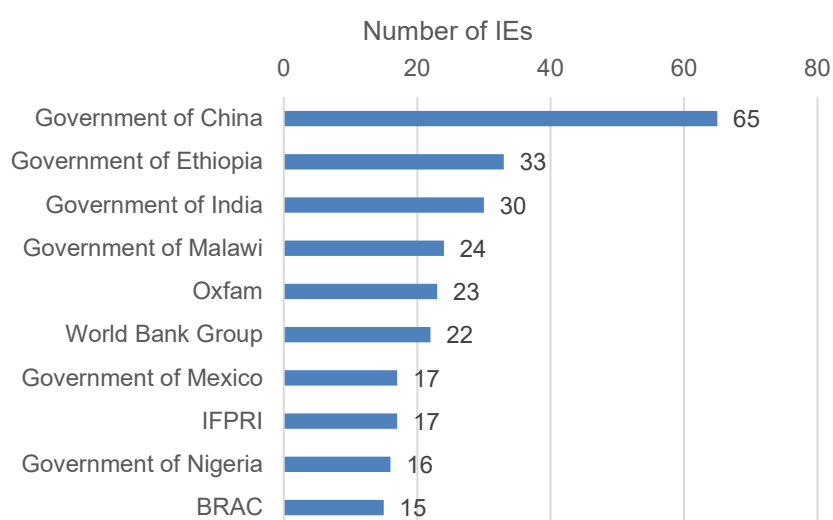**Figure 15: Impact evaluations by implementing agency type**

Number of IEs

Agency type	Value
Country government	506
Non-profit organization	159
International aid agency	66
For-profit firm	48
Academic institution	42
International financial institution	18
Charitable or private foundation	42
Not specified	587

Figure 16: Top 10 implementers of evaluated programs

Number of IEs

Implementer	Value
Government of China	65
Government of Ethiopia	33
Government of India	30
Government of Malawi	24
Oxfam	23
World Bank Group	22
Government of Mexico	17
IFPRI	17
Government of Nigeria	16
BRAC	15

Note: IFPRI = International Food Policy Research Institute.

Country governments are also the most frequent funders of evaluated programs, though this is less commonly reported (Figure 17). Of the 565 studies that report this information, 298 describe interventions funded by country governments. However, as compared with program implementers, there are a greater number of internationally focused agencies among the top program funders (Figure 18). These include the World Bank Group (n = 52), USAID (n = 39), the Chinese government (n = 34), the International Fund for Agricultural Development (n = 23), and the UK government (DFID/FCDO) (n = 21).[6]

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[6] The UK's former Department for International Development (DFID) is now the Foreign, Commonwealth & Development Office (FCDO).
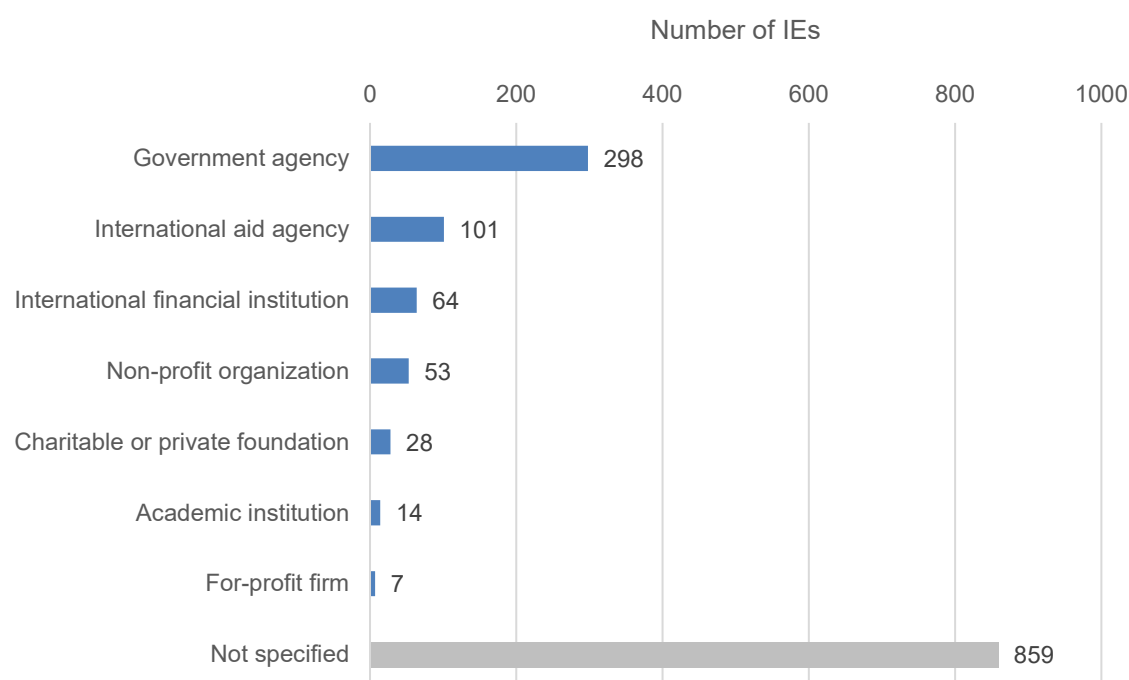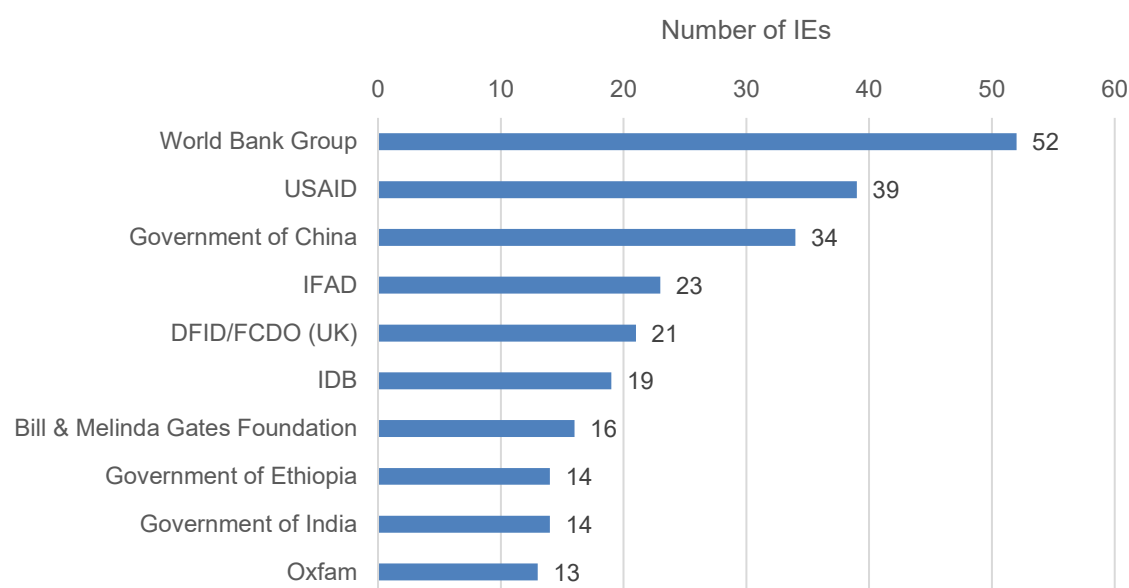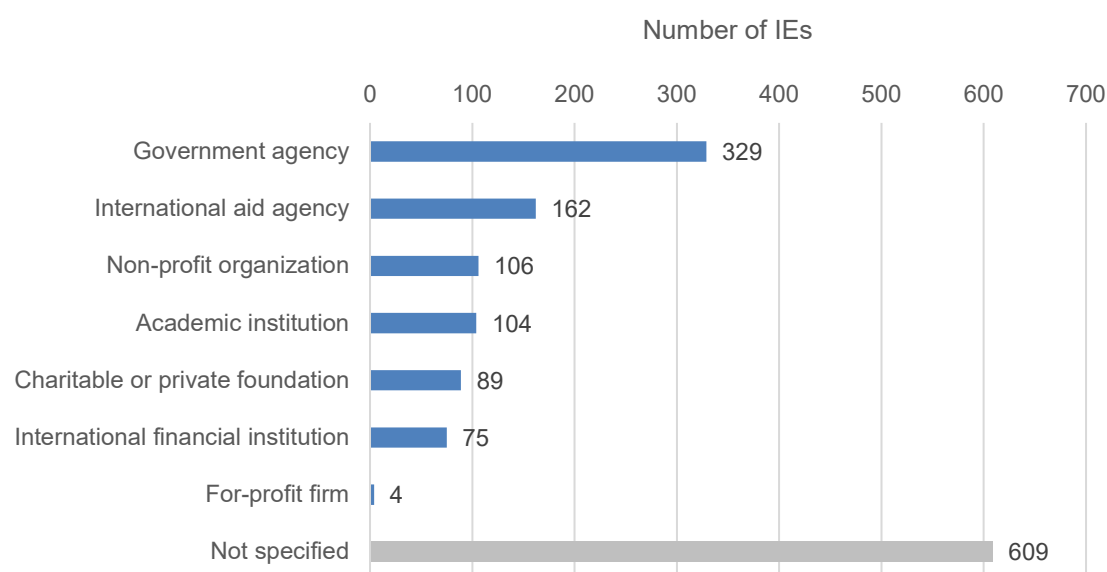
Figure 17: Impact evaluations by program funder type

Number of IEs

Funder type	Number
Government agency	298
International aid agency	101
International financial institution	64
Non-profit organization	53
Charitable or private foundation	28
Academic institution	14
For-profit firm	7
Not specified	859

Figure 18: Top 10 funders of evaluated programs

Number of IEs

Funder	Number
World Bank Group	52
USAID	39
Government of China	34
IFAD	23
DFID/FCDO (UK)	21
IDB	19
Bill & Melinda Gates Foundation	16
Government of Ethiopia	14
Government of India	14
Oxfam	13

Note: IFAD = International Fund for Agricultural Development; FCDO = UK Foreign, Commonwealth & Development Office; IDB = Inter-American Development Bank.

Finally, we examine the sources of research funding for IEs. Here again, country governments lead, though there is a more even distribution across agency types than we observe for implementers or program funders (Figure 19). Of the 946 research funders mentioned, 329 are domestic government agencies. Funding by for-profit firms is rare (n = 4), with the number of studies funded by other agency types ranging from 75 to 162. USAID is the top funder of IEs in the agricultural sector (n = 107), by a significant margin (Figure 20).

Figure 19: Impact evaluations by impact evaluation funder

Number of IEs

Funder	Number of IEs
Government agency	329
International aid agency	162
Non-profit organization	106
Academic institution	104
Charitable or private foundation	89
International financial institution	75
For-profit firm	4
Not specified	609

Note: because some research projects have multiple funders, the number of funders is greater than the number of IEs in the map.

Figure 20: Top 10 funders of impact evaluations

Number of IEs

Funder	Number of IEs
USAID	107
World Bank Group	76
NSFC	63
Bill & Melinda Gates Foundation	60
DFID/FCDO (UK)	53
3ie	48
IFPRI	38
SIDA	25
IDB	24
NSF	17
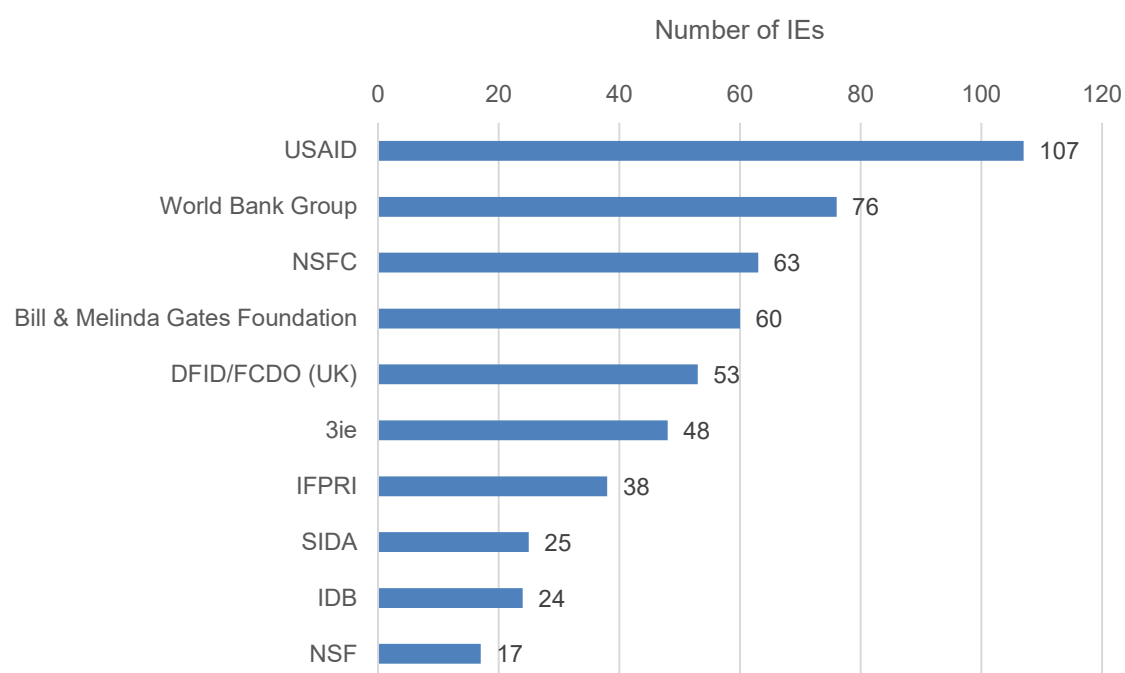
Note: NSFC = National Science Foundation of China; FCDO = UK Foreign, Commonwealth & Development Office; IFPRI = International Food Policy Research Institute; SIDA = Swedish International Development Agency; IDB = Inter-American Development Bank; NSF = National Science Foundation (US).

5.2.8 Attention to gender and equity

Most studies – approximately 80 per cent of IEs and SRs – do not report on considerations of gender or equity in their research designs (Figure 21). When IEs do take equity considerations into account, it is most often by conducting subgroup analysis by sex (about 5.1% and 3.3% for IEs and SRs, respectively).

Figure 21: Equity focus of included studies
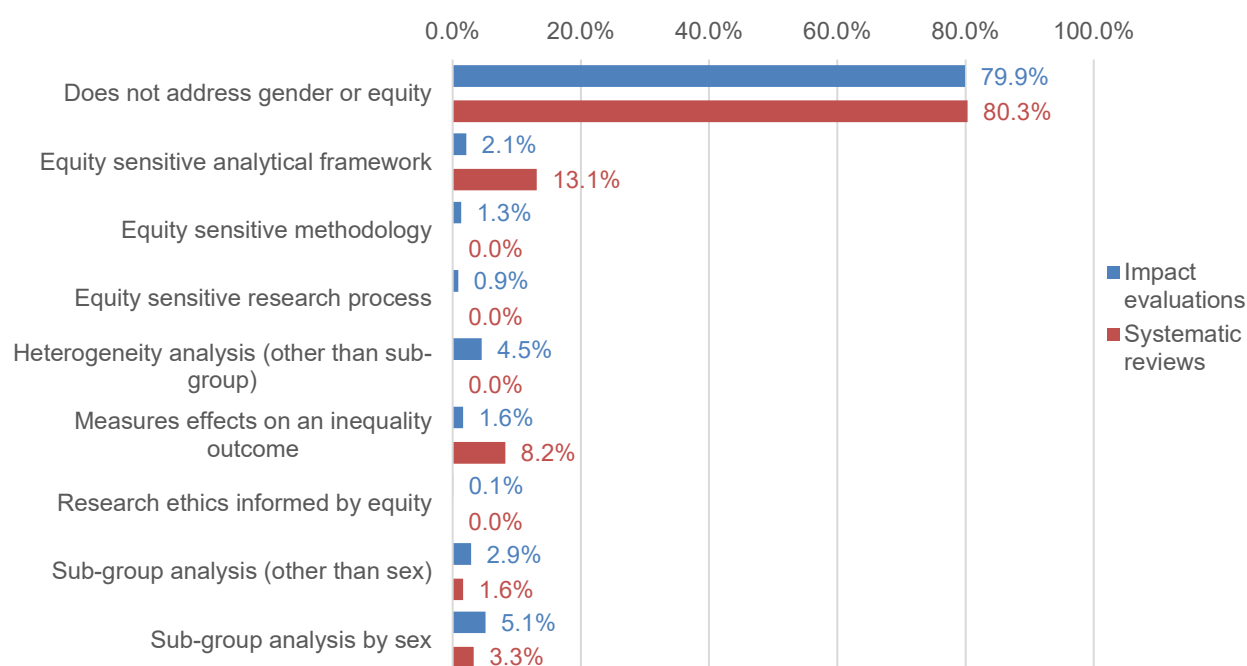
Among studies that do have an equity focus, the most common dimensions to examine are sex (n = 140 for IEs and n = 7 for SRs) and socioeconomic status (n = 64 for IEs and n = 9 for SRs) (Figure 22).

Figure 22: Equity dimensions considered in included studies
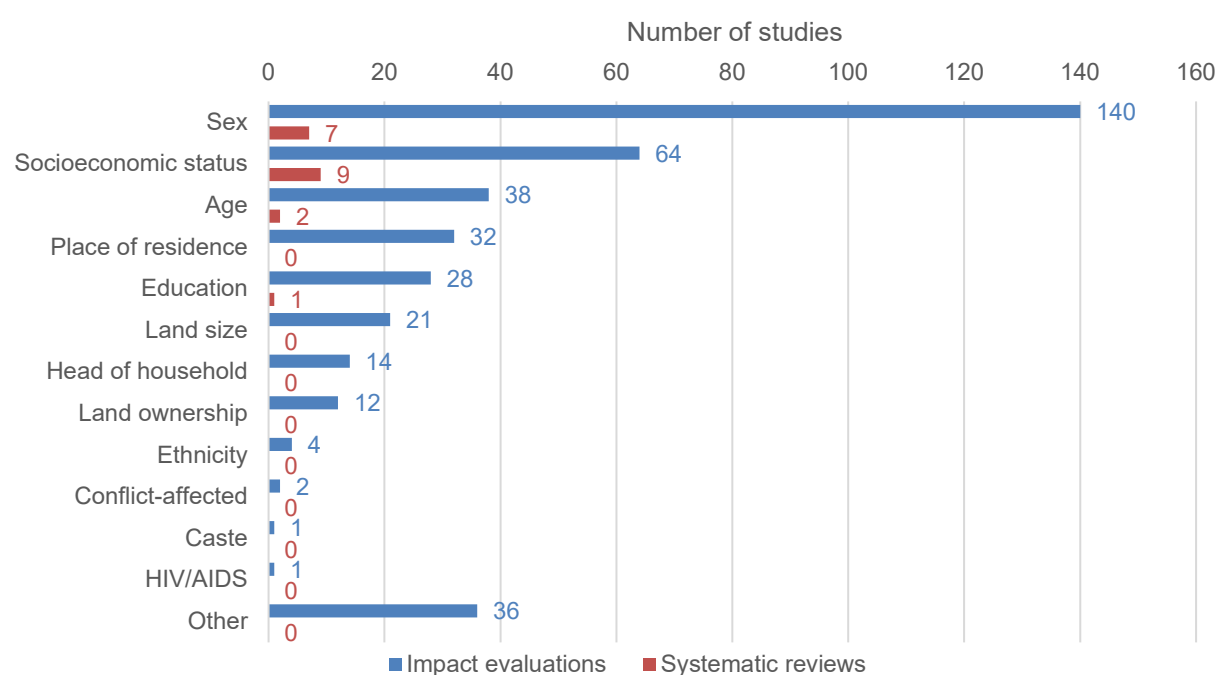
5.3 Findings from high-confidence SRs

We provide a summary of findings from the 14 included high-confidence SRs in Table 2. A prevailing theme across the high-confidence reviews is that there is evidence for beneficial effects of agricultural interventions, but this evidence is generally of low quality and the results must therefore be viewed with considerable caution. Examples include the reviews of Stewart and colleagues (2015) on improved inputs and training, Waddington and colleagues (2014) on farmer field schools, Snilstveit and colleagues (2019) on payments for environmental services, Garbero and colleagues (2018) on adoption of improved varieties, and Visser and colleagues (2020) on education to reduce aflatoxins in staple food crops.

Despite these limitations of the evidence base, multiple reviews (Waddington et al. 2014; Garbero, Marion, and Brailovskaya 2018; Stewart et al. 2015; Gonzalez Parrao et al. 2021) find evidence consistent with the hypothesis that improved inputs and knowledge dissemination lead to better adoption of beneficial practices, higher incomes and consumption, and better food security among smallholder farmers. Evidence for reductions in poverty levels as a result of such interventions, however, is weak.

Table 2: Key findings from high-confidence SRs

Reference	Title	No. studies included	Key findings
(Bassey et al. 2022)	Impact of Home Food Production on Nutritional Blindness, Stunting, Wasting, Underweight and Mortality in Children: A Systematic Review and Meta-Analysis of Controlled Trials	16 (8 included in meta-analysis)	▪ The authors rated all evidence "low certainty" based on GRADE criteria.[7] ▪ Included interventions are primarily multi-component programs combining training and distribution of chicks and/or improved seeds. ▪ The review primarily covers interventions in Sub-Saharan Africa (9 studies), East Asia (5 studies), and South Asia (2 studies). ▪ Overall, the evidence suggests "home food production may slightly reduce stunting, wasting and underweight in children" (p. 12). The meta-analysis for effects for wasting/underweight are positive but not statistically significant. ▪ The review also found evidence of a small increase (0.25 standard deviations) in dietary diversity scores for children under five, though this was based on meta-analysis of only three studies. ▪ The meta-analysis identified no significant effects on serum retinol.
(Gonzalez Parrao et al. 2021)	Aquaculture for Improving Productivity, Income, Nutrition and Women's Empowerment in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis	21 (covering 13 unique programs)	▪ The authors rated 12 of the included studies as having a high risk of bias. ▪ Included interventions took place in Bangladesh (7 studies), Nigeria (2 studies), Cambodia, Indonesia, Malawi, and Kenya (1 study each). ▪ Meta-analyses found small effects of aquaculture programs on productivity, income, and food consumption. ▪ The authors did not identify sufficient evidence to assess the effects of aquaculture interventions on food security, diet quality, or women's empowerment.
(Visser et al. 2020)	Agricultural and Nutritional Education Interventions for Reducing Aflatoxin Exposure to Improve Infant and Child Growth in Low- and Middle-Income Countries	3	▪ The authors rated at least two of the included studies as having a high risk of bias; one was unclear. ▪ Included interventions took place in Kenya, Zimbabwe, and Tanzania. ▪ It is unclear whether average treatment effect estimates were obtained as results from single studies were presented. ▪ None of the three included studies examined the effects of nutritional education on

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[7] GRADE (Grades of Recommendations, Assessment, Development and Evaluation) is a tool used to assess the overall quality of decision-relevant evidence and strength of accompanying recommendations. For details, see Schünemann et al. (2013).

Reference	Title	No. studies included	Key findings
			• pre- and post-natal growth, or unintended effects of agricultural and nutrition education. • One low-confidence study found that children from farmers' households who received agricultural education experienced increases in z-scores of weight-for-age (0.57), as compared to children from households where farmers only received routine services. Alternatively, agricultural education may reduce the proportion of underweight children on average by 6.7%, compared to routine services.
(Snilsveit et al. 2019)	Incentives for Climate Mitigation in the Land Use Sector—The Effects of Payment for Environmental Services on Environmental and Socioeconomic Outcomes in Low- and Middle-Income Countries: A Mixed-Methods Systematic Review	44	• The authors judge the available evidence to be of low or very low quality. • Evidence comes from a relatively small number of countries, primarily in Latin America and East Asia. • Overall, the evidence suggests payment for environmental services (PES) may have small positive effects on forest cover and household income. • Evidence from 11 studies suggests PES interventions improve environmental outcomes (deforestation and other measures of forest/vegetation cover) by 0.21 standard deviations (95% CI 0.09–0.33). • Evidence from 14 studies suggests PES improves household economic outcomes (income, expenditure, assets) by 0.15 standard deviations (95% CI 0.03–0.27).
(Garbero, Marion, and Brailovskaya 2018)	The Impact of the Adoption of CGIAR's Improved Varieties on Poverty and Welfare Outcomes	21	• The authors judge the overall quality of available evidence to be low, finding that 10 of the 21 included studies have high risk of bias, and another 7 have medium risk of bias. • The evidence is primarily focused in Sub-Saharan Africa (17 studies). There are an additional two studies from Mexico and one each from Bangladesh and China. • Evidence from 12 studies suggests adoption of improved varieties increases income by 35%, while evidence from 8 papers suggests adoption increases expenditure by 14%. • Evidence from seven papers revealed no significant effects of adoption on poverty.
(Oya et al. 2017)	Effects of Certification Schemes for Agricultural Production on Socio-Economic Outcomes in Low- and Middle-Income Countries: A	43	• The authors describe the quality of available evidence as "mixed, with a significant number of studies that are weak on a number of methodological fronts" (p. 5). • Most evidence comes from Latin America and the Caribbean or Africa, with lesser representation from South or East Asia.

Reference	Title	No. studies included	Key findings
	Systematic Review		▪ Evidence is concentrated on evaluation of a few certification schemes, particularly fairtrade, which accounts for over half of the included studies. ▪ Based on evidence from four studies (moderate to high risk of bias), certification schemes appear to have beneficial effects on prices: farmers participating in these schemes fetch prices 14% higher than non-participants. ▪ There is little evidence for the effectiveness of certification schemes in improving other outcomes, including household income, wealth, or health.
(Ton et al. 2017)	The Effectiveness of Contract Farming in Improving Smallholder Income and Food Security in Low- and Middle-Income Countries: A Mixed-Method Systematic Review	22	▪ The authors rated 15 of the included studies as having a high risk of bias (as measured by mechanism of assignment or group equivalence bias). ▪ Included interventions took place in Nigeria, Madagascar (2), Uganda (2), the Philippines, Indonesia (3), Peru, Ethiopia, China (2), Senegal (2), Zimbabwe, India (2), Kenya (2), Vietnam (2), Laos, and Cambodia. ▪ The meta-analysis found a 62% increase (95% confidence interval = 40%, 87%) in income for contract farmers as compared to non-contract farmers. Authors caveat that publication bias is likely, and the true effect of contract farming is likely to be much lower, but still substantially higher than non-contract farming.
(Samii et al. 2015)	Decentralised Forest Management for Reducing Deforestation and Poverty in Low–And Middle-Income Countries: A Systematic Review	12 (8 included in meta-analysis)	▪ The authors rated three of the included studies as having a high risk of bias (as measured by lack of controls for potential confounding bias). ▪ Included interventions took place in Bolivia, Ethiopia, India, Kenya, Malawi, Nepal, and Uganda. ▪ Authors reported that meta-analyses of key outcomes were challenged by variations in how indicators were measured. It is unclear whether average treatment effect estimates were obtained, as results from single studies were presented. ▪ Regarding forest conservation outcomes, two studies (India, Bolivia) found an annual forest cover change rate range from 0.026 percentage points (SE = 0.060, 95% CI: [-0.09, 0.14]) for a study examining decentralized forest management and community forest use in India, to 0.80 percentage points (SE = 0.20, 95% CI: [0.41, 1.19]) for a study examining decentralized forest management-based administration of protected forests in Bolivia.

Reference	Title	No. studies included	Key findings
			▪ Three studies examined the effects of decentralized forest management on welfare or poverty outcomes (Ethiopia, Malawi, Uganda), and found that on average, it increased either a household's forest or income.
(Stewart et al. 2015)	The Effects of Training, Innovation and New Technology on African Smallholder Farmers' Economic Outcomes and Food Security: A Systematic Review	19	▪ The authors rated eight of the included studies as having serious or critical risk of bias. ▪ Included interventions took place in Ethiopia (2), Kenya (2), Uganda (4), Malawi, Tanzania, West Africa (northern Benin and the Sudano-Sahel), Kenya (3), South Africa (2), Mozambique (2), and Swaziland. ▪ Authors caveat that they were unable to estimate an average effect of smallholder farming interventions on farmers' economic outcomes and food security due to small sample sizes, large variation across effect sizes of included studies, and risk of bias. The findings should be interpreted with caution. ▪ Among six agricultural input innovations, interventions were found to increase farmers' levels of food security as measured by nutrition indicators (g = 0.71; 0.44, 0.98). ▪ Among five orange–fleshed sweet potato interventions, interventions were found to increase farmers' income as measured by the increased monetary value of their total harvest (g = 0.26; 0.1, 0.41). ▪ Among five training interventions, no effects were measured for farmers' income as modelled on monetary value of their total harvest (g = 0.12; -0.04, 0.27).
(Korth et al. 2014)	What Are the Impacts of Urban Agriculture Programs on Food Security in Low and Middle-Income Countries: A Systematic Review	0	▪ This review did not identify any eligible studies.
(Samii et al. 2014)	Effects of Payment for Environmental Services on Deforestation and Poverty in Low- and Middle-Income Countries: A Systematic Review	20 (11 studies that performed IEs included, covering 6 payment-for-environmental-	▪ The authors rated the studies as methodologically weak because none are random experiments, and only one used a source of exogenous variation to reduce the issue of self-selection. ▪ The 11 payment-for-environmental-services studies took place in Costa Rica (6), China (1), Mexico (3), and Mozambique (1). ▪ Nine studies focused on effects on forest cover suggest that payment-for-

Reference	Title	No. studies included	Key findings
		services programs)	• environmental-services (PES) programs have reduced annual deforestation and increased annual forest coverage change rates. • Only two studies focused on the effect of PES on household income and found a positive impact.
(Waddington et al. 2014)	Farmer Field Schools for Improving Farming Practices and Farmer Outcomes in Low- And Middle-Income Countries: A Systematic Review	92 (15 of high enough quality to be included in the meta-analysis)	• The studies in this review are primarily short-term or pilot programs, and there are no studies rated as low risk of bias (only medium and high risk). • The interventions took place in Pakistan (2), Ecuador (1), Kenya (1), Tanzania (1), Indonesia (2), Peru (2), China (2), Thailand (1) Vietnam (1), Ethiopia (1), and the Philippines (1). • The review found that farmer field schools increase knowledge and adoption of recommended practices, and reduce the use of pesticides and environmental degradation. • The meta-analysis also suggests that this leads to a 13% increase in agricultural yields and 19% increase in profits, though only two studies assessed profits. • The authors did not identify studies with valid estimates of the impact on health outcomes.
(Pullin et al. 2013)	Human Well-Being Impacts of Terrestrial Protected Areas	79 (14 included in the meta-analysis)	• The authors rated 14 studies as low/medium risk of bias and 63 as high risk of bias. • Of all 79 quantitative studies in this review, many interventions took place in India, Nepal, South Africa, and Uganda. • Only two studies reporting results on ecosystem goods are not highly susceptible to bias. • The meta-analysis does not report specific estimates and suggests that a large range of factors lead to positive and negative impacts of establishing protected areas.
(Curran and MacLehose 2006)	Community Animal Health Services for Improving Household Wealth and Health Status of Low Income Farmers	0	• This review did not identify any eligible studies.

5.4 Evidence gap analysis

This EGM has identified a number of evidence gaps that would benefit from additional attention from the field.

5.4.1 Gaps in intervention and outcome coverage
Absolute gaps
While there are sizable evidence bases for several types of market-oriented interventions, others have been the subject of very few evaluations. In particular, evaluations are rare for interventions targeting non-producer actors in agricultural markets: we find very little evidence on interventions such as building business-to-business and business-to-government linkages, market information systems for SMEs, or linking of farmers or agribusinesses to private investors.

Several important outcomes are rarely measured in the literature, particularly those related to non-farmer actors in agricultural value chains. We identify very few evaluations that assessed the impact of interventions on the income or profitability of agribusinesses and non-agribusiness actors. While there is relatively good coverage of most adoption-related outcomes, there is very little measurement of the adoption of post-harvest practices (or of post-harvest losses).

Synthesis gaps
There is a potential synthesis gap with respect to land rights-reform interventions.
This type of intervention is heavily studied, with 120 IEs and 5 SRs, but these are all low-confidence reviews. There are significant clusters of IEs covering the effects of this intervention on several outcomes, including farmer adoption of productivity-enhancing practices, product volume/yield, food security/household poverty, and landscape change.

There are potential synthesis gaps concerning the impact of access to financial products and insurance. We identified 76 IEs on financial access interventions, but all SRs (n = 3) were assessed as low confidence. We found 53 evaluations of insurance interventions, and the lone medium-confidence review is now 10 years old.

Another potential synthesis gap concerns multi-component interventions that combine productivity-oriented training with access to productivity-enhancing technologies. We identified 49 IEs on this type of intervention (which includes direct transfers of assets or cash), but only two SRs, both rated as low confidence.

There may also be synthesis gaps on livestock-oriented services and urban agriculture. Both of these intervention types have been the subject of high-confidence SRs, but these reviews identified no relevant studies at the time they were conducted. A review by Curran and MacLehose (2006) found no studies on the effects of community animal health services for farmers. Our framework did not distinguish this type of intervention from other interventions focused on extension and related services, but we identified over 200 studies measuring livestock management outcomes – suggesting that there is now a considerable evidence base for livestock-oriented interventions that may benefit from high-quality synthesis.

A review by Korth and colleagues (2014) on urban agricultural interventions also identified no relevant studies. Our framework does not permit us to identify urban

agricultural interventions specifically, so we are not able to say whether there now exists an evidence base on the topic that could be synthesized. But as we approach ten years since this review was published, it is possible that now there is a synthesis gap.

5.4.2 Geographical gaps

We find that evidence is unevenly distributed across regions and countries. Among major regions, Sub-Saharan Africa has the most evidence, (although this is heavily concentrated in East Africa), with large agricultural economies such as China, Nigeria, India, and Brazil also being sites of large numbers of evaluations. Evidence is much scarcer in other areas of Sub-Saharan Africa.

5.4.3 Methodological gaps

Quasi-experimental methods, and particularly statistical matching approaches, are more common in the agricultural sector than in other fields. The reason for this pattern is unknown, but one possibility is that researchers in this sector make greater use of existing datasets to perform retrospective evaluations (most other IE methods require multiple rounds of primary data collection). Using existing datasets is one way to reduce the costs associated with IEs, and in this sense evaluators in the agricultural sector may be making better use of existing resources than evaluators in other sectors.

We also observe a significant lack of attention to gender and equity considerations in evaluation research, with over three quarters of included studies failing to address such considerations at all.

6. Conclusions and implications

6.1 Implications for decision makers

There are substantial evidence bases for a number of interventions, particularly those related to training, insurance, access to credit, and land rights reform. High-quality SRs exist for most of these as well, meaning that there are resources available to inform decisions about whether, where, and how to implement such interventions. Although, as highlighted above, high-quality reviews frequently emphasize the methodological limitations of the existing evidence base, these reviews can nonetheless guide decision makers to the best available evidence, and can often shed light on barriers and facilitators for effective implementation.

The available high-confidence reviews suggest that interventions providing improved inputs and knowledge dissemination may lead to modest increases in outcomes related to the adoption of beneficial technologies, income, consumption, and food security among smallholder farmers. Evidence for reductions in poverty levels as a result of such interventions, however, is weak. One potential implication of this pattern is that reducing poverty through agriculture-oriented interventions may require longer timeframes, as well as addressing other binding constraints besides those related to information and access to inputs (Bell and Engelbert 2023).

Finally, there are steps that policymakers and practitioners can take when decisions are required regarding an intervention or outcome with inadequate evidence. For areas with a synthesis gap (i.e., available IEs but no reliable SRs), one can consult low-confidence SRs (with appropriate caution) and individual IEs, although it is important not to place too

much weight on any individual study. For those deciding to launch an intervention where relevant IE evidence is lacking, we suggest considering whether incorporating an IE of the program would be feasible.

6.2 Implications for researchers and commissioners

Given the large evidence base we have identified for interventions that impart productivity-related information to farmers, researchers and commissioners may wish to consult the existing literature on these interventions before investing in additional research, to avoid redundancy and to identify questions that will benefit from further research attention.

Some of the gaps in intervention coverage – such those related to national-level policy interventions – will likely be difficult to address through quantitative IEs. However, researchers may wish to explore whether emerging methods like the synthetic control method, which is designed for causal inference with small samples (see Fremeth et al. 2013), might be useful in evaluating such interventions.

Other intervention gaps are amenable to evaluation through traditional IE methods, and therefore may be fruitful areas for further research. These include interventions related to weather information systems for farmers, market information systems for SMEs, loan guarantees, and building relationships with private investors.

A strikingly small proportion of studies report that they have accounted for gender and equity considerations in their research design or analysis. This represents a significant gap in the evidence base concerning how to promote equitable and sustainable growth through agriculture-related interventions. We encourage researchers to consult and follow available guidelines for conducting and reporting equity-sensitive research (e.g., Hankivsky et al. 2018; Welch et al. 2016, 2017).

Where we have identified geographical gaps, researchers and commissioners may wish to prioritize conducting evaluations of agricultural interventions in some of these countries, particularly those with large populations working in agriculture but comparatively few IEs. An example is the Democratic Republic of the Congo, where 70 per cent of the country's 100 million-plus population is employed in agriculture (USAID 2016), but for which we identified only 16 IEs.

As noted above, RCTs are rarer in agriculture than in other development sectors, and the reliance on quasi-experimental designs may increase doubts about the reliability of available IE research. The validity of quasi-experimental methods for assessing impact depends on stronger assumptions than is the case for methods like RCTs. Methodological research indicates that quasi-experimental methods can replicate the findings of RCTs, but only when they are well constructed (Fenton et al. 2019). Therefore, quasi-experimental studies are, in general, at greater risk of producing biased impact estimates. Indeed, most of the high-quality SRs we identified highlight the poor quality of available evidence due to methodological limitations of included studies. Thus, while quasi-experimental methods – particularly matching approaches – can be cost-effective ways to estimate impact, it may be worth supplementing matching studies with RCTs for key intervention types.

Online appendixes

Online appendix A: Summary of evidence by intermediate results (GFSS results framework)

https://3ieimpact.org/sites/default/files/2023-06/REAPER-Agriculture-EGM-Online-appendix-A.pdf

Online appendix B: Additional methods detail

https://3ieimpact.org/sites/default/files/2023-06/REAPER-Agriculture-EGM-Online-appendix-B.pdf

Online appendix C: Search strategy detail

https://3ieimpact.org/sites/default/files/2023-06/REAPER-Agriculture-EGM-Online-appendix-C.pdf

Online appendix D: Data extraction codebook

https://3ieimpact.org/sites/default/files/2023-06/REAPER-Agriculture-EGM-Online-appendix-D.pdf

Online appendix E: Summary of the systematic review critical appraisal tool

https://3ieimpact.org/sites/default/files/2023-06/REAPER-Agriculture-EGM-Online-appendix-E.pdf

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