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# Addressing the systemic causes of malnutrition

## The nutrition-sensitive agriculture evidence gap map

June 2023

Evidence  
Gap Map  
Report 24

Health



International  
Initiative for  
Impact Evaluation

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## 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 of nutrition-sensitive interventions in low- and middle-income countries. 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, Charlotte Lane at [clane@3ieimpact.org](mailto:clane@3ieimpact.org).

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**Evidence Gap Map Report 24**

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# Summary

## **Background and scope**

Malnutrition represents a major public health crisis. Underlying causes of malnutrition include age-appropriate, nutrient rich foods; age-appropriate feeding and dietary practices; and adequate nutrition, health, education, sanitation, and social protection services (UNICEF 2021). Across sectors, nutrition-related challenges have been exacerbated in recent years due to climate change, the COVID-19 pandemic, and the recent conflict in Ukraine. Addressing malnutrition requires action within health systems, food systems,<sup>1</sup> and in fragile and emergency settings. Approaches to address malnutrition through food systems often focus on nutrition-sensitive approaches, which “address the underlying and systemic causes of malnutrition” (USAID 2014). Systemic determinants that affect optimal nutrition include resources, norms, and governance.

In this evidence gap map (EGM), we systematically describe the available evidence on the effects of nutrition-sensitive agricultural interventions across food systems in low- and middle-income countries. The map covers interventions related to: (1) production; (2) transport and distribution; (3) support for food processing, storage, and packaging; (4) fortification and re-formulation; (5) pricing and profit initiatives; (6) market places; (7) voluntary adoption of standards and ethical practices; (8) women’s empowerment; and (9) consumer behavior. To the extent possible, we categorized intervention groups into education interventions; the direct provision of goods, services, or technologies; market-based approaches; and structural approaches.

The map is focused on impact evaluations (IEs) and systematic reviews (SRs) of impact evaluations. It provides a starting point for exploring and accessing the available literature. Other sources of evidence, including qualitative research and local knowledge, were not identified in this map, but can and should be used to interpret and contextualize the research presented.

## **Objectives**

1. To identify, describe and summarize evidence on the effects of eligible interventions on nutrition and food security outcomes in low- and middle-income countries;
2. To identify potential primary and synthesis evidence gaps; and
3. To facilitate the use of existing evidence by making it easily available.

## **Methods**

We searched 17 academic databases and 30 grey literature sources. We only included impact evaluations and systematic reviews of impact evaluations considering eligible interventions and outcomes related to nutrition and food security, as defined by an intervention-outcome framework established *a priori*. We extracted descriptive and bibliographic data from all included studies. For systematic reviews, we critically appraised the methods applied.

Using 3ie’s EGM software, we created an online, interactive map of all included studies, displayed according to the interventions and outcomes assessed in each study. The platform provides additional filters for users to further explore dimensions of interest. For

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<sup>1</sup> <https://www.usaid.gov/feed-the-future/document/rfs-food-systems-conceptual-framework>

example, users can search for evidence by age group or nutrition product targeted. The EGM can be viewed at <https://developmentevidence.3ieimpact.org/egm/reaper-nutrition-evidence-gap-map>.

### ***Main findings***

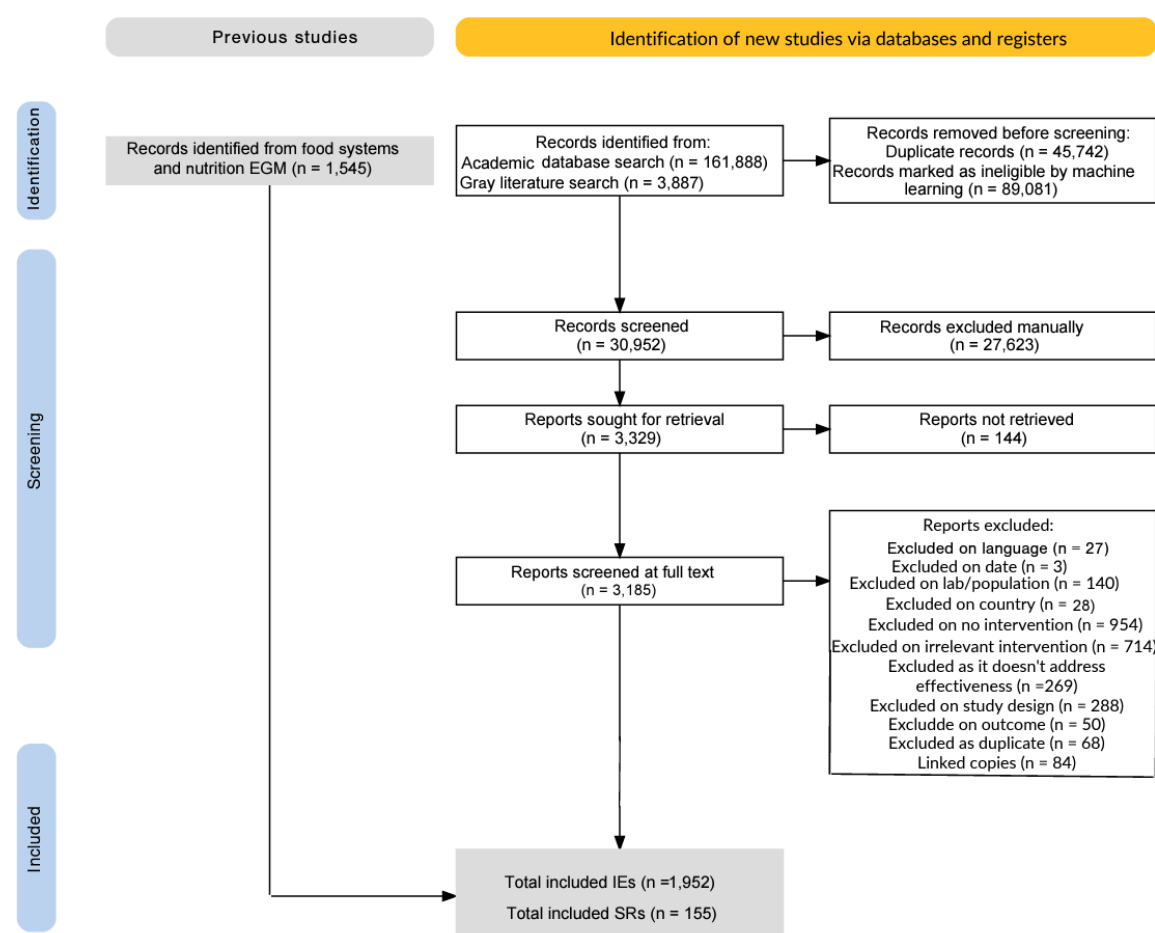
We identified 161,888 records through our academic database search and an additional 3,887 articles through our grey literature search. After title and abstract screening, 3,185 of these were screened at full text. Finally, 562 studies from this search and an additional 1,545 articles identified through 3ie's previous EGM on food systems and nutrition<sup>2</sup> were included in this map, resulting in a total of 1,952 impact evaluations and 155 systematic reviews presented here (Figure 1).

The rate of publication in the sector increased steadily until 2019, and then slowed. Because our search was conducted in January 2022, and due to the delay in indexing papers in bibliographic databases, not all articles from 2021 and 2022 are reflected in this map. The cause of the reduction in 2020 is unknown but could be related to issues in completing studies due to the COVID-19 pandemic.

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<sup>2</sup> While the food systems and nutrition EGM and this nutrition-sensitive EGM have some similarities, the set of interventions considered in the two maps is somewhat different. We include interventions excluded from the food systems and nutrition EGM, such as those related to transportation, voluntary adoption of standards and ethical practices related to food and food safety, nutrition interventions in the marketplace, and pricing and profiting initiatives. Many of the interventions in the nutrition-sensitive EGM are defined in a broader sense than those in the food systems and nutrition EGM. In addition, the nutrition-sensitive EGM explicitly takes a resilience perspective in its framing of nutrition.

**Figure 1: Summary of the search and screening process**



Source: 3ie 2023

The most studied countries were India ( $n = 183$ ), Bangladesh ( $n = 124$ ), and Kenya ( $n = 116$ ). Studies tended to take place in rural settings ( $n = 1,195$ ). Although a plurality of studies targeted the whole population ( $n = 817$ ) and did not target specific foods ( $n = 1,264$ ); those that did most often focused on infants between seven months and two years ( $n = 412$ ) and fortified foods, respectively ( $n = 317$ ).

Few studies considered structural approaches<sup>3</sup> (IEs = 41; medium- and high-quality [M/H] SRs = 1) or the mobilization of public and private sector actors (IEs = 63; SRs = 3). The most common interventions were *educational support for agricultural production* (IEs = 290, M/H SRs = 6), *direct provision of food* (IEs = 274; M/H SRs = 17), and *nutrition classes* (IEs = 274; M/H SRs = 14).

*Diet quality and adequacy* were the most evaluated outcomes (IEs = 747; M/H SRs = 25). Within this group, measures of *dietary diversity* were the most common (IEs = 346; M/H SRs = 10). However, *anthropometric* (IEs = 684; M/H SRs = 48) and *economic* (IEs = 547; M/H SRs = 14) were also commonly considered. Outcomes related to *advertising and presentation* and *food movement and spoilage* were considered fewer than 10 times.

<sup>3</sup> Interventions were categorized as direct provision, educational, market-based, and structural. Structural approaches related to the development of policies, laws, and administrative systems that could affect nutrition outcomes.

Most studies used experimental methods (n = 1,259). Those that used quasi-experimental approaches tended to use fixed effects modeling (n = 585) or statistical matching (n = 402). Few studies presented cost evidence (n = 214) or used mixed methods (n = 249). About half of all included systematic reviews were rated as low confidence (n = 77), with the remainder rated as medium (n = 36) and high (n = 33).

Most impact evaluations did not consider equity or gender (n = 1,583). Among those that did, the most common way of doing so was through subgroup analysis by sex (n = 135). The most common equity focus was sex (n = 206), followed by socioeconomic status (n = 124), and age (n = 94).

### ***Conclusions and implications***

This study systematically identifies and describes the available impact evaluations and systematic reviews of impact evaluations of interventions related to the nine categories listed in the introduction above. It expands upon previous work by including a broader range of interventions and presenting the available evidence based on approaches used by major stakeholders in the field. We identified a large evidence base with 1,952 impact evaluations and 155 systematic reviews.

Although this EGM provides a useful starting point for informing future research and facilitating its use in decision-making processes, evidence presented in this map should be further synthesized and contextualized with other sources of information, such as qualitative research and local knowledge. This EGM does not answer questions as to whether an intervention works; rather, it reveals the state of the evidence landscape and whether the effects of an intervention have been evaluated and provides access to such studies.

### ***Implication for decision makers***

The online, interactive version of this EGM can be used by decision makers to quickly identify and reference medium- and high-confidence systematic reviews on the effects of interventions of interest. Decision makers can also consult individual impact evaluations to understand effects in specific contexts.

Although we identified 2,107 studies, decision makers may find a lack of cost evidence and mixed-methods research. Those interested in gender and equity may also find relatively little evidence. However, the filters in the online map can help users to quickly identify the research that is available in these areas.

Decision makers should be cautious and avoid assuming that areas with little evidence are not worth pursuing. Rather, they should consult other forms of research, such as qualitative work, to identify promising approaches and integrate evaluation into the design of new projects in under-researched areas to perpetuate the development of new evidence.

### ***Implications for researchers and commissioners***

The nutrition field is growing rapidly. With the renewed focus on the multi-sectoral nature of nutrition, new intervention areas are currently being explored. As such, there are several areas of emerging research, such as evaluation of structural and market-based approaches to addressing nutrition. In some areas, there are emerging bodies of evidence, with several impact evaluations but no medium- or high-confidence systematic reviews.



In these areas – such as *education and market-based approaches for traders to move into new markets; education and direct provision of goods and services supporting food processing, packaging, and storage (including on-farm, post-harvest processing); water access and management; and women’s empowerment and gender equity* – high-quality systematic reviews could be useful in establishing average treatment effects and supporting evidence-informed decision-making. Researchers may also wish to consider the adoption of mixed methods, equity-focused research designs, cost evidence, and mediation analysis, as these are all relatively uncommon.

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## **List of abbreviations and acronyms**

<b>EGM</b>	Evidence gap map
<b>M/H</b>	Medium- and high-confidence
<b>IE</b>	Impact evaluation
<b>LMICs</b>	Low- and middle-income countries
<b>RFS</b>	Bureau for Resilience and Food Security
<b>SR</b>	Systematic review
<b>USAID</b>	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 (ND) were commissioned by the U.S. 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, 2014-2025.

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 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) on nutrition-sensitive agricultural interventions related to: (1) production; (2) transport and distribution; (3) support for food processing, storage, and packaging; (4) fortification and re-formulation; (5) pricing and profit initiatives; (6) marketplaces; (7) voluntary adoption of standards and ethical practices; (8) women's empowerment; and (9) consumer behavior in low- and middle-income countries (LMICs).

In this report, Section 1 presents the background, objectives, and reasons why it is important to carry out this EGM. Section 2 describes the conceptual framework adopted for the EGM and the scope of included studies. Section 3 describes the methods applied in the systematic search, screening, data extraction and analysis of the identified studies. Section 4 presents the findings from the map, including the gaps analysis, and Section 5 outlines implications for policy and future research and concludes the report.

## 1.1 Background

### ***1.1.1 Global threats and crises have led to backsliding on achievement of nutrition targets***

The UN Decade of Action on Nutrition marked a commitment of international actors and governments to meet global nutrition targets, including ending malnutrition in all its forms by 2030 (SUN 2020a; UN 2022). However, few countries are on track to meet the nutrition targets established by the World Health Assembly and the Sustainable Development Goals (FAO et al. 2021; SUN 2020b; World Bank 2021).

An estimated 14 million children under five years of age are suffering from severe acute malnutrition (Action Against Hunger 2021), with 149.2 million children stunted and 45.4 million wasted. At the same time, over 40 per cent of the world population (2.2 billion

people) are overweight or obese (Development Initiatives 2021). Malnutrition results in the loss of human capital and has negative, often cyclical, social and economic consequences, increasing the probability of disease later in life (Feed the Future 2021a).

The cycle of undernutrition and poverty is exacerbated in the context of COVID-19. Immune systems are weaker in undernourished individuals, who are more likely to become severely ill from COVID-19 (Development Initiatives 2021). The pandemic's impact on economic, health and food systems resulted in significant backsliding of recent progress towards achieving nutrition goals (Development Initiatives 2021). Market closures, supply chain disruptions, and economic losses have led to increased food insecurity (Feed the Future 2021a). Travel bans and lockdowns across the globe resulted in challenges and delays for many interventions (Feed the Future 2021b). In this context of global crisis, the prevalence of undernourishment increased by 1.5 percentage points in 2020 alone (FAO et al. 2021).

The war in Ukraine has further aggravated these issues. In June 2022, the agricultural commodity price index, a measure of the price of food, was 34 per cent higher than in January of 2021 (World Bank 2022). Rising food prices have greater impact in LMICs, as people in these countries spend a larger proportion of their income on food (World Bank 2022). Consequently, there has been an increase in food insecurity and malnutrition since pre-pandemic times (World Bank 2021).

### **1.1.2 Global response to address malnutrition**

Food security and malnutrition have received widespread attention at a global policy level. In 2015, the United Nations set Sustainable Development Goal 2: Zero Hunger, to be achieved by 2030. The World Health Assembly agreed to six global nutrition targets to be achieved by 2025 and declared the Decade of Nutrition. In 2021, there two major international events were convened around nutrition: the United Nations Food Systems Summit and the Nutrition for Growth Summit.

At these events, governments made significant new commitments to address food security and nutrition. USAID Administrator and Feed the Future Coordinator Samantha Power announced a \$5 billion commitment over five years to Feed the Future, the U.S. government's global hunger and food security initiative, and an expansion of Feed the Future's target countries (White House 2021).

The US government's "Feed the Future" program was launched in response to the 2007–2008 food price crisis, with a mission to combat global hunger. Operating in twenty target countries, the program has supported government agencies, communities, and private actors in their journey to tackle key development challenges. Since 2011, it has channeled more than \$3.5 billion in agricultural financing to farmers and businesses in target countries (Feed the Future 2021a).

In parallel, there have been significant efforts to address nutrition at a programmatic level. For example, the Scaling-up Nutrition (SUN) movement – a country-led movement of 65 countries and 4 Indian states – brings together multiple actors to generate evidence-informed action at a country level, with the goal of eliminating malnutrition (SUN 2014). The World Food Program (WFP) provides food assistance to people displaced by conflict and made destitute by disasters in 123 countries (WFP 2021).

Increasingly, nutrition programming considers the importance of systems-level interventions that go beyond household-level approaches. The USAID RFS Center for Nutrition focuses on such systems-level approaches to combat undernutrition, in addition to those directed at the household level (Feed the Future 2021a). To advance the U.S. Government Food Security Strategy (2022/2026), RFS seeks to address the underlying causes of malnutrition and ensure a well-nourished population – particularly women and children.

Such approaches to reducing malnutrition that target underlying causes are considered *nutrition-sensitive*, while those targeting the immediate determinants of malnutrition are *nutrition-specific* (USAID 2014). This EGM systematically collects and presents available impact evaluations and systematic reviews of impact evaluations consider a selected set of nutrition-specific and nutrition-sensitive agricultural interventions.

### **1.1.3 Contributions to the evidence base**

To be effective, investment in nutrition-sensitive agriculture and food systems should be informed by evidence on what interventions work, for whom, and at what cost. Research must be made accessible and investments in research prioritized to fill evidence gaps. Fortunately, a large and growing body of literature evaluating the effects of nutrition and food systems interventions has emerged over recent decades. There have been previous efforts to synthesize and map this literature, including 3ie's [food systems and nutrition EGM](#) (Moore et al. 2021a, b).

The food systems and nutrition EGM is a living evidence surveillance product that systematically collects and presents all available impact evaluations and systematic reviews of impact evaluations that consider the effect of food systems interventions on food security and nutrition in low- and middle-income countries. The food systems and nutrition EGM defines food systems narrowly based on a restricted definition of the food supply chain, food environment, and consumer behavior, as provided by de Brauw and colleagues (2019). The project is updated every four months to provide periodic descriptions of the evidence base.

This Nutrition-sensitive Agriculture EGM draws on and expands the food systems and nutrition EGM in a number of ways. Firstly, we include enabling context and systems interventions which were excluded from the food systems and nutrition EGM, such as those related to transportation, voluntary adoption of standards and ethical practices related to food and food safety, nutrition interventions in the marketplace, and pricing and profiting initiatives.

Secondly, many interventions in this EGM are defined in a broader sense than those in the food systems and nutrition EGM. For example, the food systems and nutrition EGM only considers women's empowerment interventions and cash transfers in the context of the food system; however, this EGM includes these regardless of the implementation context. Interventions that take place within the health system, education system, or other system or sector are eligible for inclusion.

Thirdly, we explicitly add a resilience perspective, by developing our scope and intervention-outcome framework to reflect that of USAID's Bureau for Resilience and Food Security (RFS)'s and programmatic and strategic approaches (Appendix F). In

particular, we focus on three (out of five) nutrition strategic approaches: (1) increase access and affordability of safe, nutritious foods; (2) increase consumption of safe, nutritious foods, particularly in the first 1,000 day window; and (3) facilitate an enabling environment that supports sound food and health systems.

Finally, we leverage existing search strategies and results from the food systems and nutrition EGM to populate overlapping fields related to behavior change and agricultural interventions.

## **2. Study objectives and questions**

This project aims to identify, describe, and make available the existing impact evaluations and systematic reviews of impact evaluations on the effects of resilience focused, nutrition-sensitive agricultural programming. While it does not provide interpretation, analysis, or synthesis of what the evidence says, it aims to provide an entry point for understanding where the evidence exists – including whether there is evidence on how the intervention affects different populations, and where more evidence may be needed prior to large-scale investment.

This EGM has three specific objectives:

1. To identify, describe and summarize evidence on the effects of the following interventions on nutrition and food-security outcomes in LMICs: (a) production; (b) transport and distribution; (b) support for food processing, storage, and packaging; (d) fortification and re-formulation; (e) pricing and profit initiatives; (f) marketplaces; (g) voluntary adoption of standards and ethical practices; (h) women's empowerment; and (i) consumer behavior;
2. To identify potential primary and synthesis evidence gaps; and
3. To facilitate the use of existing evidence by making it easily available.

Research questions that are addressed by this study are presented as follows:

1. What are the extent and characteristics of empirical evidence on the effects of eligible interventions on nutrition and food-security outcomes in LMICs?
2. What are the major primary and synthesis evidence gaps in the literature?
3. What intervention/outcome areas should be prioritized for primary research and/or evidence synthesis?

This report serves as an accompaniment to the interactive map. Here, we address the key research questions through analysis of the characteristics of the available evidence and key trends (i.e., number of impact evaluation published over time, geography, focus on interventions and outcomes, target populations).

### **2.1 How to use the EGM**

This EGM was commissioned by RFS to collate and characterize the available evidence base of impact evaluations and systematic reviews related to their strategic approaches and programmatic approaches (Appendix F). The map is meant to facilitate the generation and use of evidence to ensure the efficient allocation of resources. By identifying primary evidence gaps and evidence synthesis gaps, this map can support the generation of new evidence in areas where evidence is scarce or does not exist. By systematically presenting the available impact evaluations and systematic reviews of



impact evaluations in an easy to navigate manner that directly aligns with the decision-making needs of donors and implementers, the map can facilitate decision making. Stakeholders can refer to the medium- and high-confidence (M/H) systematic reviews to determine the likely impacts of interventions of interest. They can also read individual impact evaluations to understand outcomes within specific contexts.

EGMs are not designed to determine whether interventions work or if they should be implemented. A plethora of evidence does not mean that an intervention is successful, just as a dearth of evidence does not indicate that an intervention will be unsuccessful. Instead of summarizing impacts, the platform and the accompanying report demonstrate where more research is needed by showing absolute gaps (no or few impact evaluations) and synthesis gaps (no systematic reviews, but clusters of impact evaluations).

### **3. Defining the scope of interventions**

#### **3.1 Conceptual framework**

The scope and framework of this EGM was developed based on a review of the literature and consultations with USAID and external advisory groups. It focuses on production; transport and distribution; support for food processing, storage, and packaging; fortification and re-formulation; pricing and profit initiatives; market places; voluntary adoption of standards and ethical practices; women's empowerment; and consumer behavior, as these are a major part of the current global response to address malnutrition in Section 1.2 and the strategic approaches presented in Section 1.3 and Appendix G.

Based on RFS's strategic approaches, we conceptualize malnutrition as a challenge which can be addressed through existing supply chains, market linkages, and community structures (Appendix F). These responses target the underlying causes of malnutrition (USAID 2014).

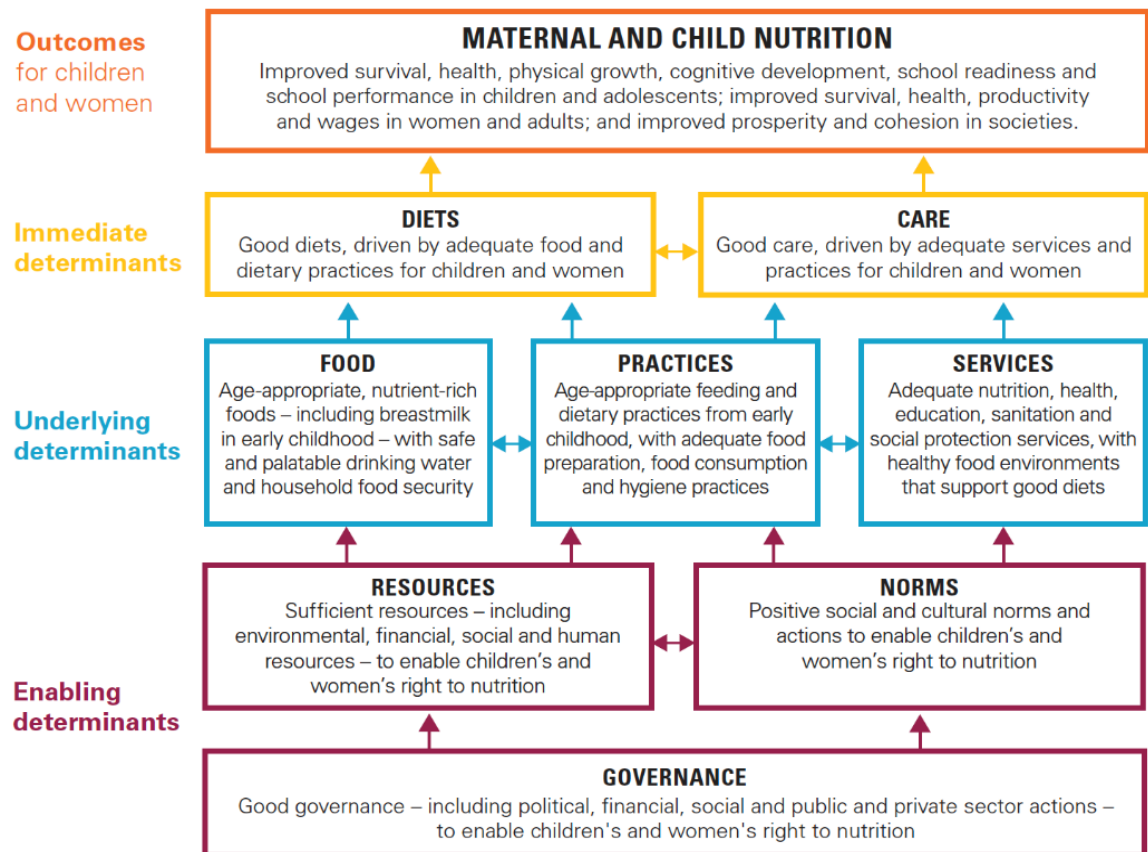
The underlying determinants of nutrition are age-appropriate, nutrient-rich foods; age-appropriate feeding and dietary practices; and adequate nutrition, health, education, sanitation, and social protection services (UNICEF 2021, Figure 2). Achieving these outcomes requires an enabling environment with sufficient resources, positive social and cultural norms, and good governance (UNICEF 2021).

We conceptualized our map by identifying interventions that target the underlying determinants of malnutrition throughout the food supply chain – from food production through to transport and distribution, processing, storage, and packaging, and sale (Kennedy et al. 2021). This last step, the sale of food, straddles the food supply chain and food environment. It includes factors affecting the price of foods, the physical location of foods, and standards around food.

We included women's empowerment interventions in the map as these are currently a priority in international development. We also included some interventions targeting the direct determinants of nutrition to facilitate a comparison of approaches, such as those targeting consumer behavior (Moore et al. 2021b). Where it made theoretical sense, we disaggregated intervention groups into education interventions; the direct provision of

goods, services, or technologies; market-based approaches; and structural approaches. The full list of interventions is provided in Table 1.

**Figure 2: UNICEF’s conceptual framework on determinants of maternal and child malnutrition**



UNICEF Conceptual Framework on the Determinants of Maternal and Child Nutrition, 2020.  
A framework for the prevention of malnutrition in all its forms.

Source: UNICEF 2020

### 3.2 Interventions of interest

Table 1: List of interventions

Intervention category	Subcategory	Intervention	Clarifications and examples
Production	Education / information	Educational support for agricultural production	Farmer field schools Agricultural extension programs
		Educational support for on-farm processing and post-harvest management of food	
	Direct provision of goods and services	Direct provision of goods, services, or technologies related to agricultural production	Provision of seeds, fertilizers, pesticides, livestock, mechanical equipment, and other agricultural inputs <i>Excludes production initiatives targeting biofortified foods</i>
		Direct provision of goods, services, or technologies for on-farm and post-harvest management of food	
		Water access and management	Drilling wells Constructing dams Installing small-scale irrigation Natural resource management
	Market-based provision of goods and services	Mobilization of public and private actors to establish commercial relationships between producers of agricultural inputs and local farmers / small and medium-sized enterprises	
		Mobilization of public and private actors to establish commercial relationships between producers of post-harvest handling inputs and local farmers / small and medium-sized enterprises	
Transport and distribution	Education / information	Education to support logistics and trade	
	Direct provision of goods and services	Direct provision of food	Giving food School feeding programs State-supported distribution initiatives <i>Excludes transport, food vouchers, and cash transfers</i> <i>Note: If fortified foods are distributed, these will be double-tagged as both.</i>

Intervention category	Subcategory	Intervention	Clarifications and examples
		Provision of transport for food and nutrition products	Refrigerated trucks Services to connect producers and sellers
		Transportation infrastructure	Roads
		Creation of warehouses and storage centers	Cold storage
	<b>Market-based provision of goods and services</b>	Mobilization of public and private actors to establish relationships between transport / distribution services, producers, and consumers	
<b>Support for processing, storage, and packaging</b> (excludes fortification)	<b>Education / information</b>	Education to support food processing, packaging, and storage	Classes on canning vegetables
	<b>Direct provision of goods and services</b>	Direct provision of goods, services, or technologies to support food processing, packaging, and storage	Hermetically sealed bags On-site storage centers Provision of canning equipment
		Mobilization of public and private actors to establish relationships between food actors involved in food processing, storage, and packaging	Includes relationships between producers, small and medium-sized enterprises, and consumers involved in food processing, storage, and packaging
	<b>Market-based provision of goods and services</b>	Legal / administrative practices regarding food processing and packaging	Includes an evaluation of the practice itself or a change in the practice Includes advocacy efforts around these laws / practices
		Legal / administrative practices to food safety regulations	Includes an evaluation of the practice itself or a change in the practice Includes advocacy efforts around these laws / practices
		Advertising, marketing, and labeling regulations	Includes an evaluation of the regulation itself or a change in the regulation Includes advocacy efforts around these regulations
		Administrative, technical, and direct support for the adoption and enforcement of food safety regulations	
	<b>Structural approaches</b>	Education to support large-scale fortification	
		Direct provision of goods, services, or technologies to support large-scale fortification	
		Mobilization of public and private actors to establish relationships between food actors involved in large-scale fortification	
<b>Fortification and re-formulation</b>	<b>Large-scale fortification*</b>		

Intervention category	Subcategory	Intervention	Clarifications and examples
	<b>Small-scale fortification*</b>	Consumption / provision of large-scale fortified foods	<i>Note: A study that compares the provision of fortified foods to a no-treatment control will be double-tagged with "direct provision of foods."</i>
		Education to support small-scale fortification	
		Direct provision of goods, services, or technologies to support small-scale fortification	
		Mobilization of public and private actors to establish relationships between food actors involved in small-scale fortification	Supporting consolidation of small-scale producers to allow for more efficient fortification activities
	<b>Biofortification</b>	Consumption / provision of small-scale fortified foods	<i>Note: A study that compares the provision of fortified foods to a no-treatment control will be double-tagged with "direct provision of foods."</i>
		Consumption / provision of biofortified foods	<i>Note: A study that compares the provision of fortified foods to a no-treatment control will be double-tagged with "direct provision of foods."</i>
		Direct provision or promotion of planting materials for biofortified food	Provision/promotion of planting materials with the intent of biofortifying foods
		Engagement with market actors to expand the availability of biofortified foods	Includes engagement with producers and retailers
	<b>Re-formulation</b>  (excluded fortification)	Education to support re-formulation	Re-formulation generally involves shifting the composition of foods to be healthier. In recent years, many large-scale food producers have shifted the nutrient content of their foods to have fewer trans-fats, less salt, and reduced added sugars. These shifts in the food content of established products are considered re-formulation.
		Direct provision of goods, services, or technologies to support re-formulation	
		Mobilization of public and private actors to establish relationships between food actors involved in re-formulation	The addition of specific micronutrients would be considered fortification rather than re-formulation.
		Consumption / provision of re-formulated foods	Comparisons of the impacts of consuming / providing similar foods which are and are not re-formulated (e.g., determining the impact of Coca Cola using cane sugar versus high-fructose corn syrup)

Intervention category	Subcategory	Intervention	Clarifications and examples
Pricing and profit initiatives	Education / information	Create, train, and otherwise support micro-lending / informal groups	Self-help and women's groups that provide access to credit
		Marketing and technical support for domestic, concessional, private-sector, and innovative financing for food	Market analysis to determine productive investments
		Business, marketing, or entrepreneurial support to individuals or groups involved in food-related enterprises	Business literacy and management training Support in accessing domestic, concessional, private-sector, and innovative financing mechanisms The creation of new organizations for this purpose <i>Excludes credit and technical education on food processing, packaging, and storage</i>
	Provision of goods and services	Conditional cash transfers	
		Unconditional cash transfers	
		Direct provision of credit	
	Market-based provision of goods and services	Mobilization of public and private actors to establish relationships between financial service providers and small and medium-sized enterprises, entrepreneurs, and smallholders	Digital finance Agent banking Value chain financing
	Structural approaches	Legal / administrative practices that facilitate domestic, concessional, private-sector, and innovative financing within the food sector	Includes an evaluation of the practice itself or a change in the practice Includes advocacy efforts around these laws / practices <i>Excludes tax reforms</i>
		Legal / administrative practices that improve access to credit through formal lending institutions for individuals or groups	Includes an evaluation of the practice itself or a change in the practice Includes advocacy efforts around these laws / practices Changes in regulatory requirements Alterations to lending structures
		Direct financial incentives to increase domestic, concessional, private-sector, and innovative financing for nutrition	Alterations to the tax code for investments Includes advocacy efforts around these incentives
		Competitive pricing initiatives	Taxes and subsidies for producers and consumers Only at the national level Includes advocacy efforts around these initiatives <i>Excludes taxes and subsidies to investors</i>

Intervention category	Subcategory	Intervention	Clarifications and examples
		Tariffs for foods	Includes an evaluation of the tariff itself or a change in the tariff Includes advocacy efforts around tariffs Function internationally
Marketplaces	Education / information	Education and provision of services to support safe and healthy market structures	Teaching people at markets about the need to separate meat vendors from produce vendors
		Education on market governance	Training market management committees on approaches to increase competitiveness
		Education and advocacy to support local traders and retailers to move into new markets	Both new geographic areas and new products
	Provision of goods and services	Direct provision of goods, services, and technologies for local traders and retailers to tailor their market-based approaches and move into new markets	Both new geographic areas and new products
		Physical improvements of market / workplace facilities	Installing breastfeeding areas in outdoor markets Increased installation of vendor infrastructure Separating meat vendors from produce vendors
	Market-based provision of goods and services	Mobilization of public and private actors to establish relationships that support local traders and retailers to move into new markets	Linking market research, business-development service providers, or local business associations to local retailers and traders Facilitating the development of a market management committee
	Structural approaches	Trade regulation for foods	Includes an evaluation of the regulation itself or a change in the regulation Includes advocacy efforts around trade regulations Both legal and administrative <i>Excludes tariffs</i>
		Designations of space and zoning laws	Formal designations of space for a new market "Sugar-sweetened-beverage-free" zones in schools, or restrictions on what can be sold on school grounds
		Alterations to physical spaces to encourage consumers to choose nutritious foods	Removing candy from checkout lines

Intervention category	Subcategory	Intervention	Clarifications and examples
<b>Voluntary adoption of standards and ethical practices</b>		Advocacy for and voluntary changes to marketing practices	TV broadcasters limiting when sugar-sweetened beverage advertisements are aired
		Advocacy for, science-based efforts to support, the actual development, and the adoption of guidelines, public statements, standards, and certificates for food	Includes the public sector or civil society Introduction of a “heart healthy” label on foods Food manufacturers agreeing to a limit on the amount of salt they add to processed foods Development of national dietary guidelines
		Administrative, technical, and direct support for producers, consumers, and civil society actors on food safety standards and practices	Includes educational initiatives for consumers on food safety standards
		Administrative, technical, and direct support for the adoption of new or existing food safety management policies	
<b>Women's empowerment</b>		Women's empowerment and gender equity	
<b>Consumer behavior</b>		Peer support / counsellors	The use of peer support or counsellors to increase healthy eating
		Professional services (dietitians / nurses)	The use of professional services such as dietitians or nurses to provide messages regarding healthy eating
		Community meetings	The use of community meetings to provide messages regarding healthy eating
		Classes	The use of a classroom structure to provide messages regarding healthy eating (including classrooms outside of schools)
		Healthy food social marketing campaigns	Healthy food social marketing campaigns (including campaigns on social media, radio, and TV)
		Door-to-door campaigns	The use of door-to-door campaigns to provide messages regarding healthy eating.

\* Definitions of large-scale fortification are described in Table 2.

Source: 3ie 2023



Large-scale fortification was categorized based on definitions presented in Table 2. Fortified foods that were produced in quantities below the thresholds reflected in the table were defined as “small-scale fortified.” In most studies, exact processing rates were not provided in the text; however, they could be inferred based on the scale described. For example, if fortification occurred at home, it was considered small-scale fortification.

**Table 2: Processing rates for an intervention to be considered large-scale fortification**

<b>Commodity</b>	<b>Metric tons/hour</b>	<b>Metric tons/day</b>	<b>Metric tons/year</b>
Sugar	20	500	75,000
Wheat flour	20	150	45,000
Rice	10	100	30,000
Salt	10	100	30,000
Oil	5	50	15,000

Source: 3ie 2023

### 3.3 Outcomes of interest

**Table 3: List of outcomes**

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
Increase access and affordability of safe, nutritious foods	Economic	Income	The total monetary income earned from an activity by an individual, household or firm (e.g., income earned from selling fish stock at a market or a salary earned by a laborer). This does not account for the costs incurred by the individual, household, or firm.	Farm or non-farm income, revenue, sales, costs, profits: Business costs, profit measures, income diversification
		Assets	Assets refer to property owned by individuals, households, or companies. There are many metrics to measure assets, including indicators as to whether households have items such as TVs, refrigerators, and lights, as well as more complex scoring systems. <i>Excludes livestock and landownership, which are included elsewhere</i>	Agricultural assets
		Output value	A measure of the value of the output produced because of an intervention. A study might examine the change in market value for a crop due to changes in seed variety. Here it may be the case that stock has not yet been sold, and therefore income has not been generated.	Crop value, livestock value
		Prices received for goods	Measures of the price at which producers can sell their goods	Sale prices for crops
		Other socioeconomic status indicators	Measures of social and economic privilege not included elsewhere	Wages, wealth, poverty (absolute, relative), labor productivity, credit access and use, savings, market access for producers, access to business service
		Economic, social, and political stability	Measures of economic, social, and political stability	Border dispute risk
		Import / export	Measures of how much food enters / leaves a region / country	Production and sale of export and non-export crops

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
	Food movement and spoilage	Movement of food	Measures of the country of origin of food, distance food travelled, and time food spent in transport	
		Time food remains unspoiled	Measures of how long food remains unspoiled	
		Food spoilage	Amount of spoiled, near-spoiled, or traditionally uneaten food / agricultural byproducts used, Amount (e.g., mass, weight) of repurposed food / agricultural byproducts	Amount of fruit damaged by fruit flies (of total production)
		Food loss	Loss of food after it leaves the farm	Including food waste
	Affordability and availability	Food distribution centers	Measures of the amount of time spent in line or waiting for rations to become available Measures of how often foods are unavailable in retail / distribution locations	Wait lines, stock-outs, amount of food distributed, number of individuals who received food
		Food access	Access to markets as assessed by the distance to a market or similar (note: definitions of "market" may vary), number of different types of food-retail options in an area <i>Excludes trade regulations, which are included elsewhere</i>	Distribution or prevalence of markets or other food outlets, number of months per year with sufficient access
		Food availability and supply	Measures of the types of foods available in an area	Import / export, national food availability tables, national food balance sheets, number of retail outlets
		Affordability	Measures of the cost of a healthy diet. Can be calculated as the expected cost of a healthy diet for a family of five for one week. However, units and definition of healthy / sustainable will vary. Any definition used by the authors should be included. For example, the food consumer price index reflects the average change in food prices over time.	Food consumer price index
		Food insecurity measures	Composite measures of food insecurity, typically reflecting a household's reported food security	Self-reports of food insufficiency, food insecurity experience scale, household food

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
Increase consumption of safe, nutritious foods, particularly in the first 1,000 day window				insecurity access scale, food security, household food security level / score
		Food-stressed households	Reflects the proportion of food-stressed households in an area. Any definition of food stress adopted by the authors will be accepted	
	Intrinsic motivators	Consumer preferences	Stated preferences regarding foods and purchases	Acceptability measures, demand, sensory assessments, measures of how purchases are informed by perceived "healthiness"
		Perceptions about healthy diets	An individual's perception of how able they are to adopt behaviors which have been targeted by the intervention	Self-efficacy
		Perceptions about healthy diets	What one expects to gain by adopting the behavior promoted in an intervention	Benefits of behavior adoption
		Perceptions about healthy diets	Reasons why one believes they cannot adopt the behaviors promoted by an intervention	Barriers to behavior adoption
		Perceptions about healthy diets	Consequences one believes could occur if the promoted behaviors are not adopted	Susceptibility
		Perceptions about healthy diets	An individual's perception of how others tend to behave	Perceived norms, self-efficacy, attitudes, perception of other traits and emotions, perceived benefits and costs of behaviors, Pender's HPM constructs, health belief model constructs, reported motivations
		Knowledge about nutrition	Knowledge gained through the intervention, measured by pre / post tests or similar means	Nutrition knowledge, infant and young child feeding knowledge
	Behavior change	Purchasing behavior	Measures of purchasing patterns	Food purchases, reallocation of budgets, impulse purchases, measures of consumption or expenditure Measures of what foods are bought and how much of the foods are bought

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
				Measures related to reallocation of budgets due to the intervention (e.g., an intervention could increase food prices, and this could result in a smaller proportion of the household budget used for education) Measures related to the proportion of goods purchased that were intended to be bought when the consumer entered the store
		Other behavior change	Measures or the number / proportion of individuals who adopted the behaviors explicitly related to food security and nutrition. Education, health, and physical activity behavior change are excluded, as they are not directly linked to food security and nutrition.	Adoption of agricultural methods, technology etc. Change in dietary habits
	Nutrient availability	Food nutrient content	Measures of the nutrient content of food	Breastmilk nutrient content, changes in nutrient content of food due to farming practices, product re-formulation, and cooking habits
		Nutrient bioavailability	Measures of the amount of a nutrient that can be used by the body, as opposed to simply the nutrient content of the food.	Rates of absorption (e.g., iron absorption)
	Micronutrient status	Iron	Any measure of micronutrient content within the body (as opposed to intake)	Iron deficiency anemia, serum ferritin level, transferrin saturation, hemoglobin level Includes markers in the blood, urine and hair, etc. Also included are clinical signs of deficiency or toxicity.
		Iodine	Any measure of micronutrient content within the body (as opposed to intake)	Iodine deficiency disorder, goiter, hyperthyroidism, cretinism, thyroid-stimulating hormone level Includes markers in the blood, urine, hair, etc. Also included are clinical signs of deficiency or toxicity.
		Vitamin A	Any measure of micronutrient content within the body (as opposed to intake)	Night blindness or xerophthalmia prevalence, plasma/serum retinol

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
				Includes markers in the blood, urine, hair, etc. Also included are clinical signs of deficiency or toxicity.
		Zinc	Any measure of micronutrient content within the body (as opposed to intake)	Serum zinc, plasma zinc Includes markers in the blood, urine, hair, etc. Also included are clinical signs of deficiency or toxicity.
		Other micronutrient status outcome	Any measurement of any micronutrient or trace mineral not listed above. Specify the micronutrient in "other."	Includes salt, vitamin B6, C, D (serum 25 (OH)D; 25-hydroxyvitamin D in nmol/L), E, B-12, calcium, copper, magnesium, thiamine (vitamin B1), folate (vitamin B9), riboflavin (B2); potassium excretion, beta carotenoids Includes markers in the blood, urine, hair, etc. Also included are clinical signs of deficiency or toxicity.
	Diet quality and adequacy	Breastfeeding	Any measurement related to breastfeeding	Breastfeeding initiation, exclusive breastfeeding, continued breastfeeding, introduction of complementary foods, infant and child feeding index, breastfeeding status, complementary foods introduced, breastfeeding within given timescales, early initiation, infant and young child feeding scores, complementary feeding practices, paternal perceptions, and attitudes toward breastfeeding
		Dietary diversity	Any quantification of types of food or food groups consumed. Dietary diversity indicates the amounts of different types of foods eaten. Changes in quantities or frequencies of specific types of foods do not reflect diversity unless you are going from "none" to "some."	Food consumption score, dietary diversity score, Shannon metric / modified functional attribute diversity, dietary diversity, food variety score. Individual and household dietary diversity score. Example: the effect of cash transfers on food security was examined in seven programs, while their effect on

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
				dietary diversity was examined in nine programs. Minimum dietary diversity for women, food consumption score, dietary diversity score
		Insufficient diet	Measures of inadequate diet in terms of frequency or quality of food. Indicates that something is sufficient / insufficient relative to an established standard. <i>Excludes minimum dietary diversity and infant and young child feeding, which are included elsewhere</i>	Alternative healthy eating index, 24-hour recall assessment, minimum meal frequency, micronutrient density adequacy, probability of adequacy
		Micronutrient intake	Measures of the intake of specific micronutrients because of the intervention	% intake of recommended daily intake value
		Other diet quality and adequacy	Any other measure not captured above	Measures the intake of specific food groups (e.g., fish, animal-source foods, leafy greens, fast food), frequency of intake, consumption, diet quality index, intake of macronutrients, calories, consistency of food (infants)
	Food safety	Food toxins	Measures of the content of toxins in food	Aflatoxin, pesticides, arsenic measures
		Food-borne illness	The frequency at which food-born illnesses are reported	Diarrhea incidence
		Other food safety outcome	Any other measure not captured above	Milk hygiene (total bacteria count)
Facilitate an enabling environment that supports sound food and health systems	Advertising and presentation	Exposure to advertisement	Measures of exposure to advertisement	Number of advertisements viewed, number per hour on TV / radio, recognition of advertising slogans, whether people read and understand labels and if these labels inform their food choices
		Advertisement topics	Measures of the topics of advertisement and their targets	Frequency of cartoon characters in advertisements Frequency of fast-food ads during programming targeting children
		Accuracy of advertisement	Measures of the frequency and accuracy of health claims and disclaimers after advertisements	

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
			Considers how often health claims are made and if these claims are accurate	
		Location of foods in stores	Where food is located within stores, schools, canteens, offices	Healthy foods are highlighted at the front of the store
		Violations or regulations	Measures of how often regulations are violated	
		Fines for violations of regulations	Measures of the fines levied due to regulatory violations	
		Other regulation outcome	Other steps taken due to non-compliance Measures reflecting other steps taken due to regulatory violations	
		Tax revenue	Measures of the amount of money received by the state	
		Other steps taken due to non-compliance	Measures reflecting other steps taken due to regulatory violations	
Intermediate outcomes	Agricultural	Water-related	Any measure of on-farm water quality and / or quantity	Amount of water that reach fields due to the intervention, hours water pumped, mechanically; distance travelled / time to retrieve water; animals / herders / farmers using the water source
		Animal husbandry	Any measure on animal well-being, health, growth (weight, height) or reproduction	
		Plant / crop production	Any measure of plant / crop productivity, growth, health, nutrient composition, or measures of presence of pests, diseases or similar. Investment in agricultural inputs for production	Crop yield, crop health, crop loss. Volume of input sales, crop losses / bad harvest / spoilage pre-farm gate, grain moisture (in context of quality arising from changes to storage), grain losses, measures of production diversity (e.g., Shannon index)



Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
		Land-related	<p>Measured in hectares, acres, or other units of size</p> <p>Measures related to replacing one crop with another</p>	Area farmed, changes in crops planted, land use, size of cultivated land or land used for agricultural production, area cultivated, proportion of different crops produced (changes thereof), intensity of land use, crop diversity, multiple cropping index, land investment, crop switching
		Quality of agricultural inputs	Measures of the type and quality of agricultural inputs	Soil nutrients, compost measures. Quantity and quality of agricultural inputs. Investment in agricultural inputs, value of purchased agricultural inputs, investment in farm modernization, input purchases, including electricity; compost/soil quality
		Climate impact	CO <sub>2</sub> , methane, and other environmental impacts of food production and transport. Measures of the environmental impacts of the food value chain	Can be measured with environmental impact quotient
		Agricultural co-operatives	Any measure related to agricultural co-operatives (e.g., related to the profitability of the co-operative, savings, and debt; related to cooperation between producers, reliability of fees being paid, and ability of the co-operative to meet its obligations to farmers)	Number of co-operatives created, financial viability of co-operatives, measures of the functioning of co-operatives
	Women's empowerment	Women's decision-making	Measures of women's participation in household decision-making	Women's bargaining power, intra-household food allocations
		Women's ownership	Outcomes regarding women's ownership of land or assets	Livestock ownership, agricultural assets
		Other women's empowerment outcome	Other measures or composite measures of the above	Women's empowerment in agriculture index, project-level women's empowerment in agriculture index, measures of intimate partner violence, SWPER
	Other	Self-esteem	Any measure of self-esteem	Empowerment of having paid work

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
		Time use	Changes in time use due to the interventions <i>Excludes women's time use, which is included elsewhere</i>	Hours or days of labor, cooking, eating while watching TV
		Caloric requirements	Measure of changes in caloric requirements of an intervention's target population	Mechanizing otherwise labor-intensive tasks
		Non-food waste produced	Waste produced through the production of food that is not the food / crop (could be related to packaging and processing of foods)	
Anthropometric and developmental	Linear growth		Any measure of length or height. Outcomes may be in centimeters / inches, in standardized units such as length-for-age and height-for-age z-scores, and binary outcomes reflecting length / height thresholds such as stunting. Can be measured as average / prevalence at a national or sub-national level. <i>Excludes birth outcomes, which are included elsewhere</i>	Stunting prevalence  Cm/m, LAZ, HAZ
	Weight		Any measure of weight. Outcomes may be in kilograms/pounds, in standardized units such as weight-for-age z-scores, and binary outcomes reflecting weight thresholds, such as "underweight." Can be measured as average / prevalence at a national or sub-national level. <i>Excludes birth outcomes, which are included elsewhere</i>	Kgs, lbs
	Relative weight		Any measure of the weight of an individual relative to that person's height or age. Can be measured as average / prevalence at a national or sub-national level. <i>Excludes birth outcomes, which are included elsewhere</i>	WAZ, WHZ, BMI, wasting prevalence, overweight / obesity prevalence, underweight prevalence, severe acute malnutrition / moderate acute malnutrition prevalence, fat-free mass indices
	Mid-upper arm circumference		Any measure of the mid-upper arm circumference of an individual. Can be measured as average / prevalence at a national or sub-national level.	Centimeters, inches

Goal	Outcome group	Outcome subgroup	Definitions	Examples indicators
			<i>Excludes birth outcomes, which are included elsewhere</i>	
		Birth outcomes	Any measure of anthropometry at birth. Could be measures other than weight, but these are less common. Can be measured as average / prevalence at a national or sub-national level	(Very) low birth weight, small / large for gestational age (z-score), macrosomia, birth weight, birth length, birth head circumference, LAZ
		Other anthropometric	All other anthropometric measures	Head circumference, Hip-to-waist ratio, skinfold thickness (subscapular, tricipital) in millimeters, waist circumference, bone length, body fat
		Physical	Any measure of child's physical development and growth not captured in anthropometric outcomes	Tooth eruption, bone closure, and organ development
		Other developmental outcome	All other outcome measures of child development, such as cognitive and socio-emotional, or other	Bayley Psychomotor scales, Raven's matrices, ASQ, Denber II-Jimma screener, Griffiths' developmental scores; measures of IQ, Raven's Colored Progressive Matrices, Universal Nonverbal Intelligence Test; Stroop (numbers) test, Backward Digit Span test, Movement Assessment Battery for Children, finger-tapping test

Source: 3ie 2023

## 4. Methods

We followed the standards and methods for EGMs developed by 3ie (Snijlsteit et al. 2016, 2017). The 3ie methodology is defined by the following evidence standards:

- 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 systematic reviews

We developed a protocol with a detailed description of our methodology *a priori*. In brief, we developed a systematic search strategy covering an expansive list of databases, websites, and grey literature. We utilized new machine learning approaches to assist with identification of eligible studies (Appendix A). De-duplication was conducted within the search results for this map, as well as against the studies screened for the food systems and nutrition EGM.

Studies excluded from the food systems and nutrition EGM for reasons that made them ineligible for this EGM, such as a high-income country setting, were automatically excluded. Studies included in the food systems and nutrition EGM and known to be eligible for the nutrition-sensitive agriculture EGM, such as those related to agricultural interventions, were automatically included and removed from the set of records to be screened. This approach avoided duplication of screening across the two maps.

We systematically extracted data from included studies and used 3ie's EGM software to create an online, interactive map of all included studies displayed according to the outcomes framework. This provides a visual display of the volume of evidence, the type of evidence (impact evaluation, systematic review, observational study, completed or ongoing), and a rating of our confidence in the findings of available systematic reviews based on an objective and transparent assessment. The platform provides additional filters so that users can further explore the available evidence, for example by global regions or population. The EGM can be viewed [here](#).

This map includes impact evaluations and systematic reviews of impact evaluations. An impact evaluation measures the effects on targeted outcomes that can be attributed to a particular program or intervention; systematic reviews extract and synthesize data from multiple impact evaluations of similar interventions to generate more robust conclusions about their effectiveness than could be provided by a single study. Although these study designs are explicitly used for drawing causal inference, other important sources of evidence – such as qualitative research, professional expertise, and local knowledge – should be used to contextualize findings (USAID 2020). For a more comprehensive description of the methodology, see Appendix A.

### 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.

For systematic reviews, we also present the results of a critical appraisal based on the protocol outlined by Lewin and colleagues (2009). Criteria considered are the search, screening, data extraction, and synthesis activities conducted (Appendix D). Each systematic review was rated as low, medium, or high confidence. While we do confirm certain identification strategy design elements exist, we do not critically appraise impact evaluations. Importantly, this means that, while we can comment on the quantity of impact evaluations identified, we are not able to comment on the quality of the evidence base.

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 regarding policymaker and practitioner priorities for future research.

## **5. Findings**

In this section, we present a description of the volume and characteristics of the impact evaluations and systematic reviews of impact evaluations considering the effects of eligible interventions on food security and nutrition in low- and middle-income countries. The evidence presented here is limited to only impact evaluations and systematic reviews of impact evaluations. Other types of knowledge are not reflected in the map and should be used to contextualize this work (USAID 2014). In some cases, significant qualitative research, theoretical work, process evaluations, or implementation science research may exist and meaningfully address the identified evidence gaps. However, these would not be reflected in this EGM.

### **5.1 Volume of the evidence**

Through our search of academic databases, we identified 161,888 records (Figure 3). An additional 3,887 records were found through a grey literature search. After removing duplicates, 120,033 records remained. Through a machine learning approach, we automatically excluded 89,081 citations at title / abstract stage, with an additional 27,623 citations excluded manually (Appendix A).

We estimate that our machine-aided screening process captured approximately 80 per cent of all eligible studies among our search results.<sup>4</sup> We retained 3,185 articles for

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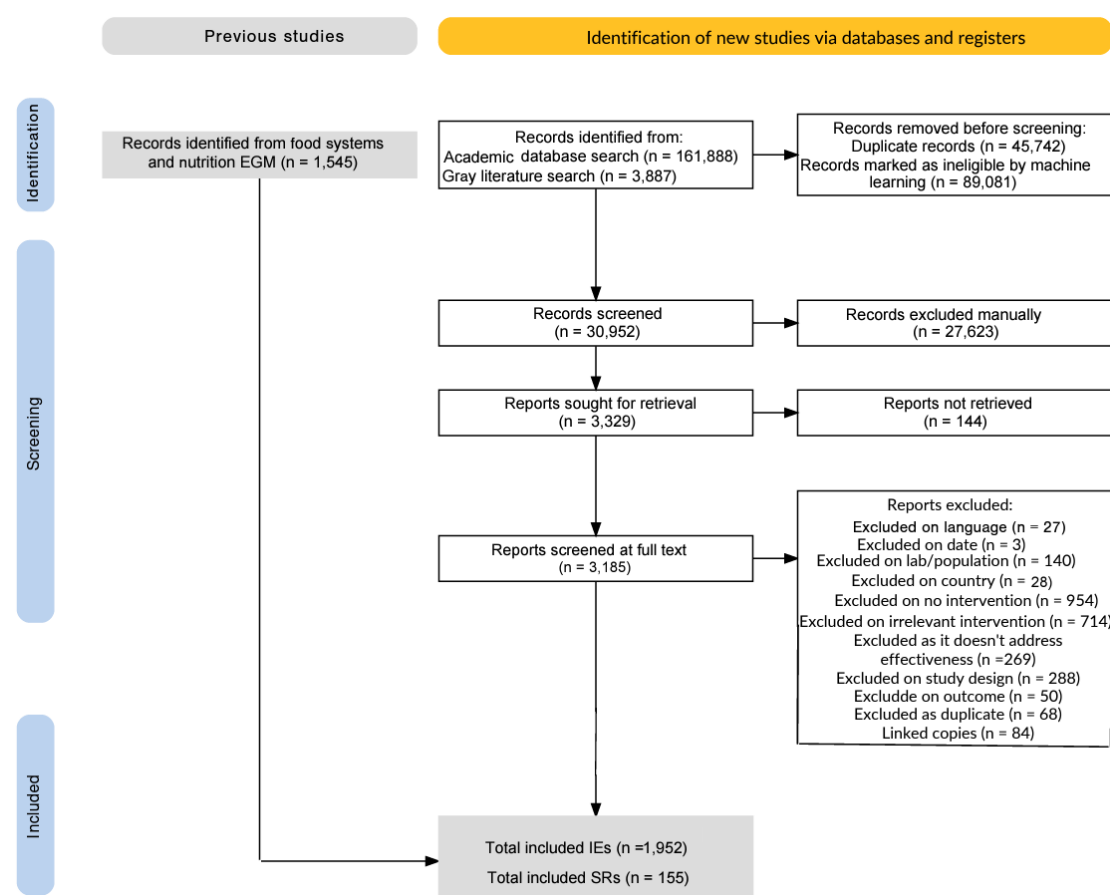
<sup>4</sup> See "model accuracy and potential for missed studies" in Appendix A for additional detail on the potential for missed papers. It is worth noting that we deliberately adopted a very sensitive search strategy that was designed to capture as many relevant studies as possible, at the cost of 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 search results, while increasing the percentage of eligible studies identified relative to the entire literature.

screening at full text, 562 of which were included in the EGM. In addition, 1,545 studies from our previously developed food systems and nutrition EGM are presented in this EGM. Ultimately, this resulted in the inclusion of 1,952 impact evaluations and 155 systematic reviews in this EGM.

Common reasons for exclusion at full text were that studies did not consider an intervention ( $n = 954$ ), considered an ineligible intervention ( $n = 714$ ), or employed an ineligible study design ( $n = 288$ ). Studies that did not consider interventions tended to consider the effects of behaviors rather than the effects of interventions to support the adoption of these behaviors. Studies that used ineligible study designs generally provided associational evidence without establishing causality.

The evidence base has increased steadily over time. The rate of increase peaked in 2019, when 253 articles were published (Figure 4). A decrease in publications in 2020 could be the result of challenges in completing projects due to the COVID-19 pandemic. The apparent decrease in publications in 2021 and 2022 is likely due to the timing of the search, which was run in January 2022 with additional grey literature searches afterwards. Studies published in late 2021 and not indexed until 2022 may not have been identified. Most studies from 2022 were not yet published when the search was completed.

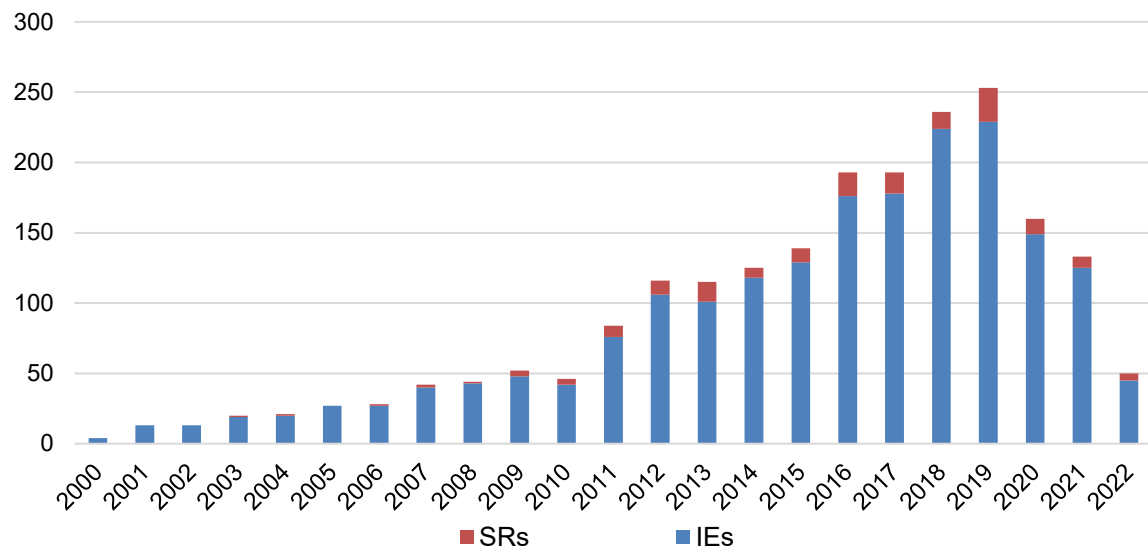
**Figure 3: Search results**



Note: PRISMA diagram shows the process by which studies were identified based on a standard process of search, de-duplication, screening at title and abstract, and screening at full text.

Source: 3ie 2023

**Figure 4: Development of the evidence over time**



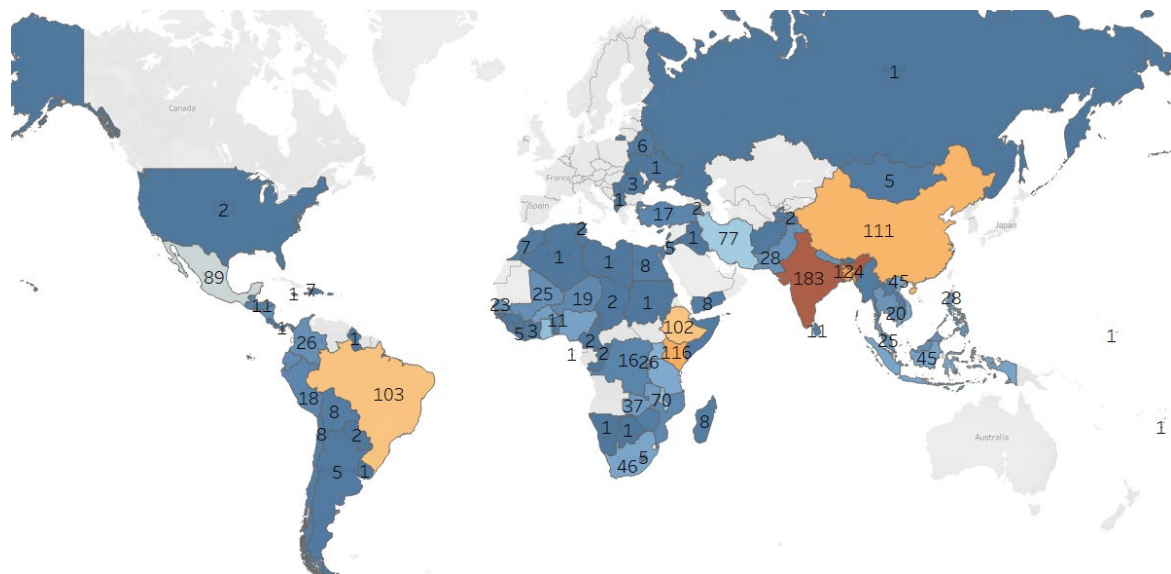
Note: The search for this work was conducted in January 2022. Studies published late 2021 may not have been indexed and most studies published in 2022 would not have been available. The total number of studies is 2,107.

Source: 3ie 2023

## 5.2 Characteristics of the evidence base

**Country:** The most common country studied through impact evaluations was India (9%,  $n = 183$ , Figure 5), followed by Bangladesh (6%,  $n = 124$ ), and Kenya (6%,  $n = 116$ ). Although there are some high-income countries reflected in the map, this is either because they were multi-country studies, including LMICs (e.g., United States,  $n = 2$ ) or they became high-income countries recently (e.g., Chile,  $n = 8$ ).

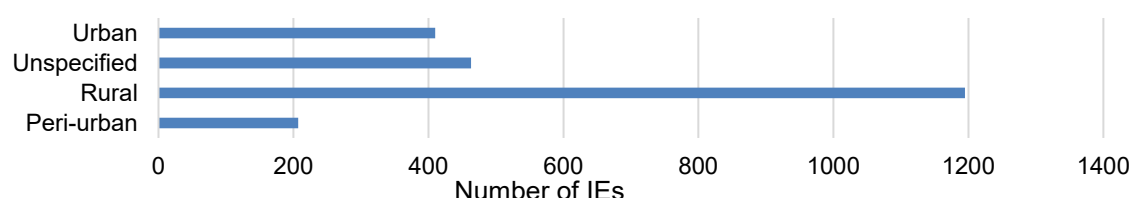
**Figure 5: Geographical spread of impact evaluations**



**Setting and population:** Just over half of the included impact evaluations took place in rural settings (61%, n = 1,195, Figure 6). Urban (21%, n = 410) and peri-urban (11%, n = 207) settings were much less common. A plurality of impact evaluations did not target specific age groups (42%, n = 817, Figure 7). However, many interventions tried to affect the health of infants aged seven months to two years (21%, n = 412), and those under six months (17%, n = 326). A total of 10 per cent of impact evaluations targeted pregnant and lactating women (n = 186), with an additional 6 per cent targeting women generally (n = 122)

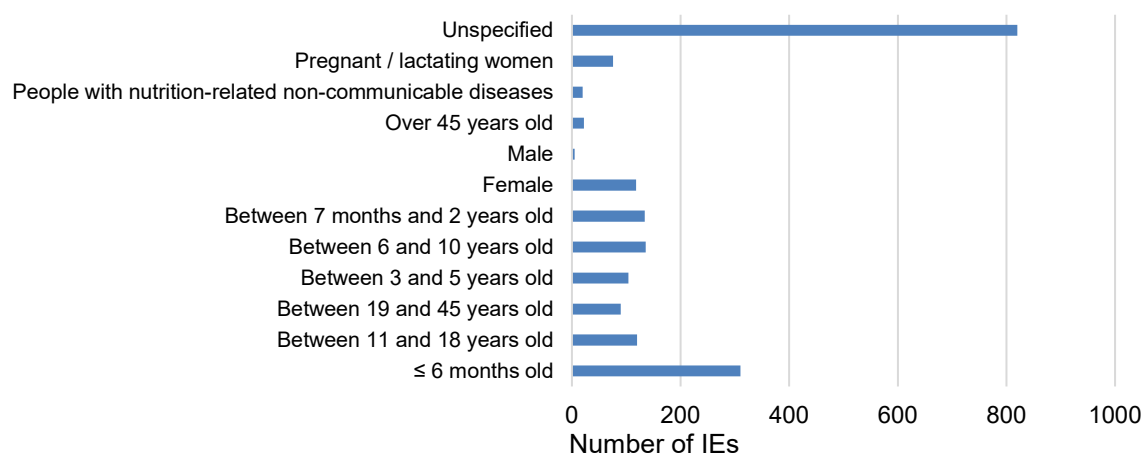
**Target products:** Most impact evaluations did not target specific foods or food products (65%, n = 1,264). However, among those that did, fortified foods (16%, n = 317, Figure 8) and nutrient rich foods<sup>5</sup> (12%, n = 228) were the most common. Specialized products for women of reproductive age were the least common, with only seven studies considering these.

**Figure 6: Study setting**



Note: Numbers reflect unique impact evaluations in each setting. Studies which took place in multiple countries appear within the counts for each setting. The total number of studies is 1,952.  
Source: 3ie 2023

**Figure 7: Population whose health is targeted**



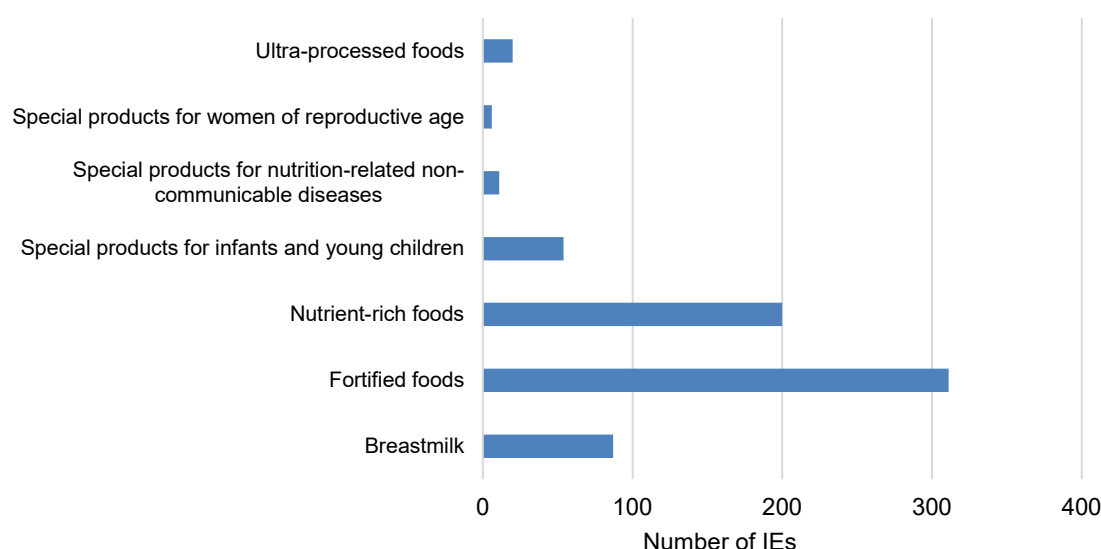
Note: Numbers reflect unique impact evaluations targeting each population. Studies which target multiple populations appear within the counts for each population. The total number of studies is 1,952.

Source: 3ie 2023

<sup>5</sup>An adapted version of the definition of nutrient rich foods from the FANTA project was employed (FANTA, 2015). Nutrient-rich foods included legumes, nuts, seeds, animal-source foods, dark yellow, purple, or orange-fleshed roots or tubers, fruits, and vegetables. The slight change in definition was made to facilitate screening by non-experts.



**Figure 8: Target product**



Note: Most impact evaluations did not target a specific product. Only evaluations targeting a product are represented here. The total number of studies is 688.

Source: 3ie 2023

**Interventions:** Interventions were generally related to increasing consumer knowledge about nutrition (IEs = 655; M/H SRs = 28, Figure 9, Table 4), increasing the market competitiveness of foods (IEs = 614; M/H SRs = 15), strengthening maternal, infant and young child feeding (IEs = 661; M/H SRs = 35). Specifically, the most common interventions were educational support for agricultural production (IEs = 290; M/H SRs = 6), direct provision of food (IEs = 274; M/H SRs = 17), and nutrition classes (IEs = 274; M/H SRs = 14).

Other areas of current interest within the sector include the direct provision of credit (IEs = 95; M/H SRs = 3), education for microfinance groups (IEs = 45; M/H SRs = 3), and interventions which combine these two approaches (IEs = 9; M/H SRs = 0). The mobilization of public and private actors (termed “market-based provision actors” in Figure 9) was used to develop relationships between producers of agricultural inputs and local farmers / small- and medium-sized enterprises (IEs = 32; M/H SRs = 3) and to support local traders moving into new markets (IEs = 24; M/H SRs = 1).

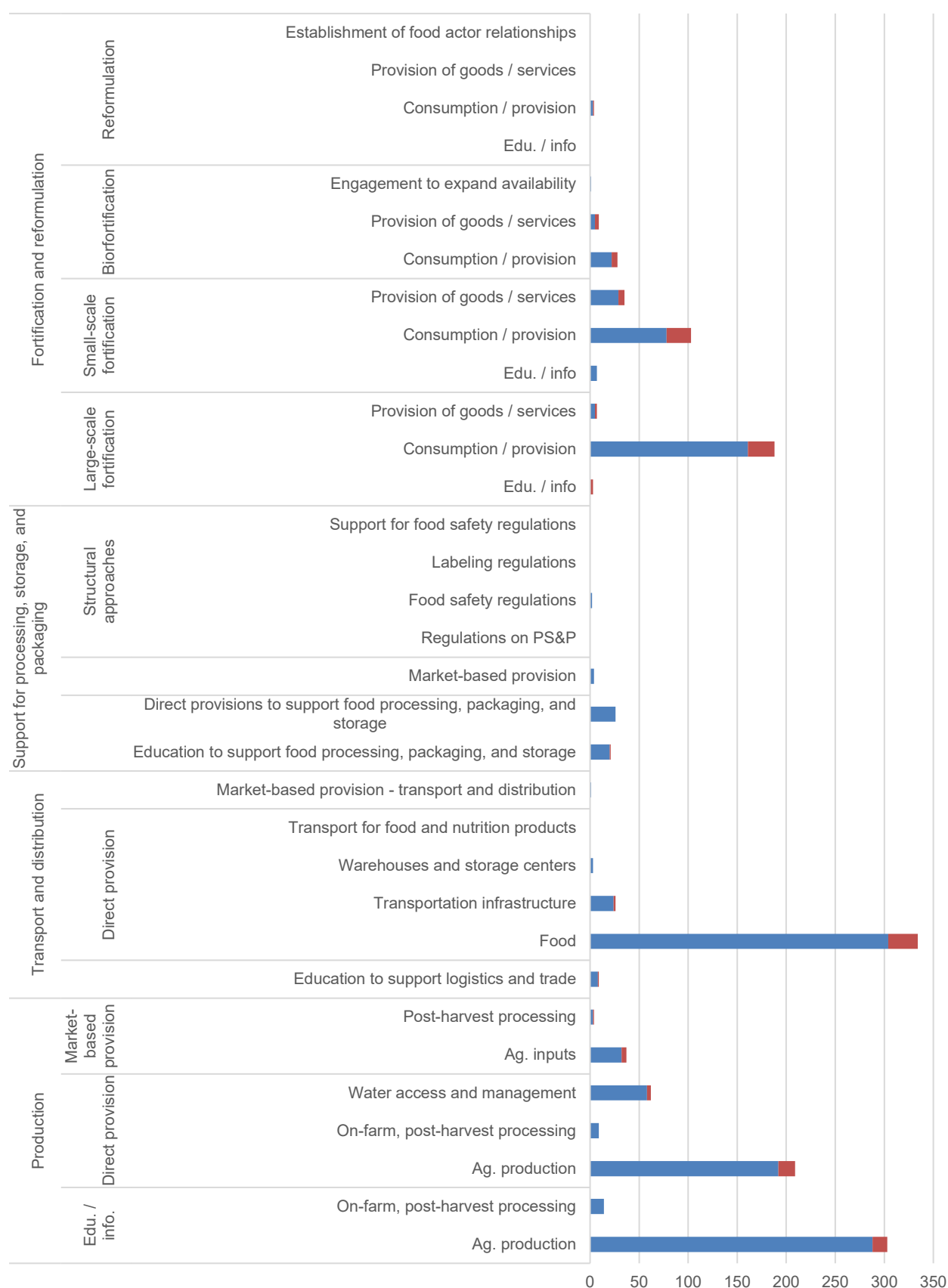
There are no evaluations of interventions to mobilize actors for large-scale or small-scale fortification, and only one evaluation of mobilizing market actors around biofortified foods. However, we did find studies evaluating the consumption or provision of large-scale fortified foods (IEs = 74; M/H SRs = 7), small-scale fortified foods (IEs = 113; M/H SRs = 17) and biofortified foods (IEs = 22; M/H SRs = 2).

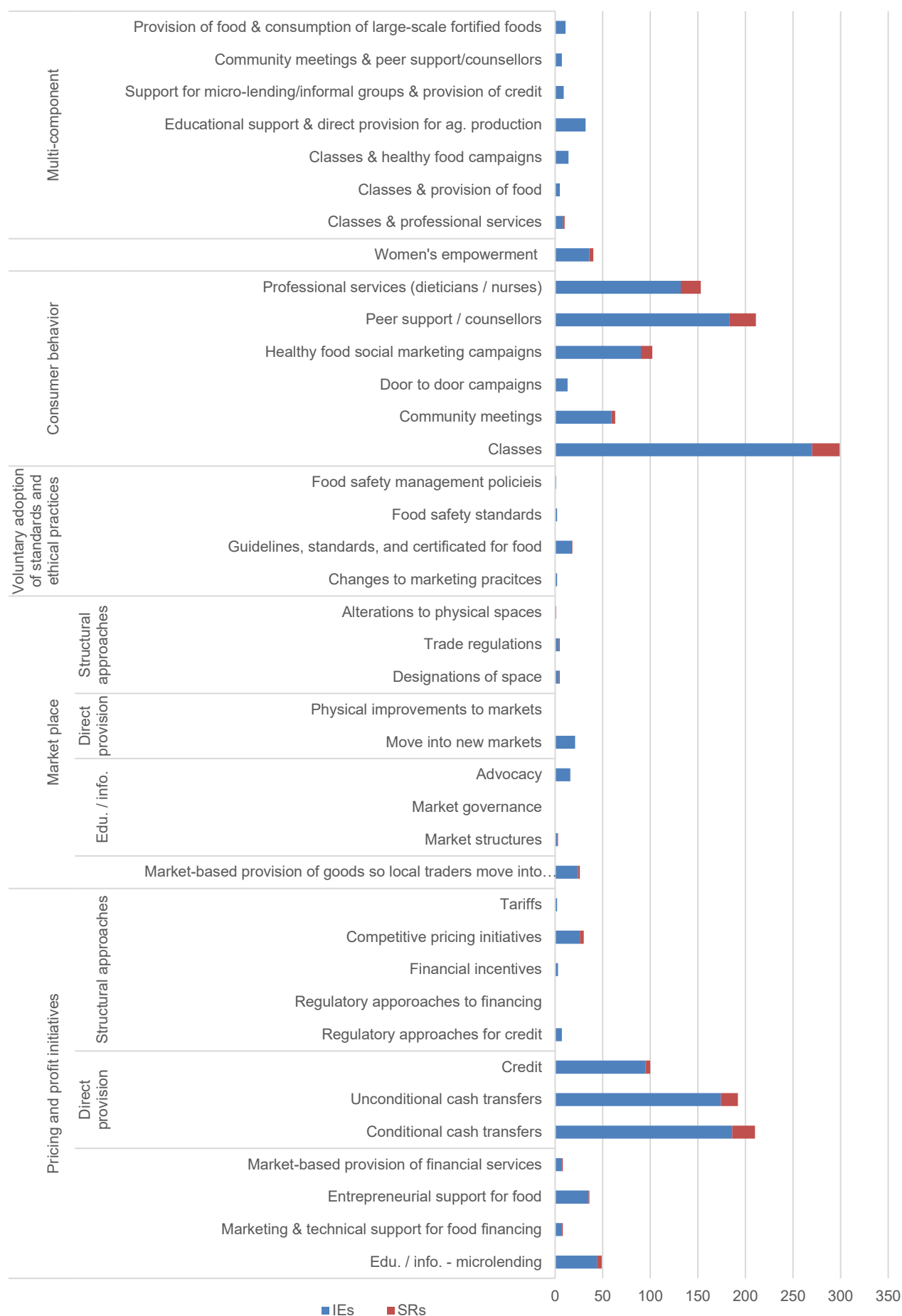
Other market-oriented approaches to supporting nutrition included entrepreneurial support for food businesses (IEs = 39; M/H SRs = 0) and transportation infrastructure (IEs = 24; M/H SRs = 2). We find 138 impact evaluations and five high- or medium-confidence systematic reviews related to credit and innovative financing approaches. Few studies (8%, n = 163) used digital tools.

**Outcomes:** Impact evaluations and systematic reviews measured consumption of safe, nutritious food most frequently (IEs = 1,362; M/H SRs = 51, Table 5). Diet quality and adequacy outcomes were most frequently considered (IEs = 747; M/H SRs = 25, Figure 10), followed by anthropometric outcomes (IEs = 684; M/H SRs = 48). Dietary diversity was the most common dietary quality and adequacy outcome considered (IEs = 346; M/H SRs = 10). The most common anthropometric outcomes were related to linear growth (IEs = 436; M/H SRs = 36), weight relative to height (IEs = 414; M/H SRs = 27), and weight (IEs = 374; M/H SRs = 33).

Measurement of economic outcomes were somewhat less common (IEs = 547; M/H SRs = 14). The most common economic outcomes were income (IEs = 408; M/H SRs = 10) and assets (IEs = 169; M/H SRs = 4). Only two impact evaluations considered efforts to facilitate an enabling environment for a sound food and health system.

**Figure 9: Frequency of interventions evaluated in impact evaluations and systematic reviews**





Notes: In instances where multiple interventions were evaluated within the same study, the following decision rules applied:

1. If the effect of each intervention is established in isolation (e.g., through a two-by-two randomized design), the study is counted under each intervention evaluated.
2. If the study considers a set of interventions which is evaluated five or more times, a new intervention is established and all studies considering this set of interventions are counted within the corresponding intervention.
3. If the study considers a set of interventions which is evaluated fewer than five times, the study is coded under each intervention it evaluates.

The total number of studies is 2,107.

PS&P = processing, storage, and packaging.

Source: 3ie 2023

**Table 4: Evidence distribution relative to programmatic approaches**

Programmatic approach	Corresponding intervention in EGM	IEs	M/H SRs
PA1: Strengthen on-farm production and post-harvest processing of safe, nutritious foods	Production intervention group	518	11
PA2: Promote appropriate, safe processing and packaging practices of nutritious foods, including specialized products for women of reproductive age, infants and young children	Support for food processing, storage, and packaging Special products women of reproductive age Special products for infants and young children	96	3
PA3: Improve market infrastructure for distributing safe, nutritious foods (e.g., cold chain)	Marketplaces intervention group Creating warehouses and storage centers Education to support logistics and trade Mobilization of public and private actors to establish relationships between transport / distribution services, producers, and consumers Provision of transport for food and nutrition products Transportation infrastructure	88	3
PA4: Increase market competitiveness of safe, nutritious foods	Support for food processing, storage, and packaging group Pricing and profit initiatives group Marketplaces group Voluntary adoption of standards and ethical practices group	614	15
	Creating warehouses and storage centers	84	3

Programmatic approach	Corresponding intervention in EGM	IEs	M/H SRs
PA5: Increase domestic and intra-regional trade of safe, nutritious foods	Education to support logistics and trade		
	<ul style="list-style-type: none"> <li>Mobilization of public and private actors to establish relationships between transport / distribution services, producers, and consumers</li> <li>Provision of transport for food and nutrition products</li> <li>Transportation infrastructure</li> <li>Direct provision of goods, services, and technologies for local traders and retailers to tailor their market-based approaches and move into new markets</li> <li>Education and advocacy to support local traders and retailers to move into new markets</li> <li>Mobilization of public and private actors to establish relationships which support local traders and retailers to move into new markets</li> <li>Physical improvements of market / workplace facilities</li> <li>Trade regulations for food</li> </ul>		
PA6: Facilitate access to credit for nutrition-focused enterprises	<ul style="list-style-type: none"> <li>Create, train, and otherwise support micro-lending / informal groups</li> <li>Direct financial incentives to increase domestic, concessional, private-sector, and innovative financing for nutrition</li> <li>Direct provision of credit</li> <li>Legal / administrative practices that improve access to credit through formal lending institutions for individuals or groups</li> <li>Legal / administrative practices that facilitate domestic, concessional, private-sector, and innovative financing within the food sector</li> <li>Marketing and technical support for domestic, concessional, private-sector, and innovative financing for food</li> <li>Mobilization of public and private actors to establish relationships between financial service providers and small and medium-sized enterprises, entrepreneurs, and smallholders</li> </ul>	144	5

Programmatic approach	Corresponding intervention in EGM	IEs	M/H SRs
PA7: Improve design, quality, and coverage of industrial food fortification programs	Direct provision of goods, services, or technologies to support large-scale fortification	7	0
	Education to support large-scale fortification		
PA 8: Improve consumer knowledge and awareness to choose safe, nutritious diets	Mobilization of public and private actors to establish relationships between food actors involved in large-scale fortification	655	28
	Consumer behavior, including relevant multi-component interventions		
PA9: Facilitate responsible marketing and labelling of safe, nutritious foods	Advertising and marketing regulations	19	1
	Labeling regulations		
PA10: Strengthen maternal and infant and young child feeding and care practices	Advocacy for and voluntary changes to marketing practices	661	35
	Advocacy for, science-based efforts to support, the actual development, and the adoption of guidelines, public statements, standards, and certificates for food		
PA11: Promote policies and initiatives that increase access to safe, nutritious foods	Population whose health is targeted, children under five years of age, pregnant / lactating women	95	2
	Administrative, technical, and direct support for the adoption and enforcement of food safety regulations		
	Advertising and marketing regulations		
	Labeling regulations		
	Legal / administrative practices regarding food processing and packaging		
	Legal / administrative practices regarding food safety regulations		
	Competitive pricing initiative		
	Legal / administrative practices that facilitate domestic, concessional, private-sector, and innovative financing within the food sector		
	Legal / administrative practices that improve access to credit through formal lending institutions for individuals or groups		
	Tariffs for food		
	Designations of space and zoning laws		
	Trade regulations for food		

Programmatic approach	Corresponding intervention in EGM	IEs	M/H SRs
	Administrative, technical, and direct support for producers, consumers, and civil society actors on food safety standards and practices		
	Administrative, technical, and direct support for the adoption of new or existing food safety management policies		
	Advocacy for and voluntary changes to marketing practices		
	Advocacy for, science-based efforts to support, the actual development, and the adoption of guidelines, public statements, standards, and certificates for food		
	Women's empowerment and gender equity		
PA12: Facilitate establishment of national dietary guidelines and nutrition standards	Advocacy for, science-based efforts to support, the actual development, and the adoption of guidelines, public statements, standards, and certificates for food	17	1
	Create, train, and otherwise support micro-lending / informal groups		
	Direct financial incentives to increase domestic, concessional, private-sector, and innovative financing for nutrition		
	Direct provision of credit		
PA21: Increase the quality and quantity of domestic, concessional, private-sector and innovative financing allocated to nutrition	Legal / administrative practices that facilitate domestic, concessional, private-sector, and innovative financing within the food sector	138	5
	Legal / administrative practices that improve access to credit through formal lending institutions for individuals or groups		
	Marketing and technical support for domestic, concessional, private-sector, and innovative financing for food		
	Administrative, technical, and direct support for the adoption and enforcement of food safety regulations		
PA22: Strengthen human, institutional, and civil society capacity to advocate and deliver on nutrition outcomes, including adoption of food safety standards and practices	Legal / administrative practices to food safety regulations		
	Administrative, technical, and direct support for producers, consumers, and civil society actors on food safety standards and practices	20	1
	Administrative, technical, and direct support for the adoption of new or existing food safety management policies		



Programmatic approach	Corresponding intervention in EGM	IEs	M/H SRs
	Advocacy for, science-based efforts to support, the actual development, and the adoption of guidelines, public statements, standards, and certificates for food		
PA24: Stimulate development and accelerate uptake of innovations for improved nutrition	Advocacy for, science-based efforts to support, the actual development, and the adoption of guidelines, public statements, standards, and certificates for food	17	1
PA25: Strengthen food safety and food quality regulatory and management systems to reduce risk of food-borne illness	Administrative, technical, and direct support for the adoption and enforcement of food safety regulations Legal / administrative practices for food safety regulations Administrative, technical, and direct support for producers, consumers, and civil society actors on food safety standards and practices Administrative, technical, and direct support for the adoption of new or existing food safety management policies	4	0

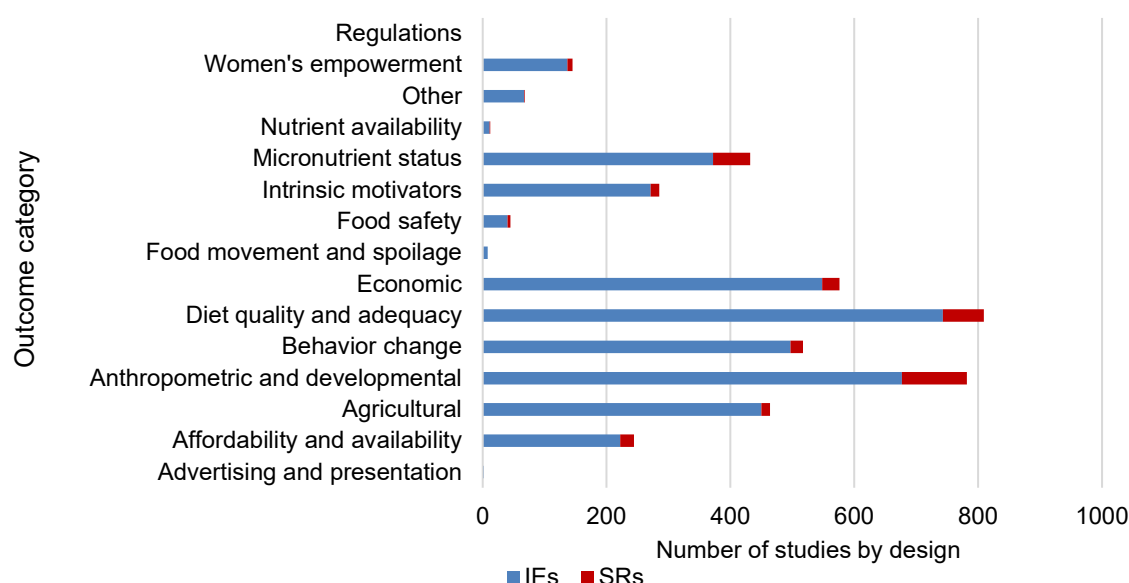
Notes: Counts reflect the number of unique studies which consider any of the interventions listed. The decision rules regarding studies considering multiple interventions are consistent with Figure 9:

1. If the effect of each intervention is established in isolation (e.g., through a two-by-two randomized design), the study is counted under each intervention evaluated.
2. If the study considers a set of interventions which is evaluated five or more times, a new multi-component is established, and all studies considering this set of interventions are counted within the corresponding intervention.
3. If the study considers a set of interventions which is evaluated fewer than five times, the study is coded under each intervention it evaluates.
4. If a study considers multiple interventions which correspond to the same programmatic approach, it is counted only once within that approach.

The total number of eligible studies is 2,107; however, not all studies consider one of these programmatic approaches.

Source: 3ie 2023

**Figure 10: Frequency of outcome categories for impact evaluations and systematic reviews**



Note: Counts reflect the number of unique studies which consider each outcome. If studies consider multiple outcomes, they are counted under each outcome. The total number of eligible studies is 2,107.

Source: 3ie 2023

**Table 5: Evidence distribution relative to strategic approaches**

Strategic approach	Corresponding outcome in EGM	IEs	M/H SRs
SA1: Increase access and affordability of safe, nutritious foods	Economic	547	14
	Food movement and spoilage	8	0
	Affordability and availability	221	9
	<b>Total unique count</b>	<b>643</b>	<b>16</b>
SA2: Increase consumption of safe, nutritious foods	Intrinsic motivators	273	7
	Behavior change	496	8
	Nutrient availability	11	0
	Micronutrient status	372	26
	Diet quality and adequacy	747	25
	Food safety	41	2
	<b>Total unique count</b>	<b>1,362</b>	<b>51</b>
SA5: Facilitate an enabling environment that supports sound food and health systems	Advertising and presentation	2	0
	Regulations	0	0

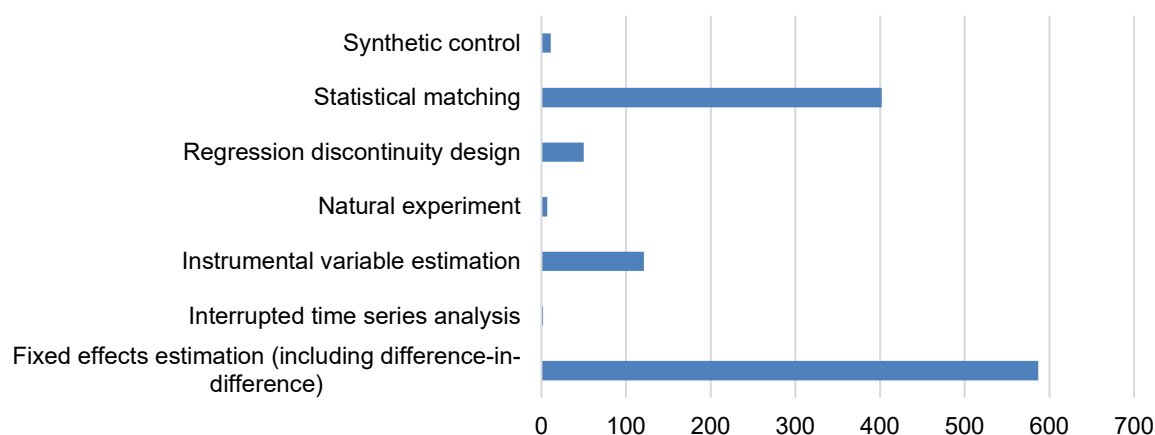
Note: Counts reflect the number of unique studies which consider any of the outcomes listed. If a study considers multiple outcomes which correspond to the same strategic approach, it is counted only once within that approach. The total number of eligible studies is 2,107; however, not all studies consider one of these programmatic approaches.

Source: 3ie 2023

**Methods and reach:** Most studies (64%, n = 1,259) used experimental methods. Among those that used quasi-experimental approaches, fixed effects estimation (including difference-in-difference) was the most common identification strategy (30%, n = 587,

Figure 11). Statistical matching was also common (21%, n = 402). Interrupted time series (0%, n = 2), natural experiments (0%, n = 7), and synthetic control (1%, n = 11) were uncommon. Only 214 (10%) studies present cost evidence and 249 (12%) use mixed methods. Half of the systematic reviews were rated as low confidence (n = 77, Figure 12). There are 36 (23%) reviews rated as medium confidence and 33 (21%) rated as high confidence.<sup>6</sup> Impact evaluations tended to take place on at the village (41%, n = 797, Figure 13) or region level (31%, n = 597). However, 285 (15%) took place at the national level.

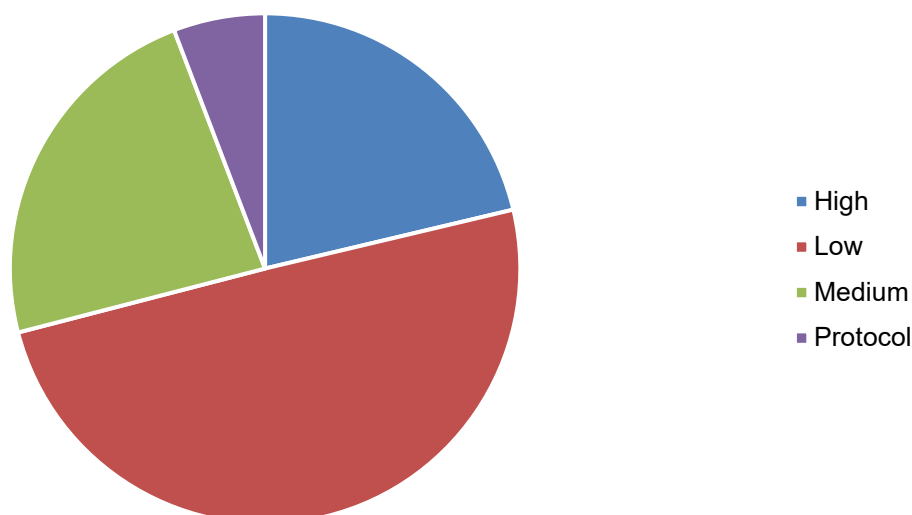
**Figure 11: Quasi-experimental evaluation methods**



Note: Numbers reflect unique impact evaluations using each method. Studies using multiple methods are counted within each method. The total number of studies is 915.

Source: 3ie 2023

**Figure 12: Systematic review confidence rating**

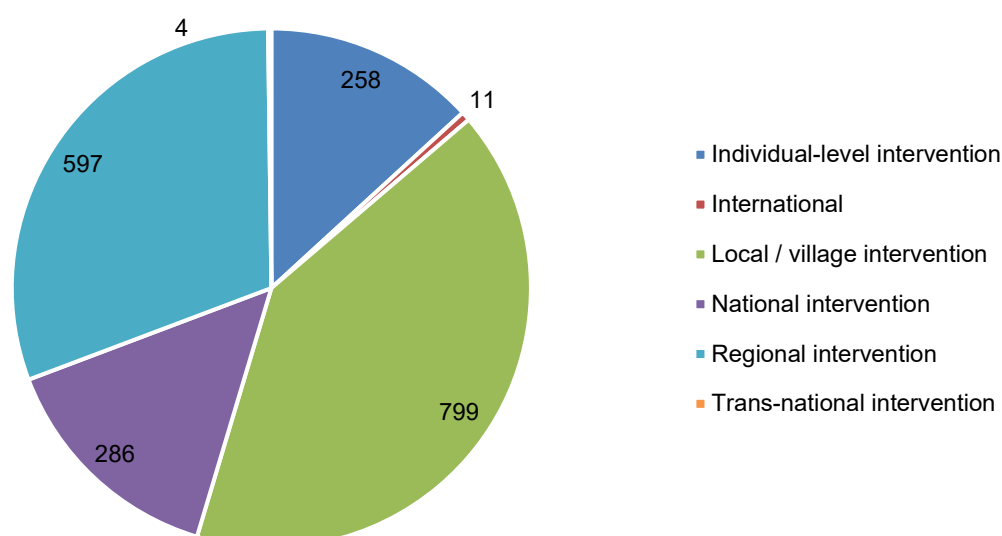


Note: Each systematic review is assigned a single confidence rating based on the tool presented in Appendix D. The total number of studies is 155.

Source: 3ie 2023

<sup>6</sup> Nine SR protocols were also identified. These are included in the total SR count, but were not appraised for quality.

**Figure 13: Reach of intervention**

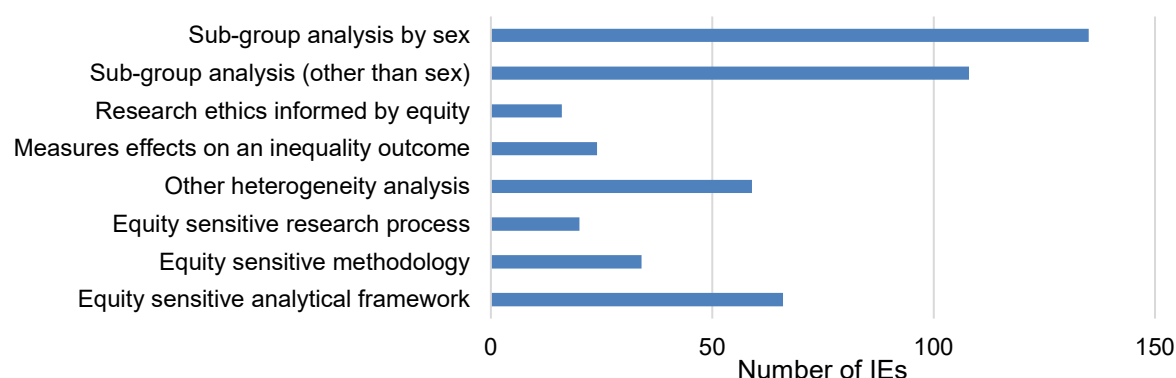


Note: Numbers reflect unique impact evaluations with each reach. Studies are assigned a single value for reach based on the largest area considered. The total number of studies is 1,952.  
Source: 3ie 2023

**Equity and ethics:** Most impact evaluations (81%,  $n = 1,583$ , Figure 14) did not consider equity or gender. However, those that did generally carried out subgroup analysis by sex (7%,  $n = 135$ ) or another factor (66%,  $n = 108$ ). Among those that considered equity, the most common equity dimension considered was sex (56% of those considering equity,  $n = 206$ , Figure 15). This was followed by socioeconomic status (34% of those considering equity,  $n = 124$ ) and age (25%,  $n = 94$ ).

Caste, culture, ethnicity, land ownership, HIV/AIDS, displaced population, disability, conflict-affected, religion, sexual identity, and social capital were considered in fewer than 10 studies each. Approximately half of the impact evaluations (49%,  $n = 947$ ) specified that they had received ethical approval.

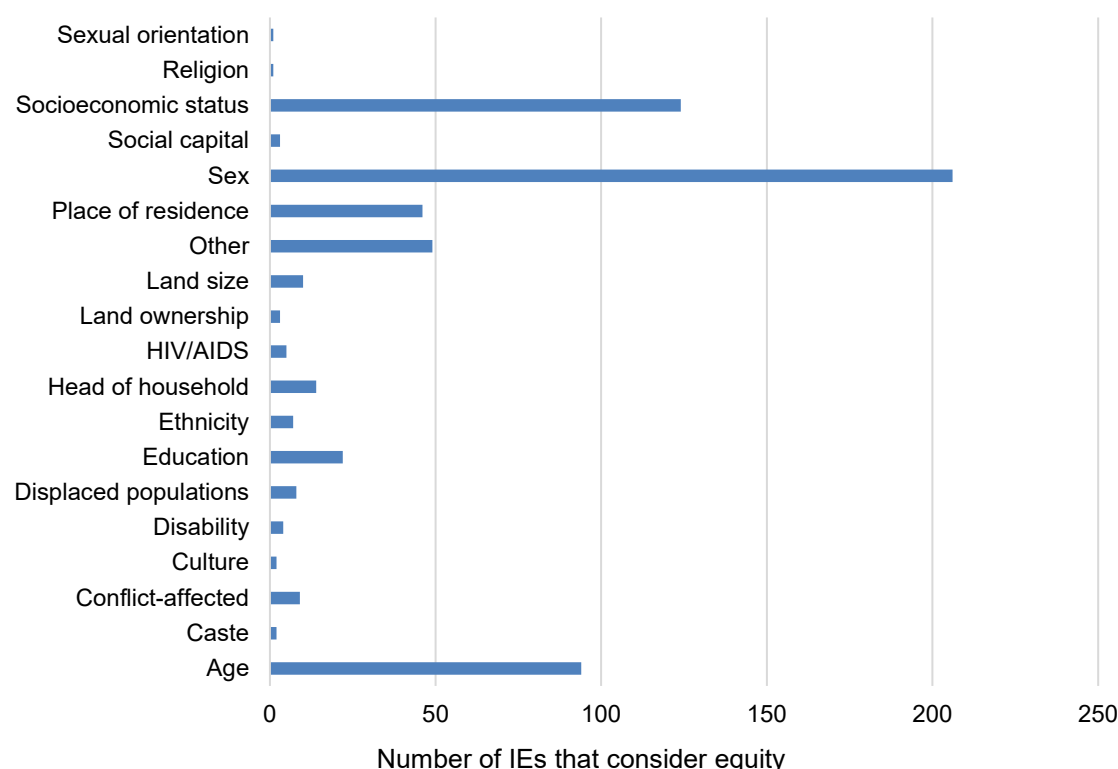
**Figure 14: Equity dimension**



Note: Numbers reflect unique impact evaluations considering each dimension. Studies considering multiple dimensions appear within the counts for each method. Only studies considering at least one equity dimension are reflected here; therefore, the total number of studies is 369.

Source: 3ie 2023

**Figure 15: Equity focus**



Note: Numbers reflect unique impact evaluations within each focus area. Studies with multiple focus areas appear within the counts for each method. However, only studies that consider an equity dimension are reflected here. The total number of studies is 369.

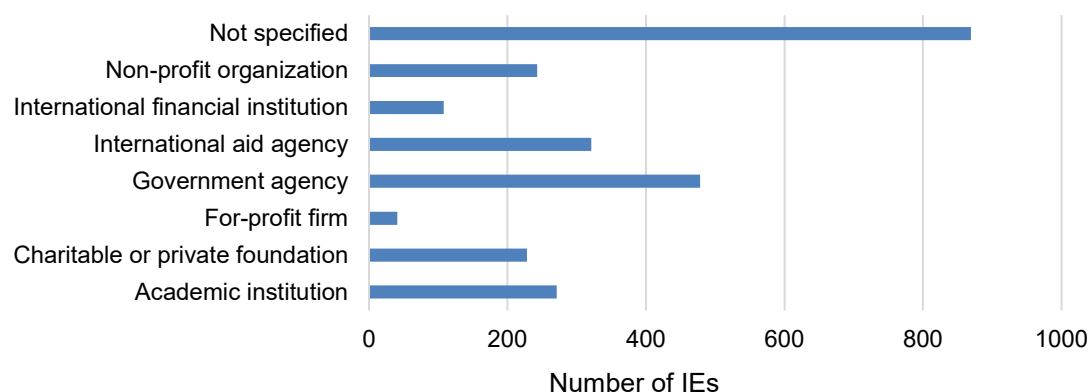
Source: 3ie 2023

**Implementation and funding agencies:** Nearly 60 per cent of the studies did not specify the implementer ( $n = 1,136$ ; Figure 16). The most common implementation agencies for the interventions evaluated were government agencies (29% of interventions,  $n = 564$ , Figure 16), followed by non-profit organizations with (18%,  $n = 356$ ). All other agency types were implemented in less than 10 per cent of interventions.

Program funding agencies were also mostly unreported (62%,  $n = 1,215$ , Figure 16); those that were reported were largely government agencies (19%,  $n = 376$ ). There were more international aid agencies (11%,  $n = 205$ ) than program implementers (5%,  $n = 107$ ) reported as program funders.

A smaller proportion of studies failed to report research funding agencies than those that failed to report program funding or implementation agencies (45%,  $n = 869$ , Figure 16). Government agencies are the most common research funders (24%,  $n = 478$ ), followed by international aid agencies (16%,  $n = 321$ ), and academic institutions (14%,  $n = 271$ ).

**Figure 16: Implementing agencies, program funding agencies, and research funding agencies**



Note: Numbers reflect unique impact evaluations with each implementing agency or funder. Studies with multiple implementing agencies or funders that appear within the same group are counted only once, but those with implementing agencies or funders from different groups are counted within each. The total number of studies is 1,952.

Source: 3ie 2023

### 5.3 Discussion: what are the key evidence clusters and gaps?

There is no standard definition or threshold for an evidence gap or cluster. Not all evidence gaps need to be filled, nor does the absence of impact evaluations or systematic reviews mean that there is no information about how interventions might work. Qualitative research, process evaluations, theoretical frameworks, and implementation science can provide valuable insights into how change is achieved.

In addition, large numbers of studies in a specific area does not mean that a field is saturated. There may still be a lack of evidence for a specific context, population, or novel approach within the broader category. For example, although there is a significant amount of work on *educational support for agricultural production* (n = 305), there is less information on specific modalities, such as using digital technology for education (n = 36). In addition, the size of an evidence base does not reflect the quality of the evidence base. Although we provide confidence ratings for systematic reviews, we do not do this for impact evaluations.

We find the most evidence in the *consumer behavior* (IEs = 618; M/H SRs = 28), *pricing and profit* (IEs = 508; M/H SRs = 13), and *production* (IEs = 486; M/H SRs = 11) domains. Most evaluated interventions take direct provision (IEs = 996; M/H SRs = 34, Figure 9) or educational approaches (IEs = 961; M/H SRs = 35). Few studies considered structural approaches (IEs = 41; M/H SRs = 1) or the mobilization of public and private sector actors (IEs = 63; M/H SRs = 3). Eligible structural approaches generally related to legislative, administrative, or regulatory initiatives within the food system, such as food safety regulations and tariffs. Interventions which mobilized public and private sector actors often facilitated relationships to improve markets.

The specific interventions with over 150 impact evaluations and 10 medium- or high-confidence systematic reviews (H/M SR) on were *nutrition classes* (IEs = 274; M/H SRs = 14), *peer support or counsellors* (IEs = 181; M/H SRs = 13), and *direct provision of*

*food* (IEs = 274; M/H SRs = 17). The most studied outcomes are *diet quality and adequacy* (IEs = 747; M/H SRs = 25), with the most-evaluated outcome in this group being dietary diversity (IEs = 348; M/H SRs = 10). Given the concentration of evidence in these areas, they could be considered evidence clusters.

*Marketplace* interventions are the least studied (IEs = 56; M/H SRs = 1). We find no evaluations of the following interventions, which therefore represent absolute evidence gaps:

- Regulatory approaches to financing;
- Education on market governance;
- Regulations on processing, storage, and packaging;
- Labelling regulations;
- Educational and market-based approaches to large-scale fortification;
- Market-based approaches to small-scale fortification;
- Physical changes to markets / workplace facilities; and
- Education, market-based, and direct provision approaches to support re-formulation.

We also find more than 10 impact evaluations and no medium- or high-confidence systematic reviews published in the last seven years on the following interventions:<sup>7</sup>

- Education and market-based approaches for traders to move into new markets;
- Direct provision of goods and services supporting food processing, packaging, and storage;
- Education and direct provision to support food processing, packaging, and storage, including on-farm, post-harvest processing;
- Water access and management; and
- Women's empowerment and gender equity.

We find more than 10 impact evaluations and no medium- or high-confidence systematic reviews published in the last seven years on the following outcomes:<sup>7</sup>

- Consumer preferences;
- Land-related outcomes;<sup>8</sup>
- Water-related outcomes;<sup>9</sup>
- Quality of agricultural inputs;
- Women's ownership of assets; and
- Time use.

Experimental (64%) and quasi-experimental approaches were well balanced. There was not an obvious bias towards individual- or village-level interventions, which tend to be easier to randomize. Fifteen per cent of studies examined interventions at the national

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<sup>7</sup> This cut-off is somewhat arbitrary. However, in our experience, 10 would be the minimum number of studies required to perform a systematic review. After approximately seven years, we find that research tends to be viewed as outdated by decision makers.

<sup>8</sup> For example, area farmed, changes in crops planted, land use, size of cultivated land or land used for agricultural production, area cultivated, proportion of different crops produced (changes thereof), intensity of land use, crop diversity, multiple cropping index, land investment, crop switching.

<sup>9</sup> For example, amount of water that reach fields due to the intervention, hours water pumped, distance travelled / time to retrieve water, animals, herders, or farmers using the water source.

level, though many of these were related to cash transfer programs. However, mixed methods (12%, n = 251) and cost evidence (11%, n = 214) were relatively rare. We also find that equity is often not considered (81%, n = 1,585). Few studies consider key dimensions like social capital, culture, caste, or HIV/AIDS.

## 6. Limitations

This EGM is limited to only impact evaluations and systematic reviews of impact evaluations. Other types of knowledge, while potentially relevant, are not reflected in the map and should be used to contextualize this work (USAID 2014). Qualitative research, process evaluations, implementation science research, and theoretical frameworks may all be used to meaningfully address identified evidence gaps. These forms of research can provide valuable insights as to whether changes are likely to occur and how change can happen.

The absence of impact evaluations and systematic reviews of impact evaluations on a given topic does not mean that there is no information linking an intervention to an expected outcome. Furthermore, even if this was the case, the absence of information on a relationship does not mean that the relationship does not exist.

EGMs are valuable tools for collating information and describing the evidence base. They do not, however, provide any indication as to whether certain approaches are effective. Evidence gaps do not mean that interventions do not work. Rather, they indicate a lack of knowledge regarding whether interventions work. The absence of evidence is not evidence of absence. Conversely, a large evidence base could show that an intervention does not work and is ineffective. Generally, evidence gaps appear for four reasons:

1. *Previously established impact:* If the impact of the intervention was established before the search period (2000), there may have been no new studies on the topic. They would not have meaningfully increased knowledge.
2. *There is no theoretical reason to expect a relationship:* We do not expect a relationship to exist between each intervention and each outcome. For example, there is no reason to expect that physical improvements to market infrastructure would affect nutrient bioavailability. Impact evaluations should only be conducted to investigate theoretically sound relationships.
3. *The relationship has not yet been considered for evaluation:* Given the vast number of relationships to consider and the ever-growing field, there are some relationships that simply have not yet been considered. These can be more common in emerging areas of research (such as market-based approaches to support nutrition) and represent meaningful evidence gaps.
4. *The relationship is difficult to study through impact evaluation:* Certain topics are difficult to study for practical or ethical reasons (e.g., trade regulations and interventions targeting people with HIV/AIDS). As such, they may be rarely studied and represent meaningful gaps. Evidence gaps can also exist in areas where there have been other types of research, but limited impact evaluation work in LMIC contexts. For example, labeling and marketing regulations have been evaluated in high-income countries. In addition, there is a significant amount of modeling and theoretical research on these interventions which is not reflected in this map.



## 7. Conclusions and implications

This EGM considers interventions across nine intervention categories: (1) production; (2) transport and distribution; (3) support for food processing, storage, and packaging; (4) fortification and re-formulation; (5) pricing and profit initiatives; (6) market places; (7) voluntary adoption of standards and ethical practices; (8) women's empowerment; and (9) consumer behavior. We used a USAID strategy to group specific interventions into programmatic and strategic approaches that are commonly considered in the nutrition field (Tables 4 and 5). Therefore, this EGM provides a unique contribution by examining thematic programmatic and strategic approaches, as well as specific interventions and outcomes. Stakeholders can determine the state of the evidence for these approaches of interest, not just specific interventions of interest.

We found a total of 1,952 impact evaluations and 155 systematic reviews included in the map. The evidence base increased steadily until 2019. The recent apparent slowdown in growth may be related to the timing of the search (January 2022) or a reduction in publications due to challenges in conducting impact evaluations during the COVID-19 pandemic. There was some clustering in the evidence base with 12 out of 67 interventions having no impact evaluations. Studies were also geographically clustered, focusing on rural settings (61%).

### 7.1 What intervention/outcome areas could be prioritized for primary and/or evidence synthesis?

As noted above, not all evidence gaps must be filled, especially if there is no theoretical reason to do so. However, to ensure that resources are used effectively, commonly implemented interventions, expensive interventions, and those affecting a large number of people should be evaluated. As the reach and resource requirements of an intervention increase, so does the imperative to evaluate. In our evidence gaps and clusters analysis, we listed the most and least studied interventions and outcomes. Here, we expand upon this with expert knowledge in the field to reach conclusions about the types of interventions which could be prioritized for additional research.

**Because national- and international-level interventions are likely to affect many people, they could be prioritized for impact evaluation research.** The following interventions are generally implemented at the national scale and have been evaluated fewer than three times:

- Tariffs for food;
- Legal / administrative practices for food safety regulations;
- Regulatory approaches to financing;
- Regulations on processing, storage, and packaging; and
- Marketing regulations.

Our intervention-outcome framework is organized such that similar interventions are disaggregated based on the mechanisms through which they are delivered (e.g., educational approaches, direct provision, structural approaches, and market-based approaches). In some cases (such as fortification and food processing, packaging, and storage), direct provision interventions are better-studied than educational, market-based, or structural approaches.

The theory of change underlying each of these implementation approaches gets progressively longer. The evidence from direct provision interventions can be used to inform the theory of change underlying these interventions. However, **it may be beneficial to establish the effects of educational, market-based, and structural interventions to determine whether they can achieve the same outcomes**, potentially in a more sustainable manner. Particular attention to the causal chain and mediation analysis may be beneficial in these evaluations.

To ensure that evidence is used effectively, systematic reviews can be conducted in areas of research where there is sufficient primary evidence but there are no existing high-confidence or up to date systematic reviews. Systematic reviews can support the development of evidence-informed decision-making by determining the average treatment effect of an intervention. **Key opportunities for evidence synthesis include education and market-based approaches for traders to move into new markets; education and direct provision of goods and services supporting food processing, packaging, and storage (including on-farm, post-harvest processing); water access and management; and women's empowerment and gender equity.**

## 7.2 Implications for decision makers

This EGM serves as a resource for decision makers and technical advisors by identifying and making available existing evidence on: (1) production; (2) transport and distribution; (3) support for food processing, storage, and packaging; (4) fortification and re-formulation; (5) pricing and profit initiatives; (6) marketplaces; (7) voluntary adoption of standards and ethical practices; (8) women's empowerment; and (9) consumer behavior. The EGM does not provide information about the effects of interventions or the quality of the included impact evaluations. However, it does provide an easy way for decision makers to navigate the evidence that exists. Analysis is uniquely organized around programmatic and strategic approaches in the field.

- Although we find 1,952 impact evaluations and 155 systematic reviews, decision makers may find a lack of cost evidence and mixed methods research. Those interested in gender and equity issues may also find insufficient evidence. However, existing evidence in these areas can be easily identified using the filters on the online, interactive map.
- Decision makers should exercise caution when implementing interventions with limited evidence. However, the absence of evidence is not evidence of absence, so under-evaluated interventions should not be abandoned. Rather, decision makers can contextualize the information in this map with other sources of information – such as qualitative research, theory-based work, and local knowledge – to develop theories of change and carefully consider whether less-studied interventions are likely to have impact.
  - If interventions are believed to be promising, decision makers may consider implementing these interventions and integrating evaluation into program design to determine their effects.
- When deciding which interventions to fund and how to implement them, decision makers can consult the EGM to identify rigorous evidence on specific areas of interest by looking at the 69 medium- and high-confidence systematic reviews.

- If medium- and high-confidence systematic reviews are not available, decision makers may still reference individual impact evaluations to identify common implementation challenges and contextual factors related to the success of programs.

### 7.3 Implications for researchers and commissioners

- Systematic reviews on interventions related to *education and market-based approaches for traders to move into new markets; education and direct provision of goods and services supporting food processing, packaging, and storage (including on-farm, post-harvest processing); water access and management; and women's empowerment and gender equity* could effectively summarize the existing body of evidence and allow for the estimation of average treatment effects to support evidence informed decision-making. Outcomes which might be prioritized for evidence synthesis include: *consumer preferences, land-related outcomes, water-related outcomes, quality of agricultural inputs, time use, and women's ownership of assets*.
- Additional primary research, especially on national-level interventions and those considering mobilization or structural approaches, may be beneficial. These interventions are generally more challenging to evaluate and often cannot be randomized. The quasi-experimental designs used by 47 per cent of impact evaluations may be appropriate for evaluation of these interventions. Routine monitoring, big data, and remote-sensing data can also be leveraged to facilitate these evaluations.
- While other types of evidence examining these interventions and outcomes exists, we found that impact evaluations focused on India, Bangladesh, and Kenya.
- Research that integrates equity fully into the analytical framework and research methodology may allow for a deeper understanding of how to help the most marginalized.
- Cost evidence would allow decisions makers to know not just if an intervention worked, but whether it was cost effective.
- Mixed methods approaches are useful in understanding how and why interventions work.

## **Online appendixes**

### **Online appendix A: Additional methods detail**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-A.pdf>

### **Online appendix B: Search strategy detail**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-B.pdf>

### **Online appendix C: Data extraction codebook**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-C.pdf>

### **Online appendix D: Systematic review critical appraisal tool**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-D.pdf>

### **Online appendix E: External advisory group list**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-E.pdf>

### **Online appendix F: USAID's Bureau for Resilience and Food Security (RFS)'s strategic and programmatic approaches (nutrition)**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-F.pdf>

### **Online appendix G: Evidence base by programmatic and strategic approaches**

<https://3ieimpact.org/sites/default/files/2023-05/Nutrition-Sensitive-REAPER-Online-appendix-G.pdf>

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Malnutrition represents a major public health crisis and across sectors, nutrition-related challenges have been aggravated in recent years due to climate change, the COVID-19 pandemic, and ongoing conflicts. Addressing malnutrition requires action within health systems, food systems, and in fragile emergency settings. Efforts to improve it through food systems often focus on nutrition-sensitive approaches. To understand the available evidence on these, USAID's Bureau for Resilience and Food Security commissioned an evidence gap map on the effects of nutrition-sensitive agriculture interventions across food systems in low-and middle-income countries.

### **Evidence Gap Map Report Series**

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