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*Research*

# Demystifying food systems transformation: a review of the state of the field

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ABSTRACT. There is increasing interest and hype around the need for transforming food systems toward sustainability. Today, calls for food systems transformations abound in the scholarly and gray literature, and even major international platforms have brought attention to this argument. However, as happens with many sustainability-related buzzwords, trendy terms can become co-opted, emptied of meaning, or used to refer to very different types of change in relation to goals, processes, or outcomes. In addition, many terms and theories are adopted to speak of and explain change. Therefore, what is meant by food system transformation remains opaque, and underscores the fact that food systems themselves are understood in multiple ways within the research community. As the urgency in accelerating food system transformations worldwide builds up, it is important to understand how this field has evolved and how food system change is conceptualized today. We offer an overview and synthesis of the scholarly literature in English and Spanish anchored on food systems change in the past three decades to shed light on how the theory and literature landscape has evolved, and how concepts are understood. At the same time, we provide an overview of the mechanisms of change that are most prominent and the frameworks that have been proposed. We conclude with what we think is a key definition of this critical concept. Our contribution serves to confirm and expand recent reviews, while mapping out the most prominent contributions to allow fellow researchers to navigate a diverse field and build upon these insights.

Key Words: *food system transformation; frameworks; map of the field; re-design; synthesis; theory; transitions*

## INTRODUCTION

Food systems offer an important and urgent lever of change as societies face and tackle multiple sustainability challenges. Calls for food systems transformations abound in the literature, from peer-reviewed research to the diverse abundance of reports and publications from international and governmental organizations, advocacy groups, etc. (IPES-Food 2015, Gordon et al. 2017, HLPE 2017, Willett et al. 2019, FOLU 2019, Fanzo et al. 2020, FAO et al. 2020, Global Panel on Agriculture and Food Systems for Nutrition 2020, WWF 2020, Slater et al. 2022). The recognition of food systems as levers of change, especially in relation to achieving the Sustainable Development Goals has recently gained particular attention as evidenced by international initiatives such as the United Nations Food Systems Summit. Despite critiques and the coexistence of diverse viewpoints (Jonas 2021), this attention has helped highlight both the urgency and opportunities for transformative action within food systems across all societal sectors and scales (from households to nations, from governments to industry and academia).

Within the research literature, the interest in food systems as a unit of analysis (Ericksen 2008) and a locus of purposive change has been growing over the last three decades (Weber et al. 2020). In 1994, a paper by Kenneth Dahlberg, published in the journal *Futures*, called for a transition to regenerative food systems as a way to tackle emergent societal threats such as climate change, pollution, energy inefficiency, ecosystem collapse, livestock and human population increase, loss of bicultural diversity, economic inequality, social justice, and inclusion issues. The article states that the actions needed to generate large transformations of industrial agriculture, include a decolonization and restructure of industrial agriculture, the support and preservation of indigenous and traditional food systems, and a major value shift that involves adopting systems approaches and a health (rather than productivity) evaluation criteria. This conceptualization implies a particular theory of change that may have been ahead of its time three decades ago, but is particularly poignant now. A theory of change, following Thornton et al. (2017), refers to a description in the form of a hypothesis of how change is expected and planned to come about (from design, actions, outputs, and outcomes), which typically also includes making the assumptions behind such strategy and its effectiveness explicit. In Dalhberg's argument, change should be developed using systemic approaches, constitute a change in values or paradigm (which determine what outcomes or impacts are seen to be desirable), and offer a reconfiguration of structures of production, distribution, trade, and consumption that moves away from the hegemonic industrialized food system while it integrates and is sensitive to diversity: perspectives/worldviews, knowledge types, and ecosystems. Although this argument was very clear then, the current state of the myriad food systems-related concerns and the increasing calls for their transformation seems to suggest not much progress has been made (Fanzo et al. 2020, Slater et al. 2022).

As happens with many sustainability-related buzzwords (see Paehlke 2005, Davoudi et al. 2012) certain trendy terms are adopted and co-opted to the point of becoming vague or empty of meaning. The term food system transformation has been used to imply and suggest very different types of change: from mere reformation and adaptations to radical and deep overhauls (Slater et al. 2022). Oftentimes, change refers to very different types of outcomes or goals, which are in turn enabled via different strategies based on how the problems are framed, either as a technical or political challenge (e.g., solutions are suggested to range from technology-driven to governance or paradigm change). Importantly, answers to questions about how to change (strategies), or change from what to what (goals and desired outcomes) and by whom (agents of change) are not always made explicit. In a review of the most common theories of change within

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food systems transformation, Weber et al. (2020) have identified five divergent approaches in the scholarly literature, suggesting interventions and strategies oriented to sustainable diets, food as commons, sustainable agriculture, alternative food movements, or healthy and diverse societies. Although overlaps between these areas of focus do exist, synergies and trade-offs need to be considered carefully to avoid unintended impacts and ensure desired outcomes (Stefanovic et al. 2020). Another layer of complexity is found when looking at the terms adopted to describe change; some examples include shift, deep change, transformation, or transition among others.

Since the recognition that work on food systems demands systems-based approaches and special attention to outcomes (Ericksen 2008), part of the literature has integrated either socio-technical transitions (Geels 2002) or social-ecological transformations (Olsson et al. 2014) theories. These refer to two distinct academic communities that have developed theories to explain change in complex systems based on different, but overlapping, disciplinary backgrounds. Recently, these theories have become closer and some scholars argue that they offer complementary views (Hölscher et al. 2018). Within the food system change literature, Weber et al. (2020) confirms that both concepts are used, but oftentimes without a clarification of the type of change process the term refers to. Still, not all the literature on food systems change adopts approaches that are sensitive to systemic features such as complexity, uncertainty, feedback loops, emergence, and trade-offs. In addition, food systems are not always seen as the coupling of social/institutional and natural systems with connections that span across levels and spatial and temporal scales (Ericksen 2008). It is recognized that beyond the complex local and global dynamics, various contextual features are key determinants of change: local needs, resources, priorities, and interests (Stefanovic et al. 2020, Dengerink et al. 2021). Because interactions and trade-offs deserve special attention, siloed approaches (e.g., by focus area, sector, or discipline) that do not engage the politics of change or that propose singular solutions are seen as limited (Hubeau et al. 2017, Lamine 2018, Anderson and Leach 2019). This brief overview highlights how change in relation to food systems is a very elusive and often unclear concept, which complements the fact that food systems themselves are understood in multiple ways within the research community (Leeuwis et al. 2021).

The urgency to move from theory to action prompts us to outline the current state of the field and its evolution, especially in contrast with Dahlberg's seminal work. New insights on how food system change is conceptualized today could help clarify and navigate an often fuzzy field, outlining how concepts are used, the different theories of change that are implied, and how, if at all, food system transformations or transitions can be defined. Our synthesis presents the results of a semi-systematic review that confirms and expands previous work while mapping out the most prevalent literature and theoretical contributions made in the last three decades. The following sections describe the methodology and criteria adopted, offer the results based on three levels of analysis, and discuss the insights. In our discussion, we propose a novel way to describe this research field while offering signposts for fellow or new researchers to use and build upon.

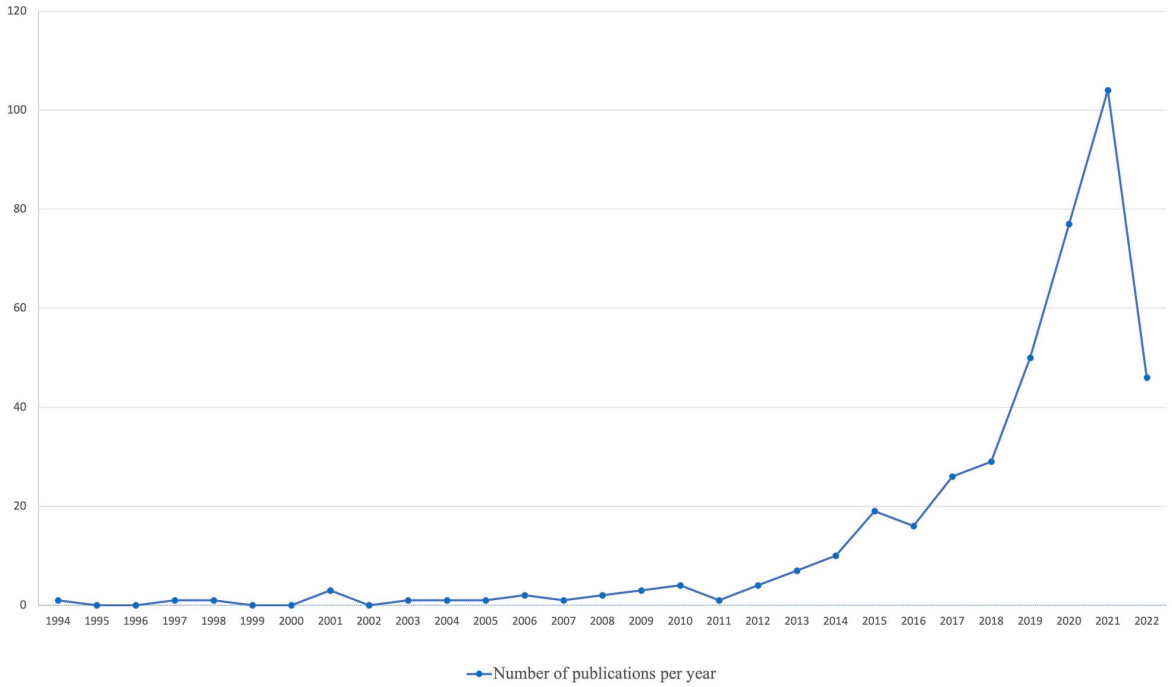
## METHODS

We carried out a semi-systematic review of the scholarly literature on food system transitions and transformations published between 1994 and 2022 (included). This type of review is suited to mapping a particular field (with key contributions, themes, and evolution over time), integrating both quantitative and qualitative results, and allowing a synthesis that can offer insights to new conceptual developments (Snyder 2019, Zunder, 2021). Although the scholarly production on the topic spans across large geographical regions, not all of the publications are written in English or indexed by global databases. To counteract this bias and capture more diverse perspectives, we complemented the English literature with inclusions from Spanish-based databases (indexing publications mainly from Latin America and Spain). All in all, three databases were reviewed: Scopus (English), Dialnet and REDIB (Spanish). The search string used in Scopus (and replicated manually in the Spanish databases) focused on key terms (food system/s, transition/s, and transformation/s) in either article titles and/or keywords. This choice focused on capturing the key (though not all) research literature theorizing food system transformation from systemic perspectives. Therefore, the exclusion criteria included filtering out unrelated subject areas (e.g., food chemistry, processing, neurology, and physics) or source formats (e.g., theses). Refer to Appendix 1 for details on search string, process, and filtering criteria. Results were merged and screened for consistency of criteria. Duplicates were removed (favoring Scopus records for data consistency if duplicated) and one article was manually added. Spanish publication titles and keywords were translated to English by the authors when a translation was not available.

To fulfill the aims of understanding how the food system transformation/transition field has evolved and what the key theoretical contributions have been in the last three decades, our analysis of the data was divided in three phases and sub-aims (with three corresponding Datasets), moving from quantitative to qualitative insights (see flowchart figure in Appendix 1): (1) generating statistical insights from the overall literature landscape (e.g., origin/authorship, journals, publication distribution); (2) mapping the thematic trends and evolution of the debate; and (3) identification of the main theoretical contributions and frameworks. An individual dataset was generated and is available for each phase.

The filtering process for each dataset was developed as follows. The first dataset includes 410 articles both in English and Spanish that matched the search and inclusion/exclusion criteria but does not discriminate on type of publication. For the second dataset, 102 research articles were considered after removing conference papers, books, book chapters, and other non-research article types (e.g., letters, editorials). During this phase, abstracts were screened to capture main themes of interest and generate a timeline of the evolution of the debate throughout the last three decades. The third dataset included 46 papers that, based on the abstract screening, suggested potential theoretical or definitional contributions. These publications were read in full to identify new theories, frameworks and gain a better understanding of the approaches, theories of change, and terms adopted. Filtering and clustering criteria was discussed and agreed amongst the three authors. A caveat is that in the case of contributions from Spanish databases, we restricted the inclusion criteria to the same search

**Fig. 1.** Number of publications per year between 1994 and 2022.




terms as in English to better grasp the theoretical and conceptual space on equivalent terms and because of limitations of the indexing platforms. We acknowledge that different terms or concepts are often adopted but may not always refer to the type of phenomena or approaches that are within the scope of this work (refer to Appendix 1 for more details). We still integrate prominent contributions throughout the discussion (and when noted) if not captured by the inclusion criteria.

## RESULTS

### 1. Statistical insights of the literature landscape

In order to understand the main characteristics of the literature landscape referring to food systems change, we first present the results from our statistical analysis based on a total of 410 articles (Dataset 1) with publications spanning between 1994 and 2022. Results report the quantitative insights based on three lenses: (1) the number of publications per year (see Fig. 1), (2) the geographical spread of publications based on corresponding authors' country of affiliation (see Fig. 2), and (3) the most prominent journals in which articles are published (see Table 1).

Looking at the publication trends within the roughly three decades between 1994 and 2022, a sharp and almost continuous rise was noticed after 2015 (going from less than 10 to 20 or more publications per year), with a particular spike from 2019 onward (an average of more than 40 publications per year). In 2021 alone, the total number of publications that matched our search criteria reached 104 and in 2022, the total was 46 (including research articles, reviews, editorials, notes, and even surveys). Of the total of publications, 90% (367) were published in the last 7 years since 2015, leaving 43 publications (10%) within the 1994–2014 20-year span where the average was between 0 to 4 publications per year except for 2013 and 2014 (7 and 10 publications, respectively).

In terms of geographic spread of publications, our results highlight a strong prominence of authorship based in the Global North, especially based at North American or European institutions. Figure 2 shows a map that highlights the number of articles by country of affiliation declared by the corresponding authors. This majority includes, for example, 78 articles with leading authors from the United States, followed by the Netherlands (37), Italy, Canada, United Kingdom, Germany, Australia, France, Spain, Finland, Sweden, and Belgium (with a range of 29 to 12 articles). On the contrary, the lowest representation of corresponding authors is recorded mainly from countries from the Global South (with some exceptions like China, South Africa, and Brazil that are relatively well represented). For example, three or less articles were registered with leading authors from countries such as Indonesia, Trinidad and Tobago, Colombia, Kenya, Ghana, Uruguay, and Chile, with most Least Developed Countries not being represented through leading authors at all. We note that many publications do have co-authorship representation based in different countries. The map in Figure 3 shows the total number of articles in which a country is registered based on the full authorship list. We found that a high representation of authors are still based in the United States (more than 100 articles), followed by the Netherlands, Italy, Canada, and the United Kingdom (between 60 and 70 each). Countries least represented in the authors list were mainly based in Latin America (Nicaragua, Cuba, Peru, Venezuela, Uruguay, Argentina, Chile), Africa (Cameroon, Senegal, Uganda, Nigeria), the Middle East (Lebanon, Israel, Russia), and Asia (India, Philippines, South Korea, Indonesia; Fig. 3). The differences in the maps confirm that collaboration between authors based in the Global North and South do exist, but in most cases, authors based at institutions in a few Global North countries take the lead or act as corresponding authors. Notice that the country refers

**Fig. 2.** Number of articles with a corresponding author from a given country. For countries marked in white, no data was available or authorship was recorded. Countries marked in gray mean no corresponding author was identified from that country even though they were represented in authorship lists (Dataset 1).

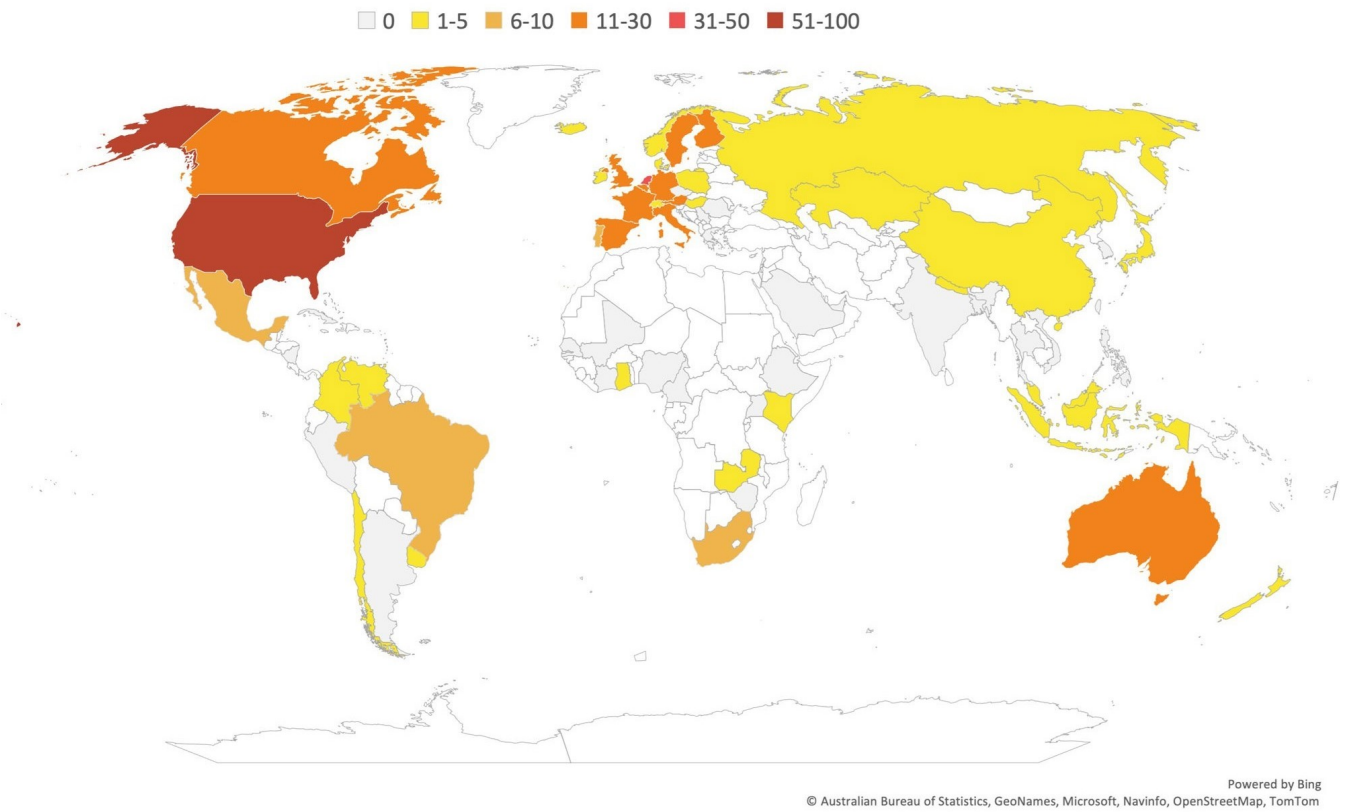



**Table 1.** List of the top ten journals in terms of total number of publications registered.

| Name of journal | Number of publications |
|---|---|
| *Sustainability* | 37 |
| *Agroecology and Sustainable Food Systems* | 19 |
| *Food Security* | 17 |
| *Agriculture and Human Values* | 17 |
| *Frontiers in Sustainable Food Systems* | 14 |
| *Nature Food* | 13 |
| *Global Food Security* | 12 |
| *Environmental Innovation and Societal Transitions* | 11 |
| *Ecology and Society* | 9 |
| *Journal of Rural Studies* | 9 |
| *Journal of Cleaner Production* | 8 |
| *Food Policy* | 7 |

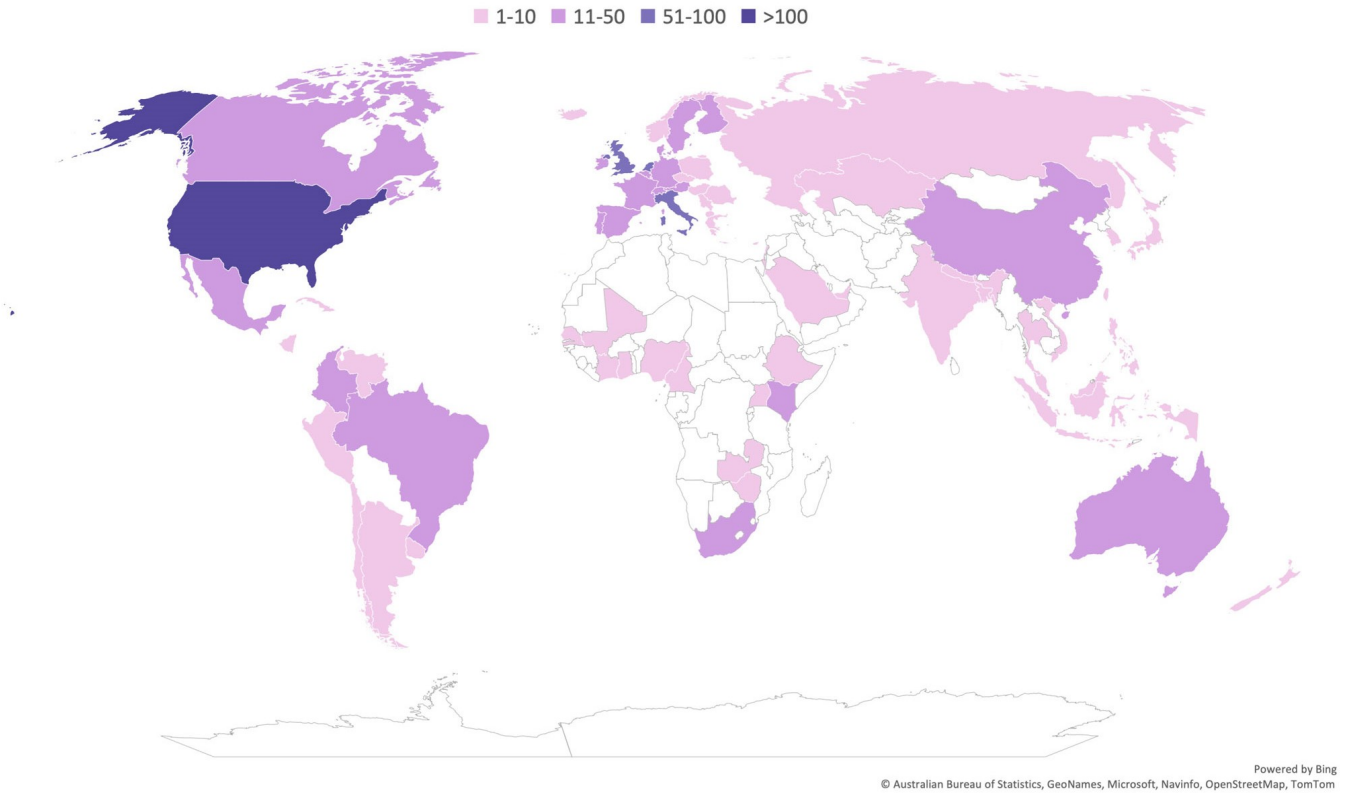
to the institutional location and not the country of origin or location of an author. It is also important to note that although some countries were registered as being represented by at least an author in the full author list (Fig. 3), some countries had no authorship representation in the literature whatsoever (shown in white in Figs. 1 and 2). Some examples are Bolivia, Ecuador, Algeria, Iran, Mongolia, and Papua New Guinea, and include some of the Least Developed Countries (LDCs) like Angola or Sierra Leone. At the same time, some LDC were represented in the authorship list, but not as corresponding authors (e.g., Ethiopia represented in 3 publications, and Bangladesh in 1).

In terms of dissemination, the top 10 journals in which the majority of the literature was published include *Sustainability* with 37 publications, and was then followed by: *Agroecology and Sustainable Food Systems* (19), *Food Security* (17), and *Agriculture and Human Values* (17). Other journals, with fewer publications include: *Nature Food*, a new journal, (13), *Environmental Innovation and Societal Transitions* (11), *Ecology and Society* (9), or *Food Policy* (7). Journals from the Spanish databases with the most publications include *Revista agroalimentaria* (4) and *Agroecología* (3). Popularity of a journal may have been dependent on aspects such as publication fees, impact factor, thematic alignment, and importantly, journal trajectory. For example, the journal *Frontiers in Sustainable Food Systems* (listing 14 publications) has been around for no more than a decade, whereas *Agriculture and Human Values* (17) has existed for more than 30 years. Please refer to Table 1 for more details.

**2. Evolution of the debate and key themes**

The second layer of analysis of the literature landscape focused on identifying the main thematic trends or areas of focus, as well as mapping out how the debate within the field has evolved. A second and smaller dataset of articles (N = 102) was used for this analysis, which included the screening of abstracts and keyword

**Fig. 3.** Number of articles with at least one author for a given country. For countries marked in white, no data was available or authorship was recorded. The figure shows the number of times an author's country affiliation was recorded. It does not correlate with total number of authors or total number of publications because some authors may have included multiple affiliations in different countries (Dataset 1).



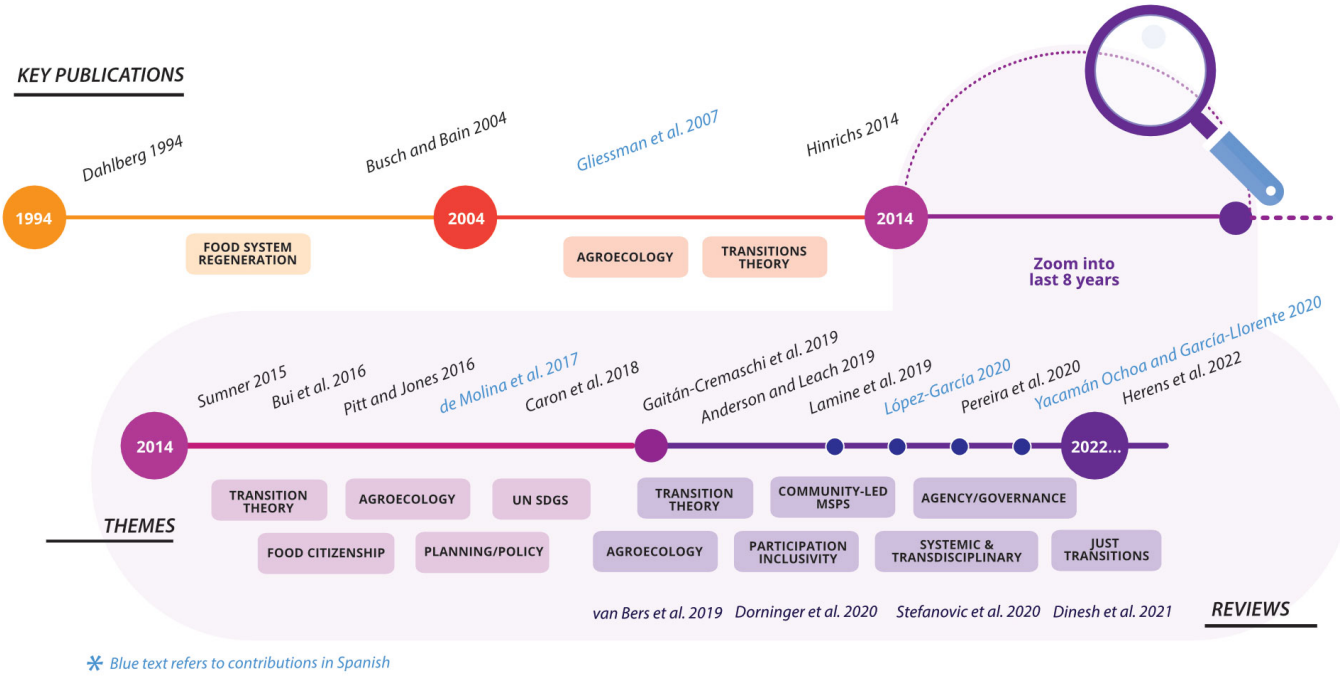

lists (Fig. 4 for a graphic timeline). It was possible to notice some key theoretical contributions as well as important synthesis and review articles. This review of the last three decades of published research referring to food system transitions or transformations rendered several key insights when looking at the differences and similarities between decades.

In the first decade (1994–2004) after Dahlberg's (1994) paper arguing for the regeneration of food systems as a means to transition to a post-fossil-fuel era, no other key publications potentially shaping the field appeared until Busch and Bain (2004). These authors offer an analysis on how the global agri-food system is transformed based on changes to international regulations and the role of the private sector. The second decade (2005–2014) was marked by the first explicit call for a connection between food system change and transitions theory (Hinrichs 2014), an interest in focusing on local food system change, mainly based on community initiatives or via social movements (Block et al. 2008), as well as the prominence of the promotion of agroecology and food sovereignty discourses in direct opposition to corporate agri-food business dominance (Gliessman et al. 2007, Holt-Giménez and Shattuck 2009, Sage 2014). In addition, Holt-Giménez and Shattuck (2009) offer an analysis showing the impacts, tensions, and challenges through the interplay between changes in agrofuels (e.g., land use, prioritization of certain crops, price fluctuation) and food system outcomes.

The third span (2015–2022) encompasses the vast majority (roughly 90%) of the literature produced altogether (in Dataset 1) and 92% of the literature within Dataset 2. We break down results in two sections to allow for a detailed look (please refer to the zoomed-in section in Fig. 4). For the range between 2015 and 2018, we identified a prevalence of publications applying transition theory and the opportunities and limitations of its analytical tools to food systems. Examples include a focus on social practices and in niche/regime interactions (Cohen and Ilieva 2015, Bui et al. 2016). During this period, a stronger political agenda is noticeable with the continuation of the discourse promoting the upscaling of agroecology as a sustainable alternative model of production, consumption, and governance (Bellamy and Ioris 2017, de Molina et al. 2017, Miles et al. 2017), in addition to food sovereignty and food citizenship (Davila and Dyball 2015, Sumner 2015). An emerging theme during this phase refers to the connection between food system change and the UN's Sustainable Development Goals (SDGs; Campbell et al. 2018, Caron et al. 2018), several publications addressing aspects related to planning, especially in urban areas, as well as processes of change based on policies (Pitt and Jones 2016, Battersby 2017).

The final group (2019–2022), depicts a continuation of some of the previous trends plus the introduction of new topics of focus. Importantly, this 4-year range includes 74 papers, or more than half of the total number of publications, revised within this

**Fig. 4.** Timeline depicting the evolution of the field and main themes within the debate (Dataset 2).




subset. Agroecology continues to appear as a key discourse (Kerr 2020, López-García 2020, Sandhu 2021), with particular attention to territorialization and land stewardship (Rastoin 2020, Yacamán-Ochoa and García-Llorente 2020, Passaro and Randelli 2022). The application of transition theory to agri-food systems becomes very prominent (Bui et al. 2019, El Bilali 2019, Gaitán-Cremaschi et al. 2019, Bui 2021, Leeuwis et al. 2021, Groot-Kormelinck et al. 2022, Lonkila and Kaljonen 2022, Mattioni et al. 2022) and is accompanied by a strong argument for the need for systemic and transdisciplinary as opposed to siloed approaches (Anderson and Leach 2019, Den Boer et al. 2021, Hebinck et al. 2021, Vilas-Boas et al. 2022). In complementarity, there is an interest in bottom-up/community-led or social-innovation processes as in the case of living labs or other multi-stakeholder processes (Anderson et al. 2019, Gamache et al. 2020, Nicol and Taherzadeh 2020, Pereira et al. 2020, Jonas 2021, Sandhu 2021, Herens et al. 2022) as well as the role of networks such as alternative food networks or other forms of governance platforms (Passaro and Randelli 2022, Reckinger 2022). Also, there is a stress on participatory processes that may be inclusive of otherwise less powerful actors and knowledge systems, e.g., indigenous peoples (Anderson and Leach 2019, Pereira et al. 2020, Argumedo et al. 2021, Dinesh et al. 2021, Carolan 2022). This marks the strong emergence of a key topic of interest related to social justice: just transitions (Lamine et al. 2019, Huttunen et al. 2022, Kuhmonen and Siltaoja 2022, Tschersich and Kok 2022, Maluf et al. 2023), power imbalances, agency, governance, and justice in governance (Anderson et al. 2019, Béné 2022, Jani et al. 2022, Mattioni et al. 2022, Säumel et al. 2022). There is also the recognition of accounting for differences based on local or contextual features and needs (Brouwer et al. 2021, Dengerink et al. 2021, Lonkila and Kaljonen 2022). A few case studies, with reports from the Global-South or comparisons across regions or scales are published as well (Muñoz Torres et al. 2022, Plassnig et al. 2022, Säumel et al. 2022, Tovar Zerpa and Rojas López 2022, Vilas-Boas et al. 2022, Maluf et al. 2023, also Juri et al. 2022 in Dataset 1).

Finally, a series of reviews are published that look into research gaps (El Bilali 2019, van Bers et al. 2019), the types of leverage points addressed by food system interventions (Dorninger et al. 2020), the different approaches or themes in food system change (Weber et al. 2020), the differences in food system outcomes prioritized (Stefanovic et al. 2020), and a synthesis of theories of change co-existent in the literature (Dinesh et al. 2021). In addition, Rodríguez Peñaguirre and González-Arellano (2022) review the literature on sustainable food cities to identify the main food system features (with literature in English and Spanish) and Guimarães et al. (2022) analyze the sustainability of global value chains and their governance while also pointing to gaps and future research.

### 3. Theoretical contributions and main frameworks

The final layer of analysis developed was based on the third dataset of articles (N = 46) published between 2014 and 2022. It involved a full review of each paper as a way to identify the main theoretical contributions, perspectives, and theories of change adopted, and analytical frameworks or models proposed. Before we present the synthesis of the main theories identified, it is important to highlight how food system change is described.

#### *Terms and definitions adopted*

Change in relation to food systems is described by the use of very different terms: fundamental transformation/change (Pitt and Jones 2016, Anderson et al. 2019, Käyhkö et al. 2020, Mattioni

et al. 2022, Tschersich and Kok 2022), reconfiguration of regime or socio-technical system (Cohen and Ilieva 2015, Bui et al. 2016, Gaitán-Cremaschi et al. 2019, Leeuwis et al. 2021), deep change (Caron et al. 2018, Pereira et al. 2020, Weber et al. 2020), profound reconfiguration (Bui 2021), regime change or shift (Hinrichs 2014, Pereira et al. 2020, Bui 2021), and as radical/dramatic change (Busch and Bain 2004, Caron et al. 2018, Anderson et al. 2019, Ruben et al. 2021; see list of terms adopted in Appendix 3). The meanings associated to such terms at times offer a direct link to the theories from which they are based (e.g., regime shifts), but also serve to stress the magnitude of change. Following this, transformative change in this scholarly literature is mainly understood to refer to a significant shift (e.g., radical, deep, fundamental) as opposed to incremental or adaptive change. Caron and colleagues (2018) and Béné (2022) are explicit about this difference. The aim of these transformations, regime shifts, is to intentionally move away from the current industrialized model that constitutes the status quo (e.g., Hubeau et al. 2017, Anderson et al. 2019, Gaitán-Cremaschi et al. 2019, Pereira et al. 2020, Leeuwis et al. 2021, Béné 2022, Holtkamp and van Mierlo 2022). In the Spanish results, especially the literature that refers to "agroecological transitions," there is strong opposition to the industrial and globalized agri-food system. The goal of such transitions is to explicitly move to an "alternative" model (Yacamán-Ochoa and García-Llorente 2020, also de Molina et al. 2017 and López-García et al. 2018 in Dataset 2). In the English literature, Reckinger (2022) also speaks of alternative food systems in the context of what she calls, "value-based territorial food networks" (e.g., short food supply chains, civic food networks, or alternative food networks).

Regarding the theories adopted, over half of the contributions (21) in Dataset 3 explicitly align with theories on transitions (e.g., Hinrichs 2014, Cohen and Ilieva 2015, Bui et al. 2019, Gaitán-Cremaschi et al. 2019, Felici and Mazzocchi 2022, Mattioni et al. 2022), then followed by five linking to transformations theories (e.g., Eakin et al. 2017, Pereira et al. 2020) and at least five that use both (Anderson 2015, Anderson et al. 2019, Yacamán-Ochoa and García-Llorente 2020, Vilas-Boas et al. 2022). However, some authors adopt both terms without discrimination or definition (e.g., Caron et al. 2018; Käyhkö et al. 2020) or do not use systems-based language or references (e.g., Sumner 2015, Caron et al. 2018, Argumedo et al. 2021). In Spanish, it is more common to find references to supply chains or definitions of food systems in relation to their components than their complex dynamics and thus reference to such theories is lacking.

Contributions typically do not offer definitions for the use of the terms food system transition or transformation (roughly 65% of Dataset 3). In most cases, ideas are either implicit or alluded to by defining transition or transformation and contextualizing it in relation to food systems (e.g., Cohen and Ilieva 2015, Bui et al. 2016, Pitt and Jones 2016). Authors that offer more direct descriptions include Pitt and Jones (2016:2) when speaking of transitions related to food systems as a "gradual, pervasive shift from one state or condition to something different" especially concerning sustainable modes of production and consumption. A similar definition is also adopted by Mattioni et al. (2022) referring to long-term and multidimensional processes within socio-technical systems shifts leading to sustainable modes of production and consumption. Also Leeuwis et al. (2021) describe food system transformation as a non-linear and long-term process of competition, negotiation, and reconfiguration, whereas Ruben et al. (2021) state that food systems transformations are interactive processes that need adaptive capacity to be able to adequately respond to unexpected challenges. On the other hand, Pereira et al. (2020) explicitly describe it as a deep change away from the current dominant (global-industrialized) food regime, and Yacamán-Ochoa and García-Llorente (2020) conceptualize agroecology as transformative practices to re-design the agri-food system. This purposive and proactive view is shared by Caron et al. (2018) who speak of transformation as a planned and agreed upon process, and Béné (2022) who highlights the contested (political) and normative (purposive rather than random) nature of food system transformations with the aim of seeking solutions (see Appendix 3 for a list of definitions). We build on these contributions in the discussion.

*Theoretical contributions*

We now turn to highlighting a series of publications that propose significant theoretical contributions to the food system transformation or transition discourse. This includes papers that articulate an explanation or offer a new lens through which to comprehend, analyze, or act toward this type of change. Key examples of explanations on how to promote food system change include Bui et al. (2016) who describe niche/regime interactions via enrolment and vision alignment, Pitt and Jones (2016) who explain transitions via policy transfers, Bui et al. (2019) who describe food system change via governance and value/paradigm changes (ethics), and also via actor-enrolment and vision alignment (Bui 2021). Later, Reckinger (2022) builds on these ideas to define the umbrella term "value-based territorial food networks." Eakin et al. (2017) propose telecoupling, or considering interactions between distant social-ecological elements (e.g., actors, institutions, ecosystem services, and functions) as a way to understand and better plan for changes and their impacts. Others focus on the role of intermediaries in driving or supporting change through innovations: Vilas-Boas et al. (2022) explains boundary infrastructures (i.e., boundary objects and institutions that consolidate), Mattioni et al. (2022) focuses on the destabilization strategies developed by regime actors situated at city-level government, and Groot-Kormelinck et al. (2022) speak of the role of producer organizations acting as transition intermediaries. These examples see change as either being top-down driven (or planned for) or happening at the interaction of niches and regimes.

On the other hand, Anderson et al. (2019), describe territorial/bottom-up approaches stemming from multiple transformational domains; and Pereira et al. (2020) explain regime changes fostered via social-ecological innovations. This territorial focus is also part of Reckinger's (2022) focus on change led by alternative food networks, and Felici and Mazzocchi (2022) who identify relational features and add a new spatial lens to the multi-level perspective, the heuristic tool from transitions theory that conceptualizes change through interactions between three analytical levels (niche, regime, and landscape) and their evolution over time (see Geels 2002). It also appears strongly in the Spanish literature as in Yacamán-Ochoa and García-Llorente (2020) arguing for land stewardship and cooperative approaches. These theories are explicit about a bottom-up transformational approach often reliant on diverse scaling processes such as scaling out or up as in Felici and Mazzocchi (2022) or upscaling policy tools emergent at a municipal level in Mattioni et al. (2022). An alternative theory other than scaling is proposed by Bui (2021) who describes niche/regime reconfigurations through vision and practice alignment

and via the combined effect of multiple but disconnected niches. It is relevant to note that a significant discourse found in the literature, especially in Spanish, is focused on specifically scaling agroecology as in López-García et al. (2018) in Dataset 2.

Regardless of the change strategy (top-down, bottom-up, or hybrid/interaction), various authors agree that the processes should be participatory (López-García et al. 2018, Baldy and Kruse 2019, Käyhkö et al. 2020, Herens et al. 2022), especially involving all stakeholders (Eakin et al. 2017, Hubeau et al. 2017, Caron et al. 2018, Gaitán-Cremaschi et al. 2019, Käyhkö et al. 2020, Roque et al. 2022), making special effort to include diverse and often excluded voices (Anderson 2015, Gaitán-Cremaschi et al. 2019, Pereira et al. 2020, Argumedo et al. 2021, Carolan 2022, Tschersich and Kok 2022), and spanning across different societal sectors (civil society, industry, government) and levels/scales (Baldy and Kruse 2019, Herens et al. 2022).

An important group of theories is focused on promoting change via governance and participatory platforms that can inform policies or planning. Cohen and Ilieva (2015), for example, propose food system change via the strategic management of social practices led by urban planners and policy makers at city level. Leeuwis et al. (2021) speaks of governance change via a process of synthesis rather than analysis to cope with the impossibility of control and the limits of knowledge when driving complex systems change; and Herens et al. (2022) refer to the potential and limitations of governance change through multi-stakeholder platforms. The shift of attention toward governance is prominent in the contributions from 2022. For example, Tschersich and Kok (2022) and Huttunen et al. (2022) are concerned with the democratization of governance and the forms of participation in the context of just transitions, whereas Säumel et al. (2022) focuses on enhancing governance in urban-rural linkages in the context of shortening supply chains and urban food system transitions. Finally, Béné (2022) reinforces the idea that the possibility for a large transformation is dependent on changes to the governance of food systems, as a way to subvert current lock-ins maintaining the status quo. As perceived before, the discourse and theoretical contributions that integrate a justice lens to the food system transformation space has emerged only recently and is outlined and debated by authors such as Tschersich and Kok (2022) and Carolan (2022). They build from the scholarship on just energy transitions to describe different dimensions of justice and what this means to different decision-making processes. Finally, Tanzer et al. (2022) offer an analysis on the procedural justice and transformative potential of large multilateral platforms such as the 2021 UN Food System Summit. Please refer to Table 2 for a more detailed breakdown of these key contributions.

Other scholarly contributions are particularly explicit about the integration of new concepts or perspectives and the development of novel tools or frameworks. Those that are particularly aimed at planning for change include Hubeau et al. (2017) offering a framework to transform the mainstream food system; Baldy and Kruse (2019) who describe food democracy dimensions especially targeted for participatory planning processes; Käyhkö et al. (2020) who outline a typology of transformative adaptation in the context of climate change decision making; Roque et al. (2022) with a framework to inform the design and implementation of sustainability programs to foster change through plant-based school meals; and Gaitán-Cremaschi et al. (2022) who map networks and identify enablers and barriers to innovation in the context of public food procurement from family farming. Another contribution to practice worth mentioning is offered by López-García et al. (2018; outside of our inclusion criteria) who offer insights for participatory processes' design in the context of agroecological transitions.

In addition, a series of authors propose new ways to categorize or analyze food system types; these include Anderson (2015) with a typology of food system change domains, Eakin et al. (2017) who offer a typology of telecoupled systems for governance arrangement analysis; Caron et al. (2018) with a framework for the assessment of SDG indicators; Gaitán-Cremaschi et al. (2019) who propose a classification of food systems based on the degrees of alignment with the dominant system. Finally, Felici and Mazzocchi (2022) adapt the multi-level perspective model from transitions theory to the sustainable food system transition context while adding a previously missing spatial scale to it.

Other conceptual propositions include Sumner (2015) articulating the role of food literacy and adult education as a strategy that enhances autonomy and affects food system change, and Argumedo et al. (2021) who propose that food system transformation can be enhanced via an emphasis on the stewardship (conservation, use, and celebration) of food-related biocultural diversity. Please refer to the table in Appendix 2 for a detailed list of frameworks.

## DISCUSSION

### Theorizing food system transformative change: strategies and goals

Insights from this review complement and expand recent review articles. For example, Stefanovic et al. (2020) identified different framings in relation to food systems change outcomes (from global environmental change, food and nutrition security, food system performance, resilience, or transformation), where these discourses shape the type of change and linked strategies dependending on how problems are understood. Our results also confirm that the strategies or actions proposed depend on the different conceptualization of food systems, the type of goals strived for, and the assumptions held (all in all, the theories of change). For example, when agroecology is seen as the alternative model to transition toward, strategies are mainly bottom-up, place-based, and focused on land stewardship and territorial, participatory governance. Whereas, when aiming to drive transformative change via planning or policy changes (at city, national, or global scales), more top-down approaches (often participatory) and tools are proposed.

Importantly, various and especially the more recent contributions offer more nuanced or hybrid approaches that transcend what Wood et al. (2023) call the "dichotomy of scale" on conceptualizing change as either bottom-up or top-down. Increasingly, there is an interest in focusing efforts on the governance of food systems change, identifying that many barriers relate to power and politics (i.e., agency, interests, and goals) and not merely a lack of scientific or technological knowledge and solutions (Béné 2022).

In addition, when food systems are mainly understood in relation to supply and value chains, solutions proposed tend to rely on spatial aspects, especially pushing to reduce the distance between direct producers and consumers, or in the role of the industry and their

**Table 2.** Overview of key theoretical contributions from the screening of Dataset 3. We characterize publications by identifying key theory proposed, theories of change and type of rationale adopted on the change level addressed, as well as the type of systemic conceptualizations adopted.

| Publication | Theory proposed | Rationale | Theory of change | Systems view |
|---|---|---|---|---|
| Dahlberg 1994: point of reference | Restructuring of relations between natural, social, and technological systems; value and conceptual shift toward systems approaches. | Multiple scales. | Transform and decolonize industrial agriculture toward regenerative food systems (post-fossil fuel era). Focus on enhancement of indigenous systems, policy change, value health over productivity. | Systemic, speaks of transition but transitions theory had not emerged then. This paper does not include a reference list (bibliography). |
| Cohen and Ilieva 2015 | Strategic management of social practices (rather than niche management), led by urban planners and policy makers at city level (practices help connect to other related systems, e.g., energy). | Top-down. | Urban transitions to sustainability (city level) using social practices as drivers to target nonmaterial (e.g., cultural meanings, political issues) and material components (e.g., technology, policies). Focus is on fostering certain practices over others, led by policy makers and planners at city levels. | Systemic, transitions theory. |
| Sumner 2015 | Fostering food literacy (and redefinition) as an avenue for transformation. | Bottom-up. | Aim to enhance food literacy in adult education to promote food citizenship and autonomy. Focus is on using food as a medium of education and promoting food as commons. | Non-systemic. |
| Bui et al. 2016 | Niche/regime interactions via actor enrolment and vision alignment creates changes to norms and rules. Explain how niche development trajectories are characterized by three phases (initiative emergence, niche construction, new model based on vision and network redefinition). | Hybrid / interaction. | No explicit aim other than sustainability transition. Example offered on alternative food networks. Focus is on constant enrolment of new regime actors and redefinition of niche activities to impact norms (local policies) and routines (behaviors, networks). Aim is to redefine the actor network. Assumes niche development as necessary, but insufficient to trigger regime shifts. | Systemic, transitions theory. |
| Pitt and Jones 2016 | Transitions enabled by policy transfers. | Top-down, scaling up and out. | Transition away from industrialized and global model (power on multinational businesses) to localized models. Aim is to scale policy innovations using participatory processes in policy transfers. | Systemic, transitions theory. |
| Eakin et al. 2017 | Telecoupling as a way to understand and plan for changes that account for interactions between distant areas or actors. Offer a typology and framework (four telecoupled food systems, three dimensions of distance) to inform change via governance. | Top-down. | General sustainability orientation. Focus is enabling governance change and avoiding unintended consequences in distant actors/ecosystems or other linked systems beyond food. Actions to be led by institutions, industry, policy makers, and social actors. Framework offers guidelines to analyze and plan such actions. | Systemic, transformations theory. |
| Hubeau et al. 2017 | Propose framework to analyze and plan how to transform mainstream agri-food system. | Top-down, macro (global) scale. | General sustainability orientation and aim to transform the mainstream agrifood system. Focus is on engaging contesting actors and multiple stakeholders in transdisciplinary processes. This is to be informed by framework and tools for planning and action (e.g., vision development). | Systemic, transformations and transitions theory. |
| Lamine 2018 | A pragmatic approach to understand transdisciplinary food system transformation processes. Insights on actor enrollment and motivations. | Hybrid. | Agroecological transition. Focus is on transdisciplinary place-based processes engaging all related stakeholders. | Non (explicitly) systemic. |
| Caron et al. 2018 | Proposal of a framework on a four-part transformation linked to Sustainable Development Goals. Elements aimed to design indicators for assessing food systems transformation. | Hybrid, multi-scale (local to global). | Transform food systems (agriculture, rural livelihoods) to align with Agenda 2030. Focus is policy change and governance. Framework to be used to define suitable metrics for decision making and synergizing local/global policies. Assumes the engagement of all stakeholders, especially excluded ones to plan and agree upon change. | Non (explicitly) systemic. Uses both terms (transition/ transformation). |
| Bui et al. 2019 | Transitions materialize via governance and ethical value changes. Proposal challenges linear scaling up in opposition to scaling deep. | Hybrid / interaction. | General sustainability orientation. Focus is enabling inclusive governance change through change in dynamics and meanings of regime actors. Aim is value change and new systemic ethics so that innovations are not absorbed but reproduce logics without deeper paradigm change. | Systemic, transitions theory. |
| Anderson et al. 2019 | Territorial approaches (e.g., agroecology) stemming from multiple transformational domains (access to ecosystems, knowledge/ culture, exchange systems, networks, equity, discourse). Proposes six domains of transformation framework to support localized governance change. | Bottom-up, scaling. | Agroecology as a transformative paradigm-radical change at territorial level. Focus is on participatory processes, governance, and power relations change in domains that may overlap (more overlap means more transformative potential). | Systemic, transition and transformation theory. |
| Yacamán-Ochoa and García-Llorente 2020 | Conceptual and practical insights on change enabled via land stewardship and cooperative approaches (local networks/ social innovation) within agroecology. | Bottom-up, scaling. | Agroecological transition away from industrial agriculture. Focus on territorialization, to be achieved via territorial governance. Agroecology as transformative practices redesigning food system. | Systemic, transition theory (indirectly). |
| Pereira et al. 2020 | Regime changes can be fostered via social-ecological innovations from emergent initiatives. | Bottom-up, mainly scaling up and out. | Sustainable and just food regimes. Focus is integration of excluded actors and voices, participation of local initiatives via social-ecological innovations. | Systemic, transformation theory. |

(con'd)

| | | | | |
|---|---|---|---|---|
| Leeuwis et al. 2021 | Food system governance change enabled by synthesis rather than analysis. | Hybrid / interaction. | Achieve multiple development goals. Focus on governance change in multi stakeholder processes. Synthesis helps cope with niche/regime tensions and nonlinear/uncertain process. Assumes knowledge is not enough (without politics) for system change. | Systemic, transition and transformation theory. |
| Bui 2021 | Change via actor-enrolment and vision alignment. Niche/regime reconfiguration enabled by combined effect of multiple disconnected niches (an alternative to scaling). | Hybrid / interaction. | General sustainability orientation. Aim is development of new paradigm and focus is on enrollment of all actors. Assumes change happens at interaction of niche/regime actors via value alignment and changes in power. | Systemic, transition theory. |
| Herens et al. 2022 | Food system change is enabled by governance change via multi-stakeholder platforms. Offer insights for practice (opportunities and limitations). | Hybrid / interaction. | Fostering healthier and sustainable diets. Focus is on engaging all stakeholders (across sectors and levels), especially excluded actors through food system governance platforms such as multi-stakeholder platforms. | Systemic, transition and transformation theory. |
| Lonkila and Kaljonen 2022 | Change at the niche-regime interaction is explained by processes of attachment and detachment of values and meanings existent in the regime (in the context of food product market changes). Contradictory insight is that alternative products can reinforce regime values and meanings, but this can also eventually help change practices in both regime and niches. | Hybrid / interaction. | Transition toward sustainability, especially in consumption practices through new (meat-alternative) market products. Focus is on alignment or detachment of values and meanings. | Systemic, transition theory. |
| Mattioni et al. 2022 | Change driven from within the regime (via city-level municipal intermediaries). These actors support and drive change of regime through discursive, material, and organizational destabilizations. | Hybrid / interaction but focus on change from within the regime. | Transition away from corporate, industrial food regime. Focus is on regime destabilization from regime actors at municipal level by "doing food differently." | Systemic, transition theory. |
| Carolan 2022 | Brings a lens that considers care and affect (feminist scholarship) to debate on just transitions to highlight the importance of integrating excluded perspectives or counting what is not countable (transcend the policy of enumeration or an over-reliance on facts and quantitative evidence). | Not explicit. Focused mainly on supply chains. | Critical perspective, especially against enacting food citizenship through the market (voting with purchases). Focus is on enabling just-in-case (rather than just-in-time) supply chains. | Not explicitly systemic. |
| Tschersich and Kok 2022 | Clarify key concepts and identify main challenges of democratization in just transition governance efforts while admitting that democratization is not a panacea for ensuring just food system transitions. | Hybrid / interaction. | Goal is to enable healthy and sustainable agri-food systems within planetary boundaries. Focus is enhancing justice and strengthening democracy in food system transitions governance. | Systemic, transition theory. |
| Holtkamp and van Mierlo 2022 | Explain strategies led by niche actors that generate ongoing democratic innovations as responses to counteract resistance to change from the regime. Authors refer to these as "paving," which in addition to meaning making and networking, help enhance democratization of food governance. This adds a contestation lens in the context of transitions and the multi level perspective model. | Hybrid / interaction. | Niche innovations from actors such as grassroots or other movements to prompt subversion of the regime through democratic innovations. Focus is on enhancing food citizenship and governance-fostering agency. | Systemic, transition theory. |

marketing strategies in shaping demand and supply. Similarly, when food systems are referred to in vague terms, arguments tend to be focused on action on the side of consumers (e.g., food citizenship or literacy). In contrast, perspectives that adopt systemic approaches are sensitive to the multiple drivers of change and less inclined to suggest sectoral, linear, or singular solutions, but propositions still stress different areas of attention. In alignment with the background theories from which they evolve, contributions based on transitions theory mostly argue for technological or institutional, policy or market-based innovations that address production or consumption patterns, while views adopting transformations theory tend to be more inclined to propose social, organizational, or policy innovations with focus on the reduction of environmental impacts or better management of resources.

Still, in terms of the outcomes sought, most of the literature reviewed is concerned with healthy, nutritious, and appropriate diets, resilience to climate change or other crises, and general ecosystem and social stability (e.g., SDGs). The perspective that is closest to Dahlberg's ideas is the one proposed by Roque et al. (2022) who propose that plant-based school meals could help foster key outcomes for a "systemic regeneration": public health, social protection, economy, community welfare, and environment.

In terms of stakeholder participation, we found that the openness to integrate either very powerful (food conglomerates) or excluded actors (indigenous or rural communities) varies within a spectrum depending on the approaches. Recently, the literature discussing justice in the context of transformative processes (Tribaldos and Kortetmäki 2022) has helped problematize and expand the debate on how to ensure equitable participation, representation and decision making. This is in line with the recognition of unavoidable power asymmetries as well as the non-neutrality of academic research.

An important insight emerging from the literature confirms that although different narratives and theories of change co-exist in relation to problem understanding, priorities for action and

strategies (Béné et al. 2019, Weber et al. 2020), the way in which change is typically understood refers to a significant shift away from the current industrial agri-food system or as Fanzo et al. (2020) states, a radical change in the status quo. This is in contrast with what Slater et al. (2022) found by reviewing major reports from international organizations (e.g., UN, IPES-Food, HLPE) in which transformation appears as a co-opted and fuzzy term that tends to suggest mere reforms or adaptations. Within the research literature, very few scholars speak of incremental or adaptive change (one exception is Groot-Kormelinck et al. 2022), and indeed recognize transitions and transformations as political processes (Leeuwis et al. 2021). This aligns with Béné (2022) understanding of the evolution of the discourse on food system transformation whereby the different terms adopted to qualify this change, as seen in our results, refer to the magnitude or scope of change, but have more recently shifted to also acknowledging its political (contested) and normative (intentional and goal-oriented) nature. Authors such as Friant (2016) and Corrado (2013; Spanish databases) explicitly mention the need to seek "alternatives to" the dominant system. This also shows an alignment with Dahlberg's seminal conceptualization from the 1990s and though not yet explicitly stated, an orientation toward decolonization. Still, questions on decolonization within the food systems change literature landscape are mainly absent since Dahlberg's publication, which could relate to the fact that most of the literature is strongly rooted in institutions from the Western developed world.

**Terms can prove misleading or obscure if not defined or contextualized**

Like Weber et al. (2020), we found that the terms transition and transformation are often used interchangeably when speaking of food systems change. In addition, they are not always explicitly linked to the theoretical traditions of either transitions in socio-technical systems or transformations in social-ecological systems. The fact that some authors use both terms may refer to an increasing overlap of these scholarly fields, but also to the adoption of these terms as trendy buzzwords. Our analysis took one step further to avoid a common bias in the literature that focuses on contributions made only in the English language. We included two Spanish-language based databases, which capture a vast geographical region where significant work is being produced. We were able to obtain important insights from the query results in Spanish, even though few publications matched our filtering criteria. We noticed two main trends: (1) the term transformation rarely appears in keywords or titles associated with food systems, and (2) the term transition is mainly adopted to speak of agroecological transitions, but again, not always explicitly linked to the food system as a unit of analysis in keywords or titles. This does not mean that literature is scarce, rather, other terms tend to be more popular such as alternative food networks or food sovereignty (Holt-Giménez and Shattuck 2009, Corrado 2013). The Spanish-based literature rarely cites transition/transformation theories from the two aforementioned epistemic communities existent in the English literature. The publications that do adopt the terms food system transition or transformation were typically also indexed in Scopus. It is important to note that the agroecological discourse has in effect taken strength from the 1970s and 1980s onward in Latin America (Altieri and Nicholls 2017), with many examples adopting a strong territorial and usually activist approach in opposition to extractive/colonialist models. It makes sense, therefore, that many contributions found in Spanish during the last three decades follow this perspective (e.g., Gliessman et al. 2007, López-García et al. 2018, Yacamán-Ochoa and García-Llorente 2020). Several of these contributions offer positions or insights from practice without proposing novel theoretical contributions explaining food system change. See for example, Galindo (2021) with a reflection on the opportunities and risks to situate agroecology at the center of the transformation of food systems (in the context of the 2021 UN Food System Summit) if misdirected or co-opted by industrial and private interests. De Molina et al. (2017) argues for politicizing food consumption (not just production) and building social alliances with capacity for change to ensure that agroecological innovations can catalyze transitions. At the same time, Holt-Giménez and Shattuck (2009) explain the role of agrofuels in driving a transition in food and energy systems alike, where the concentration of capital has significant negative social, environmental, and economic effects restructuring territories, policies, economies, and lives. In a similar theme, Jensen Castillo (2021) analyzes changes in production and commercialization of food in Chile based on market variation and land use change to understand the implications for food security or in the context of crises such as COVID-19. One contribution that resonates with Dahlberg's original paper comes from Rastoin (2020), who attempts to outline potential future configurations of food systems based on the current most dichotomic trends (oligopoly vs. local networks, market vs. social-environmental values, quantity vs. quality). He concludes that the most likely outcome will be a combination of both while dependent on collective action toward a responsible and humanist view of food that values biological and psychological health and overall well-being.

**A rapid growth of the field needs awareness of potential biases and inequalities**

Based on the statistical insights, our results confirm insights from Weber et al. (2020) on the rapid rise in publications (mainly since 2015). This is aligned with an increasing popularity of the arguments connecting climate change and food systems that gained visibility at the UN COP21 and was captured in the Paris Agreement (UNFCCC 2015) as well as a myriad of interrelated negative food system outcome impacts made visible after the 2007–2008 world economic crisis and noticeable impacts on climate change. By looking at the overall literature landscape, most of the literature debating food system transitions and transformations is generated from the Global North. Even though co-authorship with Global South researchers is noticeable, our results align with Fanzo et al. (2020) on the low representation of scholars from Low- and Middle-income Countries, and especially, Least Developed ones. Although the authorship distribution refers to institutions and not to the country of origin of either authors or research projects, more attention needs to be paid to the barriers preventing a better representation and therefore a reduction of multiple potential biases and inequities (epistemic injustices). Although country representation is not a direct proxy for understanding how much research is produced within a particular country, the stark differences suggest many barriers may be co-existent. One likely challenge (among others) is limited accessibility to funds to carry out or lead research, and to publish results because of journals' high publication fees. As authors

rooted in Global South institutions ourselves, this is a familiar phenomenon, which results in negotiations as to which institutional affiliation should lead. Another important consideration is that language may represent a significant barrier, suggesting that more efforts are needed to foreground research insights published in languages other than English.

**After three decades, theory has evolved but some themes deserve more attention**

Looking at the evolution of the debate and main themes, especially in comparison with Dahlberg's 1994 proposition for agri-food transitions, additional insights can be highlighted. First, it took about 20 years for significant contributions to appear in the literature landscape after Dahlberg, the first publication that connects transition theories applied to food systems as a unit of analysis. This trend began in the second decade (2005–2014) and continues until the present with different highlights on tools, a focus promoting changes at the level of niches, regimes, or the interaction of both. The promotion of agroecology and an interest in food sovereignty remains a prominent discourse from the second decade and until the present. This is seen as a model that is in direct opposition to the corporate agri-food business model and promises increased agency and new values as originally conceptualized by Dahlberg. In the third decade (2015 onward), a new theme enters the landscape and refers to aligning strategies and outcomes to meet the SDGs. In addition, a few key important trends emerge more recently: first, the importance of adopting both systemic and transdisciplinary approaches, the importance and role that participatory platforms or processes aiming to generate practice and governance change can have (e.g., multi-stakeholder platforms, living labs), and the urgency to adopt more inclusive approaches, especially to integrate often excluded voices and knowledge systems (e.g., via the term just transitions). In addition to this, it is also recognized that differences between contextual features and needs should be better understood and accounted for. This orientation relates directly to Dahlberg's call for decolonizing food systems and focusing on health or cultural aspects as important assessment criteria for restructuring (other than economic gain). Importantly, the decolonial and inclusive/participatory discourse took almost 30 years to start galvanizing. One contrast found with Dahlberg's position is a more expansive goal in relation to the type of risks and challenges to tackle. In his view, climate change was the most prominent threat, but the literature landscape is now more sensitive to the interrelated and multifaceted nature of challenges that relate to the food system (from livelihoods, to food security, to biodiversity, etc.), which suggests that more attention is being paid to the different types of outcomes that food systems may support.

A revision of the theoretical contributions suggest that change is understood and explained in different ways based on the different angles of focus proposed by the most prominent theories and frameworks. The focus of interventions proposed, the types of outcomes promoted, and the agents of change vary as already reported (Béné et al. 2019, Stefanovic et al. 2020). The question on how to provoke this change is answered in different ways, either bottom-up, top-down, or a combination of both. A common agreement found is the need for systemic approaches (Hubeau et al. 2017, Bui et al. 2019, Stefanovic et al. 2020, Weber et al. 2020, Herens et al. 2022). In addition, the theories proposed and the tools advanced also suggest the engagement of different actors within the food system: from mostly aimed at researchers, planners, or policy makers, to others that aim to integrate all societal sectors and even marginalized voices (Pereira et al. 2020, Argumedo et al. 2021, Herens et al. 2022). Recent scholarship is very strong about the need for transdisciplinary and participatory processes (Fanzo et al. 2020, Den Boer et al. 2021) that can be inclusive and empowering (e.g., able to change power dynamics). This focus on a justice-lens is confirmed in the most recent contributions (see Tribaldos and Kortetmäki 2022; Tschersich and Kok 2022). In this context, governance change emerges as a prominent area and avenue for change advocated in the literature, which is confirmed in Béné (2022) and Huttunen et al. (2022). Importantly, governance includes the interaction of actors at both the territorial (civil society, indigenous communities, etc.) and policy/planning levels (national government, local urban planning, etc.) and involves, in the process, a change in values. This perspective highlights how food governance change implies a series of planned and concerted actions that although impossible to fully control their outcomes, can be intentionally (normatively) steered, that is, designed for (Leeuwis et al. 2021, Béné 2022). Indeed, our results show that many frameworks have emerged that can serve practitioners as researchers analyze, make sense of, categorize, or understand various facets within the complexity of food systems. This landscape suggests that where theories are not necessarily strictly opposing, they may be explaining different components of the system and, as in other fields, that better integration and dialogue rather than competition may be beneficial. It is possible, however, that language may be a barrier to further integration. For example, in their review, Weber et al. (2020) adopt the term "deep change" as a way to bypass the transformation/transition dichotomy.

**Advancing a definition**

An important takeaway from the review is the lack of definitions on food system transition or transformation, which is highlighted in the cases where the terms are adopted in more general ways without any explicit definition (e.g., Sumner 2015, Argumedo et al. 2021). Although Béné (2022) is one of the few scholars to outline the evolution and clarify what is meant by food system transformation in the academic discourse, there is still a prominent absence of explicit definitions. To address this challenge and help practitioners engage with a landscape marked by a diverse constellation of perspectives and terms, we attempt to outline a preliminary definition in the context of scholarly research. Food system transformations refer to significant re-configurations of the assemblage of food system activities, actors, outcomes, and relationships (dynamics) to move away from the current globalized industrial model and ensure sustainable, resilient, and just models of production and consumption. These transformative processes demand the collective and inclusive re-designing (from re-imagining to re-governing) of food system components through platforms where governance, practices, power, and value-change can be debated and enacted at multiple scales. Food system re-design should therefore be seen as an ethico-political process that needs to be collectively stewarded and nurtured in an adaptive, engaged, and creative way. This also means that strategies (pathways) and tools need to respond to and resonate with current contextual needs and features, while also being future-proof and proactive (anticipatory).

This definition, which is more explicit about the transformational aspiration (why, what, and how to change) to shift away from the status quo (transform rather than reform) and encompasses a

cultural and political, and not just a mere technical challenge, is in line with the gaps noticed by Slater et al. (2022). In this way, a common and clearer understanding of the scholarly field gives research a better chance to inform systemic change and escalate from local to international recommendations without being diluted or subverted.

## CONCLUSION

Our semi-systematic review aimed to offer an overview and synthesis of the scholarly field focused on understanding and supporting food system change, with the main focus on the associated terms of transitions and transformations. This work has outlined and characterized the research literature landscape in the past three decades. We contribute to this field by expanding and complementing recently published reviews that attend to the increased interest and calls for food systems transformation. By looking at the literature, we have been able to outline a series of insights, including the diverse use of these terms, their differing theoretical contributions and frameworks, the most prominent themes, and their evolution. In addition, the data analysis has shown a series of nuances based on different regions and languages, for example, that the associated literature being produced and published in Spanish tends to adopt other terms to refer to somewhat similar research. Although results support and expand previous work in most cases, we acknowledge some limitations. For example, given the differences in how research databases work, the Scopus search string had to be manually replicated for the Spanish-based databases, which made the process prone to errors and more labor intensive. Our filtering criteria for each layer of analysis was focused on identifying theoretical contributions with a particular focus on food systems as a unit of analysis that adopts systems-based approaches, and papers were filtered by titles and keywords only. This means that this constitutes a section of a likely larger literature landscape that may have escaped this criteria (for example, case studies were removed from the last subset even though some case-study articles may still have included theoretical contributions). In spite of this, we believe this synthesis can offer an important starting point that can help clarify and navigate an often fuzzy and very diverse field.

An important contribution of this work includes the advancement of a preliminary definition of food system transformations. This helps to enhance the transparency about assumptions and implicit theories of change (to avoid the term being co-opted or emptied of meaning). As such it does not presuppose a singular and restrictive way to describe or theorize food system change (indeed, multiple theories are necessary and will likely need to co-exist), rather, it seeks to offer a way to describe the general orientation of the types of change that is referred to, if we are to enable just, appropriate, and sustainable food systems and ensure healthy flourishing of life on Earth. We hope these insights can serve as signposts to allow fellow researchers and practitioners to build upon them to expand this rapidly evolving and urgently needed work.

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**Data Availability:**

*The data that support the findings of this study (Datasets 1 to 3) are openly available in Zenodo at https://zenodo.org/record/8338518. No ethical approval was needed.*

## LITERATURE CITED

Altieri, M. A., and C. I. Nicholls. 2017. Agroecology: a brief account of its origins and currents of thought in Latin America. Agroecology and Sustainable Food Systems 41(3-4):231-237. https://doi.org/10.1080/21683565.2017.1287147

Anderson, C. R., J. Bruil, M. J. Chappell, C. Kiss, and M. P. Pimbert. 2019. From transition to domains of transformation: getting to sustainable and just food systems through agroecology. Sustainability 11(19):5272. https://doi.org/10.3390/su11195272

Anderson, M. D. 2015. The role of knowledge in building food security resilience across food system domains. Journal of Environmental Studies and Sciences 5(4):543-559. https://doi.org/10.1007/s13412-015-0311-3

Anderson, M., and M. Leach. 2019. Transforming food systems: the potential of engaged political economy. IDS Bulletin 50 (2):131-146. https://doi.org/10.19088/1968-2019.123

Argumedo, A., Y. Song, C. K. Khoury, D. Hunter, H. Dempewolf, L. Guarino, and S. de Haan. 2021. Biocultural diversity for food system transformation under global environmental change. Frontiers in Sustainable Food Systems 5. https://doi.org/10.3389/fsufs.2021.685299

Baldy, J., and S. Kruse. 2019. Food democracy from the top down? State-driven participation processes for local food system transformations towards sustainability. Politics and Governance 7(4):68-80. https://doi.org/10.17645/pag.v7i4.2089

Battersby, J. 2017. Food system transformation in the absence of food system planning: the case of supermarket and shopping mall retail expansion in Cape Town, South Africa. Built Environment 43(3):417-430. https://doi.org/10.2148/benv.43.3.417

Bellamy, A. S., and A. A. R. Ioris. 2017. Addressing the knowledge gaps in agroecology and identifying guiding principles for transforming conventional agri-food systems. Sustainability 9 (3):330. https://doi.org/10.3390/su9030330

Béné, C. 2022. Why the great food transformation may not happen: a deep-dive into our food systems' political economy, controversies and politics of evidence. World Development 154:105881. https://doi.org/10.1016/j.worlddev.2022.105881

Béné, C., P. Oosterveer, L. Lamotte, I. D. Brouwer, S. de Haan, S. D. Prager, E. F. Talsma, and C. K. Khoury. 2019. When food systems meet sustainability: current narratives and implications for actions. World Development 113:116-130. https://doi.org/10.1016/j.worlddev.2018.08.011

Block, D. R., M. Thompson, J. Euken, T. Liquori, F. Fear, and S. Baldwin. 2008. Engagement for transformation: value webs for local food system development. Agriculture and Human Values 25(3):379-388. https://doi.org/10.1007/s10460-008-9113-5

Brouwer, I. D., M. J. van Liere, A. de Brauw, P. Dominguez-Salas, A. Herforth, G. Kennedy, C. Lachat, E. B. Omosa, E. F. Talsma, S. Vandevijvere, J. Fanzo, and M. Ruel. 2021. Reverse thinking: taking a healthy diet perspective towards food systems transformations. Food Security 13(6):1497-1523. https://doi.org/10.1007/s12571-021-01204-5

Bui, S. 2021. Enacting transitions—the combined effect of multiple niches in whole system reconfiguration. Sustainability 13(11):6135. https://doi.org/10.3390/su13116135

Bui, S., A. Cardona, C. Lamine, and M. Cerf. 2016. Sustainability transitions: insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. Journal of Rural Studies 48:92-103. https://doi.org/10.1016/j.jrurstud.2016.10.003

Bui, S., I. Costa, O. De Schutter, T. Dedeurwaerdere, M. Hudon, and M. Feyereisen. 2019. Systemic ethics and inclusive governance: two key prerequisites for sustainability transitions of agri-food systems. Agriculture and Human Values 36(2):277-288. https://doi.org/10.1007/s10460-019-09917-2

Busch, L., and C. Bain. 2004. New! Improved? The transformation of the global agrifood system. Rural Sociology 69(3):321-346. https://doi.org/10.1526/0036011041730527

Campbell, B. M., J. Hansen, J. Rioux, C. M. Stirling, S. Twomlow, and E. (L.) Wollenberg. 2018. Urgent action to combat climate change and its impacts (SDG 13): transforming agriculture and food systems. Current Opinion in Environmental Sustainability 34:13-20. https://doi.org/10.1016/j.cosust.2018.06.005

Carolan, M. 2022. Just-in-case transitions and the pursuit of resilient food systems: enumerative politics and what it means to make care count. Agriculture and Human Values 40:1055-1066. https://doi.org/10.1007/s10460-022-10401-7

Caron, P., G. Ferrero y de Loma-Osorio, D. Nabarro, E. Hainzelin, M. Guillou, I. Andersen, T. Arnold, M. Astralaga, M. Beukeboom, S. Bickersteth, M. Bwalya, P. Caballero, B. M. Campbell, N. Divine, S. Fan, M. Frick, A. Friis, M. Gallagher, J.-P. Halkin, C. Hanson, F. Lasbennes, T. Ribera, J. Rockstrom, M. Schuepbach, A. Steer, A. Tutwiler, and G. Verburg. 2018. Food systems for sustainable development: proposals for a profound four-part transformation. Agronomy for Sustainable Development 38:41. https://doi.org/10.1007/s13593-018-0519-1

Cohen, N., and R. T. Ilieva. 2015. Transitioning the food system: a strategic practice management approach for cities. Environmental Innovation and Societal Transitions 17:199-217. https://doi.org/10.1016/j.eist.2015.01.003

Corrado, A. 2013. Alternative food systems and peri-urban agriculture in Milan, Italy. Habitat y sociedad(6):65-83.

Dahlberg, K. A. 1994. A transition from agriculture to regenerative food systems. Futures 26(2):170-179. https://doi.org/10.1016/0016-3287(94)90106-6

Davila, F., and R. Dyball. 2015. Transforming food systems through food sovereignty: an Australian urban context. Australian Journal of Environmental Education 31(1):34-45. https://doi.org/10.1017/aee.2015.14

Davoudi, S., K. Shaw, L. J. Haider, A. E. Quinlan, G. D. Peterson, C. Wilkinson, H. Fünfgeld, D. McEvoy, L. Porter, and S. Davoudi. 2012. Resilience: a bridging concept or a dead end? "Reframing" resilience: challenges for planning theory and practice interacting traps: resilience assessment of a pasture management system in northern Afghanistan urban resilience: what does it mean in planning practice? Resilience as a useful concept for climate change adaptation? The politics of resilience for planning: a cautionary note. Planning Theory & Practice 13(2):299-333. https://doi.org/10.1080/14649357.2012.677124

de Molina, M. G., D. L. García, and G. I. G. Casado. 2017. Politizando el consumo alimentario: estrategias para avanzar en la transición agroecológica. REDES: Revista do Desenvolvimento Regional 22(2):31-55.

Den Boer, A. C., J. E. Broerse, and B. J. Regeer. 2021. The need for capacity building to accelerate food system transformation. Current Opinion in Food Science 42:119-126. https://doi.org/10.1016/j.cofs.2021.05.009

Dengerink, J., F. Dirks, E. Likoko, and J. Guijt. 2021. One size doesn't fit all: regional differences in priorities for food system transformation. Food Security 13(6):1455-1466. https://doi.org/10.1007/s12571-021-01222-3

Dinesh, D., D. L. T. Hegger, L. Klerkx, J. Vervoort, B. M. Campbell, and P. P. J. Driessen. 2021. Enacting theories of change for food systems transformation under climate change. Global Food Security 31:100583. https://doi.org/10.1016/j.gfs.2021.100583

Dorninger, C., D. J. Abson, C. I. Apetrei, P. Derwort, C. D. Ives, K. Klaniecki, D. P. M. Lam, M. Langsenlehner, M. Riechers, N. Spittler, and H. von Wehrden. 2020. Leverage points for sustainability transformation: a review on interventions in food and energy systems. Ecological Economics 171:106570. https://doi.org/10.1016/j.ecolecon.2019.106570

Eakin, H., X. Rueda, and A. Mahanti. 2017. Transforming governance in telecoupled food systems. Ecology and Society 22 (4):32. https://doi.org/10.5751/ES-09831-220432

El Bilali, H. 2019. The multi-level perspective in research on sustainability transitions in agriculture and food systems: a systematic review. Agriculture 9(4):74. https://doi.org/10.3390/agriculture9040074

Ericksen, P. J. 2008. Conceptualizing food systems for global environmental change research. Global Environmental Change 18 (1):234-245. https://doi.org/10.1016/j.gloenvcha.2007.09.002

Fanzo, J., N. Covic, A. Dobermann, S. Henson, M. Herrero, P. Pingali, and S. Staal. 2020. A research vision for food systems in the 2020s: defying the status quo. Global Food Security 26:100397.

Felici, F. B., and G. Mazzocchi. 2022. Territory matters: a methodology for understanding the role of territorial factors in transforming local food systems. Land 11(7):1046. https://doi.org/10.3390/land11071046

Food and Agriculture Organization, International Fund for Agricultural Development, UNICEF, World Food Programme, and World Health Organization (FAO, IFAD, UNICEF, WFP, and WHO). 2020. The State of Food Security and Nutrition in the World 2020: transforming food systems for affordable healthy diets. FAO, IFAD, UNICEF, WFP and WHO, Rome, Italy.

Food and Land Use Coalition (FOLU). 2019. Growing better: ten critical transitions to transform food and land use. Food and Land Use Coalition.

Friant, M. C. 2016. Comercio justo, seguridad alimentaria y globalización: construyendo sistemas alimentarios alternativos. Íconos: Revista de Ciencias Sociales (55):215-240.

Gaitán-Cremaschi, D., L. Klerkx, N. Aguilar-Gallegos, J. Duncan, A. Pizzolón, S. Dogliotti, and W. A. H. Rossing. 2022. Public food procurement from family farming: a food system and social network perspective. Food Policy 111:102325. https://doi.org/10.1016/j.foodpol.2022.102325

Gaitán-Cremaschi, D., L. Klerkx, J. Duncan, J. H. Trienekens, C. Huenchuleo, S. Dogliotti, M. E. Contesse, and W. A. H. Rossing. 2019. Characterizing diversity of food systems in view of sustainability transitions. A review. Agronomy for Sustainable Development 39:1. https://doi.org/10.1007/s13593-018-0550-2

Galindo, P. 2021. Frutas y verduras en transición a sistemas alimentarios agroecológicos. AE. Revista Agroecológica de Divulgación 44.

Gamache, G., J. Anglade, R. Feche, F. Barataud, C. Mignolet, and X. Coquil. 2020. Can living labs offer a pathway to support local agri-food sustainability transitions? Environmental Innovation and Societal Transitions 37:93-107.

Geels, F. W. 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy 31(8):1257-1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Gliessman, S. R., J. Jedlicka, L. Trujillo, R. Jaffe, and C. M. Bacon. 2007. Agroecología: promoviendo una transición hacia la sostenibilidad. Ecosistemas: Revista científica y técnica de ecología y medio ambiente 16(1):3.

Global Panel on Agriculture and Food Systems for Nutrition. 2020. Future Food Systems: For people, our planet, and prosperity. Global Panel on Agriculture and Food Systems for Nutrition, London, UK.

Gordon, L. J., V. Bignet, B. Crona, P. J. G. Henriksson, T. Van Holt, M. Jonell, T. Lindahl, M. Troell, S. Barthel, L. Deutsch, C. Folke, L. J. Haider, J. Rockström, and C. Queiroz. 2017. Rewiring food systems to enhance human health and biosphere stewardship. Environmental Research Letters 12(10). https://doi.org/10.1088/1748-9326/aa81dc

Groot-Kormelinck, A., J. Bijman, J. Trienekens, and L. Klerkx. 2022. Producer organizations as transition intermediaries? Insights from organic and conventional vegetable systems in Uruguay. Agriculture and Human Values 39(4):1277-1300. https://doi.org/10.1007/s10460-022-10316-3

Guimarães, A. F., P. D. Malanski, S. M. de A. Schiavi, and M. D. M. Bouroullec. 2022. Governance in agrifood global value chain: the scientific field in the recent 15 years. Revista de Economia e Sociologia Rural 61:e260595.

Hebinck, A., L. Klerkx, B. Elzen, K. P. W. Kok, B. König, K. Schiller, J. Tschersich, B. van Mierlo, and T. von Wirth. 2021. Beyond food for thought - directing sustainability transitions research to address fundamental change in agri-food systems. Environmental Innovation and Societal Transitions 41:81-85. https://doi.org/10.1016/j.eist.2021.10.003

Herens, M. C., K. H. Pittore, and P. J. M. Oosterveer. 2022. Transforming food systems: multi-stakeholder platforms driven by consumer concerns and public demands. Global Food Security 32:100592. https://doi.org/10.1016/j.gfs.2021.100592

Hinrichs, C. C. 2014. Transitions to sustainability: a change in thinking about food systems change? Agriculture and Human Values 31(1):143-155. https://doi.org/10.1007/s10460-014-9479-5

High Level Panel of Experts (HLPE). 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, Rome, Italy.

Hölscher, K., J. M. Wittmayer, and D. Loorbach. 2018. Transition versus transformation: what's the difference? Environmental Innovation and Societal Transitions 27:1-3.

Holt-Giménez, E., and A. Shattuck. 2009. La transición de los agrocombustibles: Reestructurando lugares y espacios en el sistema alimentario mundial. Agroecología (4):69-78.

Holtkamp, C., and T. van Mierlo. 2022. Paving a way towards food democratisation: mechanisms in contentious niche development. Sustainability 14(3):1553. https://doi.org/10.3390/su14031553

Hubeau, M., F. Marchand, I. Coteur, K. Mondelaers, L. Debruyne, and G. Van Huylenbroeck. 2017. A new agri-food systems sustainability approach to identify shared transformation pathways towards sustainability. Ecological Economics 131:52-63. https://doi.org/10.1016/j.ecolecon.2016.08.019

Huttunen, S., A. Turunen, and M. Kaljonen. 2022. Participation for just governance of food-system transition. Sustainability: Science, Practice and Policy 18(1):500-514. https://doi.org/10.1080/15487733.2022.2088187

IPES-Food. 2015. The new science of sustainable food systems: overcoming barriers to food systems reform. International Panel of Experts on Sustainable Food Systems, Brussels, Belgium.

Jani, A., A. Exner, R. Braun, B. Braun, L. Torri, S. Verhoeven, A. M. Murante, S. Van Devijvere, J. Harrington, A. Ochoa, G. D. L. Marchiori, P. Defranceschi, A. Bunker, T. Bärnighausen, E. Sanz Sanz, C. Napoléone, E. O. Verger, C. Schader, J. Röklov, I. Stegeman, S. Tonello, R. Pederson, N. H. Kristensen, T. Smits, D. Wascher, P. Voshol, A. Kaptejins, S. Nesrallah, O. Kjørven, F. DeClerck, C. Biella, M. A. Gjorgjioska, A. Tomicic, A. T. Ferreira Oliveira, S. Bracco, S. Estevens, L. Rossi, G. Laister, A. Różalska,

B. Jankuloski, C. Hurbin, M. Jannic, F. Steel, E. Manbaliu, K. De Jager, A. Sfetsos, M. Konstantopoulou, P.-A. Kapetanakis, M. Hickersberger, E. Chiffard, and C. Woollhead. 2022. Transitions to food democracy through multilevel governance. Frontiers in Sustainable Food Systems 6. https://doi.org/10.3389/fsufs.2022.1039127

Jensen Castillo, M. 2021. Transformación de los sistemas alimentarios en Chile: cambio de uso de suelo y comercio internacional. Estudios internacionales: Revista del Instituto de Estudios Internacionales de la Universidad de Chile (199 (Mayo-Agosto)):61-90.

Jonas, T. 2021. Peoples' solutions to food systems transformation in Asia and the Pacific. Development 64:295-298. https://doi.org/10.1057/s41301-021-00306-z

Juri, S., M. Baraibar, L. B. Clark, M. Cheguhem, E. Jobbagy, J. Marcone, N. Mazzeo, M. Meerhoff, M. Trimble, C. Zurbriggen, and L. Deutsch. 2022. Food systems transformations in South America: insights from a transdisciplinary process rooted in Uruguay. Frontiers in Sustainable Food Systems 6:1-27. https://doi.org/10.3389/fsufs.2022.887034

Käyhkö, J., L. Wiréhn, S. Juhola, and T.-S. Neset. 2020. Integrated framework for identifying transformative adaptation in agri-food systems. Environmental Science & Policy 114:580-586. https://doi.org/10.1016/j.envsci.2020.10.002

Kerr, R. B. 2020. Agroecology as a means to transform the food system. Landbauforschung 70(2):77-82.

Kuhmonen, I., and M. Siltaoja. 2022. Farming on the margins: just transition and the resilience of peripheral farms. Environmental Innovation and Societal Transitions 43:343-357. https://doi.org/10.1016/j.eist.2022.04.011

Lamine, C. 2018. Transdisciplinarity in research about agrifood systems transitions: a pragmatist approach to processes of attachment. Sustainability 10(4):1241. https://doi.org/10.3390/su10041241

Lamine, C., I. Darnhofer, and T. K. Marsden. 2019. What enables just sustainability transitions in agrifood systems? An exploration of conceptual approaches using international comparative case studies. Journal of Rural Studies 68:144-146. https://doi.org/10.1016/j.jrurstud.2019.03.010

Leeuwis, C., B. K. Boogaard, and K. Atta-Krah. 2021. How food systems change (or not): governance implications for system transformation processes. Food Security 13(4):761-780. https://doi.org/10.1007/s12571-021-01178-4

Lonkila, A., and M. Kaljonen. 2022. Ontological struggle over new product category: transition potential of meat alternatives. Environmental Innovation and Societal Transitions 42:1-11. https://doi.org/10.1016/j.eist.2021.11.002

López-García, D. 2020. Who is the subject of agroecological transitions? Local agroecological dynamisation and the plural subject of food systems transformation. Landbauforschung 70 (2):36-42.

López-García, D., A. Pomar-León, V. García-García, G. Tendero-Acín, Y. Sampedro, and A. Sastre-Morató. 2018. Contradicciones en los saltos de escala. Procesos participativos y planes de acción para la transición agroecológica en la escala metropolitana. Agroecología 13(1):33-45.

Maluf, R. S., L. Burlandy, R. P. Cintrão, E. Jomalinis, M. Santarelli, and T. Tribaldos. 2023. Global value chains, food and just transition: a multi-scale approach to Brazilian soy value chains. Journal of Peasant Studies 50(7):2642-2665. https://doi.org/10.1080/03066150.2022.2105700

Mattioni, D., P. Milbourne, and R. Sonnino. 2022. Destabilizing the food regime "from within": tools and strategies used by urban food policy actors. Environmental Innovation and Societal Transitions 44:48-59. https://doi.org/10.1016/j.eist.2022.05.007

Miles, A., M. S. DeLonge, and L. Carlisle. 2017. Triggering a positive research and policy feedback cycle to support a transition to agroecology and sustainable food systems. Agroecology and Sustainable Food Systems 41(7):855-879. https://doi.org/10.1080/21683565.2017.1331179

Muñoz Torres, M. J., M. Á. Fernández-Izquierdo, I. Ferrero-Ferrero, E. Escrig-Olmedo, and J. M. Rivera-Lirio. 2022. Transitioning the agri-food system. Does closeness mean sustainability? How production and shipping strategies impact socially and environmentally. Comparing Spain, South Africa and U.S. citrus fruit productions. Agroecology and Sustainable Food Systems 46(4):540-577. https://doi.org/10.1080/21683565.-2022.2039835

Nicol, P., and A. Taherzadeh. 2020. Working co-operatively for sustainable and just food system transformation. Sustainability 12(7):2816. https://doi.org/10.3390/su12072816

Olsson, P., V. Galaz, and W. J. Boonstra. 2014. Sustainability transformations: a resilience perspective. Ecology and Society 19 (4):1. https://doi.org/10.5751/ES-06799-190401

Paehlke, R. 2005. Sustainability as a bridging concept. Conservation Biology 19(1):36-38. https://doi.org/10.1111/j.1523-1739.2005.00426.x

Passaro, A., and F. Randelli. 2022. Spaces of sustainable transformation at territorial level: an analysis of biodistricts and their role for agroecological transitions. Agroecology and Sustainable Food Systems 46(8):1198-1223. https://doi.org/10.1080/21683565.2022.2104421

Pereira, L. M., S. Drimie, K. Maciejewski, P. B. Tonissen, and R. (O.) Biggs. 2020. Food system transformation: integrating a political-economy and social-ecological approach to regime shifts. International Journal of Environmental Research and Public Health 17(4):1313. https://doi.org/10.3390/ijerph17041313

Pitt, H., and M. Jones. 2016. Scaling up and out as a pathway for food system transitions. Sustainability 8(10):1025. https://doi.org/10.3390/su8101025

Plassnig, S. N., M. Pettit, K. Reichborn-Kjennerud, and I. Säumel. 2022. Successful scaling of Edible City Solutions to promote food citizenship and sustainability in food system transitions. Frontiers in Sustainable Cities 4. https://doi.org/10.3389/frsc.2022.1032836

Rastoin, J. L. 2020. Anclaje territorial, un activo importante para una transición alimentaria responsable y sostenible. Revista agroalimentaria 26(50 (enero-junio 2020)):227-234. https://doi.org/10.53766/Agroalim/2020.26.50.13

Reckinger, R. 2022. Values-based territorial food networks: qualifying sustainable and ethical transitions of alternative food networks. Regions and Cohesion 12(3):78-109. https://doi.org/10.3167/reco.2022.120305

Rodríguez Peñaguirre, F. J., and S. González-Arellano. 2022. Revisión sistemática de los sistemas alimentarios en la transición a ciudades sostenibles. Estudios Sociales: Revista de Alimentación Contemporánea y Desarrollo Regional 32(60):20. https://doi.org/10.24836/es.v32i60.1235

Roque, L., J. Graça, M. Truninger, D. Guedes, L. Campos, M. Vinnari, and C. Godinho. 2022. Plant-based school meals as levers of sustainable food transitions: a narrative review and conceptual framework. Journal of Agriculture and Food Research 10:100429. https://doi.org/10.1016/j.jafr.2022.100429

Ruben, R., R. Cavatassi, L. Lipper, E. Smaling, and P. Winters. 2021. Towards food systems transformation-five paradigm shifts for healthy, inclusive and sustainable food systems. Food Security 13:1423-1430. https://doi.org/10.1007/s12571-021-01221-4

Sage, C. 2014. The transition movement and food sovereignty: from local resilience to global engagement in food system transformation. Journal of Consumer Culture 14(2):254-275. https://doi.org/10.1177/1469540514526281

Sandhu, H. 2021. Bottom-up transformation of agriculture and food systems. Sustainability 13(4):2171. https://doi.org/10.3390/su13042171

Säumel, I., S. Reddy, T. Wachtel, M. Schlecht, and R. Ramos-Jiliberto. 2022. How to feed the cities? Co-creating inclusive, healthy and sustainable city region food systems. Frontiers in Sustainable Food Systems 6. https://doi.org/10.3389/fsufs.2022.909899

Slater, S., P. Baker, and M. Lawrence. 2022. An analysis of the transformative potential of major food system report recommendations. Global Food Security 32:100610. https://doi.org/10.1016/j.gfs.2022.100610

Snyder, H. 2019. Literature review as a research methodology: an overview and guidelines. Journal of Business Research 104:333-339. https://doi.org/10.1016/j.jbusres.2019.07.039

Stefanovic, L., B. Freytag-Leyer, and J. Kahl. 2020. Food system outcomes: an overview and the contribution to food systems transformation. Frontiers in Sustainable Food Systems 4:546167. https://doi.org/10.3389/fsufs.2020.546167

Sumner, J. 2015. Reading the world: food literacy and the potential for food system transformation. Studies in the Education of Adults 47(2):128-141. https://doi.org/10.1080/02660830.2015.11661680

Tanzer, M., A. Gläsel, and M. Egermann. 2022. Elucidating the capabilities of international mechanisms to foster procedural just system change - the case of the 2021 UN Food System Summit. Environmental Innovation and Societal Transitions 45:72-82. https://doi.org/10.1016/j.eist.2022.09.002

Thornton, P., T. Schuetz, W. Förch, L. Cramer, D. Abreu, S. Vermeulen, and B. Campbell. 2017. Responding to global change: a theory of change approach to making agricultural research for development outcome-based. Agricultural Systems 152:145-153. https://doi.org/10.1016/j.agsy.2017.01.005

Tovar Zerpa, F. G., and J. J. Rojas López. 2022. La trilogía "sistemas agroforestales-agroecología-agricultura familiar": una referencia válida para la transformación de los sistemas alimentarios agroindustriales. Revista agroalimentaria 28(55 (julio-diciembre 2022)):231-242.

Tribaldos, T., and T. Kortetmäki. 2022. Just transition principles and criteria for food systems and beyond. Environmental Innovation and Societal Transitions 43:244-256. https://doi.org/10.1016/j.eist.2022.04.005

Tschersich, J., and K. P. W. Kok. 2022. Deepening democracy for the governance toward just transitions in agri-food systems. Environmental Innovation and Societal Transitions 43:358-374. https://doi.org/10.1016/j.eist.2022.04.012

United Nations Framework Convention on Climate Change (UNFCCC). 2015. Paris Agreement (English). UNFCCC, Rio de Janeiro, Brazil. https://unfccc.int/documents/37107

van Bers, C., A. Delaney, H. Eakin, L. Cramer, M. Purdon, C. Oberlack, T. Evans, C. Pahl-Wostl, S. Eriksen, L. Jones, K. Korhonen-Kurki, and I. Vasileiou. 2019. Advancing the research agenda on food systems governance and transformation. Current Opinion in Environmental Sustainability 39:94-102. https://doi.org/10.1016/j.cosust.2019.08.003

Vilas-Boas, J., L. Klerkx, and R. Lie. 2022. Connecting science, policy, and practice in agri-food system transformation: the role of boundary infrastructures in the evolution of Brazilian pig production. Journal of Rural Studies 89:171-185. https://doi.org/10.1016/j.jrurstud.2021.11.025

Weber, H., K. Poeggel, H. Eakin, D. Fischer, D. J. Lang, H. V. Wehrden, and A. Wiek. 2020. What are the ingredients for food systems change towards sustainability? Insights from the literature. Environmental Research Letters 15:113001. https://doi.org/10.1088/1748-9326/ab99fd

Willett, W., J. Rockström, B. Loken, M. Springmann, T. Lang, S. Vermeulen, T. Garnett, D. Tilman, F. DeClerck, A. Wood, M. Jonell, M. Clark, L. J. Gordon, J. Fanzo, C. Hawkes, R. Zurayk, J. A. Rivera, W. De Vries, L. Majele Sibanda, A. Afshin, A. Chaudhary, M. Herrero, R. Agustina, F. Branca, A. Lartey, S. Fan, B. Crona, E. Fox, V. Bignet, M. Troell, T. Lindahl, S. Singh, S. E. Cornell, K. Srinath Reddy, S. Narain, S. Nishtar, and C. J. L. Murray. 2019. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet 393(10170):447-492. https://doi.org/10.1016/S0140-6736(18)31788-4

Wood, A., C. Queiroz, L. Deutsch, B. González-Mon, M. Jonell, L. Pereira, H. Sinare, U. Svedin, and E. Wassénius. 2023. Reframing the local–global food systems debate through a resilience lens. Nature Food 4:22-29. https://doi.org/10.1038/s43016-022-00662-0

WWF. 2020. Living Planet Report 2020. Bending the curve of biodiversity loss. WWF International, Gland, Switzerland.

Yacamán-Ochoa, C., and M. García-Llorente. 2020. Enfoque cooperativo y custodia del territorio: dos factores impulsores de la transición agroecológica de los sistemas agroalimentarios locales. Estudios Geográficos 81(289):e050-e050. https://doi.org/10.3989/estgeogr.202064.064

Zunder, T. H. 2021. A semi-systematic literature review, identifying research opportunities for more sustainable, receiver-led inbound urban logistics flows to large higher education institutions. European Transport Research Review 13(1):28. https://doi.org/10.1186/s12544-021-00487-1

# Appendix 1

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## Methodology

**Search string used for Scopus (English and Spanish):**

( TITLE ( "*food system*" AND transform* ) OR TITLE ( "*food system*" AND transition* ) OR KEY ( "*food system*" AND transform* ) OR TITLE-ABS-KEY ( "*food system*" AND transition* ))

**Search criteria used for REDIB and Dialnet (Spanish):**

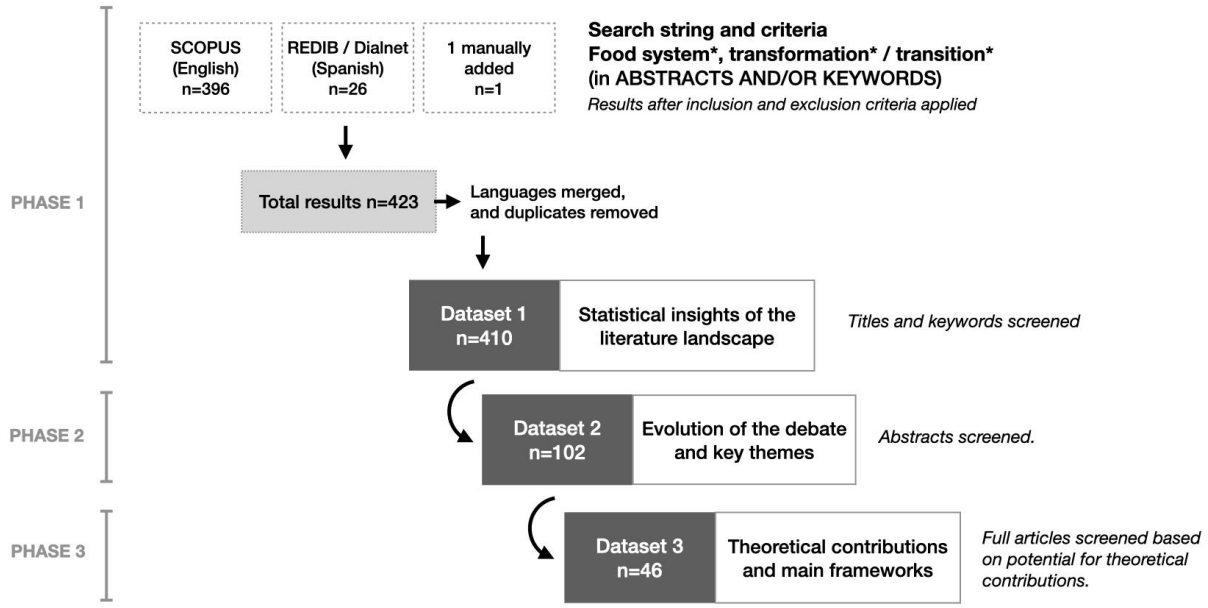
Same criteria and search term was replicated to include the following terms in Spanish in either Titles and Keywords: “sistema*” “alimentario*”, alimenticio*”,” transformación*”, “transición*”

Caveat: The online interfaces of the Spanish databases used do not allow for filtering results in the same detailed manner as Scopus. Search needed to be replicated by using a simplified search field and by manually screening results to identify potential contributions based on our research goal. In this sense, the filtering criteria could not be as rigorous as in Scopus, and meant manual screening and filtering.

Spanish results showed a prominent use of alternative terms such as “agroecological transition” or “alternative food system”. We preserved some of these that promised potential contributions, but we removed results referring to narrower sectoral analysis, for example, those related to the use of terms: “nutritional transition”, “agrarian change” or “agrarian transitions”. While the literature on “agroecological transitions” is certainly relevant for considering food system transformation, we find that the majority of the contributions do not adopt systemic approaches or theories as their background (i.e., multi-scale, interrelated, long-term) and contributions tend to describe concrete experiences (often connected to a focus on networks or supply chains) or promote and argue for the importance of this approach without developing a deeper explanation of these transitions while relating to existing theories. We therefore chose to restrict the search terms to be able to capture the most significant (not all) contributions.

**Overview of process for data collection, and inclusion/exclusion criteria:**

Three datasets were created to match three phases (and depth) of analysis. The following figure offers visual outline of this process.




**Phase 1:**

Our initial search rendered (396) articles in English (from Scopus) and (26) in Spanish (from REDIB/Dialnet combined) after applying our inclusion and exclusion criteria. We further filtered the Spanish results by excluding 2 theses and 10 articles that did not match the search string due to using other terms as prominent (e.g., agroecological transition, alternative food systems, agrarian transformation). We kept these results for later analysis (and for the Discussion section) and merged the remaining 14 results with Scopus results. One publication was duplicated and thus removed. One article was manually added to the English results. The total dataset (Dataset 1) contains 410 publications. Since the focus of the article is framed within transformative theories on food systems found in the peer-reviewed literature, we excluded likely irrelevant fields such as Neurology, or Mathematics and publication types such as books or theses. The breakdown of the inclusion and exclusion criteria is outlined in the table below. In this phase, we analyzed the quantitative results to offer statistical insights based on geographic composition of authorship, main journals and chronological breakdown of the literature landscape.

| **Inclusion criteria - Dataset 1 (n=410)** | **Exclusion criteria - Dataset 1** |
|---|---|
| Scholarly literature indexed in Scopus, REDIB and Dialnet. | - |
| Type: articles, book chapters, conference papers. | Books, theses. |
| Search terms: food system(s), transformation(s), transition(s) in titles and keywords | - |
| Fields with related or relevant contributions known to authors (eg., Environmental Science, Social Sciences, Agricultural and Biological Sciences, Earth and Planetary Sciences) | Fields with likely irrelevant contributions: For example: Dentistry, Neuroscience, Veterinary, Pharmacology, Toxicology and Pharmaceutics, Mathematics, Materials science, Physics and Astronomy, Chemical Engineering, Biochemistry, Genetics and Molecular Biology, Computer Science, Nursing, Immunology and Microbiology, Engineering, Medicine, Psychology, Neurology, Food Chemistry, Energy. |
| Languages: English, Spanish | Other languages (eg. German, Portuguese, French) |

**Phase 2**

A second filtering criteria was applied to generate Dataset 2. Here, 102 articles were kept (including Dhalberg's original paper). In this subset we constrained publications to peer reviewed research literature and excluded formats such as book chapters, conference papers or editorials. In this phase, abstracts were screened to map the evolution of the debate over roughly three decades while identifying key themes, contributions and potential trends. Details on the inclusion and exclusion criteria are outlined below.

| **Inclusion criteria - Dataset 2 (n=102)** | **Exclusion criteria - Dataset 2** |
|---|---|
| Focus on research articles (peer-reviewed) | Sources excluded: conference papers, book chapters and other non-research article types (e.g., letters, editorials). |
| Screening of titles, keywords and abstracts suggesting a theorization on food system transformation and the main themes or approaches. | Exclusion of articles that did not promise a theoretical/conceptual debate or contribution. |

**Phase 3**

A third subset (Dataset 3) was generated to carry out a full review of the publication's contents. The aim was to identify theoretical contributions, definitions or proposals of novel frameworks. From Dataset 2 (and based on such Abstracts) we kept those contributions that were either explicit or suggested a potential theoretical contribution. Therefore, we excluded narrower analysis within food system features and the majority of case studies (see inclusion and exclusion criteria outlined below). This group is made up of 46 publications. All articles were screened in full to identify different conceptualizations, theories of change and theoretical underpinnings. For example, references were reviewed to identify potential linkages to either transformations or transition theories.

| **Inclusion criteria - Dataset 3 (n=46)** | **Exclusion criteria - Dataset 3** |
|---|---|
| Focus on potential for theoretical or definitional contributions, proposal of new frameworks. | Abstracts that did not show potential or referred to theoretical contributions. For example, contributions focused on narrower aspects or analysis within food systems (e.g.Nutrition Transition) were removed. |
| Full articles were screened to identify: approaches, theoretical backgrounds, novel frameworks, terms and definitions, theories of change. | The majority of case studies were excluded, especially when they offered results or accounts of localized experiences without larger theoretical debates or implications. |

# Appendix 2

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## Novel Frameworks

| Name | Purpose / Use | Theories engaged | Reference | Notes |
|---|---|---|---|---|
| Typology of food system domains | Analyze degree of integration of food system elements with the global economy and markets. Useful to understand the role of knowledge in each domain and how this can inform planning/governance. | Social-ecological systems, resilience thinking. | Anderson 2015 | Resilient and sustainable food systems with focus on food security and democracy. |
| Transitions via policy transfers theoretical framework | Understand motivations and assess policy transfers with focus on whether to use innovation scaling processes or not. | Transitions theory | Pitt and Jones 2016 | Sustainability, especially via fostering local consumption and production initiatives. |
| Typology of telecoupled systems - heuristic model for food system governance | Understand food system governance change/planning implications by accounting for distal dynamics (multiple dimensions of distance and their effects, feedbacks) | Transformations, socio-ecological systems. | Eakin et al. 2017 | Sustainability transformations via governance changes. |
| Agri-food systems sustainability approach (AFSSA) - tool and framework. | Analyze and develop actionable plans for targeting mainstream agri-food system transitions in transdisciplinary processes (multistakeholder). | Transitions and transformations theory. | Hubeau et al. 2017 | Transform mainstream food system beyond bottom-up levels only. |
| Four-part food system transformation framework | Framework to design indicators and assessing impact/implementation of food system transformations in line with SDGs. | Mainly transformations, not very explicit. | Caron et al. 2018 | Agenda 2030, achieving SDGs via sustainable food systems. |

| | | | | |
|---|---|---|---|---|
| 8 Dimensions of food democracy | Planning and assessment of participatory democratic processes in food system transformations via 8 categories that constitute food democracy. | No explicit theory, use both terms. | Baldy and Kruse 2019 | Sustainability in general. Enhance food citizenship/democracy. |
| Food system classification framework | Characterize and diagnose dominant and alternative food systems co-existent at the country level. Offer 3 food system categories. | Transitions theory, MLP. | Gaitán-Cremaschi et al. 2019 | Sustainable food system outcomes (environmental security, food security and nutrition, social welfare). |
| 6 domains of transformation in food systems | Understanding dimensions of change in 6 domains existent at interaction of regimes and niches to identify areas of potential for transformative action. Focus is on bottom-up process and radical change. | MLP, transitions theory and also transformations literature. | Anderson et al. 2019 | Bottom-up/territory led transitions in food and agriculture, focus on agroecology. |
| Typology of transformative adaptation features – analytical framework | Analytical framework to understand adaptation measures. Used to inform policy and participatory decision making. | Not explicit, indirect link to transformations literature, use both terms. | Käyhkö et al. 2020 | Focus on climate change adaptation – fundamental changes in agri-food systems, reduction of vulnerability. |
| Multi-Level Perspective model adapted to the sustainable food system transition with a territorial lens | Offer a graphic summary of the MLP and its levels in the context of food systems while adding a territorial/spatial scale. Authors also offer a methodology for this analysis. | MLP, transitions, strategic niche management, territorialization | Felici & Mazzocchi 2022 | The graphic highlights networks at the territorial level. Graphic can be used to the explicit context of food systems. Authors also offer a novel methodology for analysing the relational dimensions at territorial innovations level and identify and map cross-scalar linkages. |
| Systemic Regeneration Wheel (SRW) | Conceptual framework (and graphic) to inform the design and implementation of sustainability programmes, research, and policy to foster change trhough plant-based school meals. | School meals, plant-based eating and sustainable food transitions. It is indirectly linked to transitions theory. | Roque et al. 2022 | The framework is the result of a narrative review of the literature, and provides a base to understand or promote change to achieve key possible outcomes for sustainable development and food system regeneration:: public health, social protection, economy, |

| | | | | |
|---|---|---|---|---|
| | | | | community welfare and environment |
| Framework on Public food procurement from family farming | The operationalization of this framework is to help identify how networks and actors are organized, linked or composed (in terms of aspects like diversity or position) and how they interact, as a way to understand how they stiumalte of block innovaitoon within public food procurement. It also helps identify demand-side barriers from actors participating in public food procurement. | Social network analysis (SNA),food systems analysis | Gaitán-Cremaschi et al. 2022 | This is particularly focused in the context of public food procurement from family farming and the patterns enabling/disabling innovations that foster transitions. |

# Appendix 3

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## Definitions of food system transformation

| Definition | Term | Authors / Publication |
|---|---|---|
| Transition as the restructuring of relations between natural, social and technological systems. This requires transforming industrial agriculture as is, through a series of strategies and concrete actions, including a shift to a health rather than productivity criteria. | Transition term, systemic but no explicit transition theory | Dahlberg 1994 |
| Transitions as a “gradual, pervasive shift from one state or condition to something different” especially concerning sustainable modes of production and consumption | Transition theory | Pitt and Jones 2016 |
| Transformation to sustainable food systems as a planned and agreed upon process that is context dependent and includes changes of significant breadth and depth. | Both terms ,but not explicitly systemic theories | Caron et al. 2018 |
| Transformation of food systems mean a deep change away from current dominant (global-industrialized) regimes to achieve human and planetary health. A transformation is understood as a change in a regime | Transformation theory | Pereira et al. 2020 |
| Food system transformation as a non-linear and long-term process of competition, negotiation and reconfiguration. | Transition and Transformation theories | Leeuwis et al. 2021 |
| Food systems transformations are interactive processes that need adaptive capacity to be able to adequately respond to unexpected challenges | Transformation term, no explicit transformation theory | Ruben et al. 2021 |
| Transitions are understood as long term and multi-level, multi-scale processes. Agroecology enables a socio-ecological vision to food systems and helps redesign it. | Transition theory | Yacamán-Ochoa and García-Llorente 2020 |

| | | |
|---|---|---|
| Food system transition seen as fundamental reconfiguration of socio-ecological systems based on paradigm changes. | Transition theory | Tschersich and Kok 2022 |
| Transformation towards sustainable food systems seek “a system that ensures food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition of future generations are not compromised” (HLPE, 2014: 31). | Transition theory | Tanzer et al. 2022 |
| Transitions to agroecology seen to require interventions in food systems and agro ecosystems through integrated long term strategies. | Systemic view but neither transition or transformation theories | Jones et al. 2022 |
| Transition as “long-term, multidimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption (Markard et al., 2012).” The aim is to transform towards more sustainable systems across scales, implicitly beyond the current dominant corporate food regime. | Transition theory | Mattioni et al. 2022 |
| First paper to discuss the meaning and evolution of the concept of transformations in food systems. Explains that transformation refers to a process that is political (contestation occurs) and normative (planned/purposive), therefore not simply random and unpredictable. In this way, it includes dimensions of scale and direction or goal. | Transformation theory | Béné 2022 |

## Adoption of terms to qualify change

| Radical | Deep | Fundamental | Intentional | Long Term / Multi-Scale |
|---|---|---|---|---|
| Radical transformation of society (Cohen and Illieva 2015)<br><br>Radical changes in food system | Profound regime reconfiguration (Bui et al. 2016; Gaitan et al. 2019; Bui 2021)<br><br>Deep change of | Fundamental transformation process (Anderson et al. 2019)<br><br>Fundamental changes in | Planned and agreed process of change (Caron et al. 2018)<br><br>Intentional transformation (Hubeau et al. 2017) | Long-term change (Caron et al. 2018, Anderson et al. 2019<br><br>Long term process of reconfiguration, |

| | | | | |
|---|---|---|---|---|
| components (Ruben et al. 2021)<br><br>Radical and collective (Caron et al. 2018, Anderson et al. 2019)<br><br>Dramatic reshape of social, political, and economic relationships (Busch and Bain 2004) | socio-technical regime (Bui 2021)<br><br>Deep change (Pereira et al. 2020; Stefanovic 2020)<br><br>Changes of significant breadth and depth at multiple scales (Caron et al. 2018) | structures<br>-production and societal (Käyhkö et al. 2020)<br><br>Fundamental transformation in modes of production and consumption (Pitt and Jones 2016)<br><br>Fundamental reorganization of socio-ecological systems (Tschersich and Kok 2022)<br><br>Transitions as long-term, multidimensional and fundamental transformation processes with socio-technical systems shifts to modes of production and consumption ( Mattioni et al. 2022) | Innovation in the system (Bui 2021)<br><br>Transitions as “purposive processes” especially driven by social innovations (Holtkamp and van Mierlo 2022) | competition and negotiation (Leeuwise et al. 2021)<br><br>Long term and multidimensional transformations (Hinrichs 2014, Anderson et al. 2019<br><br>Reshape of relationships at global scale (Busch and Bain 2004)<br><br>Transformations as interactive processes (Ruben et al. 2021) |