Food systems and nutrition
Describing the evidence from 2000 to 2023
June 2023
About 3ie

The International Initiative for Impact Evaluation (3ie) develops evidence on how to effectively transform the lives of the poor in low- and middle-income countries. Established in 2008, we offer comprehensive support and a diversity of approaches to achieve development goals by producing, synthesizing and promoting the uptake of impact evaluation evidence. We work closely with governments, foundations, NGOs, development institutions and research organizations to address their decision-making needs. With offices in Washington DC, New Delhi and London and a global network of leading researchers, we offer deep expertise across our extensive menu of evaluation services.

3ie evidence and gap map reports

3ie evidence and gap maps are thematic collections of information about impact evaluations and systematic reviews of impact evaluations that measure the effects of international development policies and programmes. The maps provide a visual display of completed and ongoing systematic reviews and impact evaluations in a thematic area, structured around a framework of interventions and outcomes.

Evidence and gap map reports provide supporting documentation for the maps, including the background information for the theme of the map, the methods and results, the protocol, and the analysis of results.

About this evidence and gap map report

This report presents the findings of a series of systematic searches to identify and map the evidence base of impact evaluations and systematic reviews of impact evaluations that assess the effects of food systems interventions on food security and nutrition outcomes. It updates the work by Moore and colleagues (2021). Some text of this report was copied directly from the original report. 3ie, with support from Innovative Methods and Metrics for Agriculture and Nutrition Actions, has been commissioned by Germany's Federal Ministry for Economic Cooperation and Development (BMZ) through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through its “Knowledge for Nutrition” programme. 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 Charlotte Lane at clane@3ieimpact.org.


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Food systems and nutrition: Describing the evidence from 2000 to 2023

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Evidence and Gap Map Report 25

June 2023

International Initiative for Impact Evaluation
Executive summary

Background and rationale

Globally, we are not on track to meet the 2030 Sustainable Development Goals and the 2025 World Health Assembly nutrition targets. In fact, undernourishment increased from eight per cent in 2019 to almost 10 per cent in 2021 (FAO, 2022). Food-related shocks disproportionately affect vulnerable populations, with women being four percentage points more likely to experience food insecurity than men (FAO, 2022). The three C's (COVID, climate, and conflict) threaten global food security (Hendriks et al., 2022; FAO, 2022).

The COVID-19 pandemic increased hunger and food insecurity, with 150 million additional people affected by hunger and 112 million unable to afford a healthy diet (Global Nutrition Report, 2022). Climate change threatens the food supply chain, undermining food security. Simultaneously, food systems contribute to greenhouse gas emissions (Willette et al., 2019; Global Nutrition Report, 2020; IPCC, 2022). Effects are most severe in low-income countries, which already experience significant food insecurity (IPCC, 2022; FAO, 2022). Conflict drove 139 million people into acute food insecurity in 2020, with chronic food insecurity and protracted conflict creating a negative spiral that can be difficult to interrupt (FSIN, 2021; Hendrix & Brinkman, 2013).

To address these challenges, the global community has committed significant research efforts to understanding what works to achieve food systems transformation, who it works for, and what it costs. To be useful, this work needs accessible and future research prioritized to fill known evidence gaps. To this end, the International Initiative for Impact Evaluation (3ie), with assistance from IMMANA and support from Gesellschaft für Internationale Zusammenarbeit (GIZ), has been systematically collecting available impact evaluations and systematic reviews of impact evaluations on the effects of food systems interventions on food security and nutrition in low- and middle-income countries (L&MICs) since February 2020. 3ie presents the identified studies in an interactive online evidence and gap map (E&GM) and publishes periodic updates on the state of the evidence. This report serves as a mid-term update on the state of the evidence regarding food systems interventions’ effects on food security and nutrition in low- and middle-income countries, with the original report published in January 2021.

Study aims and research questions

By identifying, describing, and summarising the available literature in a clear and structured way, the E&GM project aims to make evidence accessible to policymakers, researchers, and the development community. By updating this E&GM regularly, we provide the community of practice with ready access to the most recent publications so that they can quickly become aware of research that fills key evidence gaps. Ultimately, this living E&GM seeks to facilitate the use of evidence to inform policy decisions.
Table 1: E&GM research questions

<table>
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<th>No.</th>
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<tr>
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<td>Coverage</td>
</tr>
<tr>
<td>RQ2</td>
<td>How has the evidence changed over time?</td>
<td>Change</td>
</tr>
<tr>
<td>RQ3</td>
<td>What are the primary research and synthesis evidence gaps in the literature?</td>
<td>Gaps</td>
</tr>
<tr>
<td>RQ4</td>
<td>What intervention and/or outcome areas could currently be prioritised for primary research and/or evidence synthesis?</td>
<td>Research needs</td>
</tr>
</tbody>
</table>

Source: 3ie 2023; adapted from 3ie 2020

Scope

E&GMs are organized around a conceptual framework, which serves as the basis for determining the interventions and outcomes reflected in the map. This work relied on the framework from the High-Level Panel of Experts which was extended by the International Food Policy Research Institute (HLPE, 2017; de Brauw et al., 2019; Figure 1). The framework suggests three intervention domains within the food system: the food supply chain, the food environment, and consumer behaviour. The domains reflect types of actions and interventions, not a sequential flow of activities leading to one another.

Figure 1: EGM scope summary

Impact evaluations and systematic reviews of interventions considering interventions within these domains were included in the map so long as they considered outcomes related to food security and nutrition and took place in a low- or middle-income country. Studies measuring intermediate outcomes within the food system, such as food production or purchasing patterns, were also included.
Methods

In addition to the original map, this E&GM has now been updated four times. The methods for this E&GM were established a priori during the original map construction in 2020. Changes to the scope and methods for the updates are minimal. The search for the original E&GM was conducted in 12 academic databases and 31 sector-specific databases and completed September 2020. The search in the original 12 academic databases was repeated in July 2021, October 2021, January 2022, April 2022, and October 2022. The search of additional specialist databases and websites was repeated in January 2022. A review of included studies was conducted in October 2022 and January 2023.

During each update cycle, the same process was used: studies were imported into EPPI-reviewer, de-duplicated, screened at title and abstract, and then eligible studies were screened at full text. Data on the interventions, outcomes, country, population, and methods was extracted. Studies were added to the online map. Every four months, 3ie published an update note summarizing key developments in the evidence base and providing graphical descriptions of the types of studies that have been identified.

Results

Research question 1&2: What is the extent, range and nature of existing empirical evidence regarding the effects of food systems interventions on food security and nutrition outcomes in L&MICs? How has the evidence changed over time?

During the update period, we added 260 impact evaluations and seven systematic reviews to the E&GM. Although this is large in absolute terms, it represents a decrease in the rate of expansion in the literature base relative to pre-2019 trends. Our map currently includes 2,033 impact evaluations and 185 systematic reviews considering the effect of food systems interventions on to food security and nutrition outcomes in low- and middle-income countries.

Interventions

The most studied intervention types, examined in over 250 impact evaluations and 25 systematic reviews, are fortification, supplementation, and classes about consumer behaviour interventions. During the update period, the focus on fortification and supplementation interventions reduced significantly, with a much smaller percentage of studies considering these interventions (10 and 14 percentage point decrease respectively). There was not a corresponding shift towards studying any single intervention.

Packaging; private food donation; use of and education regarding the use of spoiled, near spoiled or traditionally uneaten food; and advertising regulation interventions have not been examined by any identified impact evaluations.

Women’s empowerment efforts, agricultural extension programs, other agricultural information and guidance, and water access and management interventions have been considered by 20 or more impact evaluations but no high- or medium-confidence systematic reviews.
Outcomes
The most studied outcomes, considered more than 400 times, are generally anthropometric, and included one micronutrient measure: iron status, linear growth, relative weight, and weight. The least studied final outcomes are food stressed households and food toxins. Twelve intermediate outcomes still never been evaluated: advertisement topics, caloric requirements, exposure to advertisement, fines, location of foods in stores, movement of food, other regulation outcome, other steps taken due to non-compliance, tax revenue, time food remains unspoiled, violations, and food distribution centres.

During the update period, there was a shift towards studying more intermediate (67% consider at least one intermediate outcome). In particular, there was an 18 percentage point increase in evaluations of agricultural outcomes and a corresponding 13 percentage point decrease in the evaluation of anthropometric outcomes. Only two per cent of studies consider five or more outcome groups.

Geography: There is focus on Sub-Saharan Africa (n = 751; 37%), with a disproportionate focus on food supply chain interventions in the region. India (n = 198, 10%), China (n = 139, 7%), and Bangladesh (n = 128, 6%) are the most commonly studied countries. These geographic trends were generally consistent over time.

Population and scale: Impact evaluations tend to consider all genders (n = 1,249; 61%) and people of all or unspecified ages (n = 662; 32%), with no meaningful difference between the original map and the update period. However, there was a slight increase in the number of national or transnational interventions evaluated, moving from 10 (n = 175) to 14 per cent (n = 36). This change was largest in the last update with 15 studies (24%) considering national or transnational interventions.

Methods: Most impact evaluations in the original map (n = 1,303; 73%) employed randomized designs. However, this decreased meaningfully, with only 58 per cent of impact evaluations in the update period using randomization. Few impact evaluations use mixed methods (n = 194, 10%) or present cost evidence (n = 163, 8%). This pattern was consistent in both the original map and the update. Systematic reviews are generally rated as low quality (n = 91, 49%) and tended to focus on supplementation (n = 67, 26%) and fortification (n = 48, 18%) across both the original map and the update.

Research question 3&4: What are the major primary and synthesis evidence gaps in the literature? What intervention and/or outcome areas could be prioritized for primary research and/or evidence synthesis?
Although there was growth in the evidence base, including in areas identified as key gaps in the original report, the evidence base in these areas was so small, that large proportionate increases did not fill the evidence gaps. Most identified research priorities remain the same as in the original report. Table 2 provides an updated, illustrative list of identified evidence gaps which could be prioritized for future research alongside a summary of the evidence that is available on these topics. These illustrative priorities were selected based on their policy relevance in reference to key ongoing activities in the field.
Table 2: Illustrative set of research priorities

<table>
<thead>
<tr>
<th>Illustrative list of interventions to priorities for evaluation</th>
<th>Studies and protocols added (studies in original)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government manipulations of price</td>
<td>6 (21)</td>
</tr>
<tr>
<td>Advertising and labelling regulations</td>
<td>0 (1)</td>
</tr>
<tr>
<td>On-farm, post-harvest processing</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Interventions to support food packaging</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Efforts to support women’s empowerment within the food system</td>
<td>5 (18)</td>
</tr>
<tr>
<td>Innovative store design</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Cold chain initiatives</td>
<td>0 (1)</td>
</tr>
<tr>
<td>Improved farm to market transport</td>
<td>0 (6)</td>
</tr>
<tr>
<td>Food safety regulations</td>
<td>2 (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Illustrative list of outcomes to priorities for evaluation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Women's empowerment</td>
<td>17 (40)</td>
</tr>
<tr>
<td>Economic, social, and political stability</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Food loss</td>
<td>0 (3)</td>
</tr>
<tr>
<td>Environmental impacts of the food system</td>
<td>6 (9)</td>
</tr>
<tr>
<td>Measures of diet insufficiency</td>
<td>2 (24)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Illustrative list of evidence synthesis priorities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of free or reduced-cost farm inputs to crop production</td>
<td>0 (13)</td>
</tr>
<tr>
<td>Educational approaches within the food value chain</td>
<td>0 (8)</td>
</tr>
<tr>
<td>Agricultural insurance products</td>
<td>0 (1)</td>
</tr>
<tr>
<td>Outcome related to other diet quality and adequacy measures</td>
<td>0 (24)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Illustrative list of methods and scale priorities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost evidence</td>
<td>20 (161)</td>
</tr>
<tr>
<td>Mixed methods research</td>
<td>19 (175)</td>
</tr>
<tr>
<td>High-confidence systematic reviews</td>
<td>0 (42)</td>
</tr>
<tr>
<td>National and trans-national evaluations</td>
<td>36 (175)</td>
</tr>
</tbody>
</table>

Source: 3ie 2023

Implications for policy and practice

Although decision makers can reference high-quality systematic reviews, this evidence base has not grown and could soon be outdated. The primary evidence base increased considerably in during the update period, but only two new medium-confidence systematic reviews and no high-confidence systematic reviews were identified. Therefore, the synthesis review evidence base is quickly becoming outdated. Until additional high-confidence systematic reviews are produced, decision-makers may reference individual studies included in the map to understand barriers and facilitators to outcomes achieved in specific contexts.

The availability of evidence relating to key, policy-relevant activities is highly variable, which may leave decision makers without the evidence they need. Nonetheless, we encourage decision-makers to reference the evidence available in this E&GM and other sources as relevant.
Decision-makers may continue investing in under-researched areas. Although caution should be used when implementing under-researched interventions, these interventions should not necessarily be avoided. Decision-makers and implementers may contextualize the evidence in this E&GM with other sources to determine the likely effects of an intervention in a local context. They can design interventions with the intent to evaluate them in the future to build the evidence base.

**Implications for research**

Researchers are increasingly prioritizing a range of interventions, as demonstrated by the noticeable decrease in the clustering of evaluations during the update period. However, research gaps remain (Section 5.4).

There is insufficient research on key policy priorities. Many of the interventions listed as research needs in Table 2 are already widely implemented. As such, we need to quickly establish their likely impacts to ensure that the right interventions are being prioritized. This will require the production of high-quality evidence synthesis to make generalizable conclusions in addition to primary research.

Evaluations of food systems interventions do not take a systems-level approach. Only two per cent of evaluations consider outcomes in five or more groups. Many of these do not look across the theory of change (ex. measuring production, income, diet, and anthropometrics), but instead evaluate conceptually similar outcomes (ex. micronutrient status, anthropometrics, and cognitive development). Without measurement across the causal chain, it is impossible to know how interventions affect the system as a whole. Future research may consider measuring different types of outcomes, conducting mediation analysis, and examining general equilibrium effects to understand how change echoes through the food system.

Cost evidence and mixed-methods research is still underrepresented. There was minimal change in the frequency of cost evidence or mixed methods research. This means that we still need more information to answer two key questions: are impacts worth the costs and what are the mechanisms by which impacts are achieved.
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### Abbreviations and acronyms

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<th>Full Form</th>
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<tbody>
<tr>
<td>Children's Investment Fund Foundation</td>
<td>CIFF</td>
</tr>
<tr>
<td>Department for International Development</td>
<td>DFID</td>
</tr>
<tr>
<td>Deutsche Gesellschaft für Internationale Zusammenarbeit</td>
<td>GIZ</td>
</tr>
<tr>
<td>European Union</td>
<td>EU</td>
</tr>
<tr>
<td>Evidence and gap map</td>
<td>E&amp;GM</td>
</tr>
<tr>
<td>Global Food Security Strategy</td>
<td>GFSS</td>
</tr>
<tr>
<td>Food and Agriculture Organization</td>
<td>FAO</td>
</tr>
<tr>
<td>Foreign, Commonwealth, and Development Office</td>
<td>FCDO</td>
</tr>
<tr>
<td>Germany’s Federal Ministry for Economic Cooperation and Development (BMZ)</td>
<td>(Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung)</td>
</tr>
<tr>
<td>High Level Panel of Experts</td>
<td>HLPE</td>
</tr>
<tr>
<td>Intergovernmental Panel on Climate Change</td>
<td>IPCC</td>
</tr>
<tr>
<td>International Food Policy Research Institute</td>
<td>IFPRI</td>
</tr>
<tr>
<td>International Initiative for Impact Evaluation</td>
<td>3ie</td>
</tr>
<tr>
<td>Low- and middle-income countries</td>
<td>L&amp;MICs</td>
</tr>
<tr>
<td>National Institutes of Health</td>
<td>NIH</td>
</tr>
<tr>
<td>Norwegian Agency for Development Cooperation</td>
<td>Norad</td>
</tr>
<tr>
<td>Population, intervention, comparator, outcome and study design</td>
<td>PICOS</td>
</tr>
<tr>
<td>State of Food Security and Nutrition in the World report</td>
<td>SOFI</td>
</tr>
<tr>
<td>United States Agency for International Development</td>
<td>USAID</td>
</tr>
<tr>
<td>Consultative Group for International Agricultural Research</td>
<td>CGIAR</td>
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</table>
1. Introduction

In February 2020, the International Initiative for Impact Evaluation (3ie) began developing an evidence and gap map (E&GM) collecting all available impact evaluations and systematic reviews of impact evaluations measuring the effects of food systems interventions on food security and nutrition in low- and middle-income countries (L&MICs). 3ie was funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through its “Knowledge for Nutrition” programme. The Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA) research group supported this project by contributing significant staff time, funded by the Bill and Melinda Gates Foundation and the Foreign, Commonwealth, and Development Office (FCDO). 3ie developed the map into a living evidence product, updating it every four months with the newest literature in the field. This report represents a mid-term summary of patterns in the evidence base and changes in those patterns over time.

1.1 Study aim, objectives, and research questions

By identifying, describing, and summarising the available literature in a clear and structured way, this project aims to make evidence accessible to policymakers, researchers, and the development community. By updating this E&GM regularly, we provide the community of practice with ready access to the most recent publications so that they can quickly become aware of research that fills key evidence gaps. Ultimately, this living E&GM seeks to facilitate the use of evidence to inform policy decisions. To meet these aims, the evidence and gap map has two specific objectives:

1. To identify and describe the evidence on the effects of food systems interventions on food security and nutrition outcomes in L&MICs
2. To monitor the evolution of primary research and evidence synthesis in the field, focusing on the identification of emerging trends and the filling or persistence of knowledge gaps.

The research questions shown in Table 3 seek to address these objectives. Research questions one, three, and four are consistent with the original map. Research question two was added during the update period to allow for a deeper focus on the development of the evidence base over time.

Table 3: E&GM research questions

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Source: 3ie 2023; adapted from 3ie 2020
1.2 What is an evidence and gap map and how is it used?

An E&GM aims to establish what is known and unknown about an evidence base in a thematic area (Snilstveit et al. 2016). The map is populated through a systematic search and screening process to identify all completed and ongoing impact evaluations and systematic reviews of impact evaluations that meet a set of pre-specified inclusion and exclusion criteria. All studies that meet these criteria are mapped onto a framework of interventions and outcomes, which provides a graphical display of the evidence in a grid-like framework. Frameworks are based on established theories of change within the sector.

The map presents the volume of evidence for all intervention-outcome combinations, the type of evidence (impact evaluation, systematic review, completed or ongoing), and a confidence rating of each systematic review. The final map is published on an online interactive platform that provides additional filters so that users can further explore the available evidence (e.g. by global region, year of publication, or population). Links to all included studies are provided in the map (Figure 2).

Figure 2: Screenshot of small portion of the interactive platform

Source: 3ie 2023
Notes: Full map can be referenced at https://developmentevidence.3ieimpact.org/egm/food-systems-and-nutrition-evidence-gap-map

Our living E&GM turns the search, screening, and data presentation process into a cycle that is completed approximately every four months. This keeps the map up to date and allows for the rapid identification of studies that address key evidence gaps. Through data visualisations and periodic analysis, changes in the types of studies conducted are quickly identified.

E&GMs highlight areas where evidence is concentrated and where it is noticeably absent. Absolute evidence gaps (empty cells in the framework) can be filled with new
impact evaluations. Synthesis gaps (multiple impact evaluations but no recent, high-confidence systematic reviews) can be filled with evidence synthesis. Evidence clusters may represent over-researched areas, where the effects of a particular intervention have been evaluated against a range of outcomes (or vice versa), and where additional studies may not be as necessary.

Importantly, not all evidence gaps must be filled. Gaps can occur for several reasons, including:

- **Well-established effects:** The impact (or lack thereof) may have been well established before the search period. In such a case, there is no need for subsequent studies investigating already established impacts.
- **Limited underlying theory:** There may be no theoretical reason to expect the intervention to affect the outcome. Investigating these areas might lead to incorrect conclusions due to the potential for spurious correlations.
- **Methodological and practical limitations:** It may be difficult to conduct impact evaluations on a given intervention. There may be other sources of information, such as qualitative research or process evaluations, that consider the topic of impact without fulfilling the inclusion criteria for this map. Implementation science is often used to investigate intervention outcomes as well. In addition, studies may also have been conducted but not published (e.g. because no significant effects were found).
- **Studies not captured within this evidence map:** Although a comprehensive search was undertaken, it is possible that some relevant studies are not included in this evidence map due to language or date restrictions, lack of identification through the search approach, or other potential oversights.
- **Existence of meaningful knowledge gaps:** Finally, there may be meaningful knowledge gaps that represent opportunities for future research. These gaps can be especially concerning when an intervention has been widely implemented without sufficient evidence.

The existence of an evidence cluster does not necessarily mean that no more research should be conducted in a given area. Because interventions and outcomes in E&GMs can reflect aggregates with disparate subgroups, it is possible that only a narrow portion of an intervention or outcome category has been investigated. For example, fortification is well researched. However, studies focus on iron, folate, and vitamin A. Less prioritized nutrients may be understudied despite the apparent saturation in the field. Additional research may be useful to consider specific contextual factors, implementation concerns, environmental interactions, or effects on specific populations. However, researchers considering working within areas known to be saturated may wish to reference the existing literature to ensure that their work builds upon and does not repeat what is already present.

3ie’s evidence and gap maps are envisioned as a global public good. This allows them to be used as tools to facilitate access to high-quality research to inform development decision-making. Continually updating the evidence and gap maps ensures that these decisions are based on the most up to date evidence available.
1.3 Remainder of this report

The remainder of this report is presented as follows:

- **Section 2** presents the subject background.
- **Section 3** presents the scope and method.
- **Section 4** presents the results.
- **Section 5** concludes and provides a set of considerations for using the EGM.

2. Background and rationale

2.1 Threats to food security and nutrition

It is becoming increasingly obvious that the global food system does not work for people, our planet, and prosperity (Global Report, 2020). The world is moving further away from meeting the 2030 Sustainable Development Goals in nutrition and the 2025 World Health Assembly targets (FAO, 2022). The prevalence of undernourishment rose from eight per cent in 2019 to almost 10 per cent in 2021 (FAO, 2022). The vulnerable are always the most affected by food-related shocks and growing inequality is making this divide larger (FAO, 2022). Women are now four percentage points more likely than men to experience food insecurity (FAO, 2022). Today, the three C’s (COVID, climate, and conflict) interact to threaten global food security (Hendriks et al., 2022; FAO, 2022).

Since the start of the COVID-19 pandemic, an additional 150 million people have been affected by hunger and over 112 million are now unable to afford a healthy diet (Global Nutrition Report, 2022). An additional 350 million people experienced moderate or severe food insecurity in 2021 compared to 2019 (FAO, 2022). These negative effects functioned through interruptions in the global economic, health, and food systems (Global Nutrition Report, 2021). In order to prevent the spread of COVID-19, governments reduced social services, such as important school nutrition programmes (Global Nutrition Report, 2020). Volunteers and implementing organizations did not have access to the field, causing disruptions to many interventions (GFSS, 2020). Food prices increased significantly due to supply chain and transportation challenges resulting from lockdowns and other COVID-19 response measures (FAO, 2022).

The potentially devastating effects of climate change on food security are well established (Willett et al., 2019; Global Nutrition Report, 2020). Climate events threaten the food supply chain, particularly in low-income countries (IPCC, 2022; FAO, 2022). Climate and the food system can interact in a downward spiral, with food systems being a major source of greenhouse gases (23-42%) and climate change undermining food security (IPCC, 2022; Global Nutrition Report, 2020). Climate change is expected to reduce agricultural productivity and drastically increase food prices in the coming years (IPCC, 2022). Increased food prices are associated with lower quality diets. This can result in either obesity or undernutrition depending on the context (IPCC, 2022). Meat consumption, food imports, and land use all affect both food costs and greenhouse gas emissions (IPCC, 2022). Healthy diets, rich in locally sourced fruits and vegetables, reduce greenhouse gas emissions (IPCC, 2022). However, diets associated with more affluent populations tend to include more meat and imported foods (IPCC, 2022).
The increase in food insecurity in Sub-Saharan Africa since 2014 was largely driven by increased conflict, especially in South Sudan and Nigeria, rather than climate change, which has had a constant effect on food insecurity since 2009 (Anderson et al., 2021). Globally, conflict drove 139 million people into acute food insecurity in 2020, largely due to forced displacement (FSIN, 2021). Food insecurity can increase stress, destabilize populations, and induce conflict (Hendrix & Brinkman, 2013). This was observed during the Arab spring, when a sudden increase in food prices, related to adverse climate events, lead to widespread unrest and mass uprisings (Hendriks et al., 2022; Hendrix & Brinkman, 2013). Chronic food insecurity and protracted conflict can result in a negative spiral that is difficult to interrupt, even with humanitarian aid, as the aid itself can become a source of conflict (Hendrix & Brinkman, 2013).

The full effects of the conflict in Ukraine are not yet known. However, potential effects on trade and production are significant and could cause food price increases (FAO, 2022). Already, largely attributed to the war in Ukraine, but also a result of COVID and climate change, the agricultural commodity price index was 34 per cent higher in June 2022 than January 2021 (World Bank, 2022). People in Sub-Saharan Africa, the Near East, and North Africa are likely to be most affected by the war because they spend a significant amount of their income on food and rely heavily on imported wheat and fertilizer from Ukraine and Russia (FAO, 2022).

2.2 Policy responses: transforming food systems to work for people, our planet, and prosperity

Food systems transformation is needed to develop a safe, sustainable, and equitable food system for all. Increasingly, the global community is committing to achieving this transformation. For example, the next report coming out of the Food and Agriculture Organization's (FAO) High-level Panel of Experts is expected to focus on reducing inequality within the food system.

Building on the Nutrition for Growth Summit in 2021, the Global Nutrition Report developed a Nutrition Accountability Framework to capture the SMART (specific, measurable, attainable, relevant, and time-bound) commitments from donors, monitor those commitments, and publicly report them (Global Nutrition Report, 2023a).

As of 2020, Australia, Ireland, and the Netherlands had reached their commitments and were no longer requested to report their funding to the Global Nutrition Report. The United States was the single largest donor reporting in the Global Nutrition Report in 2020, spending USD 4.2 billion, mostly on nutrition-sensitive programs (USD 4 billion; Global Nutrition Report, 2023b). The next largest donor is the United Kingdom reporting USD 1 billion, also mostly in nutrition-sensitive programming (USD 980 million). Canada, the European Union, France, Germany, and the Children's Investment Fund Foundation (CIFF) reported smaller amounts of nutrition funding, between USD 37 million and USD 907 million.

The commitment tracker reports a total of USD 42.6 billion in financial commitments made by 198 stakeholders, reflecting 897 distinct goals. Most of these commitments (96%) were made at the Nutrition for Growth Summit in 2021. These commitments focus on supporting an enabling environment for nutrition action (45%), specifically leadership
and governance (21%). They include commitments related to changing the food environment (7%), consumer knowledge (4.1%), food and nutrition security (1.6%), undernutrition (15%), and obesity (2.6%; Global Nutrition Report, 2023a).

Research, monitoring, and data is also a common commitment (9%). The High-Level Expert Group from the European Commission recently called for strengthening the science-policy-society interface by funding a series of dedicated taskforces to fill knowledge and data gaps and collectively invest in a global coordination hub (European Commission, 2022). One such coordination effort, coming out of the United Nations Food Systems Summit, is the United Nations Food Systems Coordination Hub (UNFSCH, 2022). The hub provides country-driven support, customized to help countries realize their goals and reach a sustainable food system. It highlights the importance of evidence in decision making, reaching nutrition targets, and building a sustainable food system.

2.3 Why is staying up to date on the evidence important?

The large number of commitments to research reflects the growing understanding that up-to-date evidence is needed to support decision-making which can achieve long-term food systems transformation. Decision-makers need to know what works, for whom, and at what cost. Rigorous evidence needs to be available and accessible to respond to these questions and serve as the basis of decision making. Evidence gaps need to be identified and appropriate research prioritized to fill them.

In order to be practically useful, the evidence needs to be systematically collated and presented in an easy to access manner. With over 100 new impact evaluations and systematic reviews of impact evaluations on food systems interventions published each year for the last decade, the evidence base is rapidly evolving. Therefore, any systematic search and collation process would quickly become outdated if it were not updated on a regular basis. Decision makers using the database developed through a search that was completed even just one year ago would be relying on outdated information. As such, a one-time search and collation processes would not be sufficient to respond to the evidence needs of the development community. The search and collation must be update regularly to ensure that the most up to date evidence is available to serve as the basis for decision making.

3. Scope and methods

The scope and methods for this E&GM were determined a priori during the original map construction in 2020. Changes to the scope and methods for the updates were minimal. We describe the original scope and methods below, specifying changes made during the update period noted.

3.1 Conceptual framework

The High Level Panel of Experts established a framework to systematically map food systems (HLPE, 2017). In 2019, the International Food Policy Research Institute (IFPRI) extended this framework to include additional feedback mechanisms (de Brauw et al., 2019). This extended framework was adopted as the conceptual basis of our efforts to map the evidence relating food systems to nutrition and food security.
The framework suggests three intervention domains within the food system: the food supply chain, the food environment, and consumer behaviour. The domains reflect types of actions and interventions, not a sequential flow of activities leading to one another. The food supply chain is broken down into production activities, storage and distribution, processing and packaging, and food loss and waste management (Figure 3). The food environment is the physical, economic, political and sociocultural surroundings, opportunities, and context that create, prompt, and shape dietary preferences and choices and nutritional status (Swinburn et al., 2014; Global Panel, 2017). These include the availability, physical accessibility and provision of foods; affordability; promotion and labelling; and food quality and safety. Finally, consumer behaviour involves individual preferences related to consumption, food prices and income available for food (de Brauw et al., 2019). It includes prices, preferences, women’s empowerment in the context of the food system, and information.

The framework outlines five main drivers of change in global food systems: biophysical and environmental; innovation, technology and infrastructure; political and economic; sociocultural; and demographics (HLPE, 2017; de Braw et al., 2019). These drivers work outside the food system, but have significant impacts on food systems by altering food production and demand. The framework considers outcomes related to food security and diet, and ultimate outcomes related to nutrition; health; and social, economic and environmental well-being. For this E&GM, food security and nutrition are final outcomes. We also include intermediate outcomes which measure aspects of the food system itself. Included intermediate outcomes relate to time use; steps taken due to non-compliance; regulations; advertising and labelling women’s empowerment; intrinsic motivators; food loss; food distribution; environmental impact of the food system; economic, social, and political stability; economic outcomes; bio-nutritional outcomes; agricultural outcomes; and behaviour change.

Figure 3: EGM scope summary

Source: 3ie 2020; adapted from HLPE 2017 and de Braw et al., 2019. Changes include an omission of the drivers depicted in the original framework, re-orientation of the food supply chain presentation, focus of food security and nutrition outcomes, and the addition of bi-directional arrows, which highlight that intervening at one stage in the food system may have implications for activities at another stage. The shading of the food supply chain along with the white arrow is meant to illustrate the flow of food through the value chain.
Since the inception of this work, a revised framework was published by the HLPE (2020). The updated framework includes political and institutional drivers. As with our framework, it places the food supply chain, consumer behaviour, and diet squarely within the food system and highlights the bi-directional relationship between these concepts. However, the new HLPE framework considers the food environment to overlap with the food supply chain, consumer behaviour, and diet. In the new framework, the food environment is the backdrop against which these domains function. The updated framework also highlights the roles that other systems have in supporting the food system (e.g., ecosystems, economic systems, health systems) and the effects that the food system has on nutrition, health, the economy, equity, and the environment. It frames these as straddling the line between the food system and other key aspects of society and the planetary ecosystem. These modifications highlight the interconnectedness of the food system with other systems, drivers, and outcomes. Although we acknowledge the importance of these changes to the framework, due to practical limitations and to maintain comparability of the map over time, we have not expanded the scope of our map to include these other systems, drivers, and outcomes.

3.2 Criteria for including and excluding studies

When defining the scope of relevant interventions and outcomes, the aim was to be as comprehensive as possible whilst setting a feasible scope that was not too broad to be presented in a visually approachable and interpretable manner. Table 4 presents the detailed criteria for including and excluding studies according to the population, intervention, comparator, outcome and study design (PICOS) framework. The PICOS framework sought to identify impact evaluations and systematic reviews of impact evaluations that assessed the effects of at least one food system intervention on food security and nutrition outcomes for any population based in an L&MIC.

We define an impact evaluation as a study that uses rigorous methods to provide a quantitative estimate of the impact of an intervention (Appendix A). This is accomplished by constructing a counterfactual, which provides evidence about what would have happened in the absence of the intervention. In an impact evaluation, the outcomes of those who receive the intervention are compared with those of a comparison group that does not receive the intervention. The comparison group may be a specific population in the study area that does not receive the treatment (as in a randomised controlled trial) or may be constructed by researchers (as in propensity score matching or interrupted time series). Although simple comparisons of change over time are often used to investigate impacts, we only include these studies if they have a comparison group and account for time-invariant unobservable effects, such as through the use of fixed effect models.

We limit eligible systematic reviews to synthesis of the quantitative impact evidence on a particular topic (e.g. the effectiveness of water supply and sanitation) obtained through an exhaustive systematic literature search for all relevant studies using widely accepted scientific strategies to minimise error.

Although other forms of evidence, such as qualitative research, implementation science, and process evaluations are of critical importance, they are not reflected in this E&GM. This decision was made for practical and theoretical reasons. First, such research is much more challenging to reflect in a matrix format as outcomes can be harder to
classify. Second, the body of literature identified was already quite large. The addition of entirely new areas of inquiry would have been outside our scope and resource constraints. Which leads to a third reason to exclude these other sources of information: we want to provide an easy to navigate database of impact evaluations and systematic reviews to allow for the rapid identification evidence on causal impacts. The addition of other sources of information would make navigation more cumbersome and may reduce utility. This does not, however, mean that we do not value these other types of evidence.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Studies of interventions with programme participants that were located in a L&amp;MIC in the first year of implementation¹ Impact evaluations with at least one effect size for an L&amp;MIC country population Studies focused on the prevention of clinical conditions</td>
<td>Studies focused on niche populations, such as athletes or the military Efficacy studies, unless completed in a sufficiently real-world setting Studies targeting participants with a clinical condition Studies focused on high-income country migrant populations in L&amp;MICs and vice versa</td>
</tr>
<tr>
<td>Intervention</td>
<td>Studies of interventions that directly intervene on an aspect of the food system within its three primary domains: the food supply chain, the food environment and consumer behaviour Studies evaluating multiple food systems interventions</td>
<td>Interventions not in the food system or interventions targeting drivers of the food system without an explicit food system focus Unconditional cash transfer programmes Interventions focused on the financing of a food systems intervention</td>
</tr>
<tr>
<td>Comparisons</td>
<td>Studies using appropriate comparisons included: business as usual, an alternative treatment, no treatment or an early- versus-late comparison (where those that took part in earlier years are compared to those that took part in later years)</td>
<td>Studies that did not justify and make use of an appropriate comparison group</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Final outcomes relating to anthropometry, physical and mental development outcomes, micronutrient status, diet quality and adequacy, food safety affordability and availability Intermediate outcomes were included for all interventions that were deemed relevant to the food system</td>
<td>Health and non-food-system related education outcomes Mortality and morbidity outcomes, unless a disease is directly linked to a specific micronutrient deficiency (e.g. anaemia or goitre)</td>
</tr>
<tr>
<td>Study design</td>
<td>Effectiveness studies, based in real-world settings, employing one of the following methods: randomised controlled trials (where treatment assignment is random); and quasi-experimental designs (where treatment is assigned as if it were random; e.g. regression discontinuity design, instrumental variables, panel methods, difference-indifference, synthetic control groups, interrupted time series analysis and statistical matching) Systematic effectiveness reviews, which employ recognised search and synthesis methods (Snijstveit et al., 2016)</td>
<td>Before-after studies or cross-sectional studies that do not attempt to control for selection bias or confounding in any way Case-control studies Randomised block designs where farm field sections are the blocking unit Willingness-to-pay and hypothetical experiment studies</td>
</tr>
<tr>
<td>Other</td>
<td>Studies published in or after the year 2000² Complete or ongoing studies (i.e. protocols are included) Studies in any publication format</td>
<td>Studies in any language other than English</td>
</tr>
</tbody>
</table>

Source: 3ie 2020.
2. The cut-off at the year 2000 was made arbitrarily to make the volume of search results more manageable.
3.3 Search strategy

The original systematic search of 12 academic bibliographic databases was completed in May 2020 (Appendix B). Additional studies identified before the end of September 2020 were also included in the original map. To address potential publication bias issues, the following data sources were used for the original map:

- Other specialist databases and websites: In total, 31 sector-specific databases and websites were searched. Basic search terms or strings were used where search functionality was limited.
- Backward citation tracking: Citations for all included systematic reviews were reviewed for inclusion.
- Communication with researchers: Information about potential eligible studies up to the end of September 2020 was requested. This occurred through two main channels: (1) engaging with the project advisory and policy stakeholder groups and (2) publishing a call for information via a related blog post on the 3ie website and promoting it using social media.

The search in the original 12 academic databases was repeated in July 2021, October 2021, January 2022, April 2022, and October 2022. The search strings used and the databases searched were identical to those in the original EGM, with the exception of correcting a syntax error in the strings for one database (Scopus). The search of additional specialist databases and websites was repeated in January 2022. We also screened items retrieved in the searches for 3ie’s Development Evidence Portal—a database of impact evaluations and systematic reviews across sectors in international development—for relevance to this evidence map. Monthly “evidence surveillance” searches are used to populate the Development Evidence Portal. As there is considerable overlap in the inclusion criteria for the Portal and this map, pooling these search strategies reduced overall workload and allowed more articles to be screened. However, no studies from the Portal search which were not also found from the E&GM search were included in the first update. Therefore, we do not expect that this pooling of the search results affected the number of studies identified. The last search of the Development Evidence Portal which is considered in this map was conducted in October 2022. Backwards citation tracking and contacting of experts was not conducted during the update period.

3.4 Screening

Screening of studies was managed using EPPI-Reviewer 4 software (Thomas et al., 2010) and was completed by implementing the following steps:

**Prepare study records:** All output files of the implemented search strategy were imported into EPPI-Reviewer software. Studies that were identified through the additional means specified above were added to the software manually. An automated process within the software was used to remove duplicate files. Studies which EPPI identified as having a high probability of being duplicates were removed automatically. Those which received lower scores were manually reviewed.

**Title and abstract screening:** The titles and abstracts of all imported and de-duplicated studies were screened by a single individual. The screener assigned one code, which
indicated that either the study should be included for full-text screening, that the study should be excluded, or that they were unsure. If a study was excluded, the reviewer coded the rationale for exclusion. Where screeners had any difficulty in applying the eligibility criteria, a study was screened by a second reviewer. Periodic meetings were held to discuss and resolve screening decisions for studies that screeners had coded as ‘unsure’.

During the update period, title and abstract screening was managed within the routine screening conducted for the Development Evidence Portal. All screeners for the Development Evidence Portal were trained on the inclusion criteria for the Food Systems and Nutrition Evidence Map. Studies retrieved during searches for the Development Evidence Portal or the Food Systems and Nutrition Evidence Map were pooled and assigned for screening. As screeners worked, they indicated relevance for the Development Evidence Portal and the Food Systems and Nutrition Evidence Map at the same time.

EPPI-Reviewer 4 software’s machine learning capabilities were used to streamline the process and efficiently remove clearly irrelevant studies. The same machine learning classifier was applied during the original map and the update period. An additional classifier, developed for the Development Evidence Portal, was also applied during the update period. The classifier for the Development Evidence Portal is trained to exclude studies based on country and study design but not based on intervention or outcome. Because the country and study design inclusion criteria for the Development Evidence Portal and this E&GM are the same, the application of this additional filter is not expected to have resulted in the exclusions of any studies relevant to the Food Systems and Nutrition Evidence Map.

**Full text screening:** The full text was retrieved for each study that met all the title and abstract inclusion criteria. Initially, two reviewers examined each full text in detail against the protocol and applied a code to indicate whether the study was included or why the study was excluded. Disagreements were reconciled periodically. From August 2020, full texts were single screened (with an option for screeners to mark items as unsure) due to time constraints. Overall, 30 per cent of studies included at the title and abstract stage were double screened during the original mapping process. Only screeners who had worked on the original map conducted full text screening during the update period. All studies identified for inclusion in the update period were screened by a second reviewer to confirm their eligibility.

**Checks for linked publications:** Publications were considered to be linked if the analysis was based on data related to the same study population. This typically occurred when authors followed a group of participants over time, published multiple versions of the same study in different formats (e.g. a working paper later published as a journal article), or updated a systematic review. Descriptive information was only included once for each group of linked publications, so that each study was independent. This means that the presented analysis is reported at the study level, rather than the publication level. The most recently published linked study was selected for representation in the online version of the map.

A review of included studies was conducted in October 2022 and January 2023 with studies being re-considered for eligibility in the E&GM to ensure consistent application of inclusion criteria. During this review process, we also identified 19 studies which were included, but not presented in all data counts and have now been fully coded.
3.5 Data extraction and analysis

Data were systematically extracted from all included studies using the data extraction tool described in Appendix D for the original map. Extracted data covered the following:

Study characteristics: This coding focused on capturing the general characteristics of the study, including authors, publication date and status, study location and setting, intervention type, outcomes reported, definition of outcome measures, population of interest, and study and programme funder. Methodological information was also collected, covering the type of quantitative methods employed and whether authors complemented quantitative results with qualitative inquiry and/or conducted any cost or cost-benefit analyses.

Critical appraisal: All systematic reviews were appraised following the practices adopted by the Development Evidence Portal, which draws on Lewin and colleagues (2009). This process involved appraising each review’s search, screening, risk of bias assessment, data extraction and synthesis. Each systematic review was rated as low, medium or high confidence, drawing on guidance provided in Snilstveit and colleagues (2017). Initially, a five per cent sample of reviews was appraised by two researchers, then independently reconciled by a systematic review expert. Reviewers were provided with feedback, and reliability was judged to be sufficient. Subsequently, one person appraised each systematic review, and the systematic review expert independently reviewed all completed appraisals. Impact evaluations were not critically appraised, as this is typically beyond the scope of an E&GM.

For the original map, data extraction was conducted in Excel. During the update period, 3ie E&GMs were transferred to 3ie’s custom, online data extraction platform. The data extracted for the original map was copied into the online platform, and all data for the updates were extracted directly into the online platform. Coding reflecting if the target of intervention was not a human (e.g. livestock targeted for veterinary intervention) and reproductive status for women was removed during the update period because it was not used in the analysis for the original map.

3.6 Presentation of the map

Results are presented graphically on 3ie’s interactive online platform. The main framework is a matrix of interventions and outcomes, with grey and coloured circles representing impact evaluations and systematic reviews, respectively. The systematic reviews follow a traffic-light system to indicate confidence in their findings: green for high, orange for medium, red for low. The colour blue indicates that the study is ongoing. The size of the bubble indicates the relative size of the evidence base for that intersection of intervention and outcome.

The interactive aspect of the E&GM allows users to filter the results based on key variables, thereby facilitating efficient, user-friendly identification of relevant evidence. The filters and their definitions are provided in Table 5. Users can choose to focus on specific interventions or outcomes, corresponding to the food systems domains, using additional drop-down menus.
Table 5: Study characteristics for E&GM filtering

<table>
<thead>
<tr>
<th>Filter</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>The relevant continent or region in which the intervention took place</td>
</tr>
<tr>
<td>Country</td>
<td>The country in which the intervention took place</td>
</tr>
<tr>
<td>Sex</td>
<td>The sex of the sample for which impact is estimated or the intervention broadly targets</td>
</tr>
<tr>
<td>Age</td>
<td>The age group of the sample for which impact is estimated or the intervention broadly targets</td>
</tr>
<tr>
<td>Study design</td>
<td>The quantitative experimental or quasi-experimental design implemented to estimate effects</td>
</tr>
<tr>
<td>Mixed methods</td>
<td>Whether qualitative evidence was analysed to complement quantitative results</td>
</tr>
<tr>
<td>Cost evidence</td>
<td>Whether and what cost data was reported for the intervention</td>
</tr>
</tbody>
</table>

Source: 3ie 2020

3.7 Study strengths and limitations

The study has the following strengths:

- **Current:** By updating the map approximately every four months, we provide the most up-to-date characterisation of the available evidence of the effects of food systems interventions on food security and nutrition outcomes (Figure 3).
- **Timely:** The original map was commissioned in response to a direct policy need and has been developed into a living product based on ongoing interest. It replies directly to the call to collect and coordinate evidence in the field by Webb and colleagues (2022).
- **Broad:** The scope of the map is broad. Outcome information was collected for a range of final and intermediate outcomes reported in studies.
- **Useful:** The map has served as the basis for two rapid evidence assessments (Berretta and colleagues, 2022; Kinzer, 2022) and a systematic review (Hammaker et al., 2022). It has also been referenced in documents from the Millennium Challenge Corporation (Laborde and colleagues, 2021); International Food Policy Research Institute (Njuki and colleagues, 2021); Foreign, Commonwealth, and Development Office (Carter and colleagues, 2021); and European Commission (European Commission, 2022).

The following limitations can be applied to this study:

- **No forward citation checking:** Due to the high volume of included studies, it was not feasible to screen records that cited included studies.
- **Focused data extraction:** Comprehensive characteristics relating to study equity considerations and research transparency were not extracted due to time constraints.
- **English language focus:** Studies only published in non-English languages were missed, which may introduce bias. Although this could induce some biases in the types of studies included, we expect these to be minimal and believe English language studies will be of the widest interest to the intended users of this map.
- **Quality of impact evaluations not assessed:** The standard analytical procedure for an EGM is to appraise the quality of systematic reviews but not impact.
evaluations. While the impact evaluations included met our eligibility criteria, the quality of the evaluation specification or design (e.g. through an assessment of the theory of change or the completion of a risk of bias assessment) was not appraised. Critical appraisal of impact evaluations is very time intensive and generally considered to be outside the scope of an E&GM.

4. Results

4.1 Results of the search

During the update period, 203,244 articles were retrieved through the search of academic databases (Figures 4&5). We excluded 97,038 as duplicates and 52,775 through the classifier applied in EPPI reviewer. As a result, a total of 33,912 articles were screened on title and abstract from all update rounds. We then screened 11,820 articles at full text, including 122 articles identified through the grey literature search.

Through the reviews conducted in October 2022 and January 2023, we excluded 77 studies from the original map. Of these, 40 were protocols which no longer met eligibility criteria due to being outdated, 28 were found to not meet the inclusion criteria upon additional review, and nine were identified as linked studies. We also found 19 studies that had incomplete data extraction and had been dropped from some of the original analyses, which are now included in all counts. Finally, one systematic review was identified and included through contact with the authors, but has not yet been indexed (Hammaker et al., 2022).

The process resulted in 1,951 studies (IE n = 1,773; SR n = 178) included from the original map and 267 studies (IE n = 260; SR n = 7) added during the update period. The map now contains 2,218 unique studies (IE n = 2,033; SR n = 185). We use these numbers as the denominators for all percentages reported, unless otherwise specified.

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1 Protocols are only included if they have been updated within two years or authors reply to our contact indicating that the study is still ongoing.
Figure 4: Overview of search and screening process (Original map – Update 2)
Figure 5: Overview of search and screening process (Update 3 & Update 4)

Source: 3ie 2023
Notes: Figure reflects search results and additional screening conducted over the update period.
4.2 Characteristics of the evidence base

The remainder of this section provides a descriptive overview of the distribution of studies using the PICOS characteristics described in Section 3.

4.2.1 Growth in the evidence base

The evidence base grew by 14 per cent during the update period. While this is a large increase, it reflects a reduction in the rate of change over time.

Over 100 impact evaluations on the effects of food systems interventions on food security and nutrition have been published every year since 2012, with a maximum of 238 published in 2019 (Figure 6). The addition of 260 impact evaluations and seven systematic reviews (267 total) during the update period reflects a 14 per cent growth in the evidence base. However, there was a considerable decrease in impact evaluations published per year after 2019, possibly related to a decrease in publications during the COVID-19 pandemic resulting from interruptions in the interventions being evaluated. Since the last search was carried out in October the total number of studies for 2022 is likely higher than reflected in the map.

The proportion of food supply chain evaluations evaluated increased from 42 (IE n = 744) per cent in the original map to 54 per cent (IE n = 141, Figure 7) in the update period. There was a corresponding decrease in food environment interventions evaluated from 36 (IE n = 505) per cent to 21 (IE n = 55) per cent. The relative frequency of evaluation of common multi-component interventions and consumer behaviour interventions remained consistent.

Figure 6: Cumulative distribution of included studies by publication year
4.2.2 Intervention coverage

Although gaps regarding effects of interventions remained largely unchanged, we found a decrease in evidence clustering. There was less focus on fortification and supplementation interventions.

In our 2021 report, we commented on notable evidence clusters related to the provision of supplements (SR: n = 67, 38%; IE: n = 364, 21%), fortification (SR: n = 48, 27%; IE: n = 270, 15%), classes in the consumer behaviour domain (SR: n = 26, 15%; IE: n = 233, 13%), direct provision of foods ( SR: n = 22, 12%; IE: n = 198, 11%), and peer support
and counselling in the consumer behaviour domain (SR: n = 23, 13%; IE: n = 120, 7%; Figure 8). There has been a large reduction in the focus on the provision of supplements (SR n = 1, 14%; n = 17, 7%) and fortification (SR n = 0, 0%; n = 13, 5%) interventions in the update period. The relative frequency of impact evaluations of classes in the consumer behaviour domain (n = 25, 10%), direct provision of food (n = 27, 10%), and peer support and counselling (n = 25, 10%) remain largely the same.

Previously, no evaluations of interventions related to advertising regulations, food waste education programs, private food donation, or the direct packaging of food were identified. No new studies were identified for these interventions in the update period. We also found fewer than six studies related to food safety regulations, cold chain initiatives, composting education, labelling regulations, door-to-door behaviour change communication campaigns, provision of goods and/or services to support food processing, designations of space and zoning, innovative store design, on-farm post-harvest processing, and access to pesticides in the original map. During the update period we identified two new studies on food safety regulations, but no other additions in these areas. As such, the identified evidence gaps have not been filled over the past years.

Notable evidence synthesis gaps in the original map related to agricultural extension, the provision of “other” agricultural inputs, agricultural information provision, government manipulation of price, and agricultural insurance. Only one new high- or medium-confidence systematic review on these topics was identified. It was produced by 3ie, leveraging this E&GM. The review considers the effects of taxes and subsidies to support a healthy diet (Hammaker et al., 2022). No new evidence synthesis gaps, with more than 15 impact evaluations and no high- or medium-confidence systematic reviews, emerged during the update period.2

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2 This limit is somewhat arbitrary, but we consider interventions with at least 15 impact evaluations and no high- or medium-confidence systematic reviews to be promising areas for additional synthesis.
Figure 8: Distribution of included studies by intervention domain and intervention

Source: 3ie 2020
Note: Analysis of interventions evaluated in 2,033 impact evaluations and 185 systematic reviews. MC stands for multiple-component interventions. If a study evaluated multiple interventions, the study was counted multiple times.
In the original map, we identified eight multiple-component interventions that were evaluated five or more times, of which half were combinations of consumer behaviour interventions. During the update period three additional multi-component interventions, evaluated five or more times, emerged (Table 6). Two of these additional multiple-component interventions were focused on the food supply chain (provision of fertiliser and seeds and agricultural extension and other agricultural inputs) and the other was another consumer behaviour intervention (peer support and healthy food marketing campaigns).

Table 6: Commonly evaluated multiple-component food systems intervention.

<table>
<thead>
<tr>
<th>Multiple-component interventions</th>
<th>No. SRs Update period (original map)</th>
<th>No. IEs Update period (original map)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large multiple-component interventions</td>
<td>0 (8)</td>
<td>1 (11)</td>
</tr>
<tr>
<td>Fortification and direct provision of food</td>
<td>0 (1)</td>
<td>0 (10)</td>
</tr>
<tr>
<td>Classes and healthy food campaigns</td>
<td>1 (0)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>Peer support / counselling and community meetings</td>
<td>0 (0)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>Professional services and classes</td>
<td>0 (2)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Direct provision of foods and peer support</td>
<td>0 (0)</td>
<td>0 (6)</td>
</tr>
<tr>
<td>Peer support / counselling and classes</td>
<td>0 (0)</td>
<td>0 (5)</td>
</tr>
<tr>
<td>Provision of seeds and farmer field schools</td>
<td>0 (0)</td>
<td>0 (5)</td>
</tr>
<tr>
<td>Agriculture extension and other agricultural inputs</td>
<td>0 (0)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Peer support and healthy food campaigns</td>
<td>0 (0)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Provision of fertiliser and seeds</td>
<td>0 (0)</td>
<td>4 (1)</td>
</tr>
</tbody>
</table>

Source: 3ie 2023
Notes: Analysis of interventions evaluated in 2,033 impact evaluations and 185 systematic reviews. Large multiple-component interventions are defined as those considering 5 or more intervention categories. This threshold of five is somewhat arbitrary, but consistent with the original map.

4.2.3 Outcome coverage
There was a shift to studying intermediate outcomes, with 63% of studies considering at least one intermediate outcome, which may be due to more research on agricultural outcomes and a reduced focus on anthropometric outcomes.

Almost half of studies in the original map (n = 942, 48%) and the update period (n = 126, 47%) considered only a single outcome group. Only 39 studies (2%) in the original map and six in the update period (3%) considered outcomes from five or more groups.3 In the original map, almost all studies considered at least one final outcome (SR: n = 170, 96%;

---
3 Because analysis is conducted at the study, not publication level, this accounts for the possibility that authors publish analysis on different outcomes in separate publications.
IE: \( n = 1,301, 73\% \). In the update period, there was a reduction in studies considering at least one final outcome (SR \( n = 5, 72\% \), IE \( n = 144, 55\% \), Figure 9). As with the original map (IE \( n = 340, 19\% \)), a minority of studies considered both final and intermediate outcomes in the update (IE \( n = 57, 22\% \)).

**Figure 9: Disaggregation of outcomes by intermediate and final categories and publication year.**

[Graph showing disaggregation of outcomes by intermediate and final categories and publication year.]

Source: 3ie 2023

Notes: Analysis of interventions evaluated in 2,033 impact evaluations and 185 systematic reviews.

Final outcome groups were mostly well researched in both the original map and the update period. All outcome groups are considered at least once (Figure 10). The top three most common outcome groups considered in the original map and update period are the same, but in a different order. In the original map anthropometric outcomes (IE: \( n = 633, 36\% \)) were the most commonly considered, diet quality and adequacy (IE: \( n = 522, 29\% \)) second, and agricultural (IE \( n = 292, 16\% \)) third. In the updates agricultural outcomes (IE \( n = 88, 34\% \)) are the most common, diet quality and adequacy (IE \( n = 82, 32\% \)) second, and anthropometric (IE: \( n = 64, 25\% \)) third. Economic outcomes were also measured by 64 impact evaluations. The least studied final outcomes in the original map and the update period also remain consistent. The least commonly considered final outcome group is food safety (IE: \( n = 30, 1\% \), SR: \( n = 1, 1\% \); Figure 10; Table 7). No final outcomes were completely unevaluated.

There are more gaps in the intermediate outcomes. Regulatory outcomes have never been evaluated. The intermediate outcome groups evaluated in fewer than five studies are: economic, social and political stability; regulations; food loss; food distribution; and advertising and labelling. We found new studies considering food safety (IE \( n = 4, 2\% \)), environmental impacts of the food system (IE \( n = 6, 2\% \)), food distribution (IE \( n = 2, 1\% \)) and economic, social, and political stability (IE \( n = 1, 0\% \)). However, 12 intermediate outcomes still never been evaluated: advertisement topics, caloric requirements, exposure to advertisement, fines, location of foods in stores, movement of food, other regulation outcome, other steps taken due to non-compliance, tax revenue, time food remains unspoiled, violations, and food distribution centres.
Figure 10: Outcome category frequency by outcome type

Source: 3ie 2023.
Notes: Analysis of interventions evaluated in 2,033 impact evaluations and 185 systematic reviews.

Table 7: Ten least studied outcomes, among those that have been evaluated, by impact evaluations.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Final No. update (original)</th>
<th>Intermediate No. update (original)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient diet</td>
<td>5 (24)</td>
<td>Water-related</td>
</tr>
<tr>
<td>Iodine micronutrient status</td>
<td>4 (24)</td>
<td>Women’s control of resources</td>
</tr>
<tr>
<td>Food-borne illness</td>
<td>1 (23)</td>
<td>Climate impact</td>
</tr>
<tr>
<td>Food availability &amp; supply</td>
<td>0 (12)</td>
<td>Women’s ownership of assets</td>
</tr>
<tr>
<td>Physical development</td>
<td>2 (9)</td>
<td>Import/export</td>
</tr>
<tr>
<td>Food affordability</td>
<td>0 (9)</td>
<td>Economic, social &amp; political stability</td>
</tr>
<tr>
<td>Food access</td>
<td>0 (9)</td>
<td>Women’s self-esteem</td>
</tr>
<tr>
<td>Other food safety outcome</td>
<td>1 (5)</td>
<td>Agricultural cooperative performance</td>
</tr>
<tr>
<td>Food toxins</td>
<td>2 (2)</td>
<td>Food prices</td>
</tr>
<tr>
<td>Other food security outcome</td>
<td>1 (1)</td>
<td>Food spoilage or loss</td>
</tr>
<tr>
<td>Food stressed households</td>
<td>1 (0)</td>
<td>Non-food waste produced</td>
</tr>
</tbody>
</table>

Source: 3ie 2023.
Note: Analysis of interventions evaluated in 2,033 impact evaluations. If a study evaluated multiple outcomes, the study was counted multiple times. Twelve intermediate outcomes have never been evaluated and are not reflected here: advertisement topics, caloric requirements, exposure to advertisement, fines, location of foods in stores, movement of food, other regulation outcome, other steps taken due to non-compliance, tax revenue, time food remains unspoiled, violations, and food distribution centres. All final outcomes have been evaluated at least once. Bars reflect relative frequency within the corresponding outcome group.
4.2.4 Country coverage

Geographic coverage remained consistent in the update, focusing on Sub-Saharan Africa and countries with large populations. However, new analysis indicated that there was meaningful variation in the types of interventions evaluated in different regions, with a focus on the food supply chain in Sub-Saharan Africa.

The geographic coverage of studies identified during the update period was similar to those in the original evidence map. Sub-Saharan Africa was the most commonly studied region in the original map (IE n = 642, 36%) and during the update period (IE n = 109; 42%). In the original map South Asia (IE n = 360, 20%) was second and East Asia and Pacific (IE n = 313, 18%) third most common. In the updates, this was reversed, with East Asia and Pacific (IE n = 65, 25%) as the second most common followed by South Asia (IE n = 44, 17%).

There are some meaningful differences in the types of interventions evaluated in each region (Figure 11). In Sub-Saharan Africa, South Asia, and East Asia and Pacific, the most commonly evaluated intervention domain is the food supply chain. However, this focus on the food supply chain is much larger in Sub-Saharan Africa compared to the other regions (n = 452, 60% of impact evaluations in Sub-Saharan Africa). In Latin America and the Caribbean, there was a focus on food environment interventions (n = 150, 48% of studies in Latin America and the Caribbean). In Middle East and North Africa (n = 82, 58% of studies in the Middle East and North Africa) and Europe and Central Asia (n = 25, 58%), consumer behaviour interventions are evaluated more than the other interventions.

Figure 11: Distribution of studies by region and intervention domain

Source: 3ie 2023. Analysis of interventions evaluated in 2,033 impact evaluations.
Notes: If a study took place in multiple countries, the study was counted multiple times.

The focus on low- and lower middle-income countries remained consistent with the original map. In the original, 34 per cent (n = 605; Table 8; Figure 12) of studies took place in lower middle-income countries and 38 per cent (n = 668) took place in low-income countries, with the remainder occurring in upper middle-income countries. A few studies both took place both in high income countries and low- or middle-income countries (n = 2). Similarly, during the update period, we found that 43 per cent (n = 112) studies took place in lower middle-income countries and 30 per cent (n = 79) in low-income countries with the remainder occurring in upper middle-income countries.
Population size still seems to be a major driver of the geographic focus of included studies. Previously, India (n = 174; 10%), Bangladesh (n = 114; 7%), China (n = 109; 6%), Brazil (n = 100; 6%), and Iran (n = 94, 5%) were the most common countries. During the update, the most studied countries were China (n = 30, 12%), India (n = 24, 9%), and Ethiopia (n = 23, 9%).

**Figure 12: Percentage point change in distribution of included studies by country**

![Map of percentage point change in distribution of included studies by country](image)

Source: 3ie 2023.

Notes: Descriptive analysis of data extracted from 2,033 included impact evaluations, which include 2,097 evaluations in total once multi-country studies are accounted for. Percentage point change reflects the percent of studies taking place in the country in the update period minus the percentage of studies taking place in that country in the original. As such, larger values, corresponding to darker colours, reflect a shift towards studying the country.

**Table 8: Overview of the most studied countries by region**

<table>
<thead>
<tr>
<th>Region / rank</th>
<th>Country with most studies No. update (original)</th>
<th>Country with second most studies No. update (original)</th>
<th>Country with third most studies No. update (original)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>Kenya: 15 (86)</td>
<td>Ethiopia: 23 (73)</td>
<td>Ghana: 11 (58)</td>
</tr>
<tr>
<td>South Asia</td>
<td>India: 24 (174)</td>
<td>Bangladesh: 14 (114)</td>
<td>Nepal: 2 (34)</td>
</tr>
<tr>
<td>East Asia and the Pacific</td>
<td>China: 30 (109)</td>
<td>Indonesia: 14 (46)</td>
<td>Vietnam: 10 (44)</td>
</tr>
<tr>
<td>Latin America and Caribbean</td>
<td>Brazil: 7 (100)</td>
<td>Mexico: 3 (80)</td>
<td>Peru: 0 (24)</td>
</tr>
<tr>
<td>Europe and Central Asia</td>
<td>Turkey: 2 (19)</td>
<td>Belarus: 0 (6)</td>
<td>Albania: 0 (3)</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>Iran: 10 (94)</td>
<td>Lebanon: 2 (6)</td>
<td>Egypt: 0 (7)</td>
</tr>
</tbody>
</table>

Source: 3ie 2023

Notes: Descriptive analysis of data extracted from 2,033 included impact evaluations, which include 2,097 evaluations in total once multi-country studies are accounted for. Ranking is total across original and update period.
4.2.5 Population and scale
Most evaluations targeted both sexes and no specific age group. Those that did target a group tend to target women and / or infants.

As with the original map, most impact evaluations included in the update targeted both sexes (n = 196; 76%, Figure 13). If sex was targeted, women were generally the focus of the intervention (n = 37; 14%), with one study targeted exclusively men in the update. Interventions which targeted women focused on consumer behaviour with a corresponding absence to interventions targeting women within the food production interventions. Although 27 (n = 71) per cent of impact evaluations generally were on behaviour change communication interventions, 45 (n = 172) per cent of evaluations targeting women fall in this category. Conversely, 27 (n = 602) per cent of impact evaluations considered food production interventions, but only six (n = 22) per cent of studies targeting women considered these interventions.

Similarly, most often impact evaluations considered the whole population or an unspecified age group (n = 644, 34%, Figure 14). Among the impact evaluations that targeted a specific age group, the most commonly targeted group was infants under two in the original map (n = 445, 25%) closely followed by adults 20 to 60 years old (n = 451, 25%). During the update, this shifted with adults being the most studies (n = 72, 28%) followed by adolescents (n = 49, 18%). Studies which targeted infants were generally related to providing free or reduced cost food (n = 264; 53% among infants relative to n = 671; 33% across the whole map). The distribution of studies evaluating interventions targeting adults was generally similar to the distribution of evaluations in the map as a whole.

Figure 13: Distribution of impact evaluations by gender

Source: 3ie 2023
Notes: Descriptive analysis of data extracted from 2,033 included impact evaluations. Percentages are calculated based on the corresponding study period.
There was a slight change in the distribution of the scale of interventions considered. In the original map, evaluations were dominated by interventions which took place at the local level (n = 1,401, 79%, Figure 15) with few studies taking place at the national (n = 141, 8%) or transnational (n = 34, 2%) level. However, during the update period, more studies considered larger scales: 12 per cent (n = 31) took place at the national level and two per cent (n = 5) at the transnational level. Originally, these large-scale interventions focused on cash-for-food programs (n = 30, 18% of large-scale interventions), the direct provision of food (n = 27, 16%), and classes in consumer behaviour (n = 22, 13%). During the update period, there was less clustering in the types of large-scale interventions evaluated, with the direct provision of food (n = 4, 11%), land markets and management programs (n = 4, 11%), other production systems improvements (n = 3, 8%), and governmental manipulation of price (n = 3, 8%) being the most commonly evaluated.
4.2.6 Research and program funding

Research and program funding agencies were not often reported. However, among those that did report, governments were the most common funders.

We continued to see that relatively few studies reported on implementing (n = 106, 41%) or funding agencies (n = 74, 28%) for the evaluations and underlying interventions. When funding was specified, governments were the most common program funders in both the original (n = 403; 23%) map and during the update period (n = 29; 11%, Figure 16). During the update period, we also found that non-profit organizations (n = 18, 7%) and non-governmental international aid agencies (n = 16, 6%) were commonly reported as program funders.\(^4\)

In the original map, the United States Agency for International Development (USAID) was the most frequently reported program funding agency, followed by the World Bank and the Bill & Melinda Gates Foundation (Table 9). In the updates, the Bill & Melinda Gates Foundation are first (n = 6), followed by USAID and the World Bank both second (n = 5). Government of China, European Union, and Consultative Group for International Agricultural Research (CGIAR) were in the top 10 most common agencies during the update period, surpassing the National Institutes of Health (NIH), Government of Mexico, and Swiss Agency for Development and Cooperation.

Research funding agencies were reported more frequently than program funding agencies in the update period (IE n = 174, 67%). Government agencies are the most reported (n = 74, 28%) followed by international aid agencies (n = 47, 18%), and non-profit organizations (n = 43, 17%). The top research funders are similar for the original map and update period (Table 9). USAID (n = 18) and the Bill & Melinda Gates Foundation (n = 15) are the most commonly reported research funders. Another three agencies were identified as most common in the update period; CGIAR, Japan Society for the Promotion of Science, and Swedish International Development Agency. These surpassed the NIH, 3ie, and the National Council for Scientific and Technological Development in the list of top 10 research funders. CGIAR funded five per cent of the total studies in the update period.

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\(^4\) For the purpose of this study governmental agencies are all agencies part of the national, federal, state and local governments where the intervention took place. These can include agencies from high-income countries involved in these interventions. The international aid agencies to bilateral agencies that provide humanitarian or development aid as official development assistance. These include all UN agencies.
Figure 16: Programme funder and research funder categories for impact evaluations

Source: 3ie 2023
Notes: Descriptive analysis of data extracted from 2,033 included impact evaluations.
Table 9: Top programme and research funders of impact evaluations

<table>
<thead>
<tr>
<th>Funding agencies</th>
<th>No. update (original)</th>
<th>Per cent update (original)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program funding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USAID¹</td>
<td>5 (51)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>World Bank²</td>
<td>5 (32)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Bill &amp; Melinda Gates Foundation</td>
<td>6 (32)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>DFID / FCDO</td>
<td>2 (27)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>UNICEF</td>
<td>2 (26)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>World Food Programme</td>
<td>3 (19)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>National Institutes of Health (NIH)³</td>
<td>1 (17)</td>
<td>0 (1)</td>
</tr>
<tr>
<td>European Union</td>
<td>2 (15)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Government of India</td>
<td>0 (11)</td>
<td>0 (1)</td>
</tr>
<tr>
<td>Government of Mexico</td>
<td>0 (8)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Swiss Agency for Development and Cooperation</td>
<td>1 (7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Consultative Group for International Agricultural Research (CGIAR)</td>
<td>2 (6)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Government of China</td>
<td>3 (4)</td>
<td>1 (0)</td>
</tr>
<tr>
<td><strong>Research funding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USAID¹</td>
<td>18 (114)</td>
<td>7 (6)</td>
</tr>
<tr>
<td>Bill &amp; Melinda Gates Foundation</td>
<td>15 (95)</td>
<td>6 (5)</td>
</tr>
<tr>
<td>DFID / FCDO</td>
<td>10 (55)</td>
<td>4 (3)</td>
</tr>
<tr>
<td>World Bank²</td>
<td>7 (47)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>UNICEF</td>
<td>3 (51)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>NIH³</td>
<td>2 (48)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>CGIAR</td>
<td>13 (28)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>National Natural Science Foundation of China</td>
<td>10 (29)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>3ie</td>
<td>2 (35)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>International Food Policy Research Institute (IFPRI)</td>
<td>6 (31)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>National Council for Scientific and Technological Development</td>
<td>1 (24)</td>
<td>0 (1)</td>
</tr>
<tr>
<td>Swedish International Development Agency</td>
<td>4 (16)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Japan Society for the Promotion of Science</td>
<td>6 (6)</td>
<td>2 (0)</td>
</tr>
</tbody>
</table>

Source: 3ie 2023.
Notes: Descriptive analysis of data extracted from 2,033 included impact evaluations. Only 632 studies report program funding and 1,199 studies report research funding. Some studies report more than one funder.

1. Includes sub-offices and projects of USAID
2. Includes programmes, funds, and committees associated with the World Bank
3. Includes the Fogarty International Centre and the Eunice Kennedy Shriver National Institute
4. Percentage does not include studies that do not specify funders
4.2.7 **Impact evaluation and synthesis methods**

There was a decrease in the reliance on randomized designs, but no overall change in the availability of cost evidence or mixed-methods research. The overall quality of systematic reviews decreased.

We saw a shift in the types of evaluation methods being used. In the original map, randomised controlled trials dominated the evaluation methods (n = 1,303, 73%). However, this decreased to 58 per cent (n = 151, Figure 17) during the update period. We found a stronger reliance on quasi-experimental methods, such as fixed effects (n = 68, 26%) and statistical matching (n = 57; 22%). More advanced statistical techniques such as synthetic control (n = 1; 0%) and regression discontinuity (n = 4, 2%) remained uncommon. However, the use of interrupted time series almost doubled during the update, increasing from five per cent (n = 95) to eight per cent (n = 22). Other methods, such as qualitative research, implementation science, and process evaluations were not eligible for this map and are not represented here, despite their understood, potential importance to the field (Section 3.2).

The proportion of studies considering cost evidence (n = 20; 8%) and mixed methods approaches (n = 19; 7%) in the update period was roughly similar to that of the original map (cost evidence: n = 161, 9%, mixed methods: n = 175; 10%).

**Figure 17: Distribution of impact evaluation methods and systematic review quality**

Source: 3ie 2023

Notes: Descriptive analysis of data extracted from 2,033 included impact evaluations and 185 systematic reviews. Percentages are calculated based on the corresponding study period.
Few systematic reviews were identified during the update period (n = 7). We previously found that the quality of systematic reviews was increasing over time. In the original map, 49 per cent (n = 87) of included systematic reviews were rated as low confidence. But, in 2019 alone, 10 high and 10 medium confidence systematic reviews were published (69% of SRs published in 2019). Since the original map, systematic review quality appears to have reduced, with only two (29%) medium confidence and zero high-confidence systematic review being published.

5. Conclusions and implications

Two years into our first project to continually update an evidence and gap map, we find that the evidence in the field of food systems and nutrition is growing quickly. We identified 267 impact evaluations and systematic reviews indexed in the period between the close of our first search in September 2020 and our most recent search in October 2022. We demonstrated the feasibility and utility of engaging in such an evidence surveillance project. The E&GM is now being used as the basis of additional work to fill key evidence gaps identified through this project. It has served to support the development of a systematic review on governmental price manipulations and a rapid evidence assessment on women’s empowerment within the food system (Berretta et al., 2022; Hammaker et al., 2022).

Based on the results presented above, answers to the research questions specified in Section 1.1 are presented below.

5.1 Research question 1 – Coverage

*What is the extent, range and nature of existing empirical evidence regarding the effects of food systems interventions on food security and nutrition outcomes in L&MICs?*

Our map currently includes 2,033 impact evaluations and 185 systematic reviews considering the effect of food systems interventions on food security and nutrition outcomes in low- and middle-income countries.

Interventions:
Several intervention types have been examined in over 250 impact evaluations and 25 systematic reviews: fortification, supplementation, and classes about consumer behaviour.

In contrast, packaging; private food donation; use of and education regarding the use of spoiled, near spoiled or traditionally uneaten food; and advertising regulation interventions have not been examined by any identified impact evaluations.

Women’s empowerment efforts, agricultural extension programs, other agricultural information and guidance, and water access and management interventions have been considered by 20 or more impact evaluations but no high- or medium-confidence systematic reviews.

Outcomes:
Most final outcomes have been examined at least five times, with the exception of food stressed households and food toxins.
The most studied outcomes, considered more than 400 times, are generally anthropometric, but included one micronutrient measure: iron status, linear growth, relative weight, and weight.

Several intermediate outcomes have never been considered: advertisement topics, caloric requirements, exposure to advertisement, fines, location of foods in stores, movement of food, other regulation outcome, other steps taken due to non-compliance, tax revenue, time food remains unspoiled, violations, and food distribution centres.

Geography: Evaluations focus on Sub-Saharan Africa (n = 751; 37%), lower middle-income countries (n = 718; 35%), and countries with large populations. India, China, and Bangladesh are the most commonly studied countries. There is a disproportionate focus on food supply chain interventions in Sub-Saharan Africa relative to other regions.

Population and scale: Impact evaluations tend to consider all genders (n = 1,249; 61%) and people of all or unspecified ages (n = 664; 33%). Most impact evaluations took place at the local level (n = 1,509; 74%), with few national or transnational evaluations (n = 211, 10%).

Methods: Most impact evaluations (n = 1,454; 72%) employed randomised designs. Among quasi-experimental evaluations, fixed effects estimation is the most common method (n = 443; 22%). Few studies use mixed methods (n = 194, 10%) or present cost evidence (n = 163, 8%). Systematic reviews are generally rated as low quality (n = 91, 49%) and tend to focus on supplementation (n = 68, 37%) and fortification (n = 48, 26%).

5.2 Research question 2 – Change

How has the evidence changed over time?

There has been a 14% increase in the evidence base between September 2020 and October 2022. Most of the new work is primary research, rather than evidence synthesis (IE n = 260, SR n = 7). However, key evidence gaps have not been filled.

Despite the expansion in the evidence base, there has been a decrease in the rate of new studies published during the update period relative to the proceeding years (Figure 7). The decrease may be related to work interruptions during the COVID-19 pandemic and may be reversed as lockdowns lift. Food supply chain (17% increase), consumer behaviour (13% increase), and multi-component interventions (14% increase) all experienced relatively similar rates of increase. There has been less of a focus on the food environment (8% increase).

Most of the newly identified work focuses on the direct provision of foods (n = 27, 10%, Figure 8), peer support and counsellors (n = 25, 10%), consumer behaviour classes (n = 25, 10%), and agricultural extension programs (n = 22, 8%). The most studied outcomes during the update period relate to agricultural outcomes (n = 88, 34%, Figure 10), diet quality and adequacy (n = 82, 32%), and anthropometrics (n = 64, 25%). This continues the trends we saw in the original map.

We find the largest relative reductions in the evaluations focusing on supplementation (n = 17, 7% in update; 14 percentage point decrease from original) and fortification (n = 13, 5% in update; 10 percentage point decrease from original) during the update period.
Table 10 shows the corresponding reduction in evaluations of food processing and packaging and food provision / price reduction interventions. The decreases are not offset by a disproportionate shift to studying a specific other intervention. Instead, other agricultural education programs (n = 23, 9% in update period; 6 percentage point increase) and other production systems improvements (n = 16, 6% in update; 5 percentage point increase) experienced modest relative increases in evaluation during the update period.
Table 10: High-level summary of the evidence mapping of impact evaluations and systematic reviews

<table>
<thead>
<tr>
<th>Intervention / outcome</th>
<th>Food safety</th>
<th>Food affordability &amp; availability</th>
<th>Micronutrient status</th>
<th>Diet quality &amp; adequacy</th>
<th>Developmental outcomes</th>
<th>Anthropometric</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food production</td>
<td>2.1%</td>
<td>(4.0%)</td>
<td>11.4%</td>
<td>20.7%</td>
<td>10.4%</td>
<td>32.12%</td>
<td>(153, 8%)</td>
</tr>
<tr>
<td>Food transport / storage</td>
<td>0.0%</td>
<td>(0.0%)</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>(10, 1%)</td>
</tr>
<tr>
<td>Processing and packaging</td>
<td>0.0%</td>
<td>(5.0%)</td>
<td>1.0%</td>
<td>3.1%</td>
<td>2.1%</td>
<td>14.5%</td>
<td>(319, 16%)</td>
</tr>
<tr>
<td>Food loss and waste management</td>
<td>0.0%</td>
<td>(0.0%)</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>(1, 0%)</td>
</tr>
<tr>
<td>Food provision / price reduction</td>
<td>0.0%</td>
<td>(19.1%)</td>
<td>4.1%</td>
<td>10.4%</td>
<td>18.7%</td>
<td>29.11%</td>
<td>(371, 19%)</td>
</tr>
<tr>
<td>Promotion and labelling</td>
<td>0.0%</td>
<td>(0.0%)</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>(0, 0%)</td>
</tr>
<tr>
<td>Women's empowerment in the food system</td>
<td>0.0%</td>
<td>(0.0%)</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>1.0%</td>
<td>(10, 1%)</td>
</tr>
<tr>
<td>Behaviour change communication</td>
<td>0.0%</td>
<td>(8.0%)</td>
<td>1.0%</td>
<td>7.3%</td>
<td>46.17%</td>
<td>32.12%</td>
<td>(255, 13%)</td>
</tr>
<tr>
<td>Quality and safety</td>
<td>1.0%</td>
<td>(0.0%)</td>
<td>0.0%</td>
<td>1.0%</td>
<td>0.0%</td>
<td>1.0%</td>
<td>(10, 1%)</td>
</tr>
<tr>
<td>Multi-component</td>
<td>2.1%</td>
<td>(0.0%)</td>
<td>1.0%</td>
<td>6.2%</td>
<td>1.0%</td>
<td>4.1%</td>
<td>(10, 1%)</td>
</tr>
<tr>
<td>Total</td>
<td>4.1%</td>
<td>(31.2%)</td>
<td>17.6%</td>
<td>27.10%</td>
<td>83.31%</td>
<td>68.25%</td>
<td>(148, 55%)</td>
</tr>
</tbody>
</table>

Source: 3ie 2023.
Notes: Numbers in each cell reflect the number of new studies identified considering the corresponding intervention-outcome combination with the number from the original map in parentheses. Percentages are based on the corresponding period, not the total in the final map, ie the percentage for studies in the update period reflects a total of 267 studies. Colours reflect the percentage point change over time with dark colours reflecting a decrease and light colours reflecting an increase. If a study evaluated multiple interventions and outcomes across different categories, the study was counted multiple times. As a result, the total number of studies reported here is higher than the actual number of studies included in the map.
During the update period, final outcomes, particularly *anthropometrics* (n = 68, 25% in update; 13 percentage point decrease) and *micronutrient status* (n = 27, 10% in update, 20 percentage point decrease), were evaluated less often. This corresponded with a strong shift towards studying *agricultural* outcomes (n = 89, 33% in update; 18 percentage point increase from original).

There have not been significant changes in the gender or geographic distribution of targeted populations. However, the number of national or transnational interventions evaluated increased from 10 (n = 175) in the original map to 14 per cent (n = 36) in the update period. This change was largest in the last update with 14 studies (24%) considering national or transnational interventions. When geography and scale were considered together, we found a remarkable number of studies considering the impacts of national level policies in China. Although seven per cent (n = 139) of studies took place in China, 23 per cent of the national studies added during the update period took place in China.

The change in the types of interventions evaluated may have been facilitated by a shift in the methods used in impact evaluations. We saw a reduction in the reliance on experimental designs from 73 per cent (n = 1,303) to 58 per cent (n = 151). The most common quasi-experimental method remains fixed effects estimation (original: n = 375, 21%; update: n = 68, 26%). However, the use of interrupted time series almost doubled during the update, increasing from five per cent (n = 95) to eight per cent (n = 22).

In our original report, we commented that the quality of systematic reviews increased over time, with most high-confidence systematic reviews published in or after 2013. We did not see this trend continue. Five of the seven systematic reviews added during the update period were rated as low-confidence.

In our original report, we identified *women’s empowerment*, *taxes on sugar-sweetened beverages*, *labelling regulation*, *support for post-harvest processing*, *national interventions*, *cost evidence*, and *mixed methods research* as key gaps. We also provided a longer list of potential areas for future research. We have identified new research in some of these key areas (Table 11). The largest relative increases have occurred measures of *environmental impacts of the food system* (66% increase); *women’s empowerment* (33% increase); and *economic, social, and political stability* (33% increase) outcomes. We also find meaningful increases in the evaluations of *on-farm*, *post-harvest processing* (25% increase) and *women’s empowerment* (22% increase) interventions.
Table 11: Newly identified studies addressing previously identified evidence priorities.

<table>
<thead>
<tr>
<th>Illustrative list of interventions to priorities for evaluation</th>
<th>Studies and protocols added (studies in original)</th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government manipulations of price</td>
<td>3 (22)</td>
<td>14%</td>
</tr>
<tr>
<td>Advertising and labelling regulations</td>
<td>0 (0)</td>
<td>0%</td>
</tr>
<tr>
<td>On-farm, post-harvest processing</td>
<td>1 (4)</td>
<td>0%</td>
</tr>
<tr>
<td>Interventions to support food packaging</td>
<td>0 (0)</td>
<td>0%</td>
</tr>
<tr>
<td>Efforts to support women's empowerment within the food system</td>
<td>4 (18)</td>
<td>22%</td>
</tr>
<tr>
<td>Innovative store design</td>
<td>0 (5)</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Illustrative list of outcomes to priorities for evaluation</th>
<th>Illustrative list of evidence synthesis priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women's empowerment</td>
<td>Provision of free or reduced-cost farm inputs to crop production</td>
</tr>
<tr>
<td>Economic, social, and political stability</td>
<td>Educational approaches within the food value chain</td>
</tr>
<tr>
<td>Food loss</td>
<td>Agricultural insurance products</td>
</tr>
<tr>
<td>Environmental impacts of the food system</td>
<td>Outcome related to other diet quality and adequacy measures</td>
</tr>
<tr>
<td>Measures of diet insufficiency</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Illustrative list of methods and scale priorities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost evidence</td>
<td>20 (161)</td>
</tr>
<tr>
<td>Mixed methods research</td>
<td>19 (175)</td>
</tr>
<tr>
<td>High-confidence systematic reviews</td>
<td>0 (42)</td>
</tr>
<tr>
<td>National and trans-national evaluations</td>
<td>36 (175)</td>
</tr>
</tbody>
</table>

Source: 3ie 2023

Notes: Descriptive analysis of all 2,218 studies currently included in the map. Percentages are calculated independently separately for evaluation priorities (IE n = 2,033) and synthesis priorities (SR n = 185). Bars reflect percentage change.

5.3 Research question 3 – Gaps

What are the major primary and synthesis evidence gaps in the literature?

Although we note considerable increase in the evidence base, this has not meaningfully closed research gaps. Overall, the gaps identified in the original map remain.

Although there has been significant growth in the evidence base, including in areas identified as key gaps in the original report, the evidence base in these areas was so small, that large proportionate increases could not fill the evidence gaps (Table 11). For example, while there was a 32 per cent increase in the evidence on women’s empowerment outcomes, this only accounted for the addition of 13 studies and an increase in the frequency of evaluating women’s empowerment outcomes from two per cent (n = 41) in the original map to five per cent (n = 13) in the update. Evaluations of
women’s empowerment outcomes still only represent three per cent of the included impact evaluations. We continue to see a need for more mixed methods research (n = 194, 4%), cost evidence (n = 163, 7%), and evaluation of large-scale interventions (n = 211, 10%). Below, we summarize a selected set of key papers that have responded to the identified research gaps during the update period.

5.2.1 **Summary of selected new studies that address research gaps**

We identified three new studies on governmental manipulation of price. One study found that a rice price subsidy in South India positively affected food consumption, nutrient intake and purchasing power (Malairasan et al., 2021). In another study, China’s minimum grain procurement price program was found to positively affect wheat and rice prices received, land sown with wheat and rice, chemical fertilizer use, and pesticides use (Su et al., 2021). Cawley and colleagues (2021) conducted the first ever study on the impacts of a tax on sugar-sweetened beverages on BMI, and found no effect. This aligns with findings in our recent systematic review of fiscal policy interventions to support a healthy diet. We found limited impacts on purchasing behaviour and insufficient evidence on diet quality (Hammaker et al., 2022).

Another set of new studies responds to the identified gap relating to women’s empowerment. There are four new IEs on women’s empowerment interventions, and 18 IEs measuring women’s empowerment outcomes. A new study investigated the impact of an agricultural capacity building intervention and an education and behavior change nutrition intervention. The nutrition intervention included gender sensitization training. This study found that the nutrition intervention improved women’s empowerment outcomes - women were more likely to express their opinion to their spouses and in meetings. It also improved women’s control over income from food crop farming and livestock rearing (Bonuedi et al., 2020). Another evaluation considered a gender-blind intervention that offered farmers extension training in agricultural technologies and strengthened the farmers’ access to markets. The intervention reduced women’s say in production and spending of income. There was weak evidence of lower empowerment in social decisions (Ntakyo and Van Den Berg, 2022). A national study considered the effects of women’s empowerment through laws allowing Indian women to inherit their parents’ ancestral property (Ajefu et al, 2022). The evaluation showed positive effects on child health and nutrition outcomes and found some positive effects on women’s decision making. A nutrition-sensitive agroecology intervention, which provided education and seeds in Tanzania, increased decision making in income allocation but not agricultural decisions (Pamuk et al., 2021; see online map for studies on women’s empowerment outcomes).

Leveraging this E&GM, 3ie recently added to this evidence base as well, through a rapid evidence assessment considering the impacts of women’s empowerment interventions on food security, affordability and availability, diet quality and adequacy, anthropometrics, micronutrient intake, and wellbeing (Berretta et al., 2022). Women’s empowerment interventions within the food system improved food security and food affordability and availability.

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5 To limit scope, we only summarize the women’s empowerment interventions here. Readers can find the studies looking at women’s empowerment outcomes in the online, interactive map.
5.4 Research needs 4 – Research needs

What intervention and/or outcome areas could be prioritised for primary research and/or evidence synthesis?

Not all evidence gaps must be filled. Interventions which are currently being widely implemented, but for which there is little impact evaluation research or insufficient evidence synthesis could be prioritized.

When considering research needs, we balance the distribution of evidence with both the theoretical strength of relationships between interventions and outcomes and policy relevance. Interventions that are currently being widely implemented or supported and those that are likely to affect a large or vulnerable population can be prioritized for additional research. Interventions which have the possibility of harm should also be prioritized for evaluation, with a measurement plan for possible or unintended outcomes.

Generally, the research priorities identified in the original report remain (Table 11). However, we recommend additional evaluations in areas that are currently being supported by key actors in the field (Table 12). Taken together, these suggest the following research needs:

**Illustrative list of interventions to prioritise for evaluation**
- Government manipulations of price
- Advertising and labelling regulations
- On-farm, post-harvest processing
- Interventions to support food packaging
- Efforts to support women’s empowerment within the food system
- Innovative store design, designations of space, and zoning
- Cold chain initiatives
- Improved farm to market transport
- Food safety regulations

**Illustrative list of outcomes to prioritise for evaluation**
- Women’s empowerment
- Economic, social, and political stability
- Food spoilage or loss
- Environmental impacts of the food system
- Measures of diet insufficiency

**Illustrative list of evidence synthesis priorities**
- Provision of free or reduced-cost farm inputs to crop production
- Educational approaches within the food value chain
- Agricultural insurance products
- Outcomes related to other diet quality and adequacy measures

**Illustrative list of methods and scale priorities**
- Cost evidence
- Mixed methods research
- High-confidence systematic reviews
- National and trans-national evaluations
5.5 Implications for policy and practice

Although decision makers can reference high-quality systematic reviews, this evidence base has not grown and could soon be outdated. The primary evidence base has grown considerably in recent years, but it is not being synthesized by high-quality systematic reviews. As such, decision-makers may consider commissioning high-quality systematic reviews to respond to their decision-making needs. This map can be leveraged to identify evidence and synthesis opportunities. It was the basis of rapid synthesis responding to policy relevant questions and can continue to serve in this role as long as it is maintained as a living product. Until high-confidence synthesis outputs are produced, decision-makers may reference individual studies included in the map to understand barriers and facilitators to outcomes achieved in specific contexts.

Decision-makers may continue investing in under-researched areas. Although there are potentially good explanations for many evidence gaps, such as a lack of a theoretical reason to expect a relationship, additional research to establish unknown but theoretically meaningful relationships between interventions and outcomes may be useful (Section 1.2). Caution should be used when implementing under-researched interventions; however, these interventions should not necessarily be avoided. The absence of evidence supporting an intervention does not prove the intervention does not work. Decision makers and implementers can design interventions for evaluability when implementing under-researched interventions. They may contextualize the evidence in this E&GM with other sources to determine the likely effects of an intervention in a local context.

The availability of evidence relating to key, policy-relevant activities is highly variable, which may leave decision makers without the evidence they need. Nonetheless, we encourage decision-makers to reference the evidence available in this E&GM and other sources as relevant. In Table 12, we summarize the evidence base on specific activities supported by the Food Systems Dashboard, the United Nations Food Systems Summit, and The State of Food Security and Nutrition in the World Report (Food Systems Dashboard, 2023; United Nations, 2023; FAO, 2022). Many of these are likely to be highly influenced by political will and institutional drivers, which were recently added to the HLPE’s framework (HLPE 2020). We note that there is not a perfect relationship between these activities and our map. This table is meant to demonstrate the potential use of the E&GM as a database of information.

The availability of evidence is affected by program and research funding and publication decisions. However, transparent reporting of funders is limited. In addition, interventions which are not evaluated, either due to policy or research decisions, or those which are evaluated but reports not published, would not appear in the map. This can result in evidence gaps when decision-makers “know something works” and chose not to evaluate or when evaluations find negative results and are therefore not published.

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6 Designing for evaluability can involve creating a priori research plans and collecting baseline data so that impact evaluations can be conducted. Often, this can be done without significantly effecting implementation plans or requiring randomization.
Careful consideration of evidence relating to unintended consequences may support positive outcomes. When prioritizing interventions, decision makers may wish to consider impacts on key global policy priorities like climate change, women’s empowerment, and economic prosperity. Actions within the food system can have both positive and negative effects on these outcomes. The disproportionate focus on interventions targeting women for behaviour change communication interventions relative to women as food producers may inadvertently reinforce gender norms that view women as food preparers rather than producers. The limited consideration of interventions effects across many outcome categories may result in unintended effects being unidentified.
Table 12: Evaluations corresponding to selected implementation priorities.

<table>
<thead>
<tr>
<th>Activity supported</th>
<th>Corresponding interventions in our evidence and gap map</th>
<th>IEs (SRs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Systems Dashboard</td>
<td>Education / information within the food supply chain</td>
<td>322 (8)</td>
</tr>
<tr>
<td>Deliver agricultural extension programmes, infrastructure, and education to support farmers to grow and market nutritious foods.</td>
<td>Provision of goods / services for food processing and packaging</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td>Market support</td>
<td>16 (2)</td>
</tr>
<tr>
<td></td>
<td>Improved transportation from farms to markets</td>
<td>5 (1)</td>
</tr>
<tr>
<td></td>
<td>Cold chain initiatives</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>Provision of livestock</td>
<td>34 (3)</td>
</tr>
<tr>
<td>Provide low-income households, including women, with support for animal-husbandry and training for animal rearing, safety management and processing along with nutrition education.</td>
<td>Provision of free or reduced cost agricultural inputs</td>
<td>156 (8)</td>
</tr>
<tr>
<td>Redirect agriculture subsidies from staple crops to increasing production of nutritious foods.</td>
<td>Cold chain initiatives</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>Improved transportation from farms to markets</td>
<td>5 (1)</td>
</tr>
<tr>
<td>Develop infrastructure to reduce loss and waste of nutritious foods and increase its redistribution.</td>
<td>Design trade policies to prioritise the supply of nutritious foods</td>
<td>Governmental manipulations of price</td>
</tr>
<tr>
<td></td>
<td>Implement taxes to decrease affordability and incentivise reformulation of sugary drinks and foods high in fats, sugars and salt food.</td>
<td>Trade regulations</td>
</tr>
<tr>
<td>Mandate training programmes for food producers and retailers on storage, processing and packaging to reduce spoilage and contamination of nutritious foods.</td>
<td>Food safety regulations</td>
<td>3 (0)</td>
</tr>
<tr>
<td>Provide nutritious foods and meals at lower prices at point-of-purchase by subsidising public distribution programmes, state-managed stores, public restaurants, and other forms of subsidy programmes.</td>
<td>Direct provision of food</td>
<td>225 (24)</td>
</tr>
<tr>
<td>Use financial incentives and planning regulations to drive the establishment of new supermarkets, fresh food markets, shops and street vendors in underserved communities. Use zoning laws to restrict numbers of “fast food” outlets and vendors in select geographic areas.</td>
<td>Implementation of distribution centres</td>
<td>6 (0)</td>
</tr>
<tr>
<td></td>
<td>Designations of space and zoning laws</td>
<td>5 (0)</td>
</tr>
<tr>
<td>Activity supported</td>
<td>Corresponding interventions in our evidence and gap map</td>
<td>IEs (SRs)</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Require nutrition labelling on packages/menus to indicate if foods are high in calories, fats, sugars and/or salt and/or in positive nutrients. Restrict all forms of marketing, advertising and in-store promotions of HFSS foods, particularly to children.</td>
<td>Advertising regulations</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td>Labelling regulations</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Deliver culturally-appropriate nutrition education, food literacy and skills training to children and adults through schools, health services, agricultural extension, social protection schemes and community settings. Launch engaging and compelling mass media and behaviour change communication campaigns about foods and diets.</td>
<td>Classes within consumer behaviour</td>
<td>267 (27)</td>
</tr>
<tr>
<td></td>
<td>Peer support / counselling</td>
<td>164 (24)</td>
</tr>
<tr>
<td></td>
<td>Professional services</td>
<td>117 (21)</td>
</tr>
<tr>
<td></td>
<td>Healthy food campaigns</td>
<td>81 (10)</td>
</tr>
<tr>
<td></td>
<td>Door-to-door campaigns</td>
<td>3 (0)</td>
</tr>
<tr>
<td></td>
<td>Community meetings</td>
<td>51 (2)</td>
</tr>
<tr>
<td><strong>United Nations Food Systems Summit</strong></td>
<td>Provision of mechanical equipment</td>
<td>9 (0)</td>
</tr>
<tr>
<td>Increase farmer incomes, agricultural productivity, and equity by scaling up access to mechanisation services</td>
<td>Fertiliser access</td>
<td>40 (4)</td>
</tr>
<tr>
<td>Increase the returns to fertiliser subsidies for smallholders</td>
<td>Improved seeds</td>
<td>87 (5)</td>
</tr>
<tr>
<td>Provide more affordable high-yielding varieties of stable crops for food-insecure farmers in fragile environments</td>
<td>Agricultural insurance</td>
<td>29 (1)</td>
</tr>
<tr>
<td>Buffer risks faced by livestock keepers through index-based drought risk financing solutions</td>
<td>Agricultural credit and savings</td>
<td>31 (1)</td>
</tr>
<tr>
<td>Support systemic food systems change in rural communities through nutrition-sensitive agricultural extension services</td>
<td>Contract farming</td>
<td>13 (1)</td>
</tr>
<tr>
<td>Leverage women’s tenure security in collectively held lands for equitable and sustainable food systems. Vernacularise women’s land rights. Empowering women, smallholder farmers, and youth through school-</td>
<td>Agricultural extension services</td>
<td>134 (1)</td>
</tr>
<tr>
<td></td>
<td>Land markets and management</td>
<td>26 (1)</td>
</tr>
<tr>
<td>Activity supported</td>
<td>Corresponding interventions in our evidence and gap map</td>
<td>IEs (SRs)</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Based agricultural education.</td>
<td>Women’s empowerment efforts</td>
<td>22 (1)</td>
</tr>
<tr>
<td>Women’s economic empowerment for sustainable and healthy consumption patterns.</td>
<td>Governmental price manipulations</td>
<td>25 (2)</td>
</tr>
<tr>
<td>Increase fruit and vegetable consumption through consumer-level subsidies.</td>
<td>Classes within consumer behaviour</td>
<td>267 (27)</td>
</tr>
<tr>
<td>Demand generation for healthy and sustainable food.</td>
<td>Healthy food campaigns</td>
<td>81 (10)</td>
</tr>
<tr>
<td>Invest in better public sector marketing.</td>
<td>Door-to-door campaigns</td>
<td>3 (0)</td>
</tr>
<tr>
<td></td>
<td>Community meetings</td>
<td>51 (2)</td>
</tr>
</tbody>
</table>

### The State of Food Security and Nutrition in the World Report

| Market policies and fiscal policies tied to production or unconstrained use of variable production inputs. | Fertiliser access | 40 (4) |
| Trade and market interventions.                                                             | Livestock access  | 34 (3) |
| Fiscal subsidies for agriculture.                                                           | Seed access       | 87 (5) |
|                                                                                         | Pesticide access  | 4 (1)  |
| Healthy food environments and empowering consumers to choose healthy diets must be promoted through complementing agrifood systems policies. | Provision of other agricultural inputs | 78 (2) |
|                                                                                         | Trade regulations | 14 (1) |
| Fiscal subsidies for consumers.                                                             | Food environment interventions                             | 697 (92) |
| Enacting legislation on food marketing, and implementing nutrition labelling policies and healthy procurement policies. | Governmental price manipulations | 25 (2) |
|                                                                                         | Advertising regulations                                    | 0 (0)    |
|                                                                                         | Labelling regulations                                      | 1 (0)    |
| Combining land-use policies, including zoning, regulations and taxation                  | Designations of space and zoning laws                      | 5 (0)    |

Notes: Only interventions or activities which would be directly reflected in our map are presented here. Multi-component interventions are counted under each corresponding category.

1. This activity is not supported by the SOFI report. The others in this table are generally supported by their corresponding organization.
5.6 Implications for research

Researchers are increasingly prioritizing a range of interventions. There was a noticeable decrease in the clustering of evaluations during the update period. In the original map, fortification studies represented 15 per cent of the available evidence and supplementation studies represented 21 per cent. However, during the update, this reduced to five per cent and seven per cent respectively. There were modest, proportionate increases in research in under-studied areas, such as agricultural education and production systems improvements. This indicates that a broader range of interventions are being evaluated. However, research gaps remain (Section 5.4).

More quasi-experimental research and evaluations of large-scale interventions is happening. While not always the case, quasi-experimental research can be well suited to the dynamics of complex interventions in real world settings. Evaluations of large-scale interventions often require quasi-experimental designs and can be highly influential given the number of people such interventions can affect. There may be opportunity to use big data and remote sensing in the future to allow for large-scale evaluations to be conducted.

There is insufficient research on key policy priorities. Many of the interventions listed as research needs in Section 5.4 are already widely implemented. These include governmental manipulations of price, advertising and labelling regulations, and designations of space and zoning laws. As such, we need to quickly establish their likely impacts to ensure that the right interventions are being prioritized. This will require the production of high-quality evidence synthesis to make generalizable conclusions in addition to primary research.

Evaluations of food systems interventions do not take a systems-level approach. Only two per cent of evaluations consider outcomes in five or more groups. Many of these do not look across the theory of change (ex. measuring production, income, diet, and anthropometrics), but instead evaluate conceptually similar outcomes (ex. micronutrient status, anthropometrics, and cognitive development). Without measurement across the causal chain and analysis explicitly designed to examine these linkages, it is impossible to know how interventions affect the system as a whole. Future research may consider and plan for measuring different types of outcomes, conducting mediation analysis, and examining general equilibrium effects to understand how change echoes through the entire food system (Leroy et al., 2022).

Cost evidence and mixed-methods research is still underrepresented. There was no change in the frequency of cost evidence or mixed methods research. This means that we still been more information to answer two key questions: are impacts worth the costs and what are the mechanisms by which impacts are achieved.

Research transparency could be increased by additional reporting of funders. With one third of studies failing to report research funding, it is difficult to understand the underlying motivations of the available research.
References

Reference in text


**Newly included impact evaluations**


Cawley John, Daly Michael R, and Thornton Rebecca (2021) 'The Effect of Beverage Taxes on Youth Consumption and BMI: Evidence from Mauritius'. *NBER working paper No. W28960*. Available at: https://www.nber.org/papers/w28960


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Other publications in the 3ie Evidence Gap Map Report Series

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COVID-19, climate change and conflict have all adversely affected global food security in different ways. While the pandemic led to an additional 150 million people being affected by hunger, climate change has affected the global food supply and conflict drove 139 million people into food insecurity in 2020. To address these challenges and prioritize research to fill known evidence gaps, GIZ commissioned a ‘living’ evidence gap map to systematically map and update the effects of food systems interventions on food security and nutrition in low-and middle-income countries. This report examines the state of evidence from January 2021-2023.