Urban Planning
2025 • Volume 10 • Article 9676
https://doi.org/10.17645/up.9676

cogitatio

ARTICLE

Open Access Journal

Levers for Sustainable Food System Transformation: How to Foster Biodiversity and Organic and Local Food Through Public Catering

Clara Bückart-Neufeld [1,2], Franziska Bürker [3], and Birgit Hoinle [1]

[1] Department of Societal Transition and Agriculture, University of Hohenheim, Germany
[2] Nürtingen-Geislingen University, Germany
[3] Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany

Correspondence: Clara Bückart-Neufeld (bueckart-neufeld@hfwu.de)

Submitted: 22 November 2024 **Accepted:** 25 April 2025 **Published:** 30 July 2025

Issue: This article is part of the issue "Perspectives on Food in the Sustainable City" edited by Birgit Hoinle (University of Hohenheim), Alena Birnbaum (University of Kassel), and Petra Lütke (University of Münster), fully open access at https://doi.org/10.17645/up.i395

Abstract

Biodiversity loss is one of the most urgent sustainability challenges and is closely linked to our food system. How food consumption is organized, especially in urban areas, will be crucial in shaping biodiversity-friendly and sustainable food systems in the coming years. In this context, the integration of local and organic products into public food procurement can be a driver of increased biodiversity in our landscapes and greater dietary diversity on our plates. The purpose of this article is to explore the extent to which public food procurement can drive this shift towards a sustainable and biodiversity-friendly food system. We conducted a systematic literature review and qualitative content analysis of 26 articles published in the European context that focused on sustainability in public procurement in order to identify key barriers and drivers affecting the share of biodiversity-friendly, organic, and local products in public catering. After developing a conceptual framework based on the leverage points model developed by Meadows (1999), we contextualized the identified barriers and drivers in this model and sorted them into shallow and deep levers for increasing biodiversity. Our results indicate that key drivers for promoting biodiversity-friendly, organic, and local food include political will, the involvement of all stakeholders along the value chain, and the need to initiate profound changes in actors' values, the transition goals, and the rules of the system.

Keywords

biodiversity; food system; local food; organic farming; organic food; public catering; sustainability; value chains

1. Introduction

When we think of our food system and today's global sustainability challenges, we immediately associate the effects of our food production with climate change, soil degradation, and water pollution (Aleksejeva, 2022). However, the food on our plates also impacts biodiversity in agricultural landscapes, as agri-food systems contribute significantly to biodiversity loss (Andhov et al., 2024; Campbell et al., 2017). Campbell et al. (2017) state that agriculture is responsible for 80% of the decline in biodiversity. Here, there are influences on biodiversity loss such as farm management in the form of intensive agriculture, monocultures, pesticides, or excessive fertilisation. Additionally, landscape or habitat diversity can also be affected by habitat destruction, such as deforestation. Positive impacts can be enhanced through agroforestry, mixed cropping, or intercropping approaches (Monetti et al., 2021).

Such beneficial practices can be found in organic agriculture. Organic agriculture is increasingly promoted as a strategy for mitigating biodiversity loss in our food systems, due to its more sustainable farming methods and, therefore, lower environmental impacts (Sanders & Heß, 2019; Schleiffer et al., 2022; Seufert & Ramankutty, 2017). According to a review (Seufert & Ramankutty, 2017), organic agriculture, in accordance with established organic certification guidelines, such as the avoidance of synthetic fertilizers and pesticides, has been found to have a beneficial impact on local biodiversity. Seufert and Ramankutty (2017) conclude that, despite the common uncertainties about the benefits of current organic practices and the context-dependency of the performance of organic agriculture, organic farming has positive effects, particularly "for plant and pollinator biodiversity in arable systems and simple landscapes" (Seufert & Ramankutty, 2017, p. 3). This is also confirmed by a meta-analysis, which shows that organic farming in general results in a greater diversity of flora and fauna on cultivated land (Sanders & Heß, 2019). Consequently, organic farming plays a pivotal role in biodiversity conservation. In order to promote a more sustainable food system, counteract climate change, protect the environment, and preserve biodiversity, the EU is supporting organic farming with its Organic Action Plan, which aims to convert 25% of agricultural land in Europe to organic farming by 2030 (European Commission, 2021).

The focus of this article will be on organic farming, where we see the promotion of biodiversity in the context of local food systems as an integral aspect. In contrast to the organic standards, there is no definition of "local" food (Hanke & Wunder, 2023; Joannides, 2012). Therefore, the following aspects can be distinguished in order to conceptualize local food. One aspect is geography, such as being grown within 100 miles, or it may be the administrative boundaries of a region or state. Another is the transparency of the number of involved stakeholders between the final consumer and the producer through short food supply chains. It can also be the connection to the place or person who grew or produced the food (Joannides, 2012). The EU registers more than 3,400 products as "geographical indications." These identify a product as "originating in the territory of a particular country, region or locality where its quality, reputation or other characteristic is linked to its geographical origin" (European Commission, 2017, p. 9). Thus, the category "local" provides no quality criteria. However, it is often associated with small-scale and family farming. We argue that the promotion of short food supply chains can contribute to positive biodiversity outcomes in local landscapes. In contrast, globalized value chains in the food system are cited as one of the causes of disappearing biodiversity in agricultural landscapes (Teufel et al., 2020). Since the 1970s, agricultural production has increasingly focused on a limited number of species and varieties, selected to meet the demands of a global market with no connection to the local region. As a result, in terms of ecotypes and varieties, 75% of the agricultural crops present at the beginning of the

20th century have since been lost (Barbeito et al., 2020). Furthermore, due to oligopolies within the global food system, global competitive pressure and the design of the EU's Common Agricultural Policy, intensive, large-scale farming practices have become established. This intensive use of the landscape increases the loss of biodiversity by eliminating differentiated landscapes. The regionalization of food production, through public catering, could help to strengthen and promote extensive land use and the use of local varieties, especially by small farms through new sales channels (Hanke & Wunder, 2023). A literature review by Chaves et al. (2023) indicates that school feeding programs which promote local food supplies from smallholder farmers result in superior health outcomes due to the sourcing of fresher food, as well as more sustainable climate impacts due to shorter transport distances and lower carbon emissions (Chaves et al., 2023). Therefore, by increasing demand for local and organic products, especially regionally specific varieties, crop diversity is increased, which contributes to higher local biodiversity (Hanke & Wunder, 2023).

In this study, we focus on public catering as a way to promote biodiversity-friendly, organic, and local products through public procurement. Public catering, i.e., food in public institutions, is seen as a lever for an agroecological transition of the food system. Given that consumer demand for organic products is not yet sufficient to persuade farmers to convert on a larger scale, several municipal governments are focusing on public catering as a tool to increase demand for organic products (Daugbjerg, 2023; Lindström et al., 2022; Schleiffer et al., 2022). Public catering is here understood as a subcategory of out-of-home catering. Whereas out-of-home catering comprises also individual gastronomy (e.g., restaurants and food trucks), public catering is reduced to the food in public entities, such as the education sector (day-care centres and school canteens), the care and welfare sector (hospitals, rehabilitation facilities, and elderly homes) and the business catering sector (company canteens; Pfefferle et al., 2021). In this article, we will concentrate on the sub-category of public catering in education, care, and welfare entities.

The high purchasing power of public contracts, which represent approximately 12% of global GDP, enables local governments to create demand and influence environmental and social impacts through their procurement choices (Andhov et al., 2024; Cruz et al., 2023; Molin et al., 2024). With the EU's Farm to Fork Strategy and Green Public Procurement policy, the EU has created a regulatory framework that allows cities and municipalities to adopt sustainable procurement practices with a lower environmental impact (Commission recommendation of 15 December 2021, 2021). Thus, public catering policy is strongly influenced by urban authorities, which play a central role in the promotion of sustainable nutrition (Schleiffer et al., 2022). Given the purchasing power associated with public catering, cities can facilitate or accelerate the shift towards biodiversity-enhancing diets by providing a significant market for organic food (Cruz et al., 2023; Scheerer et al., 2024; Spyridon & Mikkelsen, 2018). There is a remarkable increase in the number of cities in Europe that have established targets regarding the use of organic foods in public catering facilities (Vienna, Copenhagen, and Berlin; Schleiffer et al., 2022). Nevertheless, the growth of organic food use in public catering remains relatively slow (Scheerer et al., 2024).

Previous studies have explored the potential of public catering as a lever for transforming the food system toward sustainability. Whereas some studies focus on food waste or vegetarian meals, many studies concentrate on integrating organic products into canteen kitchens or on promoting local value chains, with the objective of enhancing the sustainability of local economies (Braun et al., 2018; Filippini et al., 2018; Risku-Norja & Løes, 2017). Only a few studies focus on biodiversity in out-of-home catering regarding menu composition and eating habits (Crenna et al., 2019; Heinz et al., 2023; Monetti et al., 2021; Speck et al.,

2022). Our approach builds on linking the existing research on local and organic food in public catering with the issue of biodiversity. Our argument is that public catering can be used as a lever to strengthen local organic farming and thereby promote local biodiversity, addressing one of the major challenges of current agricultural production systems.

Therefore the research questions we follow in this article are: What are the barriers and drivers to fostering biodiversity-friendly, organic, and local food through public catering? What are the effective levers for a food system transformation toward sustainability and biodiversity?

Based on a systemic literature review, the objective of this study is to identify the key drivers and barriers influencing the uptake of biodiversity, organic, and local food in public catering. As a conceptual framework, we use a food system lens and the leverage points (LPs) concept developed by Meadows (1999) and Abson et al. (2017) to explore the potential points of intervention that could significantly increase the share of biodiversity-friendly, organic, and local products in the catering sector. We aim to provide strategies for local authorities to facilitate the integration of more organic and local food into public catering, thereby contributing to the conservation of biodiversity within the agri-food system.

2. Conceptual Framework: Biodiversity and LPs

This section presents an understanding of biodiversity and contextualizes it within the framework of food systems and public catering. It briefly outlines the LPs model, as proposed by Meadows (1999) and Abson et al. (2017), as a tool for analyzing potential intervention points for change within the public catering food system model.

2.1. Contextualizing Biodiversity in the Framework of Public Catering and the Food System

2.1.1. Biodiversity

In general, biodiversity is classified into three main categories: biodiversity of species, biodiversity of genetic resources, and biodiversity of ecosystems. Swingland (2013) offers the following definition of biodiversity: "Biodiversity/biological diversity: Species, genetic, and ecosystem diversity in an area, sometimes including associated abiotic components such as landscape features, drainage systems, and climate" (Swingland, 2013, p. 399). Species diversity describes the number of different biological species, which can be classified as animals, plants, or fungi. Furthermore, the concept of species diversity can be extended to encompass the diversity of varieties or breeds, particularly in the context of agrobiodiversity. Genetic diversity can be defined as the amount of genetic information that exists among all organisms. Ecosystem diversity refers to the number of distinct habitats, including forests, lakes, and agricultural areas. Various aspects of production systems can impact biodiversity at different levels. For example, studies examine how seed selection affects genetic diversity (Kliem & Sievers-Glotzbach, 2022) or how diversification through the use of diverse plant species influences species diversity (Azam-Ali et al., 2024; De Falco et al., 2022; Mattas et al., 2023; Zhang & Dannenberg, 2022). The type of cultivation also affects ecosystem diversity, for example, intercropping with a maize-bean mixture has positive effects (Hüber et al., 2022).

Biosphere integrity is one of the nine planetary boundaries that has already been reached, with the global decline in genetic diversity representing a significant transgression (Richardson et al., 2023). For several decades, numerous policy documents, including the Rio 1992 Convention on Biological Diversity, the EU Biodiversity Strategy 2020, and the UN Global Biodiversity Framework of Montreal 2022, have emphasized the significance of conserving global biodiversity, highlighting its critical status and the necessity for urgent action. The *Global Assessment Report on Biodiversity and Ecosystem Services* (Brondizio et al., 2020), the annual *Global Biodiversity Outlook*, and several studies have documented a global decline in biodiversity (Mantyka-Pringle et al., 2015; Newbold et al., 2015; Rounsevell et al., 2020; Urban, 2015). Given the variability of estimates of the extinction rate across studies and models, Urban's (2015) meta-study serves as a reliable reference point. Utilising a 95% confidence interval (CI) across all studies, Urban (2015) determined a value of 7.5% for the extinction rate, which increases exponentially with the gradient of global warming. In addition, an examination of the landscape species-area relationship model, as employed by Chaudhary and Kastner (2016), determined that 83% of total species loss can be attributed to the agricultural use of land for domestic consumption, with the remaining 17% resulting from export production (Chaudhary & Kastner, 2016).

2.1.2. Agrobiodiversity

Agrobiodiversity is regarded as a critical subset of biodiversity (Divéky-Ertsey et al., 2022). According to the Food and Agriculture Organization of the United Nations (2004) definition, agrobiodiversity encompasses crop varieties, livestock species, and non-harvested species that support food provision, such as pollinators. This definition highlights the importance of diverse local food production systems, which are currently facing challenges. This, in turn, raises concerns about the loss of associated local knowledge, cultural practices, and skills among food producers, particularly small-scale farmers. In the context of the food system, the concept of agrobiodiversity emphasizes the need to preserve local crop varieties, such as different bean varieties or heirloom seeds, developed over centuries by local farmers. In line with the recommendations set forth by the planetary health diet, these legume varieties, rich in plant-based proteins, have the potential to contribute to a more climate-friendly diet (Willett et al., 2019). Although the aspect of preserving traditional varieties plays a huge role in this study, we use the more general term biodiversity for the systemic literature review as it provides a broader scope for analysis.

2.1.3. Biodiversity in the Context of Public Catering

Currently, there are no labels to help consumers identify products that are biodiversity-friendly (Stampa & Zander, 2022). Labels such as Planet Score have begun to address the issue of biodiversity, but they are still in the process of being implemented (Commission recommendation of 15 December 2021, 2021). However, some studies analyse the biodiversity impact of food specifically in the context of out-of-home catering. Monetti et al. (2021) developed an assessment tool to measure the impact of individual nutrition on biodiversity in out-of-home catering settings. The indicator set can be used to link biodiversity also to food consumption in public catering. For instance, species diversity is measured in terms of key and crop species richness, e.g., the diversity of crop species per farm or area and the proportion of high biodiversity areas in the total farmland. Genetic biodiversity is measured using the number and proportion of cultivars, varieties, and production from rare, traditional, locally adapted and other genetic line varieties, as well as the red-list crop varieties. Landscape/habitat diversity is measured using indicators such as landscape complexity, the

number of land use types and heterogeneity of land use types. Farm management is measured using indicators such as land use intensity, organic standards, biodiversity practices, and on-farm agrobiodiversity, e.g., agroforestry, mixed-farming, intercropping, infrastructure, and agrobiodiversity conservation (Monetti et al., 2021). Certain production methods and product groups have different potential to foster or endanger biodiversity. In the context of out-of-home catering, recent studies have explored the influence of certain food groups on biodiversity. Crenna et al. (2019) analyze the environmental impact of 32 representative food products in the EU. Assessing biodiversity impacts is very complex, but they list the foods with the highest impacts in the following order: beef (25%), pork (19%), poultry (8%), cheese (7%), sunflower oil (4%), butter (4%), milk (4%), and eggs (4%), as well as 24 other products (<4% each with 25%; Crenna et al., 2019). The findings for a more plant-based nutrition to support biodiversity through eating habits are supported by a recent study addressing the impact of food on biodiversity at the menu level in Germany (Heinz et al., 2023). The article of Heinz et al. (2023) describes the development of an assessment framework based on a systematic literature review and expert interviews. An indicator-based approach focusing on land use was developed and validated using recipes from out-of-home catering facilities (Heinz et al., 2023). The results show that meat-based meals are not recommended from a biodiversity perspective, whereas vegetarian meals have better outcomes. Vegan meals were mostly recommended (Heinz et al., 2023).

These studies provide first insights into how the promotion of biodiversity can be integrated into public catering and offer indicators for biodiversity-friendly products. What remains open is the question of what factors promote or hinder the use of biodiversity-friendly products in public kitchens. Following up on those studies we are investigating this question in this article. Considering the aforementioned biodiversity framework, we argue that biodiversity is integrated into the public catering system through the utilization of diverse food varieties in public kitchens. Given the interconnection between organic farming methods and local short food supply chains as a way to promote biodiversity in local landscapes, our approach integrates the existing literature on organic and local food in public catering with biodiversity aspects as pathways to transforming the food system toward sustainability.

2.1.4. Actors and Interdependencies Within the Food System

Our systemic literature analysis takes a systemic approach to the food system and public catering. A schematic overview of the elements and actors of the public catering food system under consideration is given in Figure 1 as an orientation for the following analysis.

The food system encompasses the interaction of all activities and actors that influence the production, processing, distribution, consumption, and disposal of food (Andhov et al., 2024; Nguyen, 2018; von Braun et al., 2023). On the level of local stakeholders, this interaction is characterized by three main elements: food supply chains (from production systems to retail and markets), food environments (food availability, economic access, advertising and information, food quality, and safety), and consumer behaviour (cultures that shape dietary choices; High Level Panel of Experts on Food Security and Nutrition, 2017). In the context of public catering, relevant actors in the food system include: farmers, who produce food; distributors, who distribute food through suppliers and logistics companies; processors, who produce pre-cut products tailored to the needs of public catering; public purchasers, who procure food for public institutions; and public kitchens, which prepare meals for their guests, mostly students, patients, or employees of public institutions. The food system and its elements do not exist in isolation, but are integrated into other key

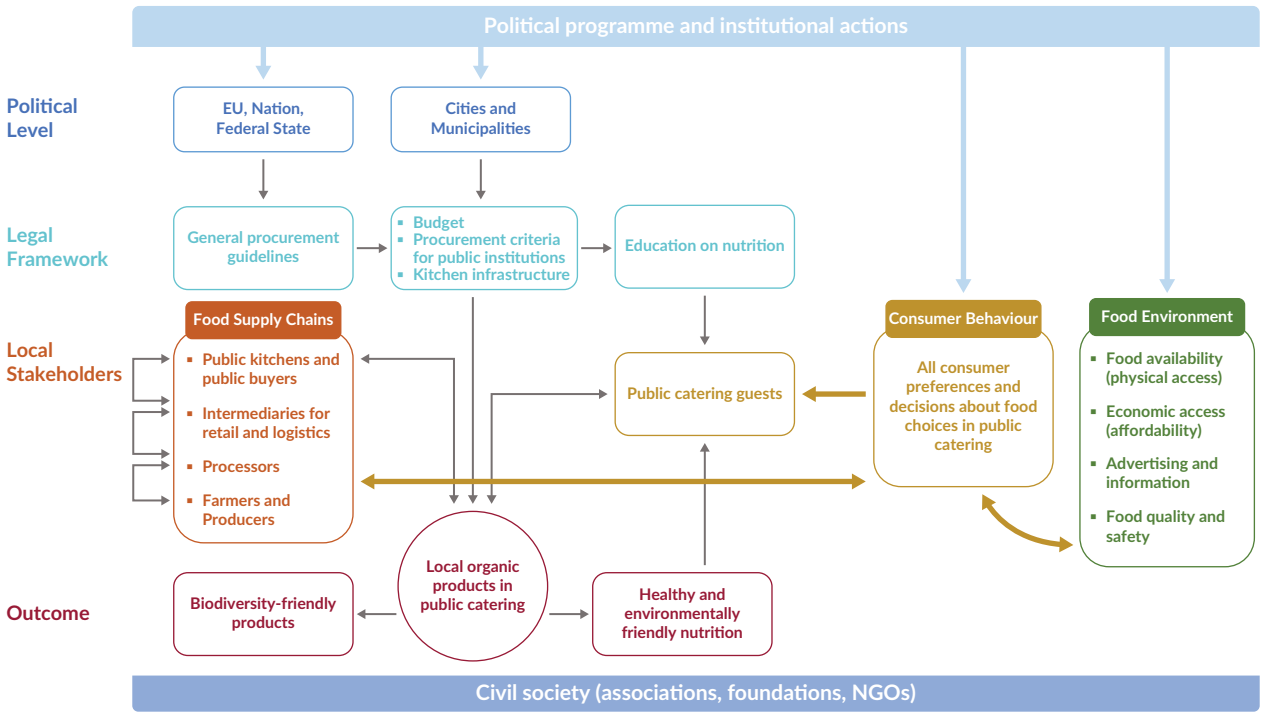

Figure 1. Schematic overview of the public catering food system. Source: Adapted from Flörke et al. (2022) and High Level Panel of Experts on Food Security and Nutrition (2017).

systems that influence each other, such as political, economic, health, and environmental systems (Andhov et al., 2024; Nguyen, 2018). On the political level, policymakers shape the legal framework with guidelines and standards. All of these actors contribute to the functioning of public catering and therefore influence the procedures and processes of the system (Molin et al., 2024). Therefore, each stakeholder group is relevant and must be taken into account in the implementation of measures to address the increase of biodiversity in public catering.

2.2. LPs

In this article, we adopt an "LPs perspective" to identify effective levers to foster biodiversity through the transition to organic and local food in public catering. The 12 LPs, which are based on Meadows' (1999) extensive research on human-environment systems, provide a conceptual framework for the implementation of effective interventions within a system. Meadows defines LP as "a place in the system where a small change could lead to a large shift in behavior" (2008, p. 145). In her hierarchy of LP (see Table 1), Meadows (1999) distinguished between "shallow" LPs, where interventions are relatively easy to implement but have limited transformative potential, and "deep" LPs, where interventions are more challenging but have significant potential for transformative change. Abson et al. (2017) developed a simplified approach, by synthesizing Meadows' 12 LPs into four system categories applicable to transformation research: parameters, feedbacks, design, and intent. Each of the four categories encompasses three of Meadows' 12 LPs (see Figure 2). Abson et al. (2017, p. 32) also categorize the four groups based on the depth of their impact, following the distinction between shallow and deep LPs:

- Parameters include "the relatively mechanistic characteristics typically targeted by policy makers," such as mechanical characteristics (e.g., taxes and standards), as well as physical structure (e.g., buffers and flows).
- Feedbacks focus on "the interactions between elements within a system of interest that drive internal dynamics," such as reinforcing (positive) or dampening (negative) feedback loops.
- Design refers to "the social structures and institutions that manage feedbacks and parameters," including information flows, rules, and power characteristics.
- Intent refers to "the underpinning values, goals, and world views of actors that shape the emergent direction to which a system is oriented," such as the mindsets from which goals emerge.

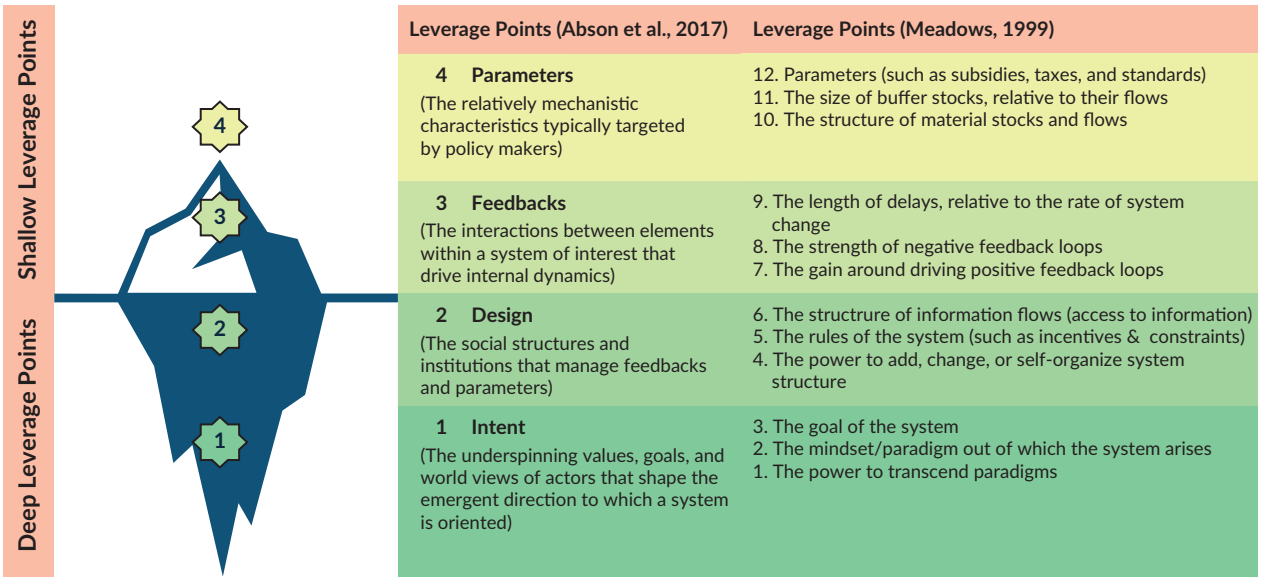

Figure 2. LPs for a transformation towards a sustainable and biodiversity-friendly food system. Source: Adapted from Meadows (1999) and Abson et al. (2017).

This model provides a general overview of LPs for change in social systems, in this case, the food system. In our discussion, we will apply this model to our analysis to identify differences in the effectiveness of LPs and develop strategies to overcome barriers identified in the literature review. It not only identifies the differences between strong and weak levers, but also suggests strategies that researchers and policymakers can use to build on the results.

3. Methodology

Our approach is based on a systemic literature review with two strands integrating the existing broad literature body on organic and local food in public catering with the more recent and very rare studies on biodiversity in public catering. Accordingly, one strand analyses the broad literature on organic, local food in public catering in order to identify key drivers and barriers to sustainable transitions in public catering. The second strand aims to deepen the analysis of the specific challenges of promoting biodiversity on the plates in public canteens.

Our approach aimed to find the most relevant scientific articles published in the past 10 years in the European context. For the bibliographic search, we focused on the well-established database SCOPUS as it provides a

large number of interdisciplinary articles. The search was then refined using the Agricola, AgEcon, and AGRIS databases, which focus on agriculture, nutrition, and food production. We distinguished two strings one with organic and local and one with a deeper focus on biodiversity.

The literature search strings were divided into thematic blocks, including terms identifying public catering, biodiversity, organic products, local products, and value chains (see Table 1). We conducted multiple searches using different combinations of keywords until a total of 16 searches yielded no new articles. The literature review was carried out from March to July 2024. We restricted our search to journal articles written in English and published in the last 10 years (2014–2024) within the EU, where the same legal framework applies. The articles were reviewed based on titles, keywords, and abstracts. Only articles specifically addressing biodiversity, organic food, and local food in public-sector catering were selected, while articles covering restaurants and company canteens (business sector) were excluded.

Table 1. Keywords used in the systematic literature search.

Themes	Keywords Search Process 1	Keywords Search Process 2
Biodiversity	—	AND biodiversity
Organic products	AND [organic food OR sustainable food OR increase of organic food]	—
Local products	AND [local OR local food OR localized food systems OR local sourcing]	—
Value chains	AND [short supply chain OR food supply chain OR regional networks]	AND [supply chain OR value chain]
Public catering	AND [public procurement OR public catering OR school catering OR school catering services OR institutional kitchens OR public school food procurement OR food service OR communal catering]	AND [public procurement OR public catering] OR school catering OR school catering services OR institutional kitchens OR public school food procurement OR food service OR communal catering]
Promotional factors	—	OR success
Inhibitory factors	—	OR barrier

The search string 1, with a focus on organic and local food, yielded a total of 1,592 articles. After removing duplicates, two researchers screened the full text of the remaining 76 articles to assess the relevance of the literature. After full-text screening and adding a further four articles through backward searching, 25 articles were deemed eligible.

The search string 2, with a focus on biodiversity, was conducted to assess the current relevance of biodiversity in public procurement literature. For this, a systematic analysis of the most up-to-date published

research was conducted using the SCOPUS database, which was comprised of three stages. The same selection criteria were employed as in the initial research, again excluding articles published prior to 2014 and those of non-European origin.

The search string "biodiversity" yielded a total of 112,210 search results, the majority of which originated from the disciplines of agricultural and biological sciences. A total of 69 articles were obtained when the term "biodiversity" was combined with different keywords synonymous with public catering (see the first line in Table 1). As mentioned, we focused on public catering as a subcategory of out-of-home catering. After screening headlines and abstracts to assess their relevance to public catering, 68 were deemed to be irrelevant. This indicates a current lack of research examining the promotion of biodiversity through public catering. An overview of the search processes is provided in Figure 3.

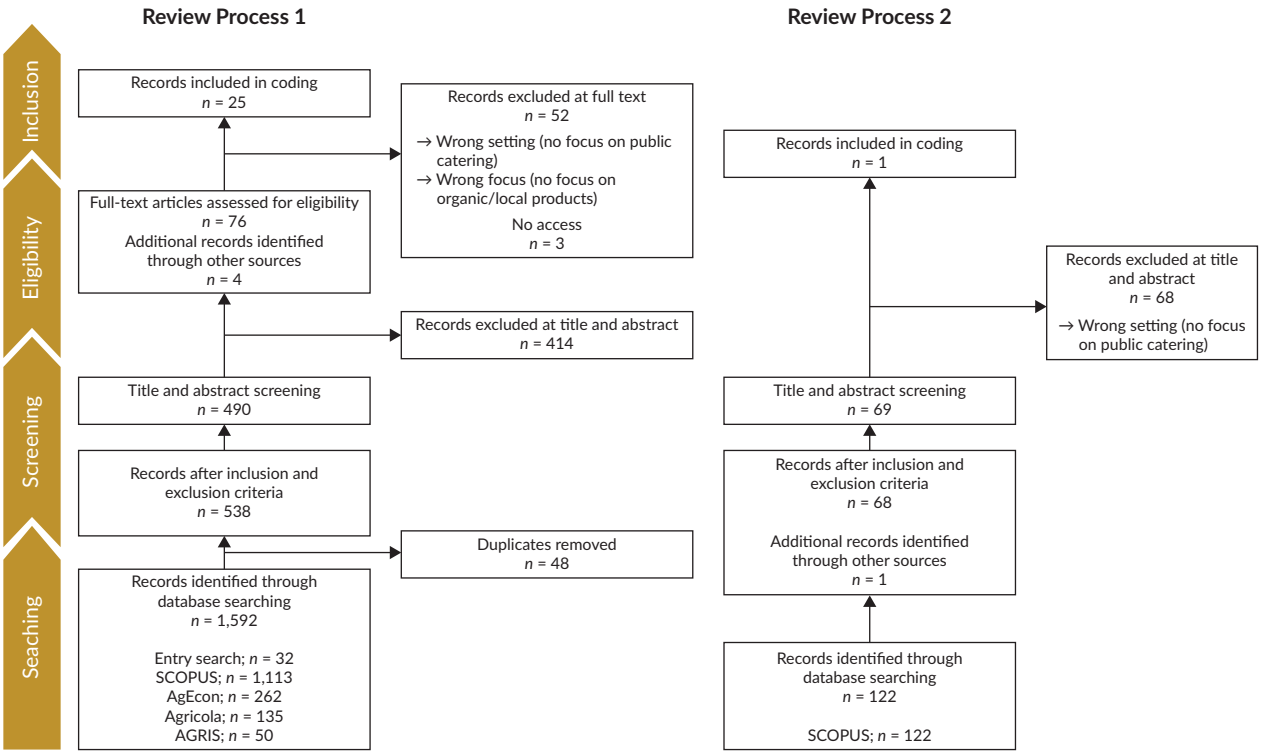

Figure 3. Depiction of the systematic literature review process.

In this article, we used qualitative content analysis to identify the most challenging barriers and most successful drivers for increasing biodiversity-friendly, organic, and local products in public catering. This highly structured evaluation method examines text material step by step, making the procedure intersubjectively comprehensible and verifiable by others through a clearly defined process (Mayring, 2022). The qualitative content analysis software MAXQDA was used to analyze the 26 selected articles. By developing a deductive-inductive category system, the scientific articles were analysed to identify key barriers and drivers to the incorporation of organic and local food in public procurement with positive effects on biodiversity. The code system utilized represents the public catering system from the perspective of the food system approach (see Figure 1) and includes the policy framework, the food environment, and all stakeholders and kitchen processes. Biodiversity has been included as its own code for analysis to discover the connection between biodiversity and public catering more precisely. The main codes used were as follows:

- A: Barriers (all aspects that act as barriers to the purchase of organic and local products);
- B: Drivers (all aspects that promote organic and local products in public catering);
- C: Governance (all aspects relating to the regulatory system and the processes between politics, administration, and civil society);
- D: Market and value chains (all aspects along the value chain including stakeholders, production, logistics, and distribution);
- E: Economic factors (all aspects of the food environment related to budget and economic framework conditions);
- F: Transformation in the kitchens (all aspects related to processes in the kitchen);
- G: Biodiversity (all aspects of biodiversity in the context of public catering).

To identify the main barriers to and drivers of the increased use of local organic products, we conducted a frequency analysis using MAXQDA's code relations browser. MAXQDA's visual tool displays the relationship between codes and the frequency of their overlap. We examined the overlap of the codes Barriers and Drivers (A and B) with the other codes (D–G) in order to identify the most frequently mentioned codes, which represent the most relevant barriers and drivers discussed in the scientific literature.

4. Results

This section presents the results of the literature analysis, focusing on the main barriers and drivers affecting the use of organic and local food in public catering. Further specific potential and challenges for promoting biodiversity-friendly products are analysed in Section 4.3. An overview of the identified barriers and drivers, organized by frequency, is presented in Table 2.

Table 2. Main barriers and drivers identified in the literature analysis.

Barriers	Amount	Drivers	Amount
Availability of organic and local products	21	Networking and cooperation along the value chain	*13*
Kitchen budget	17	Political will and motivation	*10*
Procurement policy	16	Well-trained kitchen staff	*10*
Consumer demand	10	Participation	*8*

The numbers indicate the frequency of mentionings in the literature, which can lead to interpretations of how relevant these factors are, i.e., the most mentioned factors can be interpreted as having more relevance for promoting organic and local food in public catering.

4.1. Main Barriers

4.1.1. Availability of Organic and Local Products

The availability of organic and local products is one of the main barriers. Several articles highlight that canteens face difficulties in securing a sufficient quantity of, especially pre-processed, organic, and local products for public kitchens. Limiting factors are the lack of local supply, underrepresentation in wholesale markets, procurement procedures, and the degree of pre-processing available.

The local supply of organic food often does not meet the specific demands of canteens (Risku-Norja & Løes, 2017), especially when organic food is only produced by small farms and local businesses (Filippini et al., 2018). Consequently, the required quantities of goods are unavailable or more difficult to obtain (Filippini et al., 2018; Hoinle & Klosterkamp, 2023; Kraljevic & Zanasi, 2023; Kujala et al., 2022; Lassen et al., 2023). Another significant factor affecting availability is the limited offer of organic products in the wholesale trade. Organic local producers often struggle to meet the volume and quality demands of wholesalers, making market access challenging (Braun et al., 2018; Filippini et al., 2018). From a kitchen perspective, additional planning efforts would be necessary to source certain organic products, such as organic meat or dairy products, that are unavailable in retail or only available in limited quantities. In addition, public tenders are often formulated in a way that further excludes small businesses through requirements on pricing, product range, and order volumes (Aleksejeva, 2022; Braun et al., 2018; Kujala et al., 2022; von Braun et al., 2023).

A further crucial, frequently mentioned barrier is the lack of pre-processing facilities which are the connection point between farms and public kitchens. As public kitchens rely on peeled, pre-cut, and pre-cooked products for their processes, the available range of organic local food is often unsuitable for public catering. As mentioned in different European studies, there is a lack of pre-processing infrastructure for organic local products in several countries (Braun et al., 2018; Hoinle & Klosterkamp, 2023; Kujala et al., 2022; Lassen et al., 2023; Risku-Norja & Løes, 2017).

4.1.2. Kitchen Budget

Another significant barrier to the transition to organic food in public catering is the high cost of organic produce, especially local organic food (Cruz et al., 2023; Filippini et al., 2018; Hauschildt & Schulze-Ehlers, 2014; Kraljevic & Zanasi, 2023). While the higher costs of organic products do not prevent their introduction, they do present a challenge to increasing the proportion of organic products used in kitchens on a larger scale (Filippini et al., 2018).

A major barrier for public kitchens is, therefore, their limited budget. In the context of rising food prices, outsourcing of the labour force, and just-in-time logistics, public catering is under such enormous efficiency pressure that the introduction of high volumes of local organic products is a major difficulty (Filippini et al., 2018; Risku-Norja & Løes, 2017; Schäfer & Haack, 2023; Schleiffer et al., 2022; Simon et al., 2023).

4.1.3. Procurement Policy

The public procurement norms, defined by Directive 2014/24/EU, are widely regarded as an obstacle to the promotion of local food. As public tenders for canteen food are issued at the EU level, and the principle of equal opportunities applies to suppliers, smallholders, and local producers in particular are exposed to international competition where they cannot compete on price alone (Kraljevic & Zanasi, 2023; Kujala et al., 2022; Sanz Sanz et al., 2022). In addition, the formal requirements and the design of the tenders—such as minimum order quantities and strict deadlines—often make it difficult for small producers and local suppliers to participate (Schäfer & Haack, 2023).

With its Green Public Procurement policy, the EU is opening up the possibility of including sustainability criteria in procurement processes, potentially favouring organic products. There is also the option to source

local seasonal products on the basis of more climate-friendly short transportation routes as criteria (European Commission, 2019). However, especially when it comes to higher proportions of organic products, local sourcing with higher logistics costs and smaller production volumes is more difficult to implement than offering a high proportion of organic food from larger nationwide providers at a fixed price due to differences in cost-efficiency (Braun et al., 2018; Filippini et al., 2018). Additionally, procurement managers often lack clarity on implementing sustainability criteria and face legal uncertainties regarding the correct application at the administrative level (Risku-Norja & Løes, 2017; Sanz Sanz et al., 2022; Schäfer & Haack, 2023). For these reasons, procurement guidelines often hinder the availability of organic local products in practice.

4.1.4. Consumer Demand

Lastly, consumer demand can be a barrier to introducing more organic and local food in public canteens. Procurement of organic and local food is hindered if consumers have little interest and are unwilling to bear the necessary costs. The willingness to pay for food offered by public kitchen operators is relatively low in Germany, especially in daycare and school catering settings (Hauschildt & Schulze-Ehlers, 2014; Lopez et al., 2020). Studies show that there is greater consumer interest in locally sourced, rather than organic food in terms of improving sustainability. This suggests that offering more local dishes and highlighting local origins can help to meet consumer demand (Braun et al., 2018; Scheerer et al., 2024).

Additionally, the literature identifies obstacles resulting from the intrinsic characteristics of the products themselves or from consumer inertia factors, such as "neophobia"—the fear of adopting innovations, including those related to food (Simon et al., 2023). A study about school catering in Portugal shows that "meat-centered" cultural perceptions of a "proper meal" can hinder the introduction of sustainable dishes (Graça et al., 2022, p. 331). However, some studies show that there has been a rising interest towards vegan and vegetarian meals in the past years (Lopez et al., 2020). Thus, addressing consumer demand is an important factor in the transformation towards more local and organic products in public catering (Kujala et al., 2022).

4.2. Main Drivers

4.2.1. Networking and Cooperation Along the Value Chain

Networking and cooperation between the various stakeholders along the value chain is a prerequisite and therefore a key factor for organic food in public catering and the promotion of local value chains and food networks (Aleksejeva, 2022; Cruz et al., 2023; Filippini et al., 2018; Hoinle & Klosterkamp, 2023; Kraljevic & Zanasi, 2023; Lassen et al., 2023; Martin et al., 2022; Perignon et al., 2024; Risku-Norja & Løes, 2017; Sanz Sanz et al., 2022; Schäfer & Haack, 2023; Spyridon & Mikkelsen, 2018). Networking and cooperation can take place in various forms along the value chain, for example between local farmers, processors, and canteens. In France, new partnerships have been established between kitchens and local small and medium enterprises that can process fresh local fruit and vegetables, filling the gap in pre-processed products for professional kitchens (Sanz Sanz et al., 2022). The exchange of experience and best practices between different stakeholders in the value chain is seen as particularly beneficial (Martin et al., 2022; Schäfer & Haack, 2023), as is the pooling of resources for shared logistics structures (Aleksejeva, 2022). In this way,

cooperation and networking can counteract some of the barriers, such as the lack of availability of pre-processed organic local food.

4.2.2. Political Will and Stakeholder Motivation

The political will and motivation of key stakeholders, such as policymakers and kitchen management, constitute a crucial enabling factor. Political support and commitment to the promotion of locally produced food and organic products in public catering are identified as fundamental factors (Filippini et al., 2018; Risku-Norja & Løes, 2017; Smith et al., 2016). This support is vital, particularly during the initial stages of implementing new strategies (Sanz Sanz et al., 2022; Spyridon & Mikkelsen, 2018).

The importance of motivation extends beyond policymakers to all stakeholders within the food system (Filippini et al., 2018; Kraljevic & Zanasi, 2023; Sanz Sanz et al., 2022). Sanz Sanz et al. (2022) found that the individual motivations of public officials are central to the implementation of the cities' food policy. The personal commitment of catering and procurement staff is crucial in overcoming barriers to preparing, awarding, and managing more sustainable and healthier food procurement contracts. In this case, the authors considered personal motivation to be more important than political will in overcoming barriers in the implementation process (Sanz Sanz et al., 2022).

4.2.3. Well-Trained Kitchen Staff

The inclusion of more organic local products often goes hand in hand with a reduction in meat portions or an increase in plant-based dishes. These dishes should be tasty and attractive to consumers. Staff training to create and prepare appealing vegetarian dishes using local organic produce is one of the key drivers in the shift to using more local organic products in the catering sector (Lopez et al., 2020). In practice, however, there is a lack of qualified kitchen staff with the skills to prepare plant-based dishes or use fresh produce (Lopez et al., 2020; Martin et al., 2022). The preparation of vegetarian and vegan dishes is still barely addressed in most vocational training programs. Recent staff shortages in the catering sector and the widespread use of convenience products in kitchens present additional challenges (Lopez et al., 2020). Schäfer and Haack (2023) argue that outsourcing and the flexibility of the labour force in the German catering sector hinder the creation of tasty and creative dishes. Thus, improving working conditions in public catering, together with enhancing further training options, is a key factor for improving sustainability outcomes (Hoinle & Klosterkamp, 2023).

4.2.4. Participation of Stakeholders

Participatory processes involving public catering stakeholders are identified as an important lever in the transition to more organic and local products (Cruz et al., 2023; Graça et al., 2022; Sanz Sanz et al., 2022; Smith et al., 2016). The formation of new structures, such as delivery structures, distribution channels, or procurement tenders, developed through participatory processes are more resilient and more responsive to stakeholder needs (Cruz et al., 2023). Participation is particularly recommended for the following measures: developing a food strategy (Risku-Norja & Løes, 2017); awareness raising and education about sustainable food (Hoinle & Klosterkamp, 2023); fostering acceptance of change; and mobilizing local communities and society as a whole (Reinders et al., 2024). In Italy, for instance, parents participate in canteen committees to

shape sustainable public school food procurement. This enables the consumer perspective to be considered, thereby reducing transaction costs and facilitating the flow of information (Filippini et al., 2018).

4.3. Relevance of Biodiversity in Public Catering

The qualitative content analysis of the selected articles focusing on biodiversity with their own code revealed that this concept was rarely mentioned in articles about public catering. Biodiversity was mostly mentioned in introductions, highlighting the relationship between the global food system and biodiversity loss as a sustainability challenge (Spyridon & Mikkelsen, 2018). In this context, several articles mentioned the potential of organic farming methods to produce better biodiversity outcomes (Aleksejeva, 2022; Daugbjerg, 2023). Nevertheless, some close links have been identified between biodiversity and public catering.

Braun et al. (2018) discuss the example of newly founded organic farms in Brandenburg, which started with a strong commitment to family farming and biodiversity. However, cultivating a wide diversity of vegetable crops was difficult to maintain due to the high workload involved. Ultimately, they focused on fewer crops, selling them at wholesale organic markets. This illustrates the practical challenges of implementing farming methods to foster biodiversity.

Two articles demonstrated the potential for linking biodiversity with short value chains to public catering. By emphasizing seasonality, local culinary traditions, and biodiversity, short food supply chains can be developed (Filippini et al., 2018). In this example, biodiversity is promoted by growing different varieties of the same product (e.g., tomatoes). Kraljevic and Zanasi (2023) presented a case study from the Italian biodistrict of Cilento, where a municipality is working on a project to develop 100% organic school canteens. The goal in this case is to almost rely on organic local production entirely, suggesting that an improvement in the synchronization with producers is a very likely outcome. The authors emphasize that "this goal is supported by the farmers' focus on increasing biodiversity in organic production, consequently broadening the range of organic products supplied by the Biodistrict" (Kraljevic & Zanasi, 2023, p. 13). This example provides an initial insight into how biodiversity can be promoted through local value chains involving organic, local farmers.

As shown in Section 2.1, there are also studies that assess the biodiversity impact of certain product groups in the wider category of the out-of-home catering sector. They mainly focus on providing a tool to assess biodiversity in different products that can be purchased by kitchen management as a way to promote biodiversity in menu planning (Chaudhary & Kastner, 2016; Crenna et al., 2019; Heinz et al., 2023; Monetti et al., 2021).

5. Discussion

To address the issue of promoting profound transitions in the food system toward more sustainability and biodiversity, we identified four different barriers and four drivers that contribute to the integration of biodiversity-friendly, organic, and local food in public catering. In this section, we connect our findings with the LP approach developed by Abson et al. (2017) to distinguish between deeper and shallower LPs (based on Abson et al., 2017; Fischer & Riechers, 2019; Meadows, 1999). This enables us to analyze our results from a novel perspective, in order to identify strategies for fostering effective interventions in the food

system. As outlined in Section 2.2, the LPs can be classified into four main categories: parameters, feedbacks, design, and intent. Figure 4 illustrates the alignment between these LPs and the barriers and drivers identified in our study. Based on the assumption of leveraging change in the food system, we formulate potential action strategies to facilitate transition processes and discuss the effectiveness of the different measures to promote transitions. The four LPs differ in their effectiveness in transforming a system—intent being the deepest and parameters the most shallow.

In what follows, we outline the rationale behind linking each LP to its corresponding barriers and drivers. It should be noted, however, that the presented Figure 4 represents only an approximation of a more complex reality, and that alternative interconnections are also possible.

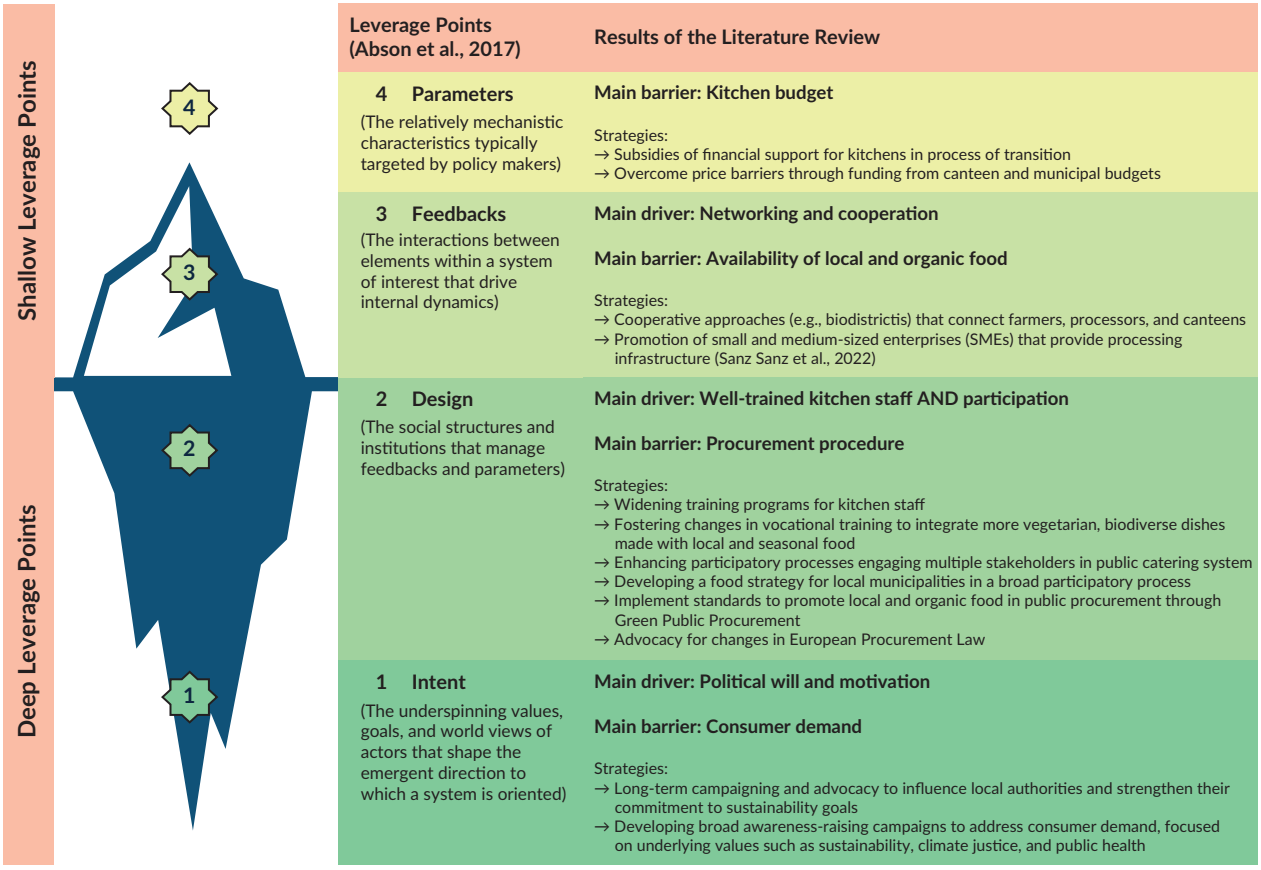

Figure 4. Overview of key barriers and drivers linked to different levels of LPs. Source: Adapted from Abson et al. (2017).

We identified "kitchen budget" (parameter) as well as "availability of organic and local food" and "network and cooperation along the value chain" (feedback) as shallow LPs that are easier to address but have less impact on system-wide change. Abson et al. (2017) define subsidies and payments to farmers as parameters. Therefore, it could be argued that kitchen budget constraints could be addressed through programs that financially support public kitchens in the process of increasing biodiversity-friendly, organic, and local food offers in their menus.

We identified "networking and cooperation along the value chain" as a feedback mechanism that could potentially produce positive, self-perpetuating effects. As "lack of availability" was identified as one of the

strongest barriers, effective mechanisms that strengthen cooperation between farmers, processors, and kitchens could address this barrier and lead to positive feedback effects in the food system. Examples of such strategies include the Biodistrict approach in Italy, which aims to strengthen networks between local organic producers and public canteens (Kraljevic & Zanasi, 2023). The strengthening of such feedback and network strategies can be regarded as having a high potential for fostering sustainable transitions in a region and should be improved through specific programs.

In the "design" category of LP, Abson et al. (2017) emphasize the importance of information flows, rules, and power relations. As shown in Section 2.1, eating habits and the choice of food product groups are decisive for biodiversity-friendly public catering. In particular, a plant-based diet with local organic products is more favourable. To achieve this, the results showed that kitchen staff need more training in creative menu planning. Accordingly, we identified the driver "well-trained kitchen staff" as LP that can be encouraged through vocational training and additional continuing professional development training for kitchen staff. This intervention point is more challenging to implement, as its outcomes are likely to only be seen in the long term. Based on our literature analysis, we argue that these interventions should include training programs and changes in vocational curricula that focus on generating creative menus with less meat and more local, seasonal foods, thereby promoting local biodiversity. Power relations and system rules represent deep LPs that are challenging to address. This particularly relates to procurement policy as a barrier, as the legal framework operates at a Europe-wide scale (European procurement policy), making it difficult for local actors to influence it. "Participation" was identified as a key driver in our literature analysis, and we see it as an opportunity to involve diverse food system actors in the transition process. This could take the form of involving students in school menu planning processes or developing a food strategy through a broad participatory process to shape the procurement policy of a local municipality.

System "intent" represents the most challenging area for intervention points in the food system. We linked "political will" and "consumer demand" to this category. While consumer demand also has feedback effects, it reflects underlying values that influence whether or not people choose biodiversity-friendly, organic, and local food. Similarly, political will is influenced by the values and goals of individual politicians and local authorities, which may or may not align with sustainability principles. In both cases, these values and goals are difficult to change and require long-term awareness-raising and advocacy campaigns, often developed by civil society actors.

As noted by Abson et al. (2017), different LPs interact with each other and can be mutually reinforcing. Thus, the LPs could be combined in a coherent way in order to create a holistic approach to transforming the food system toward more sustainability and biodiversity. This could mean that policy subsidies for organic, biodiversity-friendly kitchens (parameters) are linked with strategic networking measures for connecting actors along the food value chain (feedback) based on a participatory process (design). Further, awareness-raising campaigns about biodiversity and food address the underlying values and goals of the actors in the long run (intent).

The suggested combination of these action strategies means that all actors involved in public catering (see Figure 1)—farmers, distributors, processors, public purchasers, public kitchens, and policymakers—have a role in making public catering more biodiversity-friendly and sustainable. In particular, the decisions made by actors along the value chain influence this process, including the cultivation method used for food production, the

range of products available in the trade, the choice of products purchased in the public kitchens, the dishes selected at the counter, and the conditions set at the political level to increase the use of biodiversity-friendly, organic, and local products in public catering.

By highlighting the relevance of biodiversity in public catering, this study contributes to the existing lack of research in this field. However, our study has several limitations. As the existing literature focuses mainly on organic and local products in public catering, we had to conduct two searches to specifically analyse the role of biodiversity in public catering. Thus, the barriers and drivers identified mainly relate to the integration of local and organic food in public catering. However, as explained in Section 1, the promotion of organic farming and short food supply chains has synergies with the promotion of local biodiversity. Thus, the identified policies and LPs can be interpreted as ways to promote biodiversity-friendly dishes in public catering. Further research is needed to deepen the analysis of biodiversity in public catering, especially on certification schemes to make biodiversity-friendly products transparent to consumers, as well as research on strategies to improve the ways in which biodiversity, in particular, can be promoted in public catering.

6. Conclusion

The findings of our study indicate that biodiversity remains an undervalued and under-researched topic in the context of public catering. In this study, we have conceived biodiversity both in the sense of "agrobiodiversity"—bringing diverse varieties of vegetables or legumes onto consumer's plates and in the sense of preserving areas for pollinators within the agroecosystem. As evidenced by the findings of previous studies, organic agriculture represents the most promising approach for simultaneously enhancing food production and biodiversity conservation (Sanders & Heß, 2019).

Our research aim was to identify the key barriers and drivers influencing the uptake of organic and local food in public catering and to ascertain how biodiversity could be advanced through public catering. We undertook a systematic literature review to identify the most relevant key barriers and drivers, which included analysing studies in the European context that were published in the past 10 years. According to our systematic literature review, the main barriers preventing public canteens from sourcing biodiversity-friendly, organic, and local food are: (a) lack of availability of organic or local food, especially pre-processed products; (b) limited budgets for kitchens in the public sector; (c) procurement policies; and (d) consumer demand. Our results show that the most relevant drivers are: (a) cooperation and networking along the value chain; (b) political will and motivation; (c) well-trained kitchen staff; and (d) participation. These key barriers and drivers should not be seen as isolated but as interconnected factors. Thus, the barrier "lack of availability of organic and local food" can be addressed by networking strategies that connect farmers with processors and public kitchens. Further, the limited budget of public kitchens is connected to the political will and motivation of powerful stakeholders to design better policies for this sector. The literature review revealed a lack of research regarding biodiversity in the context of public procurement. Biodiversity was mentioned in only a few studies related to public catering which highlighted challenges, such as implementing diverse cropping systems in the context of economic constraints. As shown in Section 4.3, there are examples of the promotion of biodiversity through the implementation of short food supply chains with school canteens in Biodistricts in the case of Italy (Kraljevic & Zanasi, 2023).

In order to identify effective LPs for promoting food system change towards a more biodiversity-friendly public catering system, we analyzed our results using the LP theory developed by Abson et al. (2017) based

on Meadows (1999). This analysis enabled us to deduce several action strategies and policy measures. As demonstrated, shallow LPs are easier to implement but have less impact. However, these strategies can serve as a starting point for transitioning to more biodiversity-friendly canteens. These measures include subsidies for public canteens to transition to organic and biodiversity-friendly menus. Deeper and more challenging LPs involve changes in procurement policies, political will, and consumer demand. This would require long-term campaigns and awareness-raising programs as well as participatory approaches that connect all actors in the food system. Meanwhile, "medium-scale" interventions such as cooperative platforms that link farmers, processors, and kitchens, and training programs for kitchen staff to integrate more local, seasonal foods into diverse recipes are also recommended to improve sustainability and biodiversity outcomes in public catering. In effect, there is a need for holistic approaches that combine different intervention points in a coherent way as part of a long-term strategy with short-term measures. Further research is necessary to analyze and develop such strategies for promoting biodiversity through the creation of local value chains that supply public canteens.

Acknowledgments

We would like to thank the anonymous reviewers for their valuable feedback and insightful suggestions, which greatly improved the quality of this manuscript. We gratefully acknowledge the English editing performed by Alison Butler and Haley Swanger. Also, we like to thank Professor Dr Claudia Bieling, Department of Societal Transition & Agriculture at the University of Hohenheim, Germany, for her helpful comments on an earlier draft.

Funding

The article is the result of two research projects: BiodivRegio—Research on Concepts for the valorisation of Food From Biodiversity-Friendly, Regional Agriculture, which is funded by the Baden-Württemberg Ministry of Science, Research and the Arts, and co-financed by the European Union's European Regional Development Fund (ERDF). The second project BioregioKantine—Strategies for Local and Organic Food in Public Catering was funded by the Baden-Württemberg Ministry of Food, Rural Affairs, and Consumer Protection.

Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

References

Abson, D., Fischer, J., Levonton, J., Newig, J., Schomerus, T., Vilsmaier, U., von Wherden, H., Abernethy, P., Ives, C. D., Jager, N. W., & Lang, D. J. (2017). Leverage points for sustainability transformation. *Ambio*, *46*, 30–39.

Aleksejeva, L. (2022). Problems of local organic food procurement management at general education schools in Latvia. *Proceedings of the 2022 International Conference Economic Science for Rural Development*, *56*, 14–24. https://doi.org/10.22616/ESRD.2022.56.001

Andhov, M., Mikulic, S., & Nielsen, L. R. (2024). *Transforming food systems: The role of public procurement*. Routledge. https://doi.org/10.4324/9781003393023-16

Azam-Ali, S. N., Gregory, P. J., & Jahanshiri, E. (2024). Diversifying the UK agrifood system: A role for neglected and underutilised crops. *Agronomy*, *14*(4), Article 853. https://doi.org/10.3390/agronomy14040853

Barbeito, P., Coste, M., Lano, E., Pizzato, M., Ponzio, R., & Sardo, P. (2020). *If biodiversity lives, the planet lives* (Slow Food's Position Paper on Biodiversity). Slow Food. https://www.fondazioneslowfood.com/wp-content/uploads/2021/05/ENG_Biodiverisity_Paper_Long_Version.pdf

Braun, C., Rombach, M., Häring, A., & Bitsch, V. (2018). A local gap in sustainable food procurement: Organic vegetables in Berlin's school meals. *Sustainability*, *10*(11), 4245. https://doi.org/10.3390/su10114245

Brondizio, E. S., Settele, J., Díaz, S., & Ngo, H. T. (2020). *Global assessment report on biodiversity and ecosystem services of the intergovernmental science-policy platform on biodiversity and ecosystem services*. IBES Secretariat.

Campbell, B. M., Beare, D. J., Bennett, E. M., Hall-Spencer, J. M., Ingram, J. S. I., Jaramillo, F., Ortiz, R., Ramankutty, N., Sayer, J. A., & Shindell, D. (2017). Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecology and Society*, *22*(4), Article 8. https://doi.org/10.5751/ES-09595-220408

Chaudhary, A., & Kastner, T. (2016). Land use biodiversity impacts embodied in international food trade. *Global Environmental Change*, *38*, 195–204. https://doi.org/10.1016/j.gloenvcha.2016.03.013

Chaves, V. M., Rocha, C., Gomes, S. M., Jacob, M. C. M., & da Costa, J. B. A. (2023). Integrating family farming into school feeding: A systematic review of challenges and potential solutions. *Sustainability*, *15*(4), Article 2863. https://doi.org/10.3390/su15042863

Commission recommendation (EU) 2021/2279 of 15 December 2021 on the use of the environmental footprint methods to measure and communicate the life cycle environmental performance of products and organisations. *Official Journal of the European Union*, L 471. https://eur-lex.europa.eu/eli/reco/2021/2279/oj/eng

Crenna, E., Sinkko, T., & Sala, S. (2019). Biodiversity impacts due to food consumption in Europe. *Journal of Cleaner Production*, *227*, 378–391. https://doi.org/10.1016/j.jclepro.2019.04.054

Cruz, J. L., Hewitt, R. J., & Hernández-Jiménez, V. (2023). Can public food procurement drive agroecological transitions? Pathways and barriers to sustainable food procurement in higher education institutions in Spain. *Agroecology and Sustainable Food Systems*, *47*(10), 1488–1511. https://doi.org/10.1080/21683565.2023.2248917

Daugbjerg, C. (2023). Using public procurement of organic food to promote pesticide-free farming: A comparison of governance modes in Denmark and Sweden. *Environmental Science & Policy*, *140*, 271–278. https://doi.org/10.1016/j.envsci.2022.12.012

De Falco, E., Senatore, A., Roscigno, G., & Pergola, M. (2022). The artichoke "Bianco di Pertosa": The enhancement of crop residues through environmentally friendly uses. *Horticulturae*, *8*(10), Article 900. https://doi.org/10.3390/horticulturae8100900

Divéky-Ertsey, A., Gál, I., Madaras, K., Pusztai, P., & Csambalik, L. (2022). Contribution of pulses to agrobiodiversity in the view of EU protein strategy. *Stresses*, *2*(1), 90–112. https://doi.org/10.3390/stresses2010008

European Commission. (2017). *Agriculture: A partnership between Europe and farmers*. Publications Office of the European Union. https://doi.org/10.2775/358697

European Commission. (2019). *Commission staff working document: EU green public procurement criteria for food, catering services and vending machines* (SWD(2019) 366 final). https://data.consilium.europa.eu/doc/document/ST-12672-2019-INIT/en/pdf

European Commission. (2021). *Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions: On an action plan for the development of organic production* (COM(2021) 141 final/2). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52021DC0141R%2801%29

Filippini, R., De Noni, I., Corsi, S., Spigarolo, R., & Bocchi, S. (2018). Sustainable school food procurement: What factors do affect the introduction and the increase of organic food? *Food Policy*, *76*, 109–119. https://doi.org/10.1016/j.foodpol.2018.03.011

Fischer, J., & Riechers, M. (2019). A leverage points perspective on sustainability. *People and Nature*, *1*(1), 115–120. https://doi.org/10.1002/pan3.13

Flörke, S., Keller, M., Ross, S., & Herzig, C. (2022). *Regiowoche Kassel: Praxistest für eine bioregionale Kita—und Schulverpflegung in Stadt und Landkreis Kassel—Herausforderungen, Potenziale und Handlungsempfehlungen*. Projektteam RegioWoche Kassel. https://www.uni-giessen.de/de/fbz/fb09/institute/ibae/bea/projekte/bioregion-ks

Food and Agriculture Organization of the United Nations. (2004). *Building on gender, agrobiodiversity and local knowledge: What is agrobiodiversity?* https://www.fao.org/4/y5609e/y5609e00.htm#Contents

Graça, J., Roque, L., Guedes, D., Campos, L., Truninger, M., Godinho, C., & Vinnari, M. (2022). Enabling sustainable food transitions in schools: a systemic approach. *British Food Journal*, *124*(13), 322–339. https://doi.org/10.1108/BFJ-11-2021-1188

Hanke, G., & Wunder, S. (2023). *Regionalisierung von Ernährungssystemen: Einschätzung von Nachhaltigkeitspotenzialen und Darstellung politischer Handlungsansätze*. Umweltbundesamt. https://www.umweltbundesamt.de/publikationen/regionalisierung-von-ernaehrungssystemen

Hauschildt, V., & Schulze-Ehlers, B. (2014). An empirical investigation into the adoption of green procurement practices in the German food service industry. *International Food and Agribusiness Management Review*, *17*(3). https://doi.org/10.22004/AG.ECON.183433

Heinz, J., Menzel, A., Wagner, L., Langen, N., & Speck, M. (2023). Dishing up biodiversity: How does out-of-home catering affect biodiversity? Assessment methodology and implementation in commercial kitchens. *Ernaehrungs Umschau 2023*, *70*(10), 116–124.

High Level Panel of Experts on Food Security and Nutrition. (2017). *Nutrition and food systems: A report by the High Level Panel of Experts on Food Security and Nutrition of the committee on world food security*. https://www.fao.org/fsnforum/resources/policy-documents/nutrition-and-food-systems-report-high-level-panel-experts-food-security

Hoinle, B., & Klosterkamp, S. (2023). Food justice in public-catering places: Mapping social-ecological inequalities in the urban food systems. *Frontiers in Sustainable Food Systems*, *7*, Article 1085494. https://doi.org/10.3389/fsufs.2023.1085494

Hüber, C., Zettl, F., Hartung, J., & Müller-Lindenlauf, M. (2022). The impact of maize-bean intercropping on insect biodiversity. *Basic and Applied Ecology*, *61*, 1–9. https://doi.org/10.1016/j.baae.2022.03.005

Joannides, J. (2012). *Local food systems as regional economic drivers in southern Minnesota*. Southern Minnesota Initiative Foundation (SMIF) and The McKnight Foundation by the Minnesota Institute for Sustainable Agriculture (MISA) at the University of Minnesota. https://www.mcknight.org/wp-content/uploads/pdf-2-4-mb.pdf

Kliem, L., & Sievers-Glotzbach, S. (2022). Seeds of resilience: The contribution of commons-based plant breeding and seed production to the social-ecological resilience of the agricultural sector. *International Journal of Agricultural Sustainability*, *20*(4), 595–614. https://doi.org/10.1080/14735903.2021.1963598

Kraljevic, B., & Zanasi, C. (2023). Drivers affecting the relation between biodistricts and school meals initiatives: Evidence from the Cilento biodistrict. *Frontiers in Sustainable Food Systems*, *7*, Article 1235871. https://doi.org/10.3389/fsufs.2023.1235871

Kujala, S., Hakala, O., & Viitaharju, L. (2022). Understanding regional variation in the use of local food in public catering. *British Food Journal*, *124*(10), 3323–3337. https://doi.org/10.1108/BFJ-04-2021-0385

Lassen, A. D., Thorsen, A. V., & Trolle, E. (2023). Current Practices and opportunities for more sustainable public food procurement: A qualitative study among Danish municipalities and regions. *Foods*, *12*(10). 1–17. https://doi.org/10.3390/foods12101975

Lindström, H., Lundberg, S., & Marklund, P.-O. (2022). Green public procurement: An empirical analysis of the uptake of organic food policy. *Journal of Purchasing and Supply Management*, *28*(3), Article 100752. https://doi.org/10.1016/j.pursup.2022.100752

Lopez, V., Teufel, J., & Gensch, C.-O. (2020). How a transformation towards sustainable community catering can succeed. *Sustainability*, *12*(1), Article 101. https://doi.org/10.3390/su12010101

Mantyka-Pringle, C. S., Visconti, P., Di Marco, M., Martin, T. G., Rondinini, C., & Rhodes, J. R. (2015). Climate change modifies risk of global biodiversity loss due to land-cover change. *Biological Conservation*, *187*, 103–111. https://doi.org/10.1016/j.biocon.2015.04.016

Martin, G., Pujos, L., & Magrini, M.-B. (2022). Micro-level sustainability transition pathways of institutional food services in France. *Frontiers in Sustainable Food Systems*, *6*, Article 943020. https://doi.org/10.3389/fsufs.2022.943020

Mattas, K., Raptou, E., Alayidi, A., Yener, G., & Baourakis, G. (2023). Assessing the interlinkage between biodiversity and diet through the mediterranean diet case. *Advances in Nutrition*, *14*(3), 570–582. https://doi.org/10.1016/j.advnut.2023.03.011

Mayring, P. (2022). *Qualitative Inhaltsanalyse: Grundlagen und Techniken*. Julius Beltz. http://nbn-resolving.org/urn:nbn:de:bsz:31-epflicht-2019387

Meadows, D. (1999). *Leverage points: Places to intervene in a system*. The Sustainability Institute.

Molin, E., Lingegård, S., Martin, M., & Björklund, A. (2024). Sustainable public food procurement: Criteria and actors' roles and influence. *Frontiers in Sustainable Food Systems*, *8*, Article 1360033. https://doi.org/10.3389/fsufs.2024.1360033

Monetti, S., Pregernig, M., Speck, M., Langen, N., & Bienge, K. (2021). Assessing the impact of individual nutrition on biodiversity: A conceptual framework for the selection of indicators targeted at the out-of-home catering sector. *Ecological Indicators*, *126*, Article 107620. https://doi.org/10.1016/j.ecolind.2021.107620

Newbold, T. , Hudson, L. N., Hill, S. L. L., Contu, S., Lysenko, I., Senior, R. A., Börger, L., Bennett, D. J., Choimes, A., Collen, B., Day, J., de Palma, A., Díaz, S., Echeverria-Londoño, S., Edgar, M. J., Feldman, A., Garon, M., Harrison, M. L. K., Alhusseini, T., & Purvis, A. (2015). Global effects of land use on local terrestrial biodiversity. *Nature*, *520*(7545), 45–50. https://doi.org/10.1038/nature14324

Nguyen, H. (2018). *Sustainable food systems: Concept and framework*. Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/handle/20.500.14283/ca2079en

Perignon, M., Lepiller, O., Intoppa, B., Valette, É., Roudelle, O., & Wood, A. (2024). The role of school canteens in building more sustainable food systems. In É. Valette, A. Blay-Palmer, B. Intoppa, A. Di Battista, O. Roudelle, & G. Chaboud (Eds.), *Routledge studies in food, society and the environment: Evaluating sustainable food system innovations—A global toolkit for cities* (pp. 77–100). Taylor & Francis. https://doi.org/10.4324/9781003285441-5

Pfefferle, H., Hagsphil, S., & Clausen, K. (2021). Gemeinschaftsverpflegung in Deutschland—Stellenwerte und Strukturen. *Ernährungsumschau*, *8*, 470–483.

Reinders, M. J., Battjes-Fries, M. C. E., Bouwman, E. P., & Meeusen-van Onna, M. J. G. (2024). Effectively implementing healthy and sustainable food practices in out-of-home food service locations: The perspective of the catering staff members. *Appetite*, *193*, Article 107152. https://doi.org/10.1016/j.appet.2023.107152

Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., Drüke, M., Fetzer, I., Bala, G., von Bloh, W., Feulner, G., Fiedler, S., Gerten, D., Gleeson, T., Hofmann, M., Huiskamp, W., Kummu, M., Mohan, C., & Rockström, J. (2023). Earth beyond six of nine planetary boundaries. *Science Advances*, *9*, 1–16.

Risku-Norja, H., & Løes, A.-K. (2017). Organic food in food policy and in public catering: Lessons learned from Finland. *Organic Agriculture*, *7*(2), 111–124. https://doi.org/10.1007/s13165-016-0148-4

Rounsevell, M., Harfoot, M., Harrison, P. A., Newbold, T., Gregory, R. D., & Mace, G. M. (2020). A biodiversity target based on species extinctions: A single target comparable to the 2C climate target may help galvanize biodiversity policy. *Science*, *368*(6496), 1193–1195.

Sanders, J., & Heß, J. (2019). *Leistungen des ökologischen Landbaus für Umwelt und Gesellschaft*. Thünen-Institut. https://www.thuenen.de/de/newsroom/detail/thuenen-report-65

Sanz Sanz, E., Cardona, A., & Napoléone, C. (2022). Motivations of public officials as drivers of transition to sustainable school food provisioning: Insights from Avignon, France. *Journal of Agricultural and Environmental Ethics*, *35*(2), Article 6. https://doi.org/10.1007/s10806-022-09880-9

Schäfer, M., & Haack, M. (2023). Overcoming the efficiency paradigm—The challenges of introducing local organic beef in canteens. *Frontiers in Sustainable Food Systems*, *7*, Article 1152185. https://doi.org/10.3389/fsufs.2023.1152185

Scheerer, T., Hertweck, D., & Hakenberg, T. (2024, June 24–28). *From crop to click—Organic and digital transformation of out-of-home catering value chains in Germany* [Paper presentation]. 10th International Conference on ICT for Sustainability (ICT4S), Stockholm, Sweden. https://doi.org/10.13140/RG.2.2.15559.92325

Schleiffer, M., Landert, J., & Moschitz, H. (2022). Assessing public organic food procurement: The case of Zurich (CH). *Organic Agriculture*, *12*(3), 461–474. https://doi.org/10.1007/s13165-022-00402-5

Seufert, V., & Ramankutty, N. (2017). Many shades of gray: The context-dependent performance of organic agriculture. *Science Advances*, *3*(3), Article e1602638. https://doi.org/10.1126/sciadv.1602638

Simon, X., Copena, D., & Pérez-Neira, D. (2023). Assessment of the diet-environment-health-cost quadrilemma in public school canteens. an LCA case study in Galicia (Spain). *Environment, Development and Sustainability*, *25*(11), 12543–12567. https://doi.org/10.1007/s10668-022-02578-y

Smith, J., Andersson, G., Gourlay, R., Karner, S., Mikkelsen, B. E., Sonnino, R., & Barling, D. (2016). Balancing competing policy demands: the case of sustainable public sector food procurement. *Journal of Cleaner Production*, *112*, 249–256. https://doi.org/10.1016/j.jclepro.2015.07.065

Speck, M., Wagner, L., Buchborn, F., Steinmeier, F., Friedrich, S., & Langen, N. (2022). How public catering accelerates sustainability: A German case study. *Sustainability Science*, *17*(6), 2287–2299. https://doi.org/10.1007/s11625-022-01183-2

Spyridon, F., & Mikkelsen, B. E. (2018, September 17–21). *More organic food on the public plate—Need for a new public governance?* [Paper presentation]. Third International Conference: Agriculture and Food in an Urbanizing Society, Porto Alegre, Brazil.

Stampa, E., & Zander, K. (2022). Backing biodiversity? German consumers' views on a multi-level biodiversity-labelling scheme for beef from grazing-based production systems. *Journal of Cleaner Production*, *370*, Article 133471. https://doi.org/10.1016/j.jclepro.2022.133471

Swingland, I. R. (2013). Definition of biodiversity. In S. A. Levin (Ed.), *Encyclopedia of biodiversity* (pp. 399–410). Elsevier. https://doi.org/10.1016/B978-0-12-384719-5.00009-5

Teufel, J., Hermann, A., & Müller, R. (2020). *Biodiversitätskriterien in der Beschaffung II—Weiterentwicklung und praxisbezogene Konkretisierung von Biodiversitätskriterien in ausgewählten Produktgruppen der öffentlichen*

Beschaffung des Bundes. Bundesministerium für Umwelt, Klimaschutz, Naturschutz und nukleare Sicherheit. https://www.bmuv.de/download/biodiversitaetskriterien-in-der-beschaffung-ii-weiterentwicklung-und-praxisbezogene-konkretisierung-von-biodiversitaetskriterien-in-ausgewaehlten-produktgruppen-der-oeffentlichen-beschaffung-des-bundes

Urban, M. C. (2015). Accelerating extinction risk from climate change. *Science*, *348*(6234), 571–573. https://doi.org/10.1126/science.aaa4984

von Braun, J., Afsana, K., Fresco, L. O., Hassan, M. H. A., & Torero, M. (2023). *Science and innovations for food systems transformation: Food system concepts and definitions for science and political action*. Springer. https://doi.org/10.1007/978-3-031-15703-5_2

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., . . . Murray, C. J. L. (2019). Food in the anthropocene: the EAT-lancet commission on healthy diets from sustainable food systems. *Lancet*, *393*(10170), 447–492.

Zhang, M., & Dannenberg, P. (2022). Opportunities and challenges of indigenous food plant farmers in integrating into agri-food value chains in Cape Town. *Land*, *11*(12), Article 2267. https://doi.org/10.3390/land11122267

About the Authors

Clara Bückart-Neufeld is a PhD student in the Department of Societal Transition and Agriculture at the University of Hohenheim, Germany. She is working on the BiodivRegio project at the Nürtingen-Geislingen University, Germany. Her research focuses on the impact of co-creative workshops on the transition to a resilient economy and a sustainable food system.

Franziska Bürker is a member of the scientific staff at the Karlsruhe Transformation Centre for Sustainability and Cultural Change at the Institute for Technology Assessment and Systems Analysis (ITAS), KIT Karlsruhe. Previously, she worked on the BioregioKantine project at the University of Hohenheim, Germany. Her research focuses on the transformation of food systems, with her current work examining sustainability in public catering.

Birgit Hoinle is a postdoc researcher in the Department of Societal Transition and Agriculture at the University of Hohenheim, Germany. She holds a PhD in geography from the University of Hamburg. Her current research focuses on food justice, urban food policies, and school food. She is an active member of the Food Policy Council Tübingen.