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Links Between School Meal Programs and Regenerative Agriculture
Scoping Literature Review

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Abstract

School meal programs (SMPs) are among the largest public investments in child well-being worldwide, and they have untapped potential to act as levers for sustainable food systems transformation. This discussion paper provides an overview of evidence on linkages between regenerative agriculture and SMPs, and also presents a framework to guide future analytical work on integrating regenerative agriculture and SMPs for food systems transformation. We conducted a scoping review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Systematic Reviews (PRISMA). The reviewed literature reveals a geographically diverse but uneven distribution of research on how SMPs incentivize regenerative agriculture. The review reports emerging evidence on the ability of SMPs to generate positive outcomes for livelihoods and community development. That evidence, however, is limited in scope as it is dominated by studies on Brazil's SMP. Beyond Brazil, our review found no evidence that conclusively establishes a causal relationship between SMPs and the uptake of regenerative agriculture. Much of the literature focuses on smallholder procurement, organic production, or agroecological practices more broadly, with relatively few studies explicitly measuring regenerative outcomes such as soil health restoration, biodiversity gains, or carbon sequestration.

Keywords: School meals, regenerative agriculture, environment, nutrition.

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1 Introduction

School meals exist in nearly every country in the world, reaching over 400 million children every school day and involving investments of approximately US\$67 billion per year (GCNF 2024). School meal programs (SMPs) have traditionally served as essential interventions to support school children’s health, nutrition, and education outcomes. The evidence base on the effectiveness and costs of school meals is well established, with documented effects on child health, nutrition, education, and social protection (Alderman, Bundy, and Gelli 2024). In recent years, however, SMPs have garnered renewed attention as potential catalysts for systemic change—particularly in driving more localized and sustainable food systems. Policy and program experiences suggest that the market created by SMPs has the potential to promote improved agricultural production practices, with a goal of enhancing environmental sustainability through these program services (Sumberg and Sabates-Wheeler 2011). Such renewed attention has focused especially on the effects, if any, of SMPs on incentivizing changes in practices among agricultural producers, particularly smallholder farmers. As concerns about climate change, soil degradation, and biodiversity loss intensify, the question of how public procurement, such as SMPs, can drive agricultural transformation has become increasingly urgent (Chaves et al. 2023; Perez-Neira and Copena 2021a; Valencia, Wittman, and Blesh 2019; Wittman and Blesh 2017).

Promoting sustainable farming practices through linkages to food procurement for school meals provides an opportunity to channel the benefits of a stable market to smallholders (Sumberg and Sabates-Wheeler 2011), while at the same time introducing a wider set of benefits across a range of ecosystem services. However, there is an important gap in the evidence on the potential benefits of linking school meals with the agriculture sector more broadly, including regenerative agriculture, as well as on the financial costs of the interventions involved (Alderman et al. 2024).

“Regenerative agriculture” is defined as agriculture that improves the environment, soil, plants, animal welfare, human health, and communities.¹ It encompasses a set of principles and practices to make agricultural production more climate friendly, with a focus on building healthy soils and embracing biodiversity (Newton et al. 2020). These further affect water quality and food security. Although the term emerged in the late 1970s, it became more widely known in the early 1980s. Agronomist Richard Hardwood (1983) proposed a “regenerative agriculture philosophy” to push the term beyond organic production, which he viewed as too narrowly focused on agronomic aspects of production. While Harwood proposed a set of principles in the early 1980s, there is now a long list of agronomic principles summarized by Giller et al. (2021) that includes indicative practices (see Table 1).

¹ <https://regenerationinternational.org/2023/12/22/the-definition-of-regenerative-agriculture/>

Table 1. Agronomic principles and practices of regenerative agriculture and potential impacts			
Principles	Practices	Restoration of soil health	Reversal of biodiversity loss
Minimize tillage	Zero-till, reduced tillage, conservation agriculture, controlled traffic	***	-
Maintain soil cover	Mulch, cover crops, permaculture	***	*
Build soil carbon	Biochar, compost, green manures, animal manures	***	-
Sequester carbon	Agroforestry, silvopasture, tree crops	***	**
Rely more on biological nutrient cycles	Animal manures, compost, compost tea, green manures, cover crops, maintain living roots in soil, inoculation of soils and composts, reduce reliance on mineral fertilizers, organic agriculture, permaculture	***	-
Foster plant diversity	Diverse crop rotations, multi-species cover crops, agroforestry, intercropping	**	***
Integrate livestock	Rotational grazing, holistic grazing, pasture cropping, silvopasture	**	?
Avoid pesticides	Diverse crop rotations, multi-species cover crops, agroforestry	*	***
Encourage water percolation	Biochar, compost, green manures, animal manures, holistic grazing	***	-

Source: Giller et al. (2021), drawing on academic literature. For a description of holistic grazing, see the Savory Institute, <https://savory.global/holistic-management/>

Note: The number of stars indicate the level of impact, with * being low and *** indicating the highest impact. “-” means no impact and “?” indicates inconclusive findings.

More recently, the term regenerative agriculture has also encompassed social aspects as part of a process-oriented approach. This includes more human–environmental relational understandings of agriculture, including human ethics (Seymour and Connelly 2023) and mental models and cultural norms (Gosnell, Gill, and Voyer 2019). However, some critics argue that regenerative agriculture lacks the political weight necessary to challenge broader political and economic systems underpinning the global industrial food system (Tittonell et al. 2022). Partly, this critique reflects the breadth and diversity of definitions regenerative agriculture. Regenerative agriculture also has a strong focus on the biophysical elements of soil and soil health, which some have argued tends to overshadow social and political aims (Schreefel et al. 2020). In general, the scientific literature seems to agree that regenerative agriculture and other prominent concepts or approaches, such as agroecology and nature-positive agriculture, fit roughly under the goal of making agricultural systems more environmentally and socially sustainable. When understood as a set of practices, agroecology is much more common in the SMP literature than regenerative agriculture, while nature-positive production has been recognized as one of the five action tracks for transforming food systems by the UN Food System Summit (Hodson et al. 2021). In the context of this report, our main interest is to understand the state of knowledge on whether and how SMPs can help promote regenerative agriculture as a general set of management practices and principles (e.g., Table 1). Of secondary interest is the additive value of integrating regenerative practices into SMPs in terms of environmental and sustainability outcomes.

Integrating more sustainable production practices, such as regenerative agriculture, into SMP supply chains offers a unique opportunity to simultaneously nourish children while also supporting sustainable local farming practices and reducing climate vulnerabilities. One such example involves the introduction into school meal menus of underutilized, indigenous crop varieties that are culturally appropriate, nutrient rich, and resilient to climate shocks and stresses. By preferentially sourcing culturally appropriate food from local producers, SMPs can provide incentives for sustainable production, create stable demand for regenerative products, and foster supportive networks among governments, schools, farmers, and communities (Sidaner, Balaban, and Burlandy 2013). However, how SMPs connect regenerative farms to student’s plates is highly complex, with limited evidence on successful cases and even more limited rigorous evidence of clear differentiated impacts. Further, we found no causal evidence linking SMPs to regenerative practices.

This study has two objectives: 1) to develop a comprehensive understanding of the state of knowledge on evidence on linkages between regenerative agriculture and SMPs, and 2) to propose a framework that guides future analytical research and broader research priorities for understanding and integrating regenerative agriculture and SMPs for food system transformation.

2 Methods

To understand the evidence on links between regenerative agriculture and SMPs, we undertook a scoping review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Systematic Reviews (PRISMA-ScR) method (Page et al. 2021), searching the Web of Sciences database and complementing this with selected gray literature. The review provides an overview of the key dimensions analyzed in the literature and explores how SMPs have been leveraged to promote and incentivize socially and environmentally sustainable approaches such as regenerative agriculture in practice. It synthesizes findings across a diverse body of research—spanning high-income and low- to middle-income contexts—to examine how program design, institutional frameworks, stakeholder engagement, and policy environments affect the implementation and impact of regenerative-aligned SMPs. Drawing from case studies of home-grown school feeding programs (HGSF) (Shrestha et al. 2020), land access initiatives (Delgado 2021), and community-based participation (Galli et al. 2014), among others, the review identifies enabling conditions, barriers, and existing evidence on how SMPs are currently supporting, or might support, regenerative agriculture practices. It reveals research gaps and identifies future research directions.

The search initially focused on exclusively peer-reviewed literature. When the research team discovered the dearth of evidence in this literature linking SMPs and regenerative agriculture, we expanded to gray literature focusing on The Rockefeller Foundation's priority countries: Brazil, Ghana, Honduras, India, Indonesia, and Kenya. We also broadened the search beyond the explicit term regenerative agriculture, to consider studies on other prominent concepts and approaches, such as agroecology, local production, and organic farming, that share some key common objectives or characteristics with regenerative agriculture.

2.1 Peer-Reviewed Literature Search

We conducted the literature review following the PRISMA-ScR protocol. Figure 2 presents a flow diagram illustrating the search process and study selection. Specifically, we adopted the following steps:

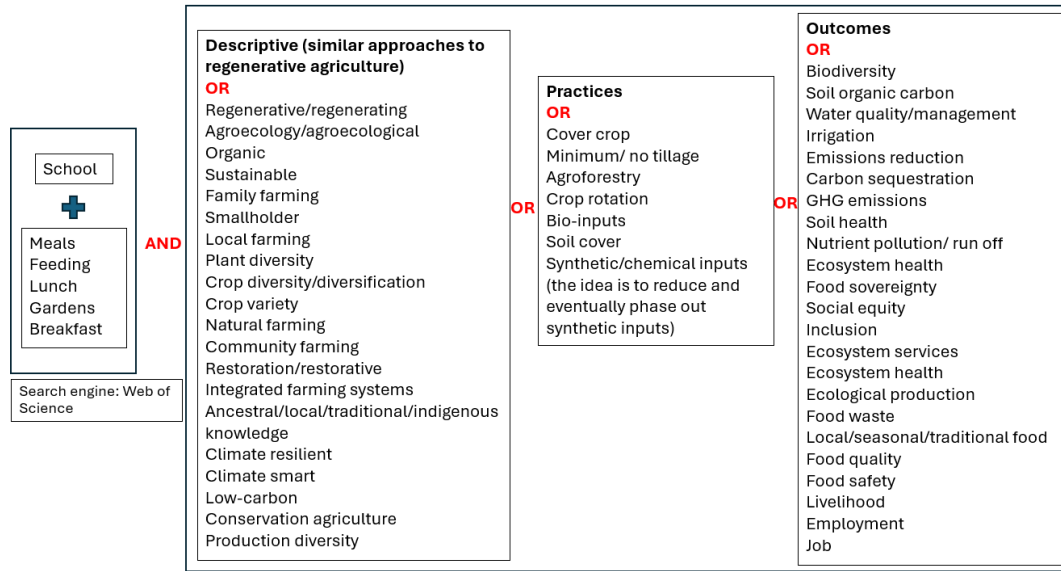
Step 1: Scoping

Relevant literature, including previous reviews and meta-analyses, was identified to inform the development of the review protocols and refine the aims of the review.

Step 2: Planning

Key search terms and Boolean operators were defined through several rounds of team discussions (Figure 1). Keywords for the search string were organized based on four categories: SMPs plus descriptive terms for regenerative agriculture, practices, and outcomes. Web of Science was selected as the search engine.

Figure 1: Key Words Used for the Search String



Source: Authors.

Step 3 – Identification/search

A search of the Web of Science for peer-reviewed articles was completed on June 10, 2025. No time restrictions were applied, and only articles published in English were included. A total of 466 papers were identified.

Step 4 – Processing and screening

All articles were exported in Research Information Systems (RIS) format from Web of Science into Zotero and then uploaded into the web application Covidence for screening. Four independent reviewers were randomly assigned to screen and process the papers in Covidence. Screening in Covidence was carried out in two stages: title, abstract, and keyword screening, and full-text screening. Each paper was screened by at least two people.

Step 5 – Selection of studies

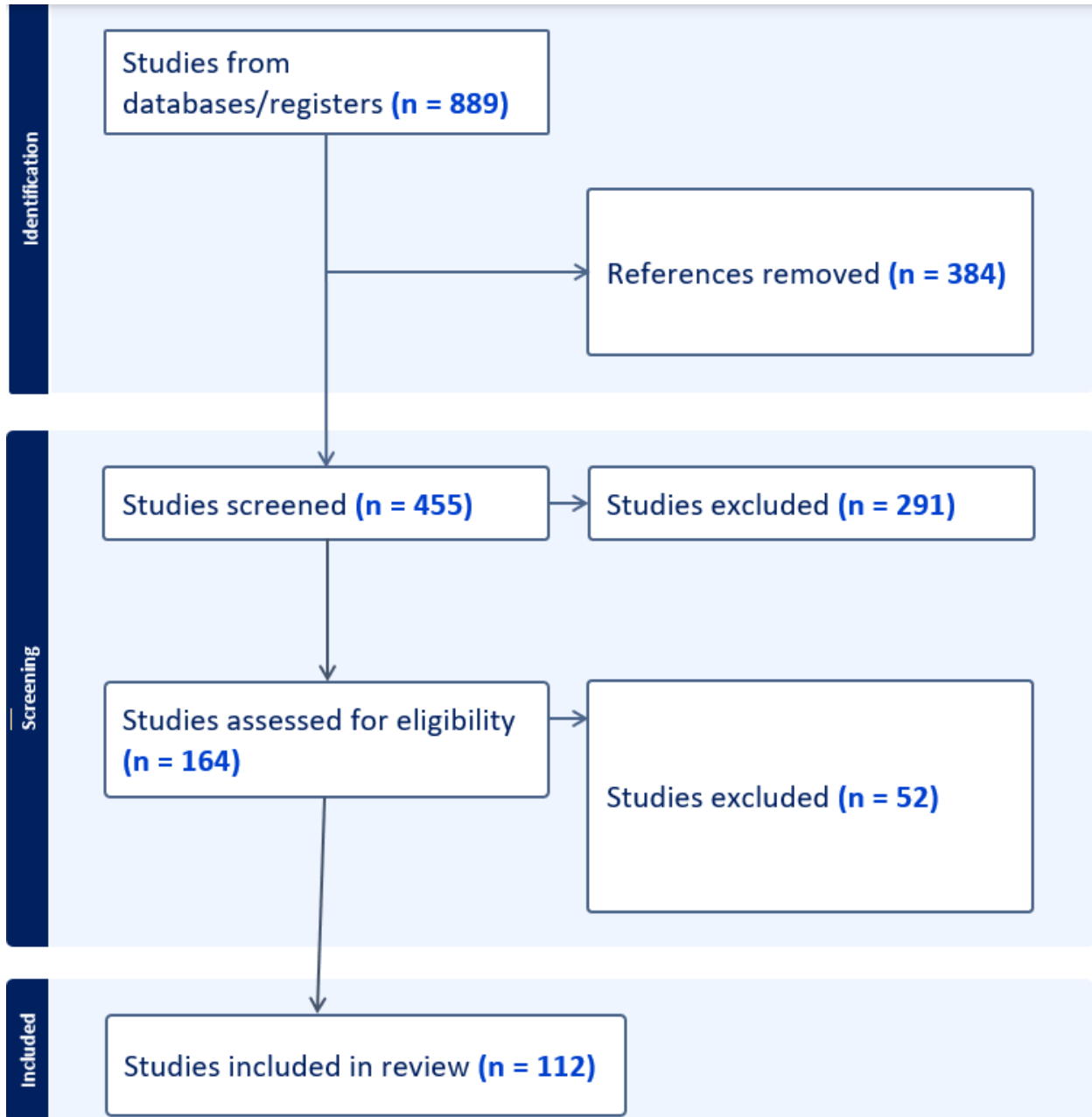
All duplicates were removed, followed by screening against inclusion criteria. Full-text screening retained 166 relevant papers for data extraction. Papers were included if they met the following criteria:

- a) discussed linkages between production and SMP.
- b) discussed linkages between food/crop selection and SMP.
- c) contributed to the development of the conceptual framework, even if they did not directly meet criteria (a) or (b).

Step 6 – Data extraction and analysis

Information was extracted from each paper according to the established PRISMA protocol. Each paper was assigned a unique ID. The data extracted included data on methods, outcomes, information on regenerative agriculture, SMPs, barriers, enabling factors, and recommendations.

Figure 2: PRISMA Flow Diagram



Source: Page et al. (2020).

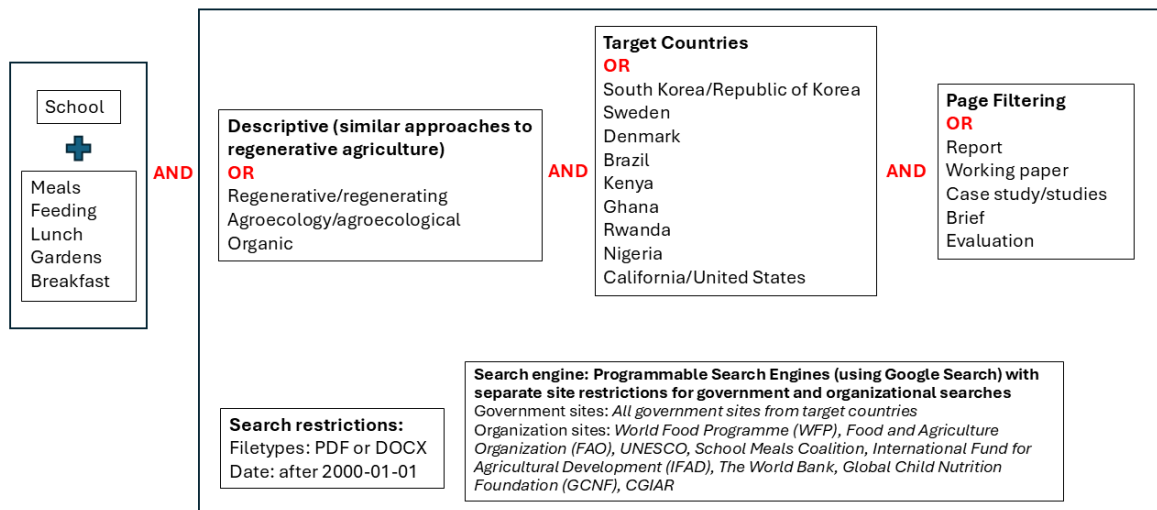
2.2 Gray Literature Search

This review also draws on gray literature identified through structured Google searches. The methodology relied on programmable search engines (PSEs), which used domain restrictions for two targeted search queries:

1. **Government websites:** The first search was limited to government website domains from priority countries (South Korea, Sweden, Denmark, Brazil, Kenya, Ghana, Rwanda, Nigeria, United States). The domains were selected by identifying where each country hosts information related to SMPs.
2. **International organizations:** The second search was restricted to domains of international organizations, which were selected through exploratory searches and expert consultation.

Figure 3 details all gray literature search parameters, which included more focused regenerative agriculture terms, page filtering for report-adjacent pages, and restriction to sites with PDF or Word files to focus the search on research documents. The first 100 results for both queries (relying on Google relevancy ranking) were screened for inclusion using the same criteria as the peer-reviewed screening stage. This gray literature review was supplemented with snowballing references from relevant papers.

Figure 3: Gray Literature Search Parameters



Source: Authors.

3 Guiding Frameworks

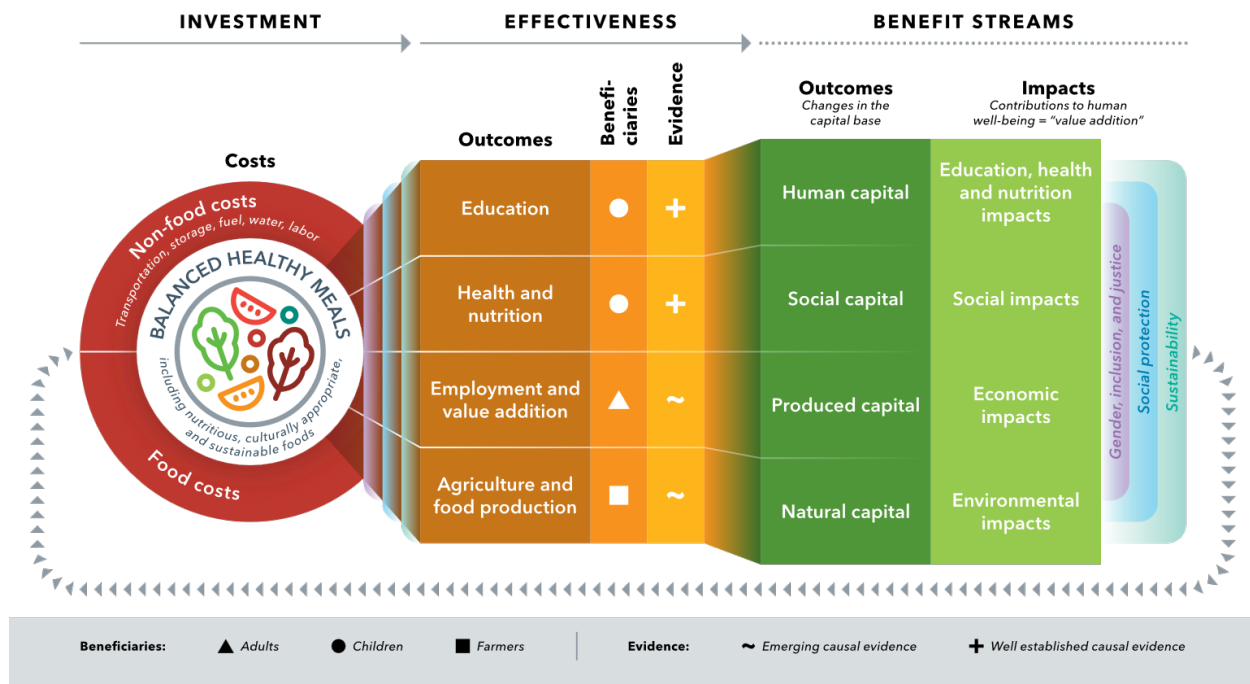
3.1 The TEEB for Agriculture and Food Evaluation Framework

The Economics of Ecosystems and Biodiversity for Agriculture and Food Evaluation Framework (TEEBAgriFood Framework) guided our conceptual framing to situate evidence on SMPs for (regenerative) agriculture (TEEB 2018). The Framework identifies and characterizes all relevant elements of agrifood systems, illuminating the externalities (positive and negative) of food systems, as a first step toward explicitly incorporating them in decision-making (see Annex 1). By providing key definitions and associated measurement concepts and boundaries, the TEEBAgriFood Framework establishes what aspects of agrifood systems should be included for a holistic assessment.

The TEEBAgriFood Framework includes four elements—stocks, flows, outcomes, and impacts—which capture a set of interactions between types of capital and human well-being. The stocks of agrifood systems comprise the four different types of “capital”—produced capital, natural capital, human capital, and social capital. These **stocks** underpin a variety of flows encompassing production and consumption activity, ecosystem services, purchased inputs, and residual **flows**. The dynamics of an agrifood system lead to outcomes that are reflected in the Framework as changes in the stocks of capitals, both quantitatively and qualitatively. In turn, these **outcomes** will have **impacts** on human well-being. The full potential of the TEEBAgriFood Framework is only realized when all stakeholders use it to guide decision-making toward a more sustainable and equitable global agrifood system.

Figure 4 illustrates our conceptualization of links between school meals and various types of evidence, drawing on the TEEBAgriFood Framework. This helps to better situate the current state of evidence on the effectiveness and benefits accrued from investments in SMPs. The figure focuses on four broad areas—education, health and nutrition, employment and value addition, and agriculture and food production—which, in turn, may have any one of four different outcomes and impacts. Cross-cutting issues of sustainability, social protection, gender, inclusion, and justice are included on the right of the figure because they are highly relevant to research on the effects of SMPs for differentiated outcomes and/or impacts. Importantly, the figure provides a high-level assessment of the literature in each of the broad effective outcomes of SMPs (e.g., education). The threshold of “causal evidence” is quite high, based on significant quantitative studies with valid counterfactuals. For the purposes of this paper, the evidence reviewed will be accompanied with a modified Figure 4 to help conceptualize and map the evidence specifically for the agriculture and food production area (see Figure 8).

Figure 4: Conceptualizing School Meal Program Evidence on Outcomes and Impacts



Source: Gelli et al. (2025).

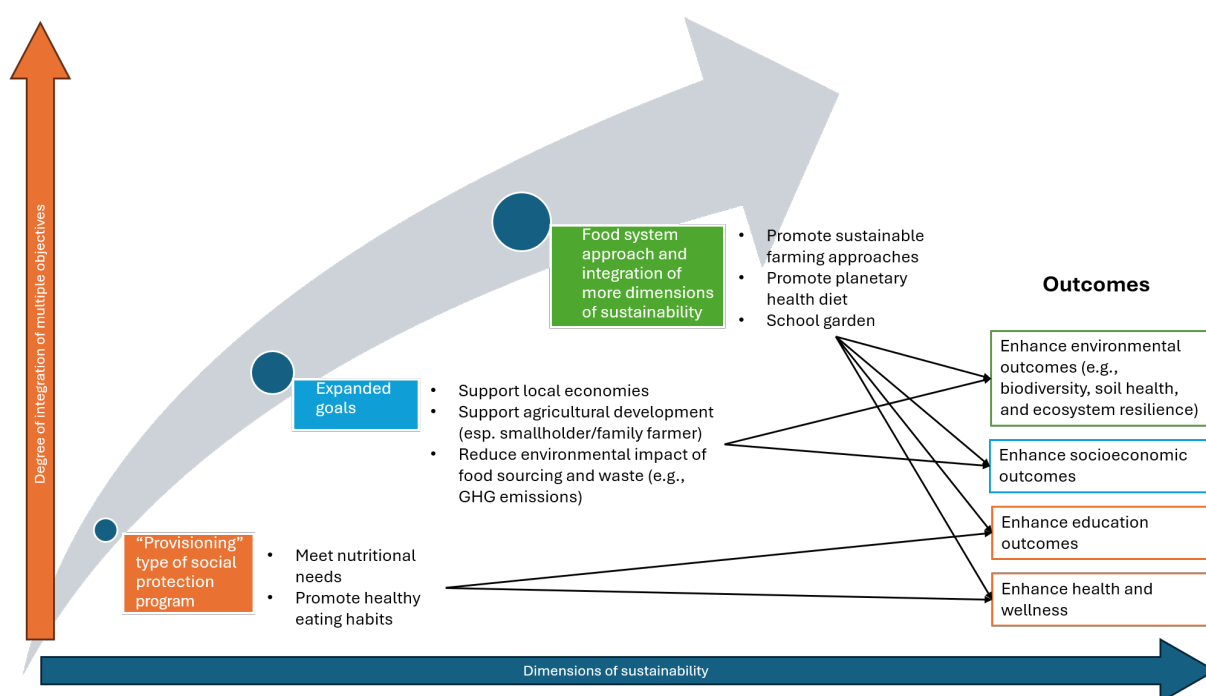
3.2 Integrated Policy as a Policy Paradigm

Evolution of the conceptual underpinning of SMPs has been marked by broadening program goals and additional outcome dimensions. Figure 5 illustrates how the initial conceptualization centered around SMPs, which serve as a “provisioning” type of social protection program to enhance pupil-related outcomes. This later expanded to include addressing the market constraints faced by small or family farms by using the public sector demand to drive a demand-assisted agricultural growth strategy (Sumberg and Sabates-Wheeler 2011). Supporting the local economy through sourcing food and services locally is another often sought-after goal. In recent years, increasing attention has been given to positive feedback and more integrated strategies that aim to simultaneously contribute to multiple dimensions of sustainability, marking a shift from growth-oriented to quality of growth-oriented objectives (e.g., Venegas Hargous et al. 2023). An integrated policy paradigm underscores the rationale for pursuing additional intended outcomes of SMPs, such as local employment and environmental sustainability, but more complex policies could also entail inherent trade-offs, and thus require evidence-based design and careful planning, including optimization analyses (Eustacchio-Colombo et al. 2020).

The role of policy integration in the governance of cross-cutting policy problems has attracted increasing scholarly attention in recent years but remains under theorized (Candel and Biesbroek 2016). Examples such as Brazil’s Zero Hunger (Fome Zero) policy framework point toward efforts to effectively bundle social and economic goals, such as poverty reduction and food security, with

broader sectoral development such as agricultural development (Silva, Grossi, and França 2011). Despite the emergence of integrated policy as a policy paradigm worth pursuing to tackle the interconnectedness of global challenges, the evidence base for public food procurement is still developing (Candel and Pereira 2017). Public food procurement operates within a complex political and regulatory landscape (Tregear et al. 2022), which presents challenges for professionals seeking to achieve greater coherence in sustainability goals and better synergies across programs implemented by separate authorities or departments (Candel and Biesbroek 2016).

Figure 5: Conceptualizing School Meal Programs along an Integrated Policy Paradigm Spectrum



Source: Authors.

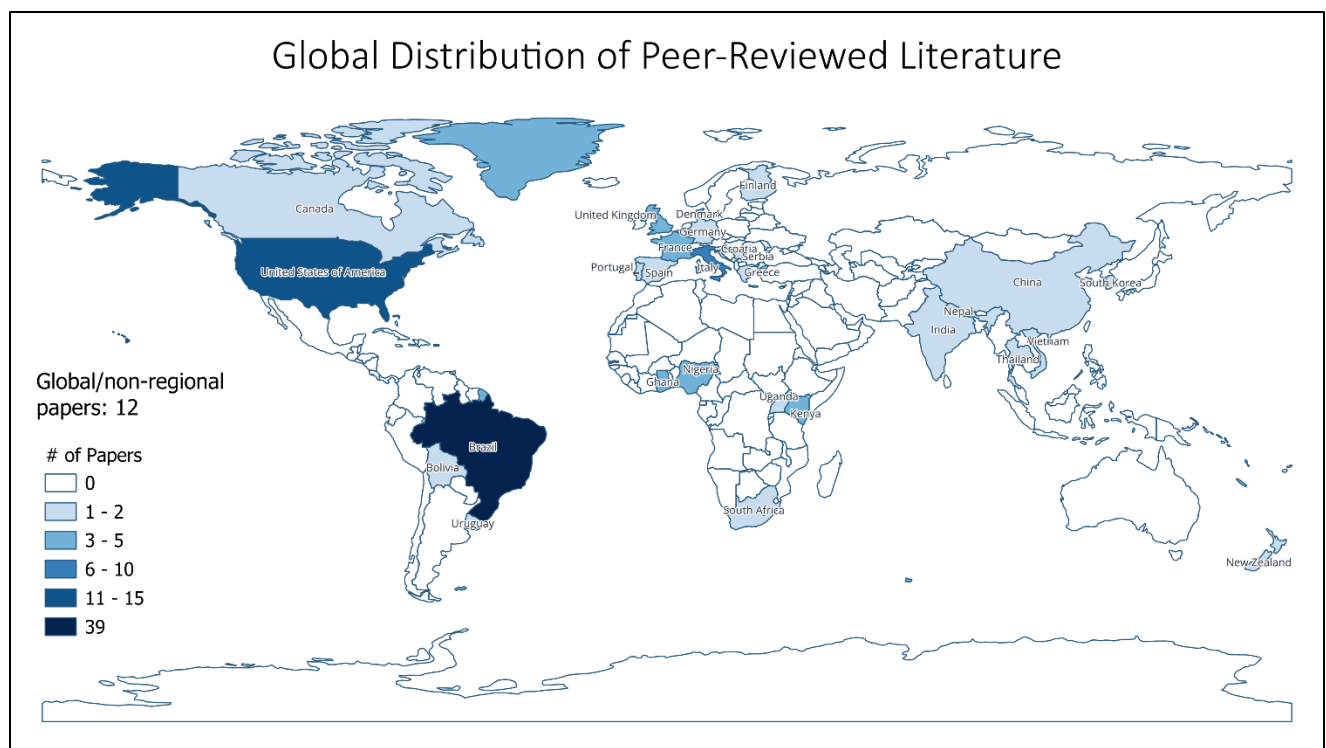
4 Overview of the Literature

The literature reviewed is diverse in geographic coverage, research methods used, and SMP design features. This section provides some high-level observations on each of those categories. The intent is to provide a descriptive overview of the characteristics of the literature before reviewing the key evidence mapped to the outcomes and impacts in a framework inspired by the TEEBAgriFood Framework.

4.1 Geographic Coverage

The reviewed literature reveals a geographically diverse but uneven distribution of research on how SMPs can contribute to incentivizing regenerative agriculture (Figure 6). While countries in South America and Europe dominate the discourse, important contributions also emerge from North America, Africa, Asia, and global comparative studies. Across these geographies, there is a continuum of urban–rural contexts that shape both the design and the feasibility of aligning SMPs with regenerative agricultural practices. Additionally, institutional and market contexts vary greatly, which also play a key role in determining the viability and effectiveness of SMPs.

Figure 6: Map Illustrating Geographic Distribution of Papers in the Review



Source: Authors.

4.1.1 South America: Leadership in Integrated Policies

South America—particularly Brazil—features most prominently in the literature, reflecting the region’s deep institutional experience with SMPs and its efforts to align these programs with broader food systems goals. Brazil’s National School Feeding Program (PNAE – *Programa Nacional de Alimentação Escolar*) is a foundational reference for effectively linking a decentralized SMP model with different types of agriculture (e.g., local, family farm, organic, agroecology). However, due in part to PNAE’s decentralized model, rural and urban areas have distinct experiences in implementation. Multiple studies indicate that the rural areas face higher

transportation costs and limited supplier diversity, whereas urban areas may have more resources but struggle to find sufficient quantities of local regenerative produce (Anjos, Lopes Filho, and Horta 2022; Azevedo et al. 2023; Chaves et al. 2020; Dias et al. 2019; Sidaner et al. 2013; Valencia et al. 2019).

4.2.1. Africa and Asia: Home-Grown School Feeding (HGSF) and Smallholder Integration

Research from Africa and Asia, while less abundant, provides crucial insights into the challenges and opportunities of linking SMPs with regenerative practices in low- and middle-income countries. In particular, the HGSF model goes beyond education and nutrition to tackle livelihoods of smallholder farmers and local communities and strengthen the nexus between nutrition, agriculture, and social protection.² For instance, Shrestha et al. (2020) explore Nepal's HGSF model, which aims to purchase food from local farmers while improving nutrition and education outcomes. Similarly, a series of studies look at the diversity of SMPs in sub-Saharan Africa (Di Prima et al. 2022; Elolu and Ongeng 2020; Gelli et al. 2018, 2021; Kamau et al. 2025; Proietti, Jordan, and Borelli 2025; Sumberg and Sabates-Wheeler 2011). These studies underscore the importance of rural contexts, where farming is often subsistence-based and infrastructure is limited. Barriers such as inconsistent production, lack of farmer training in agroecological methods, and poor storage or transportation facilities complicate efforts to institutionalize regenerative supply chains. Nonetheless, these initiatives are often embedded within broader development strategies and show potential for supporting both ecological resilience and rural livelihoods.

4.2.2. Global and Comparative Studies

Several studies adopt cross-regional or global perspectives, offering broader frameworks for understanding the conditions under which SMPs can support regenerative agriculture. For example, several systematic literature reviews have covered some of the key characteristics, impacts, and outcomes of SMPs (Chaves et al. 2023; Elinder et al. 2020; dos Santos et al. 2022). One in particular, by Oostindjer et al. (2017), conducted a comparative analysis of school food systems in 10 countries, highlighting the critical role of policy integration, multilevel governance, and educational alignment. Such studies help identify patterns and gaps across geographic and income-level divides, reinforcing the need for locally adapted, context-sensitive approaches. However, we did not find an existing literature review that focuses specifically on the connections between SMPs and agricultural production or even food systems.

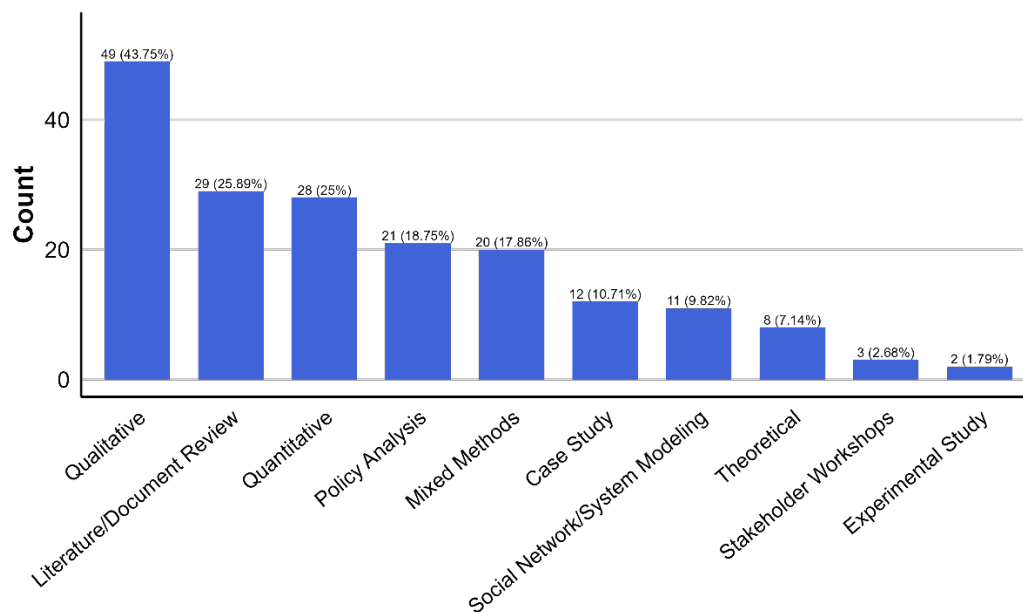
² <https://elearning.fao.org/course/view.php?id=529>

4.2 Methodologies Used Across the Literature

Regarding the methodologies found in the literature, our analysis revealed that qualitative approaches were the most frequently employed research methods, which is intrinsic to the aims and analytical frameworks of the studies dealing with transition processes (Figure 7). Systematic and scoping reviews were also commonly found but did not focus on establishing connections between SMPs and regenerative agriculture. Quantitative approaches, which were less common, utilized existing government or program datasets and larger, cross-sectional surveys. Additional studies contributed to developing theoretical models and mapping systems of stakeholder connections. A small group of studies used a mixed-methods approach.

Quantitative studies often relied on program indicators or administrative data to evaluate implementation outcomes. When quantitative methods were used, sample sizes were often small and based on local-level case studies. Two quantitative studies of note are one that utilized US national-level data (O'Hara and Benson 2019), and one that used the abbreviated Women's Empowerment in Agriculture Index (A-WEAI) in 75 farm households in Brazil (Valencia et al. 2021). Given the local nature of quantitative studies, it is difficult to draw generalizations to populations outside of the study area. A greater integration of qualitative and quantitative methods could generate more robust and complementary results.

Figure 7: Methods Breakdown of Peer-Reviewed Literature



Source: Authors.

4.3 School Meal Program Design Features

4.3.1. Type of Targeted Agriculture

Most of the studies we reviewed focused on local family farms and/or smallholder agriculture, broadly defined. Given the overrepresentation of Brazil's PNAE in the studies, this is unsurprising. However, the focus on agriculture in terms of size and/or proximity reveals the difficulty SMPs face in incentivizing specific agricultural practices. For example, while local procurement may have social (e.g., connectivity) or environmental (e.g., lower emissions) benefits, it does not necessarily promote regenerative practices. Similarly, the term "family farm" is more closely associated with sociological and/or economic understandings of agriculture, with few studies on the specific practices or environmental sustainability of family farming (Fuller et al. 2021). Not all countries have unified definitions of family farms or local agriculture, which further complicates better understanding how SMPs might target specific producer groups.

Another common type of agriculture in the reviewed literature was organic farming, particularly in upper-middle and high income countries (c.f., Baek and Radziwon 2023; Delgado 2021; He and Mikkelsen 2014; Silverio and Sousa 2014). This is also not surprising, given that organic food is often subject to government legislation that defines and certifies organic production. Additionally, organic food is commonly viewed as more nutritious and sometimes more sustainable, especially when it comes to fresh fruits and vegetables for SMPs (dos Santos et al. 2022).

Outside of the review, the Global Child Nutrition Foundation's 2024 Survey of School Meal Programs found that 44% (93) of programs reported "agriculture" to be one of their objectives, up from 35% in 2018. Among these, 91% (79) had outlined objectives to support smallholder farmers and 47% (41) of these programs specifically targeted climate-friendly foods, compared with only 30% (31) of SMPs for which agriculture was an objective. Agriculture-focused SMPs were largely managed either centrally or with a combination of centralized and decentralized structures (58%). However, a significant number of programs used semi-decentralized, third-party, or decentralized models that relied on either local or regional governments. Fifty-three percent of these SMPs procured 70% or more of purchased food for the program from local sources. The programs that appear closest to making potential linkages between SMPs and regenerative agriculture are those that report agricultural goals, attempt to support smallholders, and target climate-friendly meals, of which there are 37 programs. Of these, 56% are located in Africa, 17% in Asia, 14% in Europe, and 12% in North America (GCNF 2024).

4.3.2. Food/Menu Selection

A common element of SMPs that features prominently in the reviewed literature is the selection of school menus. How school menus are established is highly correlated to the SMP implementation model (e.g., decentralized, HGSE, etc.). Several studies explored the utility of using school menu selection optimization software, which analyzes potential outcomes associated

with meal choice (Fernandes et al. 2016; Proietti et al. 2025; Wall and Pearce 2024). Depending on the context and software, meal choice can then be modeled to analyze and in some cases optimize outcomes, such as greenhouse gas emissions (GHG), nutrition, food waste, and cost (Batlle-Bayer et al. 2021; Poinot et al. 2022; Tregear et al. 2022; Wall and Pearce 2024).

In the case of Denmark, school meals and snacks adhered to the New Nordic Diet (NND), developed by the OPUS Centre. The NND emphasizes seasonal, health-promoting ingredients sourced locally from Denmark and the Nordic region, with 75% intended to be organic. It features higher amounts of berries, cabbage, root vegetables, legumes, fresh herbs, potatoes, wild plants and mushrooms, whole grains, nuts, fish, shellfish, and seaweed, and less meat compared to the average Danish diet. Rapeseed oil is the primary fat source, and the macronutrient composition aligns with the Nordic Nutrition Recommendations (Damsgaard et al. 2012). Several studies focused on the environmental impact (e.g., GHG) of vegetarian versus meat-based school meals (Benvenuti et al. 2022; Dahmani et al. 2022; Kim and Kim 2023; Poinot et al. 2022). Those studies represent significant geographical diversity but there is a consensus that vegetarian meals are generally more favorable for the environment. Notably, however, no study incorporated local procurement as one of the factors for measurement or analysis.

Methods of menu selection vary, even within countries. For example, Fabri et al. (2015) propose using a decision tree for nutritionists to incorporate regional foods in Brazil. In France, nutritional guidelines are used for menu selection (Poinot et al. 2022), which was broadly identified as a common practice. However, menu selection tended to focus more on desirable criteria from policymakers and/or nutritionists (e.g., nutrition) than on (local) available supply. The implications are that procurement models for SMPs tend to focus more on driving demand for desirable products than on relying on existing supply. More research is needed on the implications of balancing demand for specific products (e.g., staples vs. fresh vegetables) with the supply of existing foods within a given foodshed.

4.3.3. Incentive Mechanisms

In addition to diverse types of agriculture and ways to establish school menus, there are also a range of ways SMPs can incentivize agricultural practices, although often indirectly. For example, in Viet Nam, Di Prima et al. (2022) studied an HGSF program that provided a one-time grant of a relatively small amount of money (\$172-229) to farmers as an incentive to adopt improved agricultural practices. In Brazil, the PNAE has two incentive mechanisms for agricultural production: a mandate that municipal governments must disburse at least 30% of the funding to local family farmers, increasing to 45% in 2026, and a 30% price premium offered by the PNAE for organic, agroecologically produced food (Wittman and Blesh 2017). In Jeonbuk, South Korea, the provincial government decentralized certification for local canteens to source locally processed food such as tofu and soy sauce, but the public meal center also had the authority to penalize farmers who violate production rules, such as pesticide overuse (Baek and Radziwon 2023).

4.3.4. Political Will and Governance

Depending on the program type, different levels of governance can play a crucial role in integrating regenerative agriculture with SMPs. Perspectives on governance and local coordination vary widely in the literature. For some cases, as in the HGSF program in Viet Nam, local “change agents” played a key role in harnessing the capacity of local farmers who used “nutrition-sensitive production systems” to support school meals in their community (Di Prima et al. 2022). In other cases, such as in South Korea, research focused more on the coordination between producer organizations and other value chain actors and governmental agencies at multiple scales (Baek and Radziwon 2023). Beyond vertical integration of the SMP supply chain, some research also pointed to the importance of state-based agricultural institutions, such as rural extension, to support farmers’ productive capacity and to share information on policies (Guerra et al. 2017). In Ghana, coordination and facilitation of market engagement between smallholders and SMP procurement was also a key element of a pilot intervention aimed at strengthening smallholder linkages (Gelli et al, 2021).

For more centralized programs, political will at the national level was identified as important. The case of Brazil’s PNAE is illustrative in this respect. Although the country implemented a decentralized approach to national school feeding 45 years ago, more recent federal reforms to connect school feeding to local family farming date back only 15 years (Nogueira et al. 2016). Although Brazil’s PNAE is implemented at the municipal level, some municipalities are very large relative to other countries. Political will is therefore important at multiple levels, which is relative to different countries, to push the boundaries of SMPs, especially beyond more conventional outcomes like nutrition and education, to incentivizing more sustainable agricultural practices. In short, governance and political will are important factors identified in the literature.

5 Findings

5.1 Conceptualization and Framing of Evidence

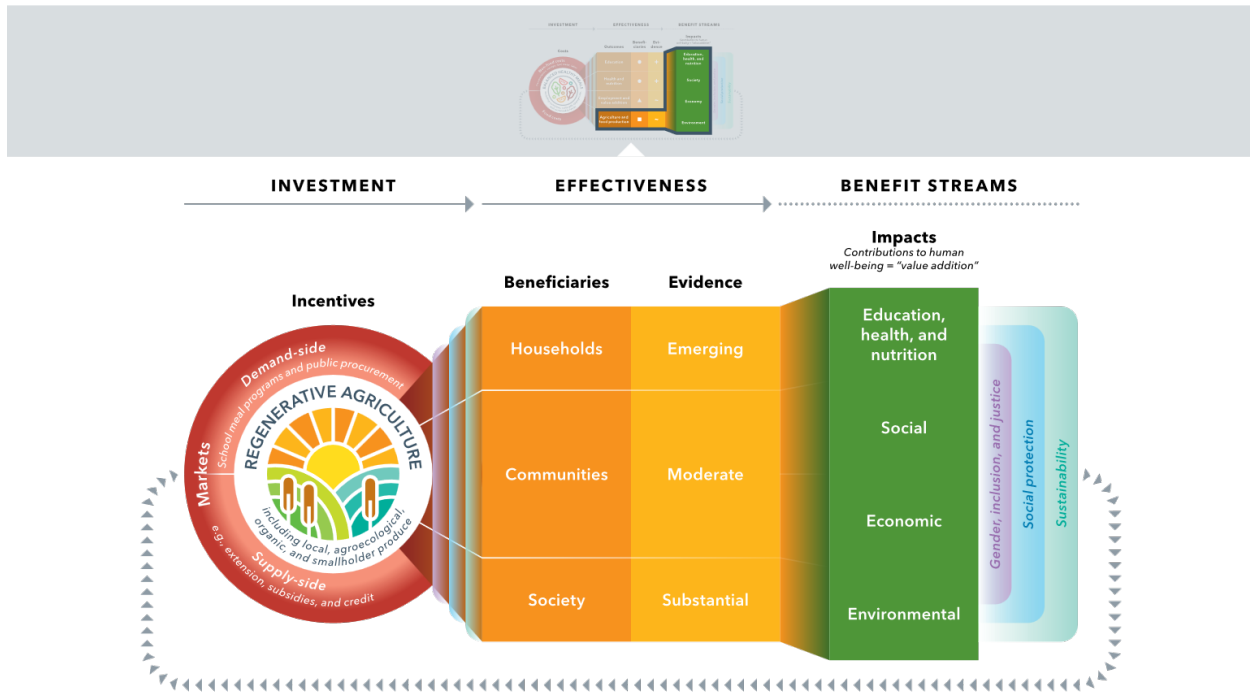
This literature review identifies evidence on connections between agricultural production, with a focus on aspects of regenerative agriculture, and SMPs. While the evidence is tenuous, at best, on the connections with specific types of agricultural practices (e.g., regenerative), an overwhelming majority of the literature reviewed unsurprisingly points to SMPs as having the *potential* to positively support agricultural production and rural livelihoods. In the literature, SMPs, and public procurement more generally, are often viewed as offering a “structured,” “mediated,” or “institutional” market, and sometimes “structured” demand (Di Prima et al. 2022; Guerra et al. 2017; Valencia et al. 2019; Wittman and Blesh 2017). This perspective argues that state intervention in markets can be directed to link small agricultural producers with vulnerable populations, including schoolchildren and populations experiencing food insecurity. The incentive is more stable prices and income opportunities for producers while potentially also improving food

security and social development (Cecconello et al. 2023; Nehring, Miranda, and Howe 2017). While there appears to be consensus on the broad understanding that SMPs and public procurement offer the potential to intervene in the market, for example to direct benefits to smallholders, there is less of a consensus on the best ways to support specific agricultural practices and what kinds of practices to support. Therefore, **our review did not find convincing evidence of a causal linkage between SMPs and regenerative agriculture.** This section outlines some of the key factors identified in the literature regarding how SMPs are currently incentivizing agricultural practices.

We propose a conceptual framework for understanding and integrating regenerative agriculture and SMPs for food systems transformation (Figure 8). Expanding on Figure 4, Figure 8 maps the evidence reviewed in this study specifically for the agriculture and food production area. Regenerative agriculture is placed on the left to see how linking production, including agroecological, local, organic, and smallholder production, to SMPs can contribute to a range of outcomes and impacts. Given the extremely limited evidence on the relationship between SMPs and regenerative agriculture, the scope is widened to include other types of production. The red circle surrounding regenerative agriculture refers to the market ecosystem within which agriculture responds to different incentives. Currently, we split policy interventions into demand side (public procurement and SMPs) and supply side, which includes policies aimed at boosting productivity. We found that this wider scope was better able to capture the full suite of incentives shaping agricultural practices, but the review focuses specifically on the relationship between demand-side interventions (school meals) and differentiated models or concepts of agricultural production (e.g., agroecology, family farming, local, smallholder).

Additionally, the bar for what counts as evidence is significantly lowered from causal evidence as displayed in Figure 4. Here we define, in relative terms, three categories of evidence strength or evidence rate: present, moderate, and substantial, where present represents the least amount of evidence and substantial represents the most, though still below the bar for causal interpretation. The levels of evidence are relative to the literature that is included in this review, and not the broader literature on regenerative agriculture or school meals. As such, we see that environmental outcomes had the most evidence in this review, relative to economic, social and education, and health and nutrition outcomes.

Figure 8: Conceptualizing Regenerative School Meal Programs



Source: Authors, based on Gelli et al. (2025).

5.2 Outcomes and Impacts

SMPs have the potential to generate a wide range of outcomes beyond the immediate goal of providing food to children. Evidence from diverse countries shows that as these programs improve child health and nutrition, they can also provide economic benefits, contribute to environmental sustainability, and provide social outcomes (Figure 8). This section organizes evidence on the differentiated outcomes of SMPs across the literature. Annex 2 provides a summary of the most relevant studies.

5.2.1 Education, Health and Nutritional Impacts

As mentioned, there is ample strong literature on child-level outcomes of SMPs. Our focus here is on regenerative agriculture SMP studies that also reported on child-level outcomes. Evidence from Brazil, China, Nigeria, Thailand, and Viet Nam shows a potential for increased dietary diversity, better quality food, and improved access to nutrient-rich meals for students when food is sourced from local producers. Programs such as HGSF and farm-to-school have led to more consistent consumption of fresh fruits, vegetables, and meat, both in school and at home (Alderman, Bundy, and Gelli 2024; Di Prima et al. 2022; Liu, Liu, and Bi 2023; Oostindjer et al. 2017). In Brazil's PNAE, multiple studies report increased variety, preservation of traditional cuisine, and improved food quality when family farms are integrated into supply chains (Affonso et al. 2025; Calixto et al. 2021; Schwartzman et al. 2017; Soares et al. 2017; Tuliende et al. 2024). Studies from Nigeria show that the national HGSF program has potential to contribute toward improved nutrition,

development, and broader improvements in health and education outcomes among rural schoolchildren (Okah et al. 2023; Okolo-Obasi and Uduji 2024). In Kenya, respondents reported perceived improvements in the health of children associated with the provision of school meals that were sourced from farmers implementing agroforestry practices (Borish, King, and Dewey 2017).

5.2.2 Social Impacts

SMPs can play a meaningful role in preserving local food cultures and traditional knowledge. In the Brazilian Amazon, the PNAE program has been shown to stimulate agrobiodiversity and support the preservation of local food practices, as schools began offering meals prepared with familiar, regional ingredients. Community members reported improved relationships between schools and local producers because of these efforts (Affonso et al. 2025). Similarly, Schwartzman et al. (2017) highlight that local procurement under PNAE not only improved the quality of life for family farmers but also contributed to the preservation of local food culture. In Southern Brazil, the implementation of family-farming food purchases increased the visibility of rural areas and improved school meal quality by diversifying menus and incorporating fresh, seasonal foods tied to local food traditions (Tuliende et al. 2024).

Studies also show that social responsibility among both institutional actors and community members can be fostered through SMPs. For example, Galloway et al. (2023) note that local food procurement is often motivated by social values, such as community solidarity and equitable development, though its success depends on policy support and adequate infrastructure. In Viet Nam, micro-entrepreneurs involved in school meal preparation were driven not by financial gain, but by a deep sense of commitment to community well-being. They shared recipes and healthy cooking practices with parents to combat undernutrition and improve child health (Di Prima et al. 2022). Similarly, in South Korea, school meal support centers operated by municipalities and cooperatives function as more than procurement hubs—they also serve as platforms for capacity building, knowledge exchange, and inclusive governance, facilitating close collaboration between farmers and school kitchens (Baek and Radziwon 2023).

5.2.3 Economic Impacts

A consistent finding across several country contexts is that connecting smallholder farmers to school meal markets improves household income, enhances food security, and reduces postharvest losses (Barnabas et al. 2023; Bisht, Rana, and Pal Ahlawat 2020; Di Prima et al. 2022; Liu et al. 2023). Valencia et al. (2019) observe that farmers participating in Brazil's PNAE increased their household autonomy by allowing farmers to diversify their farming systems as their main economic activity and they allowed farmers to provide food for their own households, which reduced their exposure to unpredictable markets. The degree to which these dimensions of autonomy were experienced by farmers varied by farm size. Wittman and Blesh (2017) found that while there was no significant difference in income between PNAE participants and non-

participants, those who sold through PNAE were able to better plan their finances due to the guaranteed market, which also served as a crucial entry point for accessing other markets.

In Nigeria, linking farmers with caterers under an HGSF program created reliable demand for vegetables and cereals, thereby improving livelihoods (Barnabas et al. 2023). Moreover, global evidence shows that local sourcing can create jobs and increase wages along the food value chain. For example, the Good Food Purchasing Policy in Los Angeles generated over 200 food chain jobs and redirected \$10 million to local producers (Godrich et al. 2023). In China and Viet Nam, local procurement was associated with improved household food security, lower food expenditures, and better prices for surplus production (Di Prima et al. 2022; Liu et al. 2023). Mensah and Karriem (2021) showed that farmers in South Africa have been able to expand their business by growing other vegetables, and that purchasing from local farmers reduces food procurement transportation costs. At the macro level, local economic multiplier effects have been modeled based on empirical data from several European countries, where catering contracts with higher local spending generated added value for local economies, with multiplier effects ranging from 1.59 to 2.46 (Tregear et al. 2022).

5.2.4 Environmental Impacts

SMPs have considerable potential to support environmental sustainability through increased farm-level agrobiodiversity, reductions in GHG emissions, and reduced food waste. In Brazil, Valencia et al. (2019) found that farms participating in PNAE had significantly higher agrobiodiversity, measured by total food species and horticultural plot richness, compared to control groups. Farmer interviews indicated that PNAE participation influenced shifts from input-intensive to more diversified, low-input systems. Among the 20% of already market-oriented farmers, the program's price premiums for certified agroecological products incentivized transitions to organic practices. Valencia et al. (2021) further found that PNAE participation was the strongest positive predictor of both horticultural and species richness.

Several studies show that shifting school menus toward more sustainable options has the potential to significantly reduce GHG emissions. These mitigation effects can be achieved through three channels, either alone or bundled: how food is produced (e.g., regenerative vs. conventional), how food is sourced (e.g., short vs. long supply chain), and what food items are offered (e.g., plant-based vs. carbon-intensive beef). The production channel is the most relevant to the current study. In Europe, school meal reforms that focused on sustainable sourcing also led to measurable reductions in emissions (Tregear et al. 2022). In Spain, replacing conventional products with organic options in school canteens could reduce GHG emissions by up to 15% (Perez-Neira et al. 2021a). In France, school menus with higher proportions of vegetarian meals, exceeding national guidelines, produced lower emissions, with beef and lamb dishes contributing the highest GHG levels (Dahmani et al. 2022). In Italy, minimizing beef and dairy in menus led to a 22% reduction in GHG emissions per meal, while maximizing pulses achieved a 12% reduction, with winter menus yielding slightly greater benefits in terms of GHG emissions reductions (Petruzzelli et al.

2023). In Australia, modifying menus based on student preferences in a decentralized system led to reductions in food waste (Chote et al. 2022).

5.3 Barriers and Challenges for Implementation

A range of barriers constrain the procurement of sustainable food in SMPs. These include financial constraints on both the supply and demand sides, limited technical capacity among farmers and institutional staff, inadequate infrastructure and logistics, weak price and procurement incentives, and resistance from key stakeholders. These challenges restrict the ability of school feeding initiatives to consistently source diverse, locally produced, and sustainably grown food. The following sections outline how these barriers manifest across different contexts and the actors involved in implementation.

5.3.1 Financial Constraints

Financial constraints on both the supply and production sides pose significant barriers to the implementation of SMPs. In Brazil's Food Procurement Program, which provided incentives for agroecological and organic production, limited labor availability and high production costs were key barriers to crop diversification, particularly for fresh fruit and vegetable production using agroecological methods (Wittman and Blesh 2017). In South Korea, farmers struggled with the high costs of implementation and limited technical capacity, which restricted efforts to diversify school meal offerings (Baek and Radziwon 2023). Uganda presents another example, where rural women food vendors were eager to supply nutritious products for school meals but lacked the financial resources to meet nutritional standards (Elolu and Ongeng 2020). In the Farm to School program in the United States, smaller districts could not benefit from economies of scale and face higher prices for local food (LoPresto, Dang, and Dove 2025).

On the demand side, constrained school and municipal budgets restrict the ability of schools to provide meals. Budgetary limitations reduce the quality, quantity, and variety of food served, and decentralized program management can further complicate procurement, leading to food supply disruptions when municipal financial contributions are lacking, as seen in the United States, Finland, and Brazil (Lehtinen 2012; Oostindjer et al. 2017; Silva, Delgrossi, and Pantoja 2023). The absence of legislative frameworks also affects budgets by causing uncertainty. Xie et al. (2022) report that the County Early Childhood Development and Education feeding program in Kenya faces unstable funding, which is linked to the absence of legislation guaranteeing permanent government financial support. Similarly, Elolu and Ongeng (2020) note that foods once provided by NGOs are now too expensive for parents to afford and there are no laws to enforce mandatory school feeding. Higher county income levels and larger school districts and populations are associated with a greater likelihood of local food purchases in the United States (O'Hara and Benson 2019). In Ghana, the inability of the government program to provide payments for caterers on time means the caterers cannot pay smallholder suppliers on delivery, which in turn may be a binding constraint in terms of smallholder participation in the supply chain (Gelli et al., 2021).

5.3.2 Lack of Technical Capacity

The lack of technical capacity across procurement, coordination, food preparation, and ability to adhere to nutritional standards undermines the effective implementation of SMPs. At the institutional level, staff often struggle to understand the importance of sourcing directly from family farmers, face difficulties in issuing necessary documentation, and experience a shortage of technical personnel, particularly when working with traditional communities (Schwartzman et al. 2017). Silva et al. (2023) report that in municipalities like São Gabriel, Brazil, the local authority for technical assistance and rural extension was inactive and failed to engage with local education authorities to support implementation of the PNAE program. De Souza et al. (2023) add that limited adoption of organic and agroecological methods among producers, despite national procurement legislation, reflects not only a lack of supportive policies but also a poor understanding of program goals among implementation actors.

Human resource issues also constrain the implementation of SMPs. In South Korea, Baek and Radziwon (2023) identify the absence of trained personnel as a constraint for schools attempting to source from family farmers. Similar issues are evident in the United States, where Harris et al. (2012) find that Farm to School programs face challenges such as a lack of skilled food preparation labor, which compounds concerns over cost, food safety, and product availability. In Brazil, Ferreira et al. (2019) find that many cities lack enough nutritionists, which leads to poor menu planning and weak implementation of food and nutrition education.

Limited technical knowledge in nutrition and agroecology limits smallholder participation in school feeding schemes. In Uganda, Elolu and Ongeng (2020) report that although rural women food vendors were enthusiastic about contributing to school meals, they lacked the technical knowledge required to meet nutritional guidelines. Wittman and Blesh (2017) also observe that low labor availability is a barrier to crop diversification in Brazil, particularly for fresh fruit and vegetable production under agroecological models.

Furthermore, gathering key information such as price data to inform program design can be technically intensive and resource consuming, but the lack of reliable price information could discourage implementation. Until 2019, the Secretaria Municipal de Educação (SEMED), one of the agencies managing PNAE in Brazil, conducted at least three price surveys in the local or regional market to formulate the amount to be paid for family farming products (Alves Da Silva, Pedrozo, and Nunes Da Silva 2023). In 2020, this price survey was performed by a Municipal Secretariat of Agriculture employee. For organic or agroecological products, if there was no way to research the price, it was possible to overprice by up to 30% in relation to conventional products, based on a case study of the municipality of Porto Velho in the state of Rondônia (Alves Da Silva et al. 2023).

5.3.3 Infrastructure and Logistics

Transport and logistics infrastructure are consistently identified as bottlenecks across contexts. Martinez, de Lourdes Saturnino Gomes, and Marini (2023) find that the coordination of food transportation by school feeding councils is a major constraint to program efficiency in Brazil. Chaves et al. (2023) and Perez-Neira et al. (2021a) also point to inefficient logistics systems and underdeveloped distribution channels as barriers to scaling school feeding initiatives. In Brazil's cities and urban centers, Dias et al. (2020) note that geographic distance from production zones hinder cities' ability to meet the 30% procurement target from family farmers. Wittman and Blesh (2017) found that long travel distances and poor roads often led to fresh produce being damaged while in transport. In South Korea, Baek and Radziwon (2023) report that schools sourcing from family farmers face challenges that include the financial burden of investing in physical storage and distribution infrastructure. Interviews with nutritionists in Southern Brazil revealed that the lack of both supply and infrastructure for food production and delivery hindered purchase of family farmed food for the school feeding program (Tuliende et al. 2024).

According to Harris et al. (2012), a number of different challenges can hinder institutional purchasing of local foods and the growth of Farm to Institution activities in the United States. Primary issues include sourcing products, cost and seasonality of local products, food safety and liability, and lack of skilled labor for food preparation. Because many factors account for cost of food, it is difficult to make direct cost comparisons between food from conventional distribution compared to short-supply chain sources, and quantitative data are limited. When making such comparisons of costs between local and conventionally purchased products, quality factors may also be considered, including taste, freshness, nutritional quality, and other factors related to utility and value in food service.

5.3.4 Stakeholder Resistance

Farmer resistance and lack of buy-in was identified in several Brazilian municipalities. Silva et al. (2023) report that in cities like São Gabriel, both the municipal nutritionist and the Secretary of Education observed low levels of farmer interest in participating in public programs such as PNAE. Moreover, farmers in regions like São Gabriel and Rio Pardo were reluctant to form cooperatives, which significantly limited their ability to meet the diversity and volume of products required for school feeding contracts. Ferreira et al. (2019) highlight that in Santa Catarina, Brazil, school lunch staff showed reluctance to serve organic food despite legal mandates for organic food procurement. Their resistance was often based on concerns about the appearance of organic products, their higher prices, and a lack of formal organic certification. Rockett et al. (2019) find that meeting the demand for local foods in schools was challenging due to a lack of organization and interest from the producers. In a UK experiment, a new technological innovation called Dynamic Food Procurement, which aimed to enable the efficient bundling of local produce for school catering, buyers faced obstacles to operation partly because the county council felt unable to risk any legal

challenges that might follow deviations from the service it outlined in its original procurement tender (Keech, Maye, and Reed 2025).

Disparities in institutional commitment are also evident in initiatives like Food as Medicine (FAM) in the United States. Gonzalez et al. (2025) note that rather than fostering genuine partnerships with local communities, many FAM programs are driven by large healthcare institutions and well-funded private actors. This trend has translated into unequal funding flows, benefiting large corporations while marginalizing the small- and medium-scale local producers that FAM was originally designed to support.

5.4 Enabling Factors and Success Conditions

Supportive government policies, community ownership, inter-institutional collaboration, culturally relevant approaches, holistic approaches, and management types play a critical role in enabling program success in building sustainable SMPs. These enabling conditions help to build resilient procurement systems, strengthen local food economies, and align nutritional goals with sustainable agricultural practices. This section outlines the institutional, social, and operational elements that have supported more sustainable and inclusive models of school feeding globally.

5.4.1 Government and Policy Support

Strong government leadership and an enabling policy environment are foundational to successful SMPs. Institutional support not only creates the regulatory foundation for program design but also signals long-term political commitment, which mobilizes actors across stakeholder groups. A key enabling condition is the government's capacity to manage the program (Kretschmer, Spinler, and Van Wassenhove 2014). The development of a new technological innovation in the United Kingdom, Dynamic Food Procurement, designed to enable the efficient bundling of local produce for school catering buyers, did not progress to implementation, partly because of the lack of meaningful encouragement from the national government. In this case, the national government withdrew support for logistics for collective municipal food procurement in the region (Keech et al. 2025). Bandoni et al. (2024) stress the need for regulatory frameworks that guide and promote sustainable approaches within school feeding systems. Similarly, Teo (2018) underscores the importance of ensuring adequate infrastructure to meet legal standards for food quality. Political leadership and advocacy further enhance program visibility and resource mobilization. In Kenya, Xie et al. (2022) illustrate how high-level political “champions” played a critical role in securing funding and institutional support for early childhood school feeding.

Secure government contracts can also reduce risk and encourage farmer participation. Alderman et al. (2024) note that secure procurement contracts with schools help lower transaction costs and offer farmers price and volume certainty. Fernandes et al. (2016) report similar findings from Ghana, where the School Meals Planner Package pilot improved communication between caterers and local producers and supported the use of forward contracts. SMPs create reliable demand for

ingredient suppliers, who are then more likely to provide both products and nutritional information that align with program guidelines (Chote et al. 2022).

5.4.2 Community Ownership

Successful implementation of SMPs relies on meaningful community involvement and shared ownership of the program (Borish et al. 2017; Gonzalez et al. 2025). Gonzalez et al. (2025) argue that achieving food sovereignty requires communities to be involved in shaping the policies that affect them and to be equipped to challenge structural inequities that perpetuate food insecurity. They find that educational initiatives focused on social entrepreneurship and business development, led by community members themselves, are more effective than externally driven approaches. Chote et al. (2022) report that when suppliers have a good working relationship with government actors, it enables them to supply needed ingredients. Effective coordination across the meal supply chain requires active community engagement. Souza and Villar (2019) suggest that the decentralized acquisition of food in Brazil presupposes closer collaboration between schools with farmers. They also observe that a higher percentage of school meal programs managed either at the school level or under mixed arrangements purchased food from family farmers.

Strengthening local capacity and accountability mechanisms further enhances community ownership. Shrestha et al. (2020) identify capacity building among local stakeholders and community ownership and accountability mechanisms as elements of success for local food procurement in SMPs. Mainje et al. (2024) highlight community involvement, particularly in funding decisions, participatory planning, and stakeholder perceptions as foundational for effective implementation of SMPs. In Viet Nam, selecting motivated local candidates to operate food microenterprises was successful because entrepreneurs were not driven by profit, but rather by a commitment to reducing undernutrition in their communities, and continued to serve families even when they could not afford to pay (Di Prima et al. 2022).

5.4.3 Inter-institutional Collaboration/Multistakeholder Participation

Collaboration across ministries and stakeholder groups at both national and local levels is essential to the long-term sustainability of SMPs. At the national level, Verguet et al. (2023) find that initiatives managed through multiple ministries are better positioned to secure sustainable funding, particularly from ministries of finance, than those overseen by a single ministry. This inter-ministerial coordination also helps embed programs into national policies.

At the local level, effective implementation relies on strong intersectoral collaboration. Analyses of Brazil's PNAE by Sidaner et al. (2013) and Gaitán-Cremaschi and Valbuena (2024) highlight the importance of government leadership, cross-sectoral decision-making, and civil society advocacy. Oostindjer et al. (2017) find that the success of Rome's school meal reforms was enabled by coordinated efforts among municipalities, city councils, businesses, trade associations, and the public. In Kenya, Xie et al. (2022) describe how the Early Childhood Development and Education

feeding program is delivered through cooperation between government departments, early childhood teachers, parents, and meal providers, many of whom come from vulnerable groups.

In addition to governance and implementation, support from producer networks strengthens program delivery. Guerra et al. (2017) and Chaves et al. (2020) emphasize the role of cooperatives, NGOs, and producer associations in promoting agroecological production and improving logistical capacity. These networks enhance smallholders' access to school food markets and help them manage challenges related to seasonality, production volumes, and procurement compliance. Social network analysis shows that 58 small family farms supplied vegetables to 203 schools in São Paulo, Brazil, through three cooperatives that move the products to a central depot where one private logistics operator collects and distributes the food (Maiellaro et al. 2022). In Rome, a permanent committee was created to allow public institutions, producers, and suppliers to meet on a regular basis to discuss problems and work toward common goals (Sonnino 2009).

5.4.4 Cultural Relevance

Culturally appropriate school meals tend to have higher acceptance within communities. In Kenya, Xie et al. (2022) report that children were served a nutrient-rich version of *uji*, a traditional porridge, by enhancing it with affordable, local ingredients like *omena* (dried fish). In the United States, Medically Tailored Meals and Medically Tailored Groceries are typically designed by registered dietitian nutritionists, 80% of whom identify as white. This often results in a lack of consideration of cultural food preferences. Involving communities in co-designing these meals enhances cultural relevance and acknowledges that food and nutrition knowledge extends beyond formally trained professionals (Gonzalez et al. 2025). Similarly, Aragi and Bandoni (2022) note that hiring nutritionists enables more culturally informed menu planning and direct engagement with local farmers.

5.5 Evidence Gaps and Research Needs

While there is a growing body of research on SMPs in connection with regenerative agriculture, significant gaps remain in the evidence base, both in terms of geographic coverage and thematic scope. Brazil is by far the most represented country in the literature, with 37 papers in the review, followed by the United States with 12 studies. Asia and Africa are underrepresented. Even within countries, many studies have a narrow geographic focus, focusing on smaller areas, meaning that results often cannot be applied nationally. National-level analyses are rare. In the review, only one national level dataset was identified: In the United States, O'Hara and Benson (2019) used the Farm to School dataset to estimate factors influencing local school expenditures for fluid milk and non-milk products. The lack of national level datasets limits the generalizability of findings. The first evidence gap is therefore on the **effectiveness and impact of different procurement models**.

Supply and producer perspectives are largely missing from the evidence. Only a handful of studies examine producer perspectives, and there is very limited evidence on the impact of SMPs on farmers' food security and incomes (Sidaner et al. 2013). The transition to regenerative agriculture

ultimately depends on producer decisions and capacities, making it essential to understand the incentives that may drive this shift from both qualitative and quantitative perspectives. The bulk of the literature focuses on SMP demand, with a focus on governments, schools, and students as actors in the space, leaving a significant gap in understanding supply-side dynamics. More research is needed on **situation and context analyses with specific attention to the production side**.

Links between SMPs and regenerative agriculture are scarce, and evidence of environmental outcomes is limited. Only Valencia et al. (2021) reported indicators related to regenerative agriculture in this review. As there is so little causal evidence, it remains unclear whether public procurement for agroecological foods actively drives the transition to regenerative practices, or whether already-diversified farms are more likely to participate. **Modeling long-term returns on investment** for biodiversity and climate change mitigation and integrating true cost accounting to capture environmental and social externalities, could help decision-makers better recognize the multiple benefits of these programs. A related research gap is on a **standardized framework to guide comparative methods and metrics** for SMPs. Other research needs, such as modeling and evaluation, will need to rely on standardized methods and metrics across diverse contexts and SMP models.

There are also significant research needs on the **processes, costs, and implementation of SMPs**, particularly in urban contexts, where supplying schools with food from local producers is challenging. Dias et al. (2020) found that the supply of food in Brazil from urban areas did not reach the 30% sourced from local farmers requirement due to longer distances from production zones and institutional bureaucracy. Future research should examine the difficulties large cities face in purchasing food produced by local farmers and propose actions that facilitate the logistics of delivering locally produced food (Amorim, Rosso, and Bandoni 2016).

Cross-sectoral engagement and political buy-in are crucial for the success of SMPs (Bandoni et al. 2024; Keech et al. 2025; Xie et al. 2022). These contribute to the enabling environment required to link SMPs to regenerative agriculture. Research is needed on **how to enhance stakeholder understanding** of the benefits of investing in school meals and to operationalize a whole-of-government approach that brings together the many areas of government including education, agriculture, health, social protection, and finance, that act as budget-holders and decision-makers. Harris et al. (2012) concluded that research and evaluation are necessary to continue to build the evidence base and best practices linking institutional purchasing of local foods to outcomes ranging from consumer health to regional economy development and job creation (Joshi and Azuma 2008). Given the interdependence of the stakeholders in local food systems, these evaluation efforts should also assess the relationships between individual stakeholders, as has recently been done in the US Farm to School system in Michigan (Harris et al. 2012).

Collectively, the evidence gaps point to the need for more geographically diverse, longitudinal, and comparative research, with stronger integration of producer perspectives and environmental outcomes. Addressing these gaps will be essential to understanding the full potential of SMPs in

catalyzing sustainable food systems transitions and will provide the basis from which governments and other actors can make informed decisions to incentivize this transition.

6 Conclusions

School meal programs are among the largest public investments in child well-being worldwide, and they hold untapped potential to act as levers for sustainable food systems transformation. This review shows that while SMPs consistently deliver positive outcomes for nutrition and education, there is only emerging evidence on SMPs' ability to impact livelihoods and community development. More specific causal evidence linking SMPs directly to regenerative agriculture remains non-existent. Much of the literature focuses on smallholder procurement, organic production, or agroecological practices more broadly, with relatively few studies explicitly measuring regenerative outcomes such as soil health restoration, biodiversity gains, or carbon sequestration.

Despite these gaps, important lessons emerge. Strong institutional and program design and implementation—anchored in supportive policy frameworks, secure procurement contracts, and participatory governance—has the potential to enable SMPs to extend their reach beyond schools to farming communities and local economies. Experiences from Brazil, Africa, and Asia highlight both opportunities and persistent challenges: weak infrastructure, limited farmer capacity, financial constraints, and fragmented governance structures often hinder integration of sustainable practices into school food systems. At the same time, cases of decentralized procurement, indigenous crop inclusion, and price premiums for sustainable produce demonstrate viable pathways forward.

The findings underscore the importance of enabling conditions for aligning SMPs with regenerative agriculture. Stable institutional demand can incentivize farmers to diversify production, reduce reliance on synthetic inputs, and experiment with climate-friendly practices—but only when complemented by technical assistance, infrastructure, and strong political will. More inclusive governance and culturally relevant menus further strengthen community ownership and long-term sustainability.

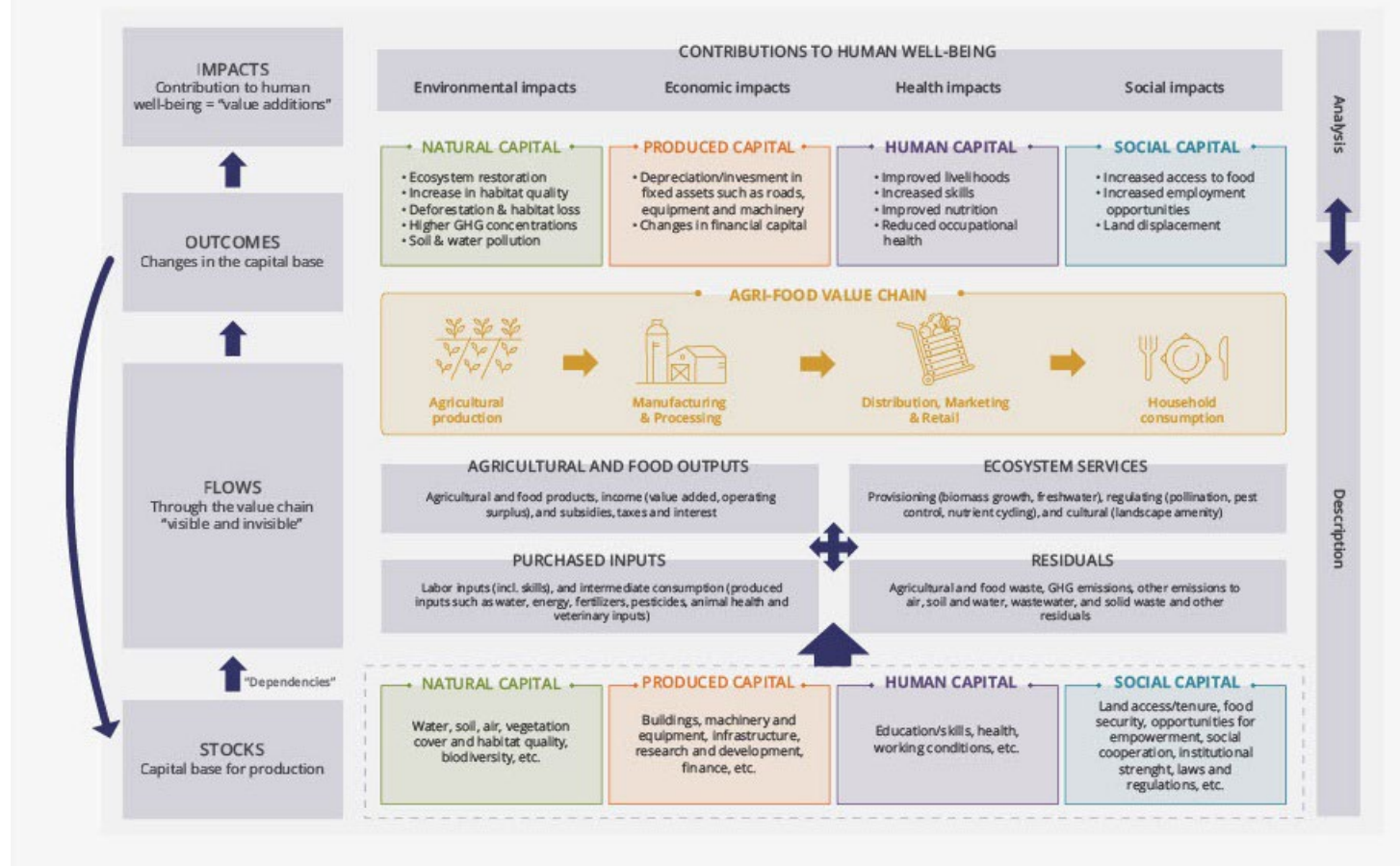
Looking ahead, advancing this agenda requires filling critical evidence gaps. Rigorous studies are needed to assess the ecological impacts of SMP-linked procurement, including soil health, carbon sequestration, and biodiversity outcomes. Comparative research across geographies would also help clarify which program models and policy environments are most conducive to integrating regenerative practices. Beyond technical measurement, future work must grapple with broader political and economic dynamics that shape procurement systems, farmer participation, and food system equity.

In sum, SMPs represent a unique and underutilized entry point for regenerative food systems transformation. By simultaneously nourishing children and investing in sustainable agricultural practices, SMPs can help bridge social, economic, and environmental goals. Realizing this

potential will depend on strengthening institutional frameworks, addressing implementation barriers, and building a more robust evidence base on the environmental benefits of linking SMPs with regenerative agriculture.

7 Annex 1: Elements of the TEEBAgriFood Evaluation Framework

Figure 6.3 Elements of the TEEBAgriFood Evaluation Framework (source: authors)



Source: TEEB (2018).

8 Annex 2: Summary of Most Relevant Literature

Title	Author/Date	Country	Methods	Outcomes
Towards a sustainable agri-food ecosystem: the case study of South Korean public food procurement	Baek & Radziwon (2023)	Korea	This article presents and discusses a unique case study in Jeonbuk, South Korea, which successfully transformed its agrifood system into an ecosystem via sustainability-oriented innovations. The research employed a multimethod approach, combining a case study, interviews, document analysis, and participant observation. Semi-structured interviews were conducted with eight key informants, and document analysis involved systematic evaluation of administrative documents and municipal ordinances. Participant observation was conducted at a workshop by the Ministry of Agriculture, Food and Rural Affairs of Korea. Data were categorized and coded using a phased approach, translating transcriptions from Korean to English.	This study demonstrates how stakeholders respond to a new SMP and identifies relevant institutions within public food procurement (PFP). The findings indicate that the meal center helped orchestrate knowledge exchange processes and integration of farmers and kitchens into the school meal value chain, enhancing communication and participation among school kitchens and producers.
Home-Grown School Feeding: Implementation Lessons From a Pilot in a Poor Ethnic Minority Community in Vietnam	Di Prima et al. (2022)	Viet Nam	A mixed-methods assessment of the HGSP intervention was conducted, focusing on qualitative data collection to provide complementary data on observed and perceived changes. Data were collected mainly through semi-structured interviews (n=30) and seven focus group discussions (n=76), alongside assessment of school meal diversity, cost, and food sources. Qualitative data collection took place between April and July 2020, with tools translated into Vietnamese for cultural appropriateness.	The home-grown school feeding (HGSP) intervention contributed to increasing the diversity of food consumed by children, with over 30% of foods used being home-grown. Respondents reported increased school attendance, improved children's food preferences and hygiene practices, and enhanced parents' caring and feeding practices.
Products purchased from family farming for school meals in the cities of Rio Grande do Sul	Ferigollo et al. (2017)	Brazil	This quantitative descriptive study utilized secondary data analysis from public calls-to-bid of local governments in Rio Grande do Sul, Brazil. The sample consisted of 52 cities, representing approximately 10% of the state's municipalities, with a focus on mesoregion and population size for selection. The study assessed 114 notices of public calls-to-bid from 2013.	Most of the analyzed cities (71.2%, n=37) reached or exceeded the 30% target for food purchased from family farming, as determined by the National School Feeding Program (PNAE) legislation. Public calls-to-bid showed a wide variety of mostly fresh products, with 90.4% (n=103) for plant products and 79.8% (n=91) for animal products. Fresh products appeared in 92.1% (n=105) of the public calls-to-bid. Centralized deliveries were the most common option at 49.1% (n=56), followed by weekly deliveries at 47.4% (n=54). Only 60% (n=68) of the public calls-to-bid contained the price of products.

Perception of the operating agents about the Brazilian National School Feeding Program	Ferreira et al. (2019)	Brazil	This observational, cross-sectional, and qualitative study gathered data from 43 nutritionists, 41 School Feeding Board members, and 16 school feeding administrators from 38 cities in Rio de Janeiro. Information was collected using a semi-structured questionnaire covering aspects like nutritionist adequacy, family farming product purchases, and educational activities. Qualitative data were analyzed using content and narrative analysis and statistical associations were investigated with chi-square testing.	Key challenges in implementing the PNAE included a low number of nutritionists, difficulties in purchasing from family farming due to bureaucracy and insufficient local production, and limited coverage of food and nutritional education. The adequacy of the number of nutritionists showed a statistically significant association with the purchase of family farming products ($p = 0.002$; power = 99%) and with food and nutritional education activities ($p = 0.021$; power = 79%). 90.7% ($n=39$) of nutritionists and 75.6% ($n=34$) of School Feeding Board members considered the number of professionals insufficient.
Pathways to agroecological management through mediated markets in Santa Catarina, Brazil	Guerra et al. (2017)	Brazil	The study investigated how participation in the PNAE mitigates constraints to agroecology adoption for family farmers in Santa Catarina through a qualitative field study conducted between May and August 2015. This involved conducting 18 key informant interviews and 38 semi-structured interviews with certified agroecological ($N = 14$), in-transition ($N = 2$), and non-certified ($N = 22$) farmers selling to the PNAE. All interviews were recorded, transcribed, and coded using NVivo, and descriptive statistics were tabulated in R.	The PNAE offers a unique but limited opportunity for farmers to participate in a price-differentiated market, where the full extent of benefits is limited by enabling supply networks and regional labor supply. Certified farmers, who were almost half the size of non-certified farmers, had a greater reliance on PNAE for their income, suggesting a higher influence on management decisions for smaller farms.
Dynamic food procurement and cross-sectoral tensions: The practical and contractual complexities of digitizing local school food supply	Keech et al. (2025)	United Kingdom	This article presents experiences and reflections from a case in the EU Horizon project ROBUST, which included an attempt to introduce Dynamic Food Procurement (DFP) in a municipal school meals service in southwest England. The ROBUST Living Labs (LL) methodology energized local procurement experiments in Gloucestershire from 2016 to 2021, covering four sequential phases: envisioning, experimenting, experiencing, and evaluating. The “experiencing” stage included detailed technical consultations and focus groups with producers to explain DFP technology and contractual supply procedures.	Public authorities face considerable challenges in changing commercial supply mechanisms for school food, particularly when municipal objectives are not clearly supported by wider policy or market realities. The DFP experiment highlighted the limited leverage of local procurement actions and policies without broader infrastructural, logistical, and technical support structures. Ultimately, DFP technology made little difference in localizing food procurement in Gloucestershire, and no change to the existing food supply arrangements resulted. The school meals service was feeding over 18,000 pupils daily.

Drivers affecting the relation between biodistricts and school meals initiatives: evidence from the Cilento biodistrict	Kraljevic and Zanasi (2023)	Italy	The study developed a flexible analytical framework based on a literature review, considering institutional relationships, legal/contractual conditions, and spatial/logistics management for organic Public School Food Procurement (PSFP). Data were collected through semi-structured interviews with spokespersons from the Vallo della Lucania Municipality, the School Canteen Commission, and organic producers from the biodistrict. A five-point Likert scale was used for scoring quantitative answers, complemented by qualitative comments.	The study found a high level of transparency among actors in the Cilento Biodistrict, attributed to the presence of short food supply chains and direct interparty relationships. Despite collaboration, major difficulties for school canteens included the high prices of organic products and insufficient volumes/ranges from local organic producers, leading to continued dependence on conventional producers. However, short food supply chains (SFSCs) proved to positively influence efficiency in exchange of products and information and stakeholders' motivation to adopt organic food appears to encourage integration of farmers and schools.
Shortening food supply chain in home-grown school feeding: experiences and lessons from south central China	Liu et al. (2023)	China	This study used a mixed research design, combining qualitative and quantitative materials to explore the direct purchase HGSF-SFSC model. Qualitative data were collected through 10 focus group discussions with various stakeholders. The quantitative part used small panel data and cross-sectional data from 106 smallholders. A baseline survey in 2018 interviewed 146 smallholder households, 72 of which formed the treatment group, while the remaining 74 comprised the comparison group. An endline survey in May 2021 interviewed 106 smallholder households.	Compared to smallholders in the comparison group, those participating in the HGSF- SFSC program showed higher income, agricultural production diversity, and dietary diversity. The gross income per capita for treated households increased by RMB 689.65 (approximately 10.5%). Households in the treatment group planted significantly more crop varieties and raised more livestock varieties than the comparison group. HGSF-SFSC participants also exhibited higher dietary diversity, with the difference being statistically significant at the 10% level. 77% of contracted smallholders identified increased income as a main benefit. Constraints included unstable supply, insufficient supply-side support, transportation limitations, and an expected decrease in demand from local preschools.
School feeding programs in Brazil: A case study of vegetables distribution using social network analysis in Mogi das Cruzes city	Maiellaro et al. (2022)	Brazil	This case study investigated the challenges of distributing agricultural products to schools within the Brazilian National School Feeding Program using social network analysis (SNA). Data were obtained from the Secretary of Education and Secretary of Agriculture of Mogi das Cruzes, São Paulo, Brazil, covering 13 vegetables commercialized by 58 small family farms in 2017 and distributed to 203 public schools. Additional data were collected through field research, including technical visits and interviews with various stakeholders.	The study identified several problems in vegetable distribution for school feeding, including a lack of consistent patterns in vegetables offered, short shelf-life leading to waste, and varying quantities per delivery. Analysis showed that beetroot, carrots, chard, chives, escarole, lettuce, parsley, and savoy are the highest consumed products between schools. They find that family farms select crops based upon what they believe is appropriate for their business and then offer to

				state procurement because of their belief that the state must support local production.
The impact of National Home Grown School Feeding Programme (NHGSFP) on rural communities in Nigeria	Okolo-Obasi and Uduji (2024)	Nigeria	The paper employed a survey research technique using a quasi-experimental design and quantitative methods, specifically combining propensity score matching (PSM) and a logit model to analyze its data. This involved sampling 2,400 households across Nigeria, divided into treatment and control groups, and collecting data through structured questionnaires and secondary sources.	The findings demonstrate that the NHGSFP makes significant contributions to improving the health and educational status of rural school children. Additionally, the program stimulates job creation, boosts the rural economy, and has been shown to decrease child and forced labor and reduce the incidence of child trafficking.
Towards sustainable school meals: integrating environmental and cost implications for nutritious diets through optimisation modelling	Petruzzelli et al. (2023)	Italy	The study used a mixed-method approach that combines optimization models, life cycle assessment (LCA), life cycle costing (LCC), and stakeholder consultation to design and assess four alternative school meal scenarios. Linear programming was employed to design four alternative scenarios (minimizing beef/dairy, pig/poultry, or all meat/dairy, or maximizing pulses) which were then assessed for economic and environmental impacts (GHG emissions).	Results suggest that reducing animal-source foods in school food schemes can ensure nutritional quality and at the same time have environmental and economic benefits. The largest benefits accrued when minimizing beef and dairy, leading to a 22% reduction in global warming potential (GWP) and a 1% reduction in cost per meal.
Towards sustainable school food: An experiential planetary health framework integrating meals and food education	Sabet and Böhm (2025)	United Kingdom	This exploratory study developed a planetary health framework for school food using a convergent mixed-methods approach. Data were collected through non-participant observations, 15 semi-structured interviews with key informants (including caterers, educational leaders, local food producers, and food educators/teachers), and an extensive web-based survey for parents, kitchen, and teaching staff in eight English primary schools. Observations lasted 4–6 hours per school in February–March 2020. Quantitative data were analyzed using SPSS, and qualitative data from observations, interviews, and open-ended survey questions were analyzed thematically using NVivo.	The study identifies three key characteristics of sustainable school food: a shift to scratch cooking, prioritizing local and agroecological food procurement, and promoting plant-based meals. Findings reveal a strong convergence between health and environmental sustainability in school meals, with stakeholders often using these terms interchangeably and supporting strategies like meat reduction. There was a substantial 69% approval for the introduction of meat-free days, with 44% of those advocating for them preferring two designated days.
Using local family farm products for school feeding programmes: effect on school menus	Soares et al. (2017)	Brazil	This study used a qualitative content analysis of 16 key informant interviews involved in the school feeding program or agriculture production, and then constructed a quantitative analysis protocol for 130 school menus from three years prior to and after the Food Procurement Program implementation.	The direct supply of the school feeding program with foods from local family farms resulted in a significant increase ($p < 0.05$) in the frequency of vegetables, fruits, and legumes in school menus. This was accompanied by a progressive reduction in concentrated foods, and interviewees recognized that the proximity between food

				production and the school increased the variety of fresh, natural, and organic options.
Structuring markets for resilient farming systems	Valencia et al. (2019)	Brazil	This comparative study examined family farmers who do and do not participate in Brazil's PNAE in Santa Catarina, Southern Brazil. 75 farmers were interviewed, with PNAE farmers designated as the treatment group (n = 20) and non-PNAE farmers as the control group (n = 55). Semi-structured surveys were used to collect data on farm agrobiodiversity, management practices, and farm household autonomy, and land use history assessments were conducted. Statistical analyses included Welch two sample t tests and two sample Wilcoxon tests, with significance at $p < 0.05$.	The PNAE played a significant role in driving transitions on family farms toward diversified farming systems, particularly horticultural production, and notably increased the cropped area under these systems. Farms enrolled in PNAE were characterized by higher agrobiodiversity compared to the control group for total food species richness and horticultural plot richness (p value < 0.01). PNAE farmers also had much lower external input intensity than the control group (p value < 0.001). For smaller farms (< 12 ha), the average size of horticulture plots for PNAE farmers was twice as large as for the control group (p value < 0.01), corresponding to 66% of total cropped area in horticultural production, compared to 28% in the control group (p value < 0.05). Total food species richness was a significant but weak predictor of dietary diversity ($R^2 = 0.06$; p value < 0.05).
Public policies for agricultural diversification: implications for gender equity	Valencia et al. (2021)	Brazil	The study aimed to explore the potential of public procurement in supporting women's empowerment within farming households in Brazil, focusing on the PNAE and social movements. Data were collected by interviewing members of 20 family farms participating in PNAE and 55 non-participating farms. Surveys were directed to the female farmer head of household to assess empowerment and participation in social groups that promote agroecology. Statistical analyses, including Fisher's exact test and Welch two-sample t-test, were conducted, with results reported as significant at p-values < 0.05 .	Female farmers played a mediating role in farm diversification in households enrolled in PNAE, supporting the shift from monocultures to diversified farming systems (horticulture) due to perceiving PNAE as a market opportunity for income generation. Participation in PNAE was the strongest positive predictor of horticulture richness (p-value < 0.0001) and total farm richness (p-value < 0.05). Targeted public food procurement programs like PNAE can contribute to sustainable consumption and production patterns, as well as poverty reduction, zero hunger, and gender equality. In Santa Catarina, on average, 50% of school meal funding was invested in acquisitions from family farmers, exceeding the 30% minimum required by law.

Food sovereignty and <i>fome zero</i> : Connecting public food procurement programmes to sustainable rural development in Brazil	Wittman and Blesh (2017)	Brazil	This paper draws from ethnographic and household survey research conducted in agrarian reform settlements in seven municipalities in the central state of Mato Grosso between 2003–06 and 2012–13. The methodological approach included six focus groups with farmer participants and marketing association leaders, leading to the development of an indicator framework for a semi-structured interview questionnaire delivered to a sample of 60 families (of which 39 had participated in the Food Procurement Program (PAA) and 16 in PNAE. Additionally, 26 stakeholders involved in program support networks were interviewed, and publicly available data on program funding and extension were accessed.	The study found that participants in the PAA had higher levels of on-farm agrobiodiversity, which they attributed to the demand for increased product variety from school feeding programs. Farmers selling through PAA/PNAE marketed a much larger range of crops on an annual basis (mean 14 crops) as compared to neighboring farmers not participating (mean 3.7 crops). While no significant difference in household income was found between participants and non-participants, interviews indicated that program participation reduced reliance on off-farm labor for cash.
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