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The roles and dynamics of transition intermediaries in enabling sustainable public food procurement: insights from Spain

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Abstract

Sustainable Public Food Procurement (SPFP) is gaining recognition for its potential to improve the sustainability of food systems and promote healthier diets. However, SPFP faces various challenges, including coordination issues, actor dynamics, infrastructure limitations, unsustainable habits, and institutional resistance, among others. Drawing upon insights from the Multi-Level Perspective (MLP) on socio-technical transitions and the X-curve model on transition dynamics, this study investigates the role of transition intermediaries in facilitating SPFP-induced transformations in food systems. Focusing on four case studies in Spain, we identify common barriers encountered in SPFP and analyse how distinct types of transition intermediaries contribute individually and collectively to address these challenges. Additionally, we explore how intermediary networks evolve throughout different phases of the transition process. Our findings reveal that SPFP barriers are systemic and interconnected, emphasizing the necessity of collective intermediation to overcome these obstacles. Furthermore, our results reveal how collective intermediation is orchestrated by pivotal intermediaries who mobilize diverse transition intermediaries, shaping multiple transition pathways. These intermediaries operate at both food system regimes and niches, challenging the conventional notion that transformative change can only originate from niche efforts. Lastly, we highlight the dynamic and flexible nature of intermediation in SPFP transitions, underscoring the importance of adaptability in strategies as these transitions evolve over time. Practical implications include the need for context-specific, adaptive approaches and strategies that leverage intermediary diversity. This research offers insights for policymakers, practitioners, and scholars into SPFP and broader transitions towards food systems transformation, fostering a more comprehensive understanding of these transition processes.

Keywords Food systems transformation · Food system transitions · Public food procurement · Transition intermediaries · Food procurement barriers

Introduction

Sustainable public food procurement (SPFP[1]) is increasingly recognized as an essential instrument for catalysing the transformation of food systems toward greater sustainability and healthier diets (FAO et al. 2021; Gaitán-Cremaschi et al. 2022). By incorporating sustainability and health considerations into the sourcing and provision of food and food services for public institutions, such as schools and hospitals,

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[1] Sustainable Public Food Procurement (SPFP): The term refers to the environmentally conscious, economically sustainable, and socially responsible process by which governments source food and provide food services for public consumption. SPFP includes activities conducted directly by the government or through catering services, impacting various institutions such as public schools, childcare centres, health facilities, retirement homes, and universities (FAO et al. 2021).

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procurement strategies have the potential to induce changes in food production, marketing, and consumption patterns (Izumi et al. 2010; Powell and Wittman 2018; Gaddis and Jeon 2020; Swensson and Tartanac 2020; Bisceglia et al. 2021, FAO et al. 2021). This generates a range of economic, environmental, social, and food and nutrition security benefits. These benefits encompass diverse aspects, including promoting sustainable production models such as agroecology and organic production (Guerra et al. 2017; Valencia et al. 2019; Lindström et al. 2020), boosting local economies, enhancing employment opportunities, creating local agricultural markets (Mensah and Karriem 2021; FAO et al. 2021), reducing greenhouse gas emissions by supporting alternative food networks (Smith et al. 2016; Perez-Neira et al. 2021; Simon et al. 2022), and encouraging sustainable and healthier dietary patterns (Sidaner et al. 2013; FAO et al. 2021).

Despite the growing recognition of the transformative potential of SPFP, its implementation remains limited (Parsons and Barling 2022). SPFP often remains what have been referred to as 'innovation niches' (Hinrichs 2014; El Bilali 2019; Hebinck et al. 2021) that cannot yet fully change the incumbent food system referred to as the so-called 'socio-technical regime' (Gaitán-Cremaschi et al. 2019) or 'food regime' (McMichael 2009) to get a more established position in food systems. The under- implementation of SPFP indicates the presence of numerous barriers that impede progress and hinder broader adoption. These barriers stem from various sources, including niche development related barriers such as the lack of coordination among stakeholders and within procuring organisations, inadequate financial, physical, and knowledge infrastructures, insufficient capabilities, and skills among relevant actors (FAO et al. 2021), as well as regime related challenges posed by institutional resistance, the predominance of conventional procurement procedures and practices (Kelly and Swensson 2017; Miranda 2018; Gaddis and Jeon 2020; Gaitán-Cremaschi et al. 2022), and a rigid 'value for money' ethos (Sonnino 2019). Furthermore, factors like unhealthy food consumption habits, inadequate policy frameworks and regulations, limited political will, insufficient articulation of societal demands, and a lack of long-term vision for SPFP contribute to the complexities faced (Kelly and Swensson 2017; FAO et al. 2021). Overcoming these barriers is of paramount importance in unlocking the transformative potential of SPFP. It is not just sufficient to support niche development, also certain elements of the regime that keep food systems 'locked-in' need to be phased out (Conti et al. 2021; Hebinck et al. 2022).

In the literature on innovation, agriculture, and food systems transformation, drawing on insights from the field of transition studies (Mignon and Kanda 2018; Kivimaa et al. 2019a, b; Glaa and Mignon 2020; Kanda et al. 2020), there is increasing recognition of the crucial role played by so-called 'transition intermediaries' in overcoming barriers and facilitating transformative change (Yang et al. 2014; Rossi 2017; Groot-Kormelinck et al. 2022; Iyabano et al. 2022). These transition intermediaries contribute both to the creation and development of niches, helping niche actors to overcome barriers to networking and collaboration, accessing knowledge and funding, overcoming institutional barriers related to unfavourable legislation, and the destabilization of unsustainable regimes (Matschoss and Heiskanen 2017; Kivimaa et al. 2019a; Kanda et al. 2020), for example by lobbying for mandatory public procurement which can weaken the position of incumbent food providers. In the case of agriculture and food systems, these transition intermediary roles have been attributed to for example farmers' organizations (Yang et al 2014; Groot-Kormelinck et al. 2022; Iyabano et al. 2022), grassroots food movements (Rossi 2017), but also dedicated 'innovation brokers' that connect demand and supply for innovation support services (Klerkx and Leeuwis 2009) and 'boundary organizations' that mediate between science and policy (Goldberger 2008; Vilas-Boas et al. 2022a). These intermediaries have important roles as facilitators, connectors, and change agents.

Existing literature on SPFP recognizes the importance of various actors acting as facilitators, connectors and change agents, including farm-to-school movements (Powell and Wittman 2018), food distributors (Izumi et al. 2010), governmental agencies (Berg et al. 2022; Son 2023), farmers and cooperatives (Conner et al. 2012; Groot-Kormelinck et al. 2022), parents, students, and social organizations (Gaddis and Jeon 2020; Bisceglia et al. 2021; Son 2023), among others, for food system transformation. These could hence be considered as transition intermediaries. However, despite the acknowledgment of their importance, they have not been the main object of study, and an explicit perspective on the individual and collective role of intermediaries in SPFP transitions remains underexplored. While there have been recent inquiries into the dynamics of transitions of public food procurement as part of food systems transformation, often utilizing the Multi-Level Perspective (MLP) to grasp socio-technical transitions (e.g., Gaddis and Jeon 2020; Son 2023), the roles of intermediaries remain implicitly studied.

There is thus a gap in knowledge on the specific roles, collaborations, and potential conflicts of these intermediaries in overcoming barriers and driving change within SPFP. Furthermore, often studies employ a static and individualistic viewpoint, describing key single actors and their roles without taking a process view, which hinders the comprehension of dynamic interactions among a network of actors and intermediaries throughout the process of transition.

This article investigates the dynamics and role of transition intermediaries in food system transitions facilitated by SPFP, drawing on four case studies in Spain. Specifically, we identify barriers to the implementation of SPFP, map and examine the networks of transition intermediaries and their dynamics across different phases of the transition processes and explore how their roles have facilitated the overcoming of

these barriers. This information can provide insights for decision-making by various actors involved in advancing these transitions, ensuring that the necessary intermediary roles are fulfilled. Beyond the case studies, this study contributes to scholarly debates about the essential role played by transition intermediaries, and strategies in facilitating transformative change within the realm of food system transitions and SPFP.

Following the presentation of the analytical framework in the next section, we introduce the four cases through a chronological narrative, highlighting milestones and key stakeholders. We subsequently detail the methodologies employed for data collection and analysis. In the results section, we outline the barriers encountered across these cases and explore the contributions of diverse types of transition intermediaries in overcoming these challenges. Building upon this analysis, we offer cross-cutting insights into the transition dynamics through cross-case comparative assessment. Finally, we engage in a discussion of the case study findings, situating them within the broader context of existing literature on food system transitions through SPFP.

Analytical framework

The analytical framework of this study is based on three key components: the multi-level perspective (MLP) on socio-technical transitions (Geels 2002); the X-curve model, (Hebinck et al. 2022); and the roles and categorizations of transition intermediaries, guided by the MLP and the X-curve model.

Sustainability transitions – food system transitions and Multi-Level Perspective (MLP)

To comprehend and facilitate transformative changes towards sustainable food systems, food system scholars have turned to the MLP as an analytical framework (Geels 2002). The MLP proposes that transitions emerge as a non-linear process that result from the interplay of three interconnected levels (Geels 2002): the socio-technical regime, the niches, and the socio-technical landscape. The socio-technical regime embodies the established practices, regulations, and institutions that shape the dominant system, typified in food systems by industrialized farming and integrated supply chains that prioritize mass production of standardized and inexpensive foods (El Bilali 2019; Gaitán-Cremaschi et al. 2019). Locked-in by path dependency and stability, the regime predominantly favours trajectories of incremental adjustments (Ingram 2015; Meynard et al. 2017). Niches, in contrast, incubate novel technologies, practices and concepts that challenge the socio-technical regime (Hinrichs 2014; El Bilali 2019; Gaitán-Cremaschi et al. 2019; Boillat et al. 2022). In the specific case under consideration, SPFP exemplifies such niche innovations, which involves concepts, regulations, technologies, and organizational structures aimed at revolutionizing food procurement practices (Gaitán-Cremaschi et al. 2022). The socio-technical landscape encompasses exogenous factors like population growth, climate change, and global crises that exert pressure on both niches and regimes, creating an environment conductive for change (Konefal 2015; El Bilali 2019; López-Cifuentes and Gugerell 2021). The dynamic interactions among the regime, niches, and the landscape can lead to a variety of transition pathways, which can vary in their degree of incremental or radical transformation (Ingram 2015). These pathways arise from the initiatives of niches, yet they can also be influenced by actors within the established regime who advocate for these innovative changes (Klerkx et al. 2010).

Dynamics in sustainability transitions—X-Curve model

The MLP emphasizes the inherent transformative potential nested within niches. Notwithstanding this emphasis, as acknowledged by Lazarevic et al. (2022), there has been comparably less focus on the actions of actors within existing regimes who aim to influence processes, including but not limited to creative destruction (Kivimaa and Kern 2016), disruption (Kivimaa et al. 2021), decline (Rosenbloom and Rinscheid 2020), reconfiguration (Laakso et al. 2021), destabilization (van Oers et al. 2021), and phase-out (Rinscheid et al. 2021) at the level of regimes. To enhance comprehension in ongoing transition processes, the X-curve framework has been introduced as a heuristic model to capture both the evolving dynamics of the breakdown of established regimes and the niche build-up of more sustainable food systems (Klerkx et al. 2022; Lennartz et al. 2022) (Fig. 1).

The dynamics of breakdown come into play as the regime confronts pressures that necessitate adaptation and *optimization* (Hebinck et al. 2022). Under persistent external pressures, this trajectory leads to *destabilization*, as it becomes increasingly apparent that the prevailing systems are no longer suitable for their intended purpose (Hebinck et al. 2022; Klerkx et al. 2022). This destabilization marks the onset of a *chaos* phase, characterized by an abrupt loss of security, the collapse of established institutions and organizations, or even acute crises (Hebinck et al. 2022). Conversely, the build-up dynamics complement breakdown dynamics by highlighting transformative innovations like SPFP, which emerge as a response to unsustainable incumbent systems. This emergence is driven by *experimentation* within alternative food systems, shielded from the pressures of the prevailing regime (Sengers et al. 2019; Hebinck et al. 2022; Klerkx et al. 2022). While certain transformative innovations may experience declines in terms of development and interest and hence fail to advance (Klerkx et al. 2022), others may gain visibility and better

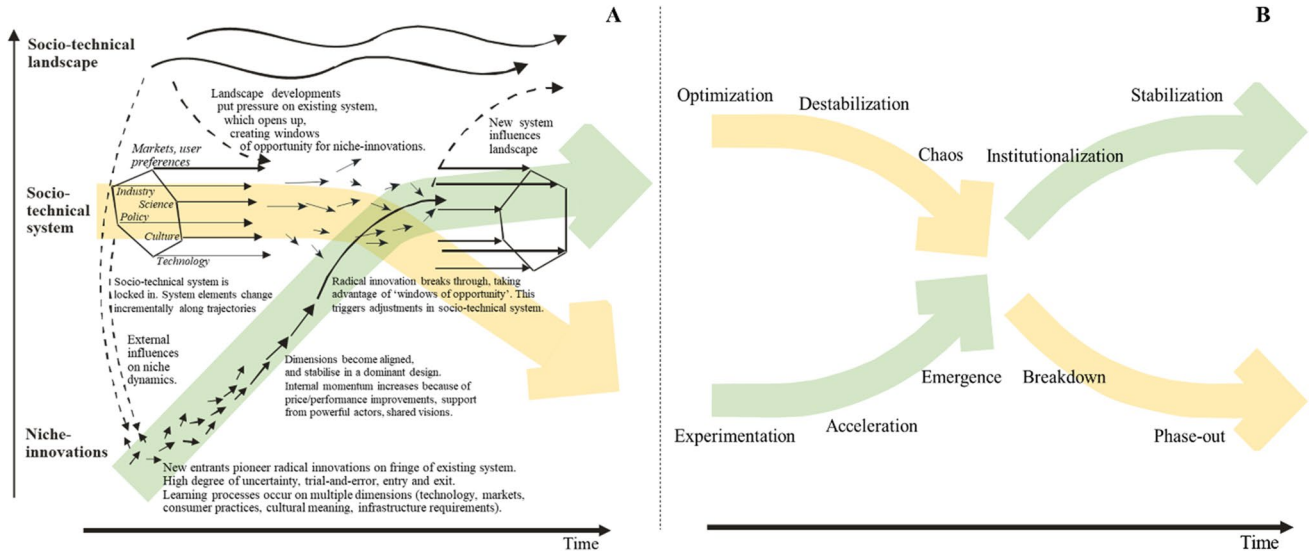

Fig. 1 Panel **A**. Multi-level perspective (MLP) illustrating its three interconnected levels: the socio-technical regime, the niches, and the socio-technical landscape. The colours in panel **A** indicate the interconnection between MLP and the X-Curve model. Source: Adapted from Geels (2019); Panel **B**. X-Curve phases depicting breakdown and niche build-up dynamics. Source: Hebinck et al. (2022)

understanding, thereby contributing to *accelerating* processes of diffusion and scaling, and gradually to the *emergence* of 'niche-regimes' (Hebinck et al. 2022). Niche-regimes then lead to *institutionalization* of routines, practices, norms, cultures, through the integration of niche and regime elements (Hebinck et al. 2022). This progression culminates in the *stabilization* of a new regime, accompanied by the *breakdown* and *phase-out* of specific elements of the original targeted agrifood system (Conti et al. 2021).

Intermediaries in sustainability transitions

Intermediaries have been studied for a long time in the agrifood context, for example looking at the role of agricultural extension, or actors who connect demand and supply for services (Klerkx and Leeuwis 2008; Koutsouris 2014; Lubell et al. 2014; Yang et al. 2014), or the roles of traders and other 'middle actors' in food systems (Legun and Bell 2016). However, this work has often not focused on transitions. In the context of sustainability transitions, intermediaries engage in both supporting radical innovation and disrupting the prevailing unsustainable socio-technical regime (Ehnert 2023). The concept of a 'transition intermediary' as outlined by Kivimaa et al. (2019a: 11) refers to *"actors and platforms that positively influence sustainability transition processes by linking actors and activities, and their related skills and resources, or by connecting transition visions and demands of networks of actors with existing regimes in order to create momentum for socio-technical system change, to create new collaborations within and across niche technologies, ideas and markets, and to disrupt dominant unsustainable socio-technical configurations".*

Drawing upon an extensive body of sustainability transition literature, Ehnert et al. (2022) developed a function-based categorization of intermediation roles. This typology encompasses six main roles:

- **Envisioning and articulating needs and expectations for change**: This role entails crafting strategies, shaping transformational visions for society, influencing the political establishment of visions, advocating alternative developmental pathways, and articulating user demands.
- **Aggregating knowledge and facilitating learning processes**: This role involves gathering and disseminating information, piloting alternatives, communication, offering advice, and providing educational and technical support.
- **Creating a shared institutional infrastructure**: This role focuses on creating an institutional infrastructure and support by connecting local projects, establishing repositories of knowledge, introducing innovative products/services to markets, and creating institutional and regulatory frameworks.
- **Framing and coordinating local-level activities**: This role encompasses identifying shared challenges across local initiatives, coordinating local actions, and fostering knowledge sharing among stakeholders.
- **Networking, building partnerships, aligning interests, and resolving conflicts**: This role involves creating networks, fostering collaboration, facilitating dialogues, resolving conflicts, brokering agreements, and building trust among various actors.
- **Advocating change and mobilizing support**: This role entails engaging in lobbying and campaigns, navigating

complex policy landscapes, and identifying opportunities for transformative change.

Transition intermediaries display a range of distinct characteristics that shape their roles and contributions. Some intermediaries are intentionally established to facilitate transitions, while others assume intermediary roles as transitions unfold (Kivimaa et al. 2019a). The latter may involve actors engaged in daily operations, yet actively contributing to the facilitation of transitions. These intermediaries operate at various scales, spanning geographical and administrative boundaries, bridging gaps between multiple actors, and linking local projects with global contexts (Kanda et al. 2020). Their goals vary, encompassing sustaining existing regimes, disrupting them, or endorsing specific niches, reflecting diverse motivations driving sustainability advancements (Matschoss and Heiskanen 2017). Transition intermediaries often adopt normative positions, demonstrating a commitment to niches or the regime (Klerkx and Leeuwis 2009). However, certain intermediaries maintain a neutral stance, acting as platforms or facilitators without a strong or distinct normative position, and, when necessary, accommodating a diverse range of food transition initiatives.

Drawing from these characteristics and in alignment with the MLP framework, Kivimaa et al. (2019a) categorizes five main types of transition intermediaries: systemic intermediaries, regime-based intermediaries, niche intermediaries, process intermediaries, and user intermediaries:

- **Systemic intermediaries** are typically established to operate across all MLP levels (niche, regime, landscape). While often considered neutral, they promote a transition agenda and lead system-level change by aligning interests across niches and regimes (Kivimaa et al. 2019a; van Lente et al. 2020). For instance, in food system transitions, food policy councils have been found to function as systemic intermediaries, fostering comprehensive science-policy-practice interfaces for food system transformation (den Boer et al. 2023).
- **Regime-based transition intermediaries** (regime intermediaries) are closely tied to established socio-technical regimes. Their approaches range from revolutionary transformations to reformist changes achieved through incremental steps (Ehnert et al. 2022). In food system transitions and SPFP, they could include existing entities such as government agencies that assume intermediary roles, actors established by regimes to facilitate transitions (Mattioni et al. 2022), and even those involved in day-to-day operations like catering companies.
- **Niche intermediaries** often emerge when a niche develops, operating on various spatial scales (local, national, international). They experiment and promote activities within specific niches to influence the prevailing socio-technical system (Kivimaa et al. 2019a). These intermediaries negotiate interests, form a shared vision, and facilitate cooperation between emerging and the dominant regime (Kivimaa et al. 2019a). Examples in food system transitions and SPFP encompass local food networks, grassroots movements, and social organizations, as well as actors engaged in day-to-day operations. These could include producer associations, agroecological food hubs, and any other food system actor advocating for radical changes in the production, processing, distribution, and consumption of food.
- **Process intermediaries,** often perceived as neutral, are commonly established, or employed to connect actor groups and facilitate projects, processes, or activities within a niche or in broader transition processes (Kivimaa et al. 2019a). Examples in food system transitions and SPFP include consultancy organizations, advisors and working groups.
- **User intermediaries** commonly emerge during the transition, engaging directly with end-users and consumers. They influence preferences and behaviours towards sustainable choices, bridging gaps between emerging sustainable technologies and user demands within niches and the dominant system (Kivimaa et al. 2019a). In the context of food system transitions and SPFP, examples of user intermediaries include consumer advocacy groups, educational initiatives, family networks, and champions in public canteens.

The complex nature of sustainability transitions requires a diverse 'ecology of intermediaries' to drive these processes. This concept captures the dynamic interactions among various types of transition intermediaries, collectively performing multifaceted roles that contribute to the complexity of transitions. The absence of roles within these ecologies may lead to 'ecology gaps' in intermediation that can hinder the progress toward sustainability transitions (Kivimaa et al. 2019a, b).

Materials and case studies

Four distinct case studies were selected to present a comprehensive overview of the dynamics of SPFP in Spain, i.e., Islas Canarias, Navarra, Comunidad Valenciana, and Barcelona. These cases offer insights into the evolution of both governmental programs and bottom-up initiatives, fostering the development of more sustainable food systems through SPFP. Geographically and administratively, these cases cover a spectrum: Islas Canarias, Navarra, and Comunidad Valenciana operate at the regional level, while Barcelona operates within the municipal context. Limited regulatory support initially has progressed in Islas Canarias. Navarra

Table 1 Distribution of interviews by case study and type of actor

Type of actor / Initiative	Islas Canarias	Navarra	Comunidad Valenciana	Barcelona
Institutional actors	2	1	2	4
Social organization / networks		1	5	1
Researchers	2			1
Consultants	1	1		1
Farmers organizations and food hubs	3	2		1
Rural advisors	2			
Catering companies				6
Family networks		1		
Nutritionists	1		1	
Total	**11**	**6**	**8**	**14**

boasts a robust regional regulatory framework supporting SPFP. Comunidad Valenciana exhibits a strong regulatory framework at the municipal level, fostering initiatives but facing weak regional support, and Barcelona recently updated regulations governing public food procurement.

In the following sections, we outline the methodology of data collection (Sect. "Data collection") and provide a chronological narrative of the four case studies, highlighting milestones and key stakeholders, as well as the development of the regulatory framework, under which SPFP initiatives have progressed (Sect. "Research context and case studies"). Subsequently, we present the adopted data analysis approach (Sect. "Data analysis").

Data collection

The research design employed a cross-comparative case study approach to investigate the diversity of transition intermediaries and their roles in transitioning to SPFP. The study focused on the presented transition processes, each characterized by varying scope, ambition, and scale.

Data collection involved several key steps. Firstly, insights from eight experts knowledgeable about food governance, agroecology, and public food procurement in Spain were used to construct a comprehensive list of actors involved in the four case studies. Subsequently, a total of 39 interviews were conducted online, with each interview lasting approximately 60 min. The variation in the number and type of interviewees was influenced by the diverse landscape of actors and their respective roles within each specific region involved in sustainable public food procurement initiatives (Table 1). The interviews took place between April and November 2022, and verbal consent was obtained from all interviewees to record the interviews and utilize the information for research purposes.

Each interview was structured into three parts. In the first part, actors were asked to provide a detailed description of the process of implementing SPFP, including a timeline and key actors involved. The second part focused on identifying and describing the barriers encountered or perceived during the transition. The third part delved into how these barriers were overcome by various actors, with illustrative examples provided. Due to the disparate distribution of interviewees across regions, we supplemented our data collection by actively participating in several events, including the Forum on Agroecology and Biodiversity in the Islas Canarias, the international conference on healthy and sustainable food in public food procurement in País Vasco, the seminar on the exchange of experiences in public food procurement in the Comunidad Valenciana, and the webinar on monitoring and control mechanisms in food tenders. These events provided opportunities to interact with stakeholders, gather insights, and further enrich our understanding of sustainable public food procurement practices in the respective regions. Additionally, information from scientific articles, webpages, reports, and other relevant documents describing activities related to SPFP in the four case studies was also incorporated.

Research context and case studies

Islas Canarias: public institutions as a catalyst for change

The Ecocomedores program originated in 2010 as a response to the challenges within the organic sector. Initiated by the Canarian Institute of Agri-Food Quality (ICCA), the program's conceptual foundation lies in the Biennial Action Plan for the Development of Organic Production, formulated in the I and II Forums on Agroecology and Biodiversity. This plan emphasized the promotion of organic production through SPFP, with a focus on schools. It is worth noting that despite the plan's emphasis on SPFP, there was no explicit regulatory framework supporting SPFP at that time. Officially launched in 2013, this program aimed to facilitate the transition of schools managing food procurement directly, without undergoing a formal tendering process,

towards an agroecological model that enhances both food sustainability and quality. It commenced as a pilot initiative in seven schools, evolving through the establishment of the coordination, production, and nutrition (now known as the food group) working groups by ICCA. Between 2014 and 2015, the program expanded to over 60 schools. In 2016 and 2019, the awareness-raising and logistics working groups were established, shaping the current operational framework. These groups addressed implementation barriers from production to consumption and the lack of cross-sectoral governance structures for the implementation of the Ecocomedores program.

Collaboration between ICCA and the production working group facilitated the emergence and professionalization of organic producer organizations. Their establishment varied due to local socio-economic factors, and production conditions. The advancement of the organic producer organizations commercializing in Ecocomedores was further reinforced by the support from the logistics working group and island councils from 2019, which collectively streamlined and enhanced food distribution mechanisms.

Initially, the Education Department exhibited limited engagement in the Ecocomedores program. However, its involvement increased in 2022, as evidenced by the Resolution 972/2022 issued by the Department mandating the program's implementation in all 152 public schools managing food procurement directly (Education Department 2022). The increase in participation was primarily driven by the commitment of a key individual within the department. Prior to this policy regulation, participation in the program was subject to the discretion of individual schools, posing a notable risk to the continuity of Ecocomedores.

Currently, ICCA actively engages stakeholders, secures funding, and extend the Ecocomedores program despite challenges, particularly stemming from resistance from school staff and producers. This resistance results from varying school commitment levels to local organic products, reducing producers' interest. Additionally, perceptions of occasional low quality organic products also reduce schools the interest of schools to participate in the program, despite Regulation 972/2022.

Furthermore, ICCA aims to broaden the program's scope to encompass additional public entities. This strategic expansion is expected to be driven by the Ecolocal Strategic Framework (2023) and the proposal for a currently lacking SPFP decree in Islas Canarias. With the envisaged decree, the aim is to ensure that public institutions procuring food and services through tenders are obligated to include health and sustainability criteria.

Navarra: hybrid collaborative agency

In 2016, social movements took the lead in establishing two Open Parliaments on Food Sovereignty, coordinated by Fundación Mundubat, with the goal of bringing food sovereignty and governance concerns, which were absent from the public discourse. This effort gave rise to the establishment of the Navarra Public Procurement and Food Sovereignty Group (Grupo de Compra Pública y Soberanía Alimentaria de Navarra – GCPSANA) in mid-2016. Comprised of representatives from public institutions, social organizations, unions, and individuals, GCPSANA emerged as a united voice advocating for local organic agriculture and more health-conscious canteen models through SPFP. By employing strategic positioning and political pressure, GCPSANA achieved substantial milestones, resulting in policy regulations that fostered SPFP. A standout achievement was the approval of Additional Provision 17 in the Regional Law on Public Procurement 2018/2 (Government of Navarra 2018), which strictly mandates to prioritize sustainability, and food sovereignty criteria in public food contracts, now establishing the regulatory framework for all subsequent initiatives. These criteria involve the use of nutritious, culturally appropriate, and locally produced food, in line with ecological practices, and fair labor and wage conditions. Despite encountering resistances, this achievement was realized through collaborative efforts involving janGela, a parents' association instituted in 2017 with support from the agroecological association Arrea, GCPSANA, and the Navarra Council of Organic Production (CPAEN).

At the municipal level, GCPSANA played a significant role in initiating the ‘Hemengoak’ project in Pamplona during 2016. This project aimed to transform municipal infant school canteens, transitioning from traditional tendering to a model that prioritizes high-quality, fresh, seasonal, organic, and locally produced products. Rooted in the commitment of the Pamplona City Council following its endorsement of the Milan Urban Food Policy Pact in 2015,[2] the project's execution was facilitated by a coordinating entity known as the Grupo Motor Hemengoak, comprised by the CPAEN, the Institute of Agri-Food Technologies and Infrastructures (INTIA) and the association Menjadors Ecològics. Starting as a pilot phase in 2016, the project expanded to encompass all municipal infant schools in Pamplona by 2018. This growth was facilitated by incorporating criteria into the procurement tender specifications, which mandated the acquisition of organic, local, seasonal, and fresh products,

[2] Municipal-level commitment to building sustainable food systems that are inclusive, resilient, safe, and diverse, that provide healthy and affordable food to all people in a human rights-based framework (Milan Urban Food Policy Pact 2015).

especially from small-scale farmers. To overcome the implementation challenges encompassing aspects like menu design, food sourcing, coordination of supply and demand, as well as monitoring, the project strategically assigned a kitchen coordinator. In 2018, the emergence of Ekoalde also took place, which brought together local organic farmers and processors in Navarra who were previously operating independently.

Since 2021, under the guidance of CPAEN, progress has been made in embedding sustainability and health criteria within food procurement contracts, now actively enforced. This effort extends to the Pamplona Home Care Service (SAD), regional public-school canteens, —despite encountering initial opposition from the regional Department of Education—, and the Hospital Público de Navarra. This expansion, significantly facilitated by Additional Provision 17, has driven the expansion of organic production dedicated to the local market through the association Ekoalde.

Comunidad Valenciana: the power of social organizations as agents of change

In 2015, a change in Valencia's municipal government created an opening for social movements to exert influence on food related policies. Leveraging political pressure, the new administration demonstrated a commitment to advancing local agriculture and food-related policies, exemplified by the establishment of the local Council of Agriculture, Huerta, and Towns (CAHT) and its endorsement of the Milan Urban Food Policy Pact. This pivotal shift laid the groundwork for the establishment of the Municipal Food Council (CALM) in 2017, and the Agri-Food Strategy of Valencia 2025 in 2018. These initiatives materialized through collaborative efforts by the CAHT, in conjunction with the Grupo Motor of the CALM. This group comprised social organizations like Justicia Alimentaria, CERAI, Fundación Mundubat, and others, such as the Polytechnic University of Valencia.

The CALM brings together 60 + stakeholders, spanning public agencies, civil society, academia, and others, for co-creating municipal agri-food policies. It operates through a plenary, a permanent committee and eight working groups, including the Short Food Supply Chain Group (CCC) and the Public Procurement and Sustainable Food Group (CPCR). The CCC group, co-led by the CAHT and CERAI, drives initiatives to establish short marketing channels. The CCC group serves as a collaborative platform for various entities and organizations, fostering the convergence of ideas that led to the creation of Ecotira and the Horta-Cuina mentoring program in 2021. Ecotira, a cooperative food hub, was established with the aim of connecting local organic farmers who were previously operating independently. Horta-Cuina focuses on fostering connections between Ecotira and schools through the involvement of catering companies. Conversely, the CPCR group, led by Justicia Alimentaria, collaborates with entities like CERAI, among many others, to provide technical and specialized advice for integrating sustainability and health criteria into local food procurement contracts. A notable milestone was the integration of these criteria into food services in municipal schools, overcoming administrative challenges from the local council's technical personnel. Although currently applied to only five schools, these criteria align with the recommendations of the 'Guidelines for the tender of the school canteen service with sustainability criteria' developed within the CALM and approved in the municipal assembly.

At the regional level, it was not until 2018 that the Health Department developed the 'regional guide for the menus in school cafeterias'. Subsequently, this guide led to Decree 84/2018 for the 'Promotion of healthy and sustainable eating in Valencia government centres' (Health Department 2018). However, it was perceived that the Decree lacked the necessary ambition to promote SPFP and did not effectively link to the 2018 Guide. In 2021, amendments were thus proposed to align the decree with the guide and agroecological principles for public food services. To facilitate this process, the regional Health Department collaborated with various social organizations to establish the 'Intersectoral Committee for Healthy and Sustainable School Food'. This committee included public representatives from the Health, Agriculture, Education, and Social Welfare sectors, alongside members of social organizations and other stakeholders united through the 'Escoles que Alimenten' platform, which has been active since 2019.

Despite varying perspectives among public agencies and differences between these agencies and the platform, the committee worked together to draft a proposal for amendments to Decree 84/2018 by the close of 2022. However, the approval process has encountered delays, largely attributed to political elections. It appears that the proposal may not gain approval from the regional Legal Advisory Council.

Barcelona: The private sector as catalysts for transformation

Commencing in 2009, facilitated by the region's decentralized management model for school canteens, the emergence of numerous small to medium-sized ecological school catering companies has gained traction. These companies, contracted directly by Parents' Associations (AMPAs) or school administrators without going into a tendering process, provide high-quality food services, emphasizing agroecological principles, and education in healthy dietary habits. A key feature of these companies is their collaboration with local organic farmers, advocating for direct marketing channels. A significant nexus within these alliances is Ecocentral, a private agroecological food hub established in 2011. Ecocentral

facilitates logistical connections between the companies and the local organic producers, which were previously absent. To extend their impact beyond their operations, the companies, along with Ecocentral and La Kosturika, a cooperative representing local organic producers, established the Agroecological School Canteens Network of Catalonia (XAMEC), to raise awareness about the need for sustainable and healthy food in school canteens.

On the public spectrum, the Barcelona City Council, operating through the municipal Institute of Education (IMEB), started a gradual integration of sustainability and health criteria into the tendering specifications of food service contracts for infant schools in 2008. In 2015, the City Council further strengthened its commitment to sustainable food policies by joining the Milan Urban Food Policy Pact. From 2020 to 2023, the City Council intensified efforts to promote various food policy instruments for healthier, sustainable, and equitable food systems. The 'Barcelona World Capital of Sustainable Food for the Year 2021' project emerged during this period, placing the transformation of the food system at the forefront of the public agenda. Achievements included the establishment of the Urban Food Policies and Responsible Consumption Section (SPACR), which coordinated initiatives such as the 'Menjadors Escolars Més Sans i Sostenibles' (MEMSS), alongside the update of the Technical Instruction for Public Food Procurement in 2022 (Barcelona City Council 2022). Guided by the leadership of SPACR and the local Council of Health, and the advice from the association Menjadors Ecològics, the MEMSS initiative sought to advance health-conscious and sustainable nutrition within more than 40 participating primary schools. On the other hand, the revised Technical Instruction for Public Food Procurement updates, expands, and incorporates environmental, social, and health criteria into food procurement conducted by various contracting bodies in Barcelona, which were not as stringent in the past. These criteria encompass various aspects, such as the utilization of organic, locally sourced, and seasonal products, and restrictions on the use of animal protein and processed foods. The implementation of the revised instruction is currently undergoing a pilot phase.

Data analysis

In this study, employed a qualitative content analysis approach (Schreier 2012) for data analysis. Timelines were initially constructed through manual coding and an abductive approach, aligning with the interview topic list structure to identify milestones and principal actors in the transition process.

Subsequently, barriers encountered in each case study were systematically classified using the typology of systemic barriers (codes) established by Wieczorek and Hekkert (2012), a framework widely employed in the context of agricultural innovation and food system transitions (see for example Lamprinopoulou et al. 2014; Vermunt et al. 2022). These barriers encompass *actor-related challenges*, including the absence of relevant actors or the presence of actors who, despite their existence, do not commit to sustainable public food procurement; *institutional challenges*, involving habits, routines, beliefs, and shared concepts (soft institutions), and rules, regulations, norms, and strategies (hard institutions); *relational challenges* covering missing interactions and weak networks; and *infrastructural challenges*, which include the absence or malfunctioning of knowledge, financial, and physical infrastructures.

Afterward, the analytical framework was utilized to map and categorize actors into different types of transition intermediaries. This categorization was based on a coding related to characteristics such as how they emerged, the goals they had for their intermediation, as well as their interests and position in the transition process (Kivimaa et al. 2019a). Additionally, an explanation of the roles these transition intermediaries played in overcoming barriers was undertaken, following the six roles of intermediation described by Ehnert et al. (2022).

Lastly, a comparative analysis was conducted across the case studies to reveal trends in transition dynamics characterized by the X-curve model. It is important to emphasize that the use of the X-curve model is intended as a heuristic tool to explore participants' perspectives on the breakdown and build-up dynamics potentially at play within the initiatives. The application of the X-curve is not intended to offer an unequivocal assessment of the absolute effects of the transitions, particularly given that the studied transitions are relatively recent in nature. Furthermore, it should be noted that within the framework of the X-curve, the dynamics of breakdown are comprehended within the context of the individual case studies and at the localized level. This interpretation does not seek to elucidate overarching structural transformations within the broader Spanish food system regime.

Findings

Barriers that hamper implementation of sustainable public food procurement (SPFP)

The findings from the interviews and case studies revealed a diverse range of challenges encountered during the transition towards SPFP. These barriers encompassed barriers related to actors, institutions, infrastructure, and relations barriers. The barriers span various dimensions of the entire food system, including production, consumption, and the articulation between food supply and demand (Table 2). These barriers are not applicable to all cases, as indicated in Table 2.

Table 2 Barriers in sustainable public food procurement (SPFP) and transition intermediaries' actions to overcome them (Generic roles of transition intermediaries described in Table 3)

Barriers	Islas Canarias	Navarra	Comunidad Valenciana	Barcelona
Actor-related barriers (absence of relevant actors or lack of actor's commitment)				
Insufficient political support and commitment	Regime intermediary (ICCA) engaged in aligning interests, fostering networking, and advocating for policy support. Further commitment is required	Systemic intermediary (Open Parliaments) aligned interests, promoted networking, and advocated for policy changes	Regime intermediaries (CAHT, regional Health Department) coordinated CALM, local activities, and offered policy support; Still uneven participation of departments	Local administration established the regime intermediary (SPACR) to envision change and frame local activities. Political commitment remains limited
Insufficient participation and engagement of public institutions such as the Departments of Education and Health	Regime intermediary (ICCA) collaborated with Education Department; Department of Health non-participant	Regime (CPAEN), niche (GCPSANA), and user (janGela) intermediaries mobilized support, and advocated for changes in regional Department of Education tenders	Regime intermediary (regional Health Department) took the lead in implementing regulation changes. Departments of Education still resist changes	Regime intermediary (IMEB) and municipal Health Department framed and implemented projects such as MEMSS
Limited presence of organized parent associations (AMPAs) and lack of critical mass in families	Lack of AMPAs advocating for change. No intermediary action	User intermediary (janGela) facilitated family networking; niche (GCPSANA) and regime (CPAEN) intermediaries supported janGela establishment	Niche intermediary (Escoles que Alimenten platform) mobilized AMPAs support; limited AMPAs involvement persists	AMPAs played a crucial role in SPFP. Niche intermediaries (ecological catering companies) instrumental in addressing AMPAs' interests
Limited presence of social organizations promoting changes towards SPFP	Social organizations are not involved. No intermediary action	Niche intermediary (social organizations) aligned interests, mobilized support, and facilitated networking in initial transition phases	Niche intermediary (social organizations) aligns interests, mobilizes support, facilitates networking and drives SPFP initiatives	Social organizations collaborate with niche intermediary (XAMEC) but do not play transition roles
Institutional problems (hard or soft)				
Absence of a well-defined governance structure for effective collaboration and coordination among entities and sectors	Regime intermediary (ICCA) organized Ecocomedores through process intermediaries (working groups) to address absence of intersectoral institutional infrastructures	Process intermediary (Grupo Motor Hemengoak) provided informal institutional infrastructure for coordination and learning. Public intersectoral structure still lacking regionally	Systemic intermediary (CALM) and process intermediary (Intersectoral Committee) established formal governance structures. Coordination among regional public agencies remains deficient	Regime intermediary (SPACR) led cross-cutting food policies but without direct competences limiting influence; niche intermediary (XAMEC) addresses intersectoral governance gaps
Absence of a regulatory framework for SPFP	Regime intermediary (ICCA) spearheaded proposal for a decree regulating SPFP and advocated for Resolution 972/2022	Niche (GCPSANA, Mundubat) and regime (CPAEN, INTIA) intermediary efforts yielded a SPFP regulatory framework (Additional Provision 17)	Systemic intermediary (CALM) supported transformative visions; Regime intermediary (regional Health Department) revised Decree 84/2018, fostering dialogue with support from niche intermediary (social organizations) for knowledge, interest alignment, and mobilization	Regime intermediary (SPACR) led the development of the Technical Instruction for Public Food Procurement. Implementation still required
Absence of established control mechanisms and procedures to assess compliance in food service contracts	Regime intermediary (ICCA) oversaw program compliance but still face challenges hindering school and farmer participation due to the lack of formal school tendering process	Regime intermediary (CPAEN) advised public agencies and promoted learning on control and monitoring mechanisms, but it remains a significant barrier	Niche intermediary (social organizations) proposed mechanisms individually or through process (CPCR) and niche (Escoles que Alimenten platform) intermediaries. Efforts remain limited	Regime intermediaries (IMEB, SPACR) implemented mechanisms, but effectiveness limited; Niche intermediary (XAMEC) proposed Ecolocal certification but not fully adopted

Table 2 (continued)

Barriers	Islas Canarias	Navarra	Comunidad Valenciana	Barcelona
Cultural shift required for adopting healthier and sustainable food choices, including reducing animal protein	Regime intermediary (ICCA) facilitated learning and sensitization among kitchen staff and the school community through process intermediaries (food and awareness-raising groups). Resistance remains	Regime (CPAEN), process (Grupo Motor Hemengoak), and user (janGela) intermediaries conducted campaigns and training targeting kitchen staff and families	Niche intermediary (social organizations) conducted sensitization and training individually or through the niche intermediary (Escoles que Alimenten platform). Process intermediary (Menjadors Ecològics) also involved in learning	Regime (IMEB, SPACR), process (Menjadors Ecològics), and niche (ecological catering companies) intermediaries engaged in awareness-raising activities and training with kitchen staff, and the school community
Infrastructural problem (knowledge, financial or physical)				
Need for expertise in defining tender specifications	Not applicable to this case study. Canteens in schools managed directly by schools without tendering process	Process (Grupo Motor Hemengoak) and regime (CPAEN) intermediaries provided technical knowledge and facilitated learning. Several tender documents improved and enforced	Niche intermediary (social organizations), act as advisors individually or through the process (CPCR) and niche (Escoles que Alimenten platform) intermediaries	Process intermediary (Menjadors Ecològics) provided advise and knowledge. Niche intermediary (XAMEC) provided knowledge for the Technical Food Instruction
Difficulties in storage, logistics, and distribution	Regime's (ICCA) process intermediary (logistics group), and niche intermediary (producer organisations) worked on distribution networks; Process intermediary (Island Councils) addressed needs	Niche intermediary (Ekoalde) professionalized logistics and distribution	Process intermediary (CCC group) developed Ecotira for logistics enhancement	Niche intermediary (Ecocentral) helped overcome challenges. Deficiency in agroecological food hubs persists
Relation problems (missing interactions or weak networks)				
Lack of associationism and professionalization of the organic primary sector to participate in SPFP	Regime intermediary (ICCA) supported formation and professionalization of niche intermediary (producer organizations) via process intermediary (production group). Paternalistic relations remain	Niche intermediary (Ekoalde) fostered associationism and professionalization, with support from regime intermediaries (CPAEN, INTIA) in establishing Ekoalde	Process intermediary (CCC group) initiated Ecotira. Challenges with associationism remain in Valencia	Niche intermediary (Ecocentral) encourages farmer association and professionalism, but individual work remains
Absence of effective communication, and understanding, between kitchen staff and organic producers	Regime intermediary (ICCA) supported communication through the process intermediaries (working groups). Cognitive distance remains	Process intermediary (kitchen coordinator) facilitated; Niche intermediary (Ekoalde) advised catering companies for menu design	Process intermediary (CCC group) introduced Horta-Cuina to enhance communication	Niche intermediary (Ecocentral) facilitated collaboration between niche intermediary (ecological catering companies) and farmers

Table 3 Characteristics and roles of transition intermediaries in the context of sustainable public food procurement (SPFP). Intermediaries are categorized as systemic, regime, niche, process, or user intermediaries based on their *emergence*: specifically established, already existing, emerging in the process, or unaware of intermediation; their *goal of intermediation*: pursuing goals on a system level, through typically more incremental solutions, through more radical solutions, or implementing context-specific priorities; and their *interest/position*: neutral position, player in the dominant system, or actor advancing niches. Roles under each type of intermediary were classified as *high* when performed by 75% to 100% of the actors categorized in that type, *medium* (50% to 75%), *low* (25% to 50%), and *very low* (below 25%)

	Systemic	Regime	Niche	Process	User
Characteristics					
Emergence	Established	Existing	Existing/ Established / Emerging	Established	Existing/Emerging/Unaware
Goal of intermediation	System level	Incremental solutions/Radical solutions	Radical solutions	Context-specific priorities	Radical solutions
Interest / position	Neutral	Dominant system	Niche	Niche	Niche
Roles of intermediaries					
Envisioning and articulating needs and expectations for change	High	High	High	Very low	Low
Aggregating knowledge and facilitating learning processes	High	Medium	High	High	High
Creating a shared institutional infrastructure	Medium	High	Medium	Very low	Low
Framing and coordinating local-level activities	Very low	High	High	High	Medium
Networking, building partnerships, and aligning interests	High	Low	High	Medium	Medium
Advocating change and mobilising support	Medium	Low	High	Low	High

Challenges were observed at the production stage, with difficulties encountered in organizing and professionalizing the local primary organic sector to actively engage in sustainable procurement initiatives (relation-based barrier). At the consumption level within schools, barriers were perceived in the resistance from school staff to adopt menu changes and the persistence of unsustainable food consumption habits among families and the school community (soft institutional barrier). Additionally, barriers were identified in the domain of storage, logistics, and distribution (physical infrastructural barrier), which hindered the effective connection between local organic production and sustainable consumption (relation-based barrier).

Barriers extend to (absence of) actors and their commitment at multiple levels, encompassing institutional actors, social organizations, and AMPAs (actor-based barriers). Furthermore, the absence of well-defined governance structures for fostering effective collaboration and coordination among various entities and sectors presented additional challenges to SPFP efforts (hard institutional barrier). This was further compounded by the lack of or weak regulatory frameworks specifically tailored to support and guide sustainable procurement initiatives (hard institutional barrier), limited knowledge of technical administrative personnel to incorporate SPFP regulations, if existing, into tender documents for food contracts (infrastructural—knowledge barrier), and lack of control mechanisms to assess compliance in food service contracts (hard institutional barrier) (Table 2).

In the subsequent Sect. "Networks of transition intermediary's types, and roles in overcoming barriers", we examine these barriers by considering the roles of intermediaries (Table 3) and describe the actions that contributed to overcoming them.

Networks of transition intermediary's types, and roles in overcoming barriers

In this section, we elaborate on the transition intermediaries introduced in the case study presentations within Sect. "Research context and case studies". These intermediaries are categorized into systemic, regime, niche, process, and user categories, as indicated by interview insights. Note that actors may belong to multiple intermediary types, but for clarity, we have classified them based on their primary characteristics (Table 3).

Following this, we explore the roles fulfilled by each intermediary type within the individual cases (Table 3), with a specific focus on their efforts to address the barriers outlined in Table 2. This analysis maintains a constructive perspective by focusing on the actions of transition

intermediaries that helped to overcome these barriers. Nevertheless, it is important to acknowledge that despite these efforts, certain barriers remain unresolved, as depicted in Table 2.

Systemic intermediaries

Systemic intermediaries are characterized by a lesser normative alignment with a specific vision of food system transition. They also adopt a neutral position in their support for a variety of food transition initiatives. Typically, these intermediaries are established early in the transition process. These operate at a systemic level, contrasting to one-to-one intermediaries. Their primary roles include identifying needs, consolidating, and sharing knowledge, facilitating learning, and forming partnerships (Table 3). By enacting these roles their actions primarily address barriers related to political support and cross-sectoral collaboration (see actions in Table 2). These intermediaries include the Forums on Agroecology and Biodiversity in Islas Canarias, the Valencia Municipal Food Council (CALM), and the Open Parliaments on Food Sovereignty in Navarra. We will now provide more detail on each.

As indicated by the interviewees, in Islas Canarias, the Forums on Agroecology and Biodiversity established by the Institute of Agri-Food Quality (ICCA) provided a dynamic platform that brings together diverse stakeholders, including public institutions, organic producers, consumers, and educators. This inclusive environment promoted dialogue, collaboration, networking, and knowledge exchange, fostering awareness and commitment to organic production and sustainable consumption practices.

In Comunidad Valenciana, the CALM provided a space that facilitated reflection, dialogue, networking, and consensus-building for agri-food policy co-construction. It engaged administrative actors to heighten commitment to sustainable food regulations, while involving non-administrative actors for a grassroots-driven approach to policy formulation. Moreover, CALM provided social legitimacy and support for projects, diagnostic studies, training, and research such as those conducted by social organizations, and a broad range of actors involved in food policy and related initiatives.

Similarly, Open Parliaments in Navarra served as inclusive platforms advocating for food sovereignty and governance. While this intermediary was only active in the early stages of the transition, it played a significant role in shaping the public agenda, garnering political commitment and support for SPFP initiatives, including the 'Hemengoak' project led by the Pamplona City Council. Additionally, it facilitated the alignment of visions and collaborative efforts for SPFP by fostering networking, exemplified by the GCP-SANA group.

Regime intermediaries

Regime intermediaries consist of established public agencies or individuals within those agencies, guiding change within prevailing systems. These intermediaries included the Canarian Institute of Agri-Food Quality (ICCA) in Islas Canarias, the Navarra Council of Organic Production (CPAEN) and Institute of Agri-Food Technologies and Infrastructures (INTIA) in Navarra, the local Council of Agriculture, Huerta, and Towns (CAHT), and the regional Health Department in Comunidad Valenciana, and the Institute of Education (IMEB) and Urban Food Policies and Responsible Consumption Section (SPACR) in Barcelona. Their goals encompass either gradual or radical shifts in procurement practices, with ICCA and CPAEN pursuing more radical transformations, while others focus on more incremental changes (Table 3). Their roles primarily include envisioning change, coordinating activities, and establishing institutional frameworks (Table 3). They addressed challenges related to political commitment and lack of regulations for SPFP. ICCA and CPAEN were particularly instrumental in overcoming multiple barriers (see actions in Table 2). We will now provide more detail on each.

Within the context of Islas Canarias, drawing inspiration from experiences in other locations, a change agent within the ICCA took on the roles of a regime intermediary and assumed leadership throughout the transition process. For simplicity, we will refer to this agent as ICCA from hereon. ICCA convened systemic spaces, including the Forums on Agroecology and Biodiversity. Furthermore, it took the lead in driving the Ecocomedores program, mobilizing resources, overcoming obstacles, and extending the program's scope. Collaborations with both public and private entities secured commitment and support, and underpinned regulatory frameworks such as Resolution 972/2022 and the proposal for a decree regulating SPFP which currently lacks in Islas Canarias. In addition to policy roles, the ICCA addressed the existing intersectoral gaps by establishing specialized working groups—production, logistics, food, and awareness—each focusing on distinct stakeholders to facilitate comprehensive of program development (Table 2).

In Navarra, members of social movements within the CPAEN and INTIA played essential roles in advancing SPFP, overcoming various barriers (see Table 2). While INTIA's engagement was confined to the early phases, CPAEN remained active throughout the entire process. Both entities contributed to political advocacy and the approval of Additional Provision 17, now forming the regulatory framework for SPFP in the region. Moreover, they provided technical guidance, aiding in the implementation of Additional Provision 17 in food service contracts. Their expertise extended to advising on sourcing, menu planning, and monitoring of food contracts, exemplified in projects like Hemengoak.

Additionally, they promoted collaboration and associationism within the local organic sector, leading to the establishment of the farmer association Ekoalde, effectively addressing organizational challenges. Their efforts also resulted in initiatives like the parent's association janGela, which encouraged family involvement (see Table 2). As one interviewee stated about the CPAEN, *"CPAEN has embraced various roles, likening the process to guerrilla warfare…. CPAEN has realized that if they want to generate a change in the public food procurement model, CPAEN needs to specialize in many things, from production to food consumption and policy"*.

In Comunidad Valenciana, the CAHT (municipal level) and the Health Department (regional level) acted as regime intermediaries, contributing to policy development, agenda-setting, and collaboration. CAHT coordinated the Municipal Food Council (CALM) from early stages and facilitated niche initiatives like the food hub Ecotira and the Horta-Cuina program. The regional Health Department engaged in advocacy and agenda-setting, facilitating dialogue between public agencies and the Escoles que Alimenten platform to revise the Decree 84/2018 in SPFP during later phases of the transition (Table 2).

In Barcelona, IMEB took a lead role in gradual integration of sustainability and health criteria into infant school canteens. SPACR, on the other hand, fostered political commitment and drove cross-cutting food policies and projects. Interviewees emphasized that these efforts facilitated the MEMSS project and the updated the Technical Instruction for Public Food Procurement to integrate sustainability criteria into public food procurement contracts, and the proposal of mechanisms to ensure compliance with these established criteria, common barriers in SPFP (Table 2).

Niche intermediaries

Niche intermediaries encompass diverse actors like social organizations, producer associations, and networks (with networks comprising multiple niche intermediaries along with other actors), existing in various stages—emerging or established in the process. They play multifaceted roles in driving transformative shifts from production to consumption and policy changes (Table 3). Their roles are contextually shaped, with some playing system-level roles, such as social organizations in Comunidad Valenciana and ecological catering companies in Barcelona. Others are more focused in specific phases of the transition, like Navarra's Fundación Mundubat, GCPSANA group, and the producer organization Ekoalde in Navarra, as well as the producer organizations in Islas Canarias. The versatile roles of these intermediaries overcome multiple barriers during the transition (see actions in Table 2). We will now outline the niche intermediaries for each case.

In Islas Canarias, organic farmer organizations offered technical guidance to farmers, facilitating collective crop planning, price negotiations, and food distribution to schools. According to insights from the interviewees, these initiatives trigger peer interest and support, addressing historical challenges of lack of associationism in this region (Table 2).

In Navarra, three niche intermediaries operate across varying transition stages. Fundación Mundubat, an early entrant, championed alternative discourses on food system sustainability. This entity coordinated the Open Parliaments and supported GCPSANA development, which in turn fostered networking and collaboration among diverse stakeholders committed to SPFP. The focused involvement of GCPSANA, tailored to specific contexts, facilitated the establishment of regulations like Additional Provision 17 in the Regional Law on Public Procurement 2018/2 – a main step in overcoming institutional barriers (Table 2). According to one of the interviewees, *"The actors comprising GCPSANA exhibit varying degrees of engagement. Nevertheless, a notable characteristic of the group is that these actors emerge in a strategic manner at different points in time"*. Another niche intermediary was Ekoalde, a local organic producer association emerging during the transition. Overcoming limited associationism and professionalization in the local organic sector, Ekoalde also acted as representatives for members in dealings with public administration and collaborated as intermediaries for catering companies, enhancing communication between kitchen staff and local organic farmers (Table 2).

In Comunidad Valenciana, interviewees identified social organizations as having significant roles in driving the entire transition and effectively tackling emerging challenges (Table 2). Their engagement encompassed diverse activities, from shaping CALM's inception and guiding CALM's working groups, to disseminating knowledge on SPFP, advising public procurement officers on the integration of sustainability criteria into food contracts, fostering connections between local organic farmers and schools through the food hub Ecotira and the Horta-Cuina program, driving cultural shifts via awareness campaigns, and advocating for policy changes. These organizations additionally bridged municipal and regional transition dynamics through the Escoles que Alimenten platform, another niche intermediary established later in the transition to influence regional educational food services and mitigating the lack of regulatory frameworks for SPFP through the proposal for modification of Decree 84/2018, which is still pending for approval (Table 2).

In Barcelona, ecological school catering companies assumed niche intermediary roles in collaboration with the food hub Ecocentral and the XAMEC network. As highlighted by interviewees, these catering companies took the lead in introducing agroecological practices within both the catering sector and schools. Through partnerships with

local organic farmers and Ecocentral, these companies established shorter marketing channels, implemented fair trade practices, and adhered to transparent standards. Ecocentral addressed logistical challenges by connecting ecological catering companies and local organic farmers, ensuring school menus aligned with local production. XAMEC, emerging later in the transition, represented a collective effort of these entities to promote agroecological school canteens and transparency in the catering sector. XAMEC initiatives, including the Ecolocal certification, addressed institutional gaps, such as the lack of effective monitoring mechanisms for catering compliance with procurement criteria (Table 2). Furthermore, and as expressed by an interviewee, *"The articulation of actors in XAMEC serves to create a network and improve practices from production to consumption in a systemic way…each member brings different areas of knowledge and experience in transitioning to an agroecological school model"*.

Process intermediaries

Process intermediaries encompass groups, platforms, food hubs, and consultants strategically established to address context-specific challenges. Their roles centre on facilitating learning, local-level activities, and acting as knowledge brokers (Table 3), aiding in overcoming multiple barriers encountered during specific initiatives or activities (see actions in Table 2). In all four cases process intermediaries were present.

In Islas Canarias, ICCA's working groups dealt with challenges within the Ecocomedores program, including limited associationism among local organic farmers, logistical issues, communication gaps, and kitchen staff resistance (Table 2). The production group offered agronomic guidance, synchronized crop planning, and fostered the formation of horizontal organic farmer organizations. As stated by one interviewee, *"Cooperative models have transformed. Some of them have adopted a completely horizontal structure. Decision-making now lies with a board, and the manager is no longer the sole authority"*. The logistics group managed orders, storage, quality control, and developed distribution networks. The food group extended advice and training to school kitchens, helping them utilize fresh, local, and seasonal organic produce. The awareness-raising group conducted educational campaigns to promote sustainable and health-conscious dietary habits within schools.

In Navarra, the 'Hemengoak' project, led by the Grupo Motor Hemengoak and a kitchen coordinator, addressed challenges like limited sector associationism, kitchen staff resistance, and the absence of sustainability criteria in procurement contracts and monitoring mechanisms (Table 2). The Grupo Motor coordinated the project, provided advisory services to schools and administrative personnel on sustainable food sourcing and menu changes, and supported short marketing channels. The kitchen coordinator ensured the continuity of the Grupo Motor's functions, further integrating menus with local production and introduced monitoring mechanisms for food contract compliance.

In the Comunidad Valenciana, the Grupo Motor of CALM pioneered the participatory formulation of CALM's governance structure. Moreover, CALM's Food Supply Chain (CCC) and Public Procurement and Sustainable Food (CPCR) groups emerged early in the transition, providing collaborative platforms for formulating proposals and transformative initiatives. CCC provided the space for the development of strategies to resolve challenges related to the scarcity of associationism, logistical complexities, and limited engagement of the organic primary sector through the food hub Ecotira. Furthermore, the Horta-Cuina program connected school food demand with food supply through catering companies, promoting mutual understanding between these actors (Table 2). CPCR provided technical and specialized advice to the administrative personnel on sustainability integration in procurement contracts, while advocating for policy changes. As pointed by the interviewees, the collaborative work within both groups, involving entities from various domains, also led to new connections between actors (niche-niche, niche-regime) and the development of a common language and consensus on what constitutes healthy and sustainable food. The 'Intersectoral Committee for Healthy and Sustainable School Food' provided a platform for consensus-building, conflict resolution, and cross-sectoral governance, aiming to enhance SPFP regulatory frameworks (Table 2).

Finally, Menjadors Ecològics advised stakeholders, diagnosed school canteen issues, proposed agroecological menus, and guided kitchen teams toward healthier and more sustainable school menus across all cases. The association advised the food working group in Islas Canarias, the Grupo Motor Hemengoak in Navarra, Horta-Cuina in Comunidad Valenciana, and multiple projects in Barcelona (Table 2).

User intermediaries

User intermediaries emerged during the transition process, often unaware of their intermediation role. Their primary roles included consolidating knowledge, fostering learning, and mobilizing support for transformative changes (Table 3). They were essential in addressing cultural shifts within school environments (see actions in Table 2). They included school kitchen teams in Islas Canarias, the parent's association janGela in Navarra, and the ecological school catering companies in Barcelona. Below we describe the functions of these user intermediaries in more detail.

In Islas Canarias, champions within school kitchen teams and school directors inadvertently assumed user

intermediary roles, as evident from the interviews. By disseminating information, sharing experiences, and implementing best practices, they motivated school staff, families, and students to embrace agroecological principles, ultimately countering resistance and fostering positive change.

In Navarra, the parent's association janGela facilitated learning processes within schools and mobilized families to advocate for agroecological canteen models. Through its active involvement, janGela amplified the collective voice of families, exerting influence over regional school food policies.

In Barcelona, ecological school catering companies influenced user preferences by engaging with the school community, catalysing sustainable and health-conscious food choices. Additionally, they demonstrated viable agroecological canteen models, inspiring other schools, and companies to adopt similar sustainable practices.

Cross-cutting insights on case illustrations –X-curve transition dynamics and evolving networks of transition intermediaries

The case studies provide a picture of distinct X-curve dynamics. Each of these dynamics is characterized by its own specific patterns of niche development and regime breakdown, all within the context of varied and evolving networks of intermediaries. Certain individuals or organizations served as pivotal intermediaries, taking the lead guiding the transitions, as illustrated in Fig. 2 (figures for each case study with names of actors are provided in supplementary material 1). In the following sections, we will delineate cross-cutting insights in build-up (Sect. "Building the pathway to change: niche build-up dynamics") and regime breakdown (Sect. "Destabilizing the status quo: regime breakdown dynamics") dynamics perceived in each case study, along with intermediation gaps (Sect. "Intermediation gaps in transition dynamics").

Building the pathway to change: niche build-up dynamics

Common patterns emerge in the niche build-up dynamics across cases, highlighting the influence of regime intermediaries, niche intermediaries, or a combination of both (Fig. 2).

In Islas Canarias, build-up dynamics are presently in *acceleration* and an early *institutionalization* phase. This progression initiated with *experimentation* led by the pivotal regime intermediary (ICCA), which catalysed collaboration between local organic farmers and schools. As ICCA introduced process intermediaries (specialized working groups) and supported emergence of niche intermediaries (farmer organizations), the network of intermediaries expanded, marking the shift to *acceleration* (Fig. 2, panel A, II and III). During *acceleration*, farmer engagement increased, SPFP adoption in schools expanded, and coordination improved. Process intermediaries (working groups and island councils) and user intermediaries (school staff champions) facilitated this phase (Fig. 2, panel A, III). Despite advancements, interviewees highlighted recent obstacles hindering further advancement such as inconsistent producer commitment, school resistance, and limitations in public agency involvement (Table 2). Signs of *institutionalization* have emerged, led by the pivotal regime intermediary (ICCA), exemplified by the Education Department's Resolution 972/2022 formalizing school commitments to join Ecocomedores.

In Comunidad Valenciana and Barcelona, build-up dynamics are in *acceleration* with elements of *institutionalization*. The progression in these regions commenced with pivotal niche intermediaries driving *experimentation* and subsequent *acceleration*. Early *experimentation*, led by social organizations in Comunidad Valenciana, resulted in the establishment of the systemic intermediary (CALM) (Fig. 2, panel C—I). An evolving network of intermediaries, including process intermediaries (CALM's working groups), facilitated experimentation and synergy among niche and regime actors (CAHT) (Fig. 2, panel C—II), which resulted, for example, in the integration of sustainability criteria into infant school food tenders. Early *acceleration* saw the establishment of the process intermediary (Ecotira) and the Horta-Cuina program, which increased participation of farmers, school catering companies, and schools in SPFP (Fig. 2, panel C – III). Establishment of a niche intermediary interconnecting multiple niche intermediaries (Escoles que Alimenten platform) to share learnings to the regional level expanded the network of intermediaries contributing further to *acceleration* (Fig. 2, panel C—III). Efforts for the *institutionalization* of SPFP practices were pursued at both the municipal and regional levels. Municipally, the systemic intermediary (CALM) played crucial roles, while regionally, interactions between the niche intermediary (Escoles que Alimenten platform) and public agencies, especially the regime intermediary (regional Health Department), were essential for the proposal of Decree 84/2018. Unfortunately, the latter effort has not yielded success.

Experimentation with ecological menus and local organic farmers, in Barcelona was initiated by pivotal niche intermediaries (ecological school catering companies). Regime intermediaries (IMEB) also engaged in *experimentation* with incremental changes by incorporating sustainability and health criteria into the tendering process (Fig. 2, panel D – I). Transition to an early *acceleration* phase was driven by niche intermediaries collaborating to share best practices, resulting in a network of ecological school menu providers (Fig. 2, panel D – II and III), gaining support from an increasing number of local organic producers, though still limited, a growing number of schools. Interviewees noted limited interaction between

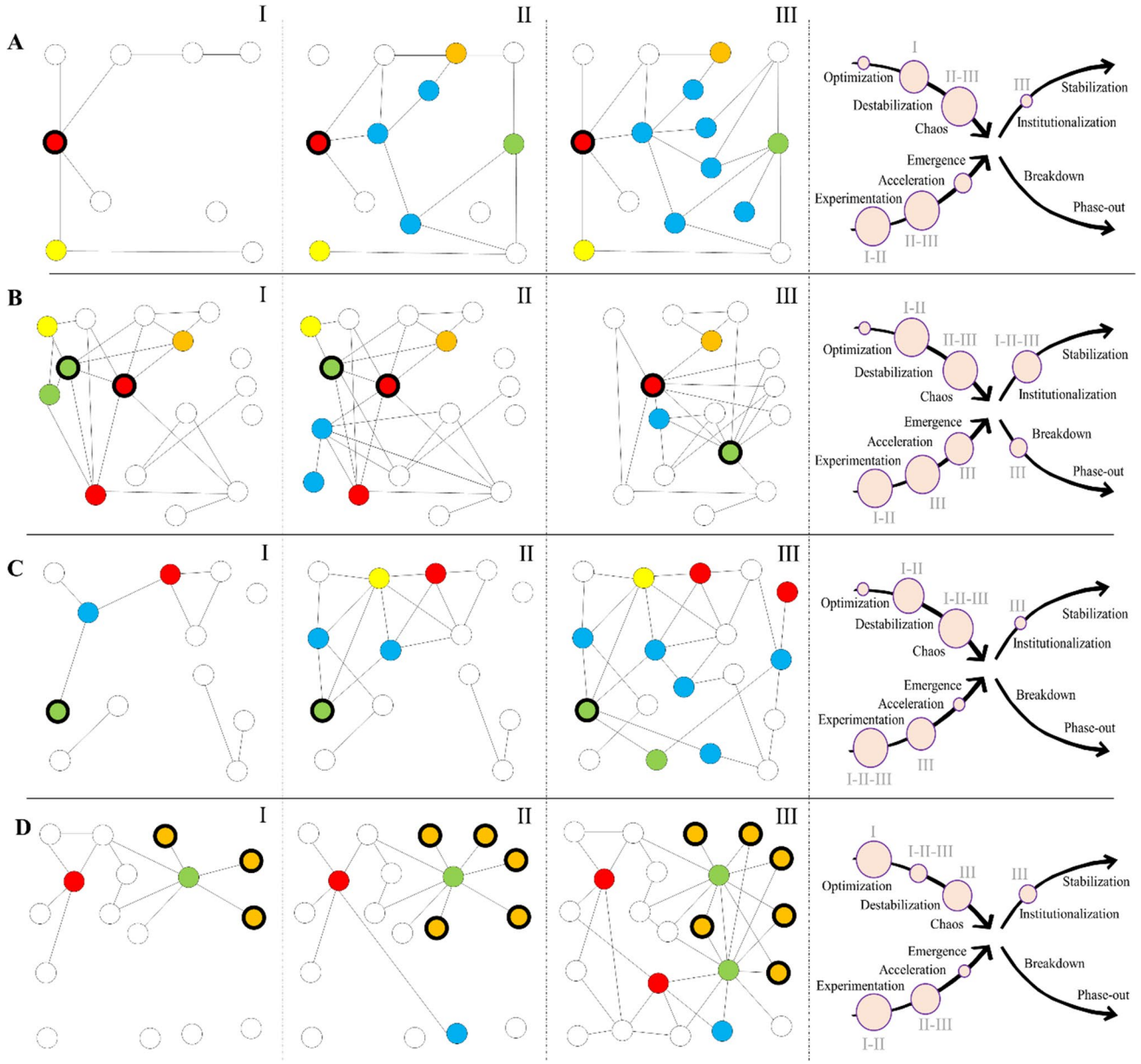

Fig. 2 Dynamic evolution of networks involving transition intermediaries throughout the transitions to SPFP and X-curve dynamics. I, II, and III represent points in time in the transition process. The colour key designates yellow for systemic intermediaries, red for regime intermediaries, green for niche intermediaries, blue for process intermediaries, orange for user intermediaries, and white for actors. While an actor may embody multiple intermediary types, the primary type is emphasized for clarity. Pivotal intermediaries are highlighted with thicker black lines. X-curves on the right of the figure indicate the estimated 'state of the transition' and the perceived X-curve phases each case has undergone. The size of circles indicates the amount of effort invested in the specific phase, with larger circles representing more effort. Subpanels (A–D) spotlight specific cases: A – Islas Canarias with a pivotal regime intermediary (ICCA), B – Navarra with pivotal regime intermediary (CPAEN) and niche intermediary (Ekoalde), C – Comunidad Valenciana with pivotal niche intermediary (social organizations), and D – Barcelona with pivotal niche intermediary (ecological catering companies)

niche and regime intermediaries during *experimentation* and *acceleration*. In Barcelona top-down *institutionalization* elements are observed, particularly in the update of the Technical Instruction for Public Food Procurement. However, the enforcement of the instruction is still in a pilot stage.

Despite the progressive developments in both Comunidad Valenciana and Barcelona, interviewees identified several challenges hindering the transition towards the *niche-regime emergence* and more advanced *institutionalization* phases. These barriers include regulatory gaps, political prioritization of SPFP, and resistance from existing systems (Table 2).

Navarra showcases advanced build-up dynamics in *niche-regime emergence* and *institutionalization*, driven by pivotal regime and niche intermediaries. Early engagement by niche intermediaries started the transition (Fundación Mundubat and GCPSANA), laid the groundwork for the transition (Fig. 2, panel B – I). *Experimentation* was facilitated by regime intermediaries (CPAEN and INTIA), forming alliances with other actors to implement projects like Hemengoak. The establishment of process intermediaries (Grupo Motor Hemengoak and the kitchen coordinator) helped overcoming barriers in *experimentation* (Fig. 2, panel B – II). The shift from *experimentation* to *acceleration* and eventual *niche-regime emergence* involved collaborative efforts between regime and the pivotal niche intermediary (farmer association Ekoalde), supported by user intermediaries (janGela). The *acceleration* phase marked the end of INTIA's role as a regime intermediary due to agency changes (Fig. 2, panel B – III). Despite obstacles, including resistance from public agencies, the transition matured, leading to *institutionalization*. Advanced build-up phases are evident through legislative advancements and the increased integration of SPFP criteria into regional and local public food services.

Destabilizing the status quo: regime breakdown dynamics

In most cases, the regime-breakdown dynamics exhibit a progression towards *chaos* within the X-curve model. This juncture prompts actors within the regime to reassess their procurement practices, as well as the overall structure of public menus. This process is often accompanied by conflicts among stakeholders with differing interests. Across cases, aside from Navarra where some signals are observed, the *breakdown* of prevailing food procurement practices remains unrealized, primarily due to persistent perceived political, institutional, and school-level resistance to change, as reported by the interviewees (Table 2).

Breakdown dynamics in all cases commenced through either a focus on regime *optimization* or regime *destabilization*, initiated by regime or systemic intermediaries.

In Barcelona and Islas Canarias, regime intermediaries challenged prevailing practices through gradual adjustments or more transformative actions. For instance, in Barcelona, the IMEB adopted incremental changes in infant school food procurement, while ICCA's initiative in Islas Canarias embraced more disruptive actions like supporting local organic food sourcing to reduce dependence on external agricultural inputs and food imports. In the former case, *experimentation* retained *optimization*, while in the latter case, *experimentation* challenged established practices, promoting regime *destabilization* (Fig. 2, panels A and D).

Conversely, according to interviewees, systemic intermediaries in Navarra and Comunidad Valenciana (Open Parliaments and Local Food Council – CALM) contributed to regime *destabilization* rather than *optimization* (Fig. 2, panels B and C). This shift emerged from a policy transition from a top-down to a participatory model to shape and co-create food-related policies. Although breakdown dynamics vary across these two cases, the establishment of systemic intermediaries, driven by the policy demands of niche intermediaries, laid the groundwork for introducing narratives of food sovereignty and agroecology into the political discourse (Sarabia et al. 2021). This shift favoured elements in build-up dynamics. A concrete illustration of this influence is evident in the legislative amendments in Navarra, a result of coordinated efforts by both niche and regime intermediaries (GCPSANA, CPAEN and INTIA). These modifications introduced new regulations and constraints to public food procurement, reinforcing *institutionalization* and the *breakdown* of unsustainable practices. Notably, these changes mandated the prioritization of sustainability and incorporated food sovereignty criteria into public food contracts.

Intermediation gaps in transition dynamics

To enhance niche build-up and regime breakdown dynamics, interviewees emphasized the need to address intermediary ecology gaps as described in Table 2. They pointed out that increased engagement of governmental regime intermediaries, especially in Barcelona, is crucial to breakdown prevailing food procurement norms and establish new approaches, thereby providing stability to the transition process. Interviewees also identified missing actors, such as social organizations in Islas Canarias and Barcelona, which can play an essential role in aligning interests, mobilizing support, and advocating for policy changes. Moreover, interviewees highlighted the importance of increasing the engagement of user intermediaries like family associations in Islas Canarias and Comunidad Valenciana. Their involvement can significantly accelerate the transition by sensitizing the community, leading to quicker acceptance and adoption of healthier and more sustainable dietary habits. For instance, an interviewee remarked, *"Ecocomedores has conducted sensitization efforts. However, the lack of family involvement is noticeable. This stands as a significant weak point affecting the program's pace and causing reluctance towards changing the school food model"*.

Additionally, interviewees emphasized the absence of associationism among local organic farmers in Barcelona, who could potentially serve as niche intermediaries for the formation of a niche-regime for SPFP. This lack of associationism was primarily attributed to time and resource constraints.

Discussion: Implications for theory and practice

In this section, we address our research objectives, commencing with an exploration of barriers, intermediary roles, and the significance of collective intermediation (Sect. "Transition barriers and the importance of collective intermediation in SPFP"). We subsequently explore into the dynamic nature of transition processes (Sect. "The dynamic nature of transition processes in SPFP initiatives"). Finally, we present the key contributions of this study and highlight promising avenues for future research on SPFP and broader food system transitions (Sect. "Concluding remarks and further research").

Transition barriers and the importance of collective intermediation in SPFP

Our research findings highlight five fundamental and interacting aspects of transition barriers and the intermediary roles within SPFP transitions.

Systemic and interconnected nature of transition barriers Our research highlights the systemic and interconnected nature of transition barriers within SPFP, consistent with similar observations made by FAO et al. (2021) and reflecting findings from recent SPFP studies (Kelly and Swensson 2017; Risku-Norja and Løes 2017; Powell and Wittman 2018; Gaddis and Jeon 2020; Pagliarino et al. 2021; Gaitán-Cremaschi et al. 2022; Parsons and Barling 2022). These barriers encompass actors, institutions, infrastructure, and relations across multiple components of the food system, from agricultural production to consumption, extending to the interfaces between food supply and demand. For instance, our research reveals limited farmer associationism and professionalization in agricultural production, while resistance to change among school staff emerges at the consumption level. Moreover, these challenges extend to encompass governance structures, regulatory frameworks, and compliance mechanisms within food tenders, among others. These findings respond to calls for the adoption of systemic approaches in food system transitions (Darnhofer 2014; Drottberger et al. 2021), which also applies in the context of SPFP. Such an approach should engage stakeholders at various levels and consider multiple components of the food system simultaneously, fostering the development of new knowledge, learning processes, and strategies to effectively address these systemic and interconnected barriers.

The significance of collective intermediation Our research demonstrates the important role of collective intermediation in effectively addressing transition barriers within SPFP, echoing findings in food system studies (Vilas-Boas et al. 2022b). While our study highlights the varying prominence and proficiency of different intermediary types in their contribution to addressing specific challenges (e.g., regime intermediaries for addressing regulatory gaps and political commitment), a one-size-fits-all approach is not suitable. Instead, our findings reveal that different intermediary types often collaborate to tackle barriers, emphasizing the collective nature of intermediation. This collaborative approach allows for the adaptation and flexibility of strategies to the specific contexts. For example, in Islas Canarias, regime and process intermediaries collaborated to address farmer associationism, while Comunidad Valenciana saw niche and process intermediaries, with regime intermediary support, addressing the same issue. A key theoretical implication for agrifood studies is that this perspective emphasises the need to shift from an individualistic focus on intermediaries, such as farmers' organizations, governmental agencies, food distributors, and grassroots movements (e.g., Yang et al. 2014; Groot-Kormelinck et al. 2022; Iyabano et al. 2022; Rossi 2017; Ramirez et al. 2018; Legun and Bell 2016), to a relational approach to agency in SPFP and food system transitions (e.g., Rossi et al. 2019; Contesse et al. 2021). This approach aligns with the concept of ecologies of intermediaries explored in transition studies (e.g., Kivimaa et al. 2019a, b; Ehnert 2023) and resonates with insights from studies on food systems (e.g., Rossi et al. 2019; Contesse et al. 2021; Vilas-Boas et al. 2022a) and SPFP (e.g., Gaddis and Jeon 2020; Graça et al. 2022; Gómez-Ramos and Rico Gonzalez 2023; Son 2023), emphasizing that transformative change is contingent on the networked interactions among diverse actors distributed across MLP levels.

Pivotal intermediaries steer diverse SPFP transitions and collective intermediation Effective transitions necessitate collective intermediation, yet this collective intermediation is orchestrated by pivotal intermediaries. These pivotal intermediaries operate at different levels within the MLP, contributing to diverse transition pathways. Some, like ICCA in Islas Canarias, operate at the regime level, promoting top-down, regime-driven transitions. These pathways tend to exhibit limited intermediary diversity, with process intermediaries controlled by the regime. Conversely, social organizations or private actors such as ecological school catering companies and Ecocentral in Comunidad Valenciana and Barcelona, respectively, operate at the niche level, promoting bottom-up, niche-driven pathways. These pathways encourage collaborations among multiple intermediaries, resulting in more diverse intermediary ecologies. Platforms such as Escoles que Alimenten in Comunidad Valenciana and Xamec in Barcelona exemplify this diversity, reflecting the interconnectedness of intermediaries. In Navarra,

pivotal intermediaries work at both regime and niche levels, fostering hybrid pathways, as seen with the public organization CPAEN, social organizations and the farmer association Ekoalde. This pathway stands out as the most diverse pathway. These findings align with prior research on food system transitions, emphasizing the existence of multiple transition pathways (Vlahos et al. 2017; Runhaar et al. 2020), which challenge the notion that transformative change in food systems, including SPFP, can only come from niche efforts.

Different transitions and collective intermediation imply advantages but also limitations Our research provides insights into the strengths and limitations of different transition pathways guided by pivotal regime or niche intermediaries or a combination of both. The regime-driven pathway, marked by influential governmental support, wields significant control over transitions. However, it faces potential legitimacy challenges, as observed in the case of schools in Islas Canarias, where perceptions of imposition emerged. Additionally, unintentional dynamics of paternalistic intermediation may arise, as observed in our findings and other SPFP initiatives (Vicente-Almazán et al. 2016). Conversely, the niche-driven pathway not only fosters diverse engagement, encouraging innovative exploration, but also reflects the strategic response to the lower position of bottom-up actors. Positioned at a relative lower power disadvantage, these actors strategically form alliances to align interests, mobilize resources, influence policy changes, and amplify their impact (De Haan and Rotmans 2018). This aligns with Hebinck et al. (2018) who emphasize that transformative change efforts in food systems may not succeed when networks lack political and economic empowerment. However, the influence of intermediaries in niche-driven pathways may remain confined to niche domains. The hybrid niche-regime pathway emerges as a balanced approach, capitalizing on the coordination strengths of the regime and the disruptive innovation potential of niches. To achieve this balance, practitioners and policymakers are advised to carefully evaluate trade-offs between short-term benefits and legitimacy challenges of regime-driven strategies, while also considering the long-term positive impacts of niche-driven pathways. Researchers must actively engage in this evaluation, proposing options that address these trade-offs and contribute with broader food system transformation goals (Klerkx et al. 2022). The transition to applied research is crucial as it fosters collaboration with intermediaries, allowing for the co-creation of practical knowledge. This collaboration enhances their capacity to address challenges in SPFP, and facilitates the translation of research findings into effective strategies and policy recommendations.

Collective intermediation requires negotiation The diversity and interactions among intermediaries found in our cases, including individuals (e.g., kitchen staff, public agency personnel), organizations (e.g., parent and farmer associations, social groups), networks, and platforms (e.g., food policy councils, advocacy networks), makes negotiation an essential process in a transition to SPFP. This diversity underlines the existence of distinct interests, languages, logics, and operational approaches among these actors (Leeuwis et al. 2021; López-García and González de Molina 2021), necessitating a complex negotiation process that encompasses a wide array of considerations, including rules, norms, practices, food governance systems, and emerging policy configurations (Moragues-Faus and Morgan 2015). While our study primarily focuses on intermediary roles and dynamics, should be acknowledged that conflicts may arise during these negotiations, as indicated by previous research in the SPFP field (Sonnino 2019; FAO et al. 2021). This emphasizes the need to establish mechanisms for negotiation and conflict resolution within SPFP initiatives. Stakeholder engagement and dialogue platforms, such as the food council CALM in Comunidad Valenciana, can serve as valuable facilitators for these processes.

The dynamic nature of transition processes in SPFP initiatives

Regarding transition dynamics, our study provides three main findings and implications for theory and practice.

Continuous evolution of collective intermediation within ecologies of intermediaries Our research underscores the dynamic and adaptable nature of intermediation within SPFP initiatives. This concept aligns with prior SPFP studies such as FAO et al. (2021), which emphasizes the context-specific nature of SPFP. Collective intermediation within the networks of intermediaries exhibits continual evolution over time, responsive to the emergence or disappearance of context-specific transition barriers and intermediaries, as well as shifts in their roles. This aligns with the broader transition studies literature, which emphasizes the dynamic and context-specific character of intermediary ecologies (e.g., Kivimaa et al. 2019a, b). Embracing this dynamic nature is fundamental for comprehending SPFP, necessitating preparedness to adjust strategies and collaborations as transition barriers evolve. Flexibility and adaptability prove paramount for SPFP, challenging the notion of relying on rigid models, a point raised by Kelly and Swensson (2017) across multiple SPFP studies.

From complexity to simplicity in the evolution of collective intermediation within ecologies of intermediaries Our research indicates a dynamic evolution in intermediary ecologies during the transition to SPFP. Initially characterized by a limited number of intermediaries and types, reflective of early phases such as destabilization and experimentation,

these ecologies progress through advanced phases, like chaos, acceleration, emergence and early institutionalization. Throughout these phases, the growing complexity of SPFP challenges necessitates intensified collective intermediation and innovative strategies across various sectors and administrative scales. For example, in the cases of Islas Canarias, Barcelona and Navarra, where pilot school experimentation with ecological school menus has taken place, complex intermediary ecologies were essential for coordinating actions and scaling changes. This coordination ensured a consistent local food supply, efficient logistics, enhanced kitchen staff skills, and sustainable consumption habits. However, as the transition progresses further, particularly evident in the Navarra case, our findings suggest a potential decrease in the complexity of intermediary ecologies, indicating a shift toward more advanced and stable transition phases, such as late institutionalization. This reduction may be attributed to the increased institutionalization of SPFP practices, and policies by various actors. This observation aligns with findings from broader transition studies (Kivimaa et al. 2019a). Recognizing the evolving demands for collective intermediation at various phases of the transition is crucial for effective role fulfilment by practitioners and SPFP initiatives, as neglecting these needs can lead to the emergence of ecology gaps, which can significantly impede the transition process. For instance, in cases like Islas Canarias, where family involvement is limited, or in Barcelona, where social organizations are absent, progress may be constrained. Conducting comprehensive mapping and analysis of intermediary roles within the ecologies during different transition phases can help identify both strengths and weaknesses. This, in turn, enables the development of targeted interventions, including the encouragement of new intermediary actors or the enhancement of existing ones (Vilas-Boas et al. 2022b). As the transition progresses to more advanced stages, strategies may need to shift focus towards maintaining SPFP improvements with reduced intermediary involvement, which is especially pertinent to practitioners and SPFP initiatives.

Non-linearity in transition dynamics and regime lock-ins While concepts like the X-curve help in simplifying the study of transitions, the SPFP transitions examined in this study demonstrate that these exhibit non-linearities. This aligns with transition studies that emphasize the unpredictable pathways of transitions and the concept of 'evolutionary revolution' (Rotmans et al. 2001; Hebinck et al. 2022). Across cases, an asymmetry becomes apparent, highlighting more advanced stages of niche build-up compared to less developed phases of regime breakdown. This asymmetry indicates substantial progress in experimenting with and scaling innovative approaches in food procurement practices, such as enhancing school menus, and incorporating sustainable criteria into food tenders. However, it also underscores persistent challenges in dismantling unsustainable practices within conventional food procurement systems. This suggests the potential presence of lock-in mechanisms within food system regimes, stemming from sources like resistance from public institutions and traditional food suppliers, cultural norms, entrenched routines, policy inertia, or path dependency in procurement procedures, all common aspects hindering progress towards SPFP (FAO et al. 2021). To navigate this complexity effectively, SPFP studies and practices need to extend beyond prioritizing niche development, placing equal emphasis on understanding and addressing existing regime lock-ins. An effective transition, therefore, necessitates some degree of synchronization between advancing niche build-up stages and breaking down regimes. Progressing through breakdown phases ensures a supportive environment, along with policy and cultural changes, providing a conducive space for the development and scaling of niche innovations. Conversely, successful niche innovations can influence breakdown dynamics by showcasing viable alternatives and exerting pressure for systemic change, ultimately facilitating the shift towards SPFP.

Additionally, our findings also show simultaneous or incongruent phases within build-up dynamics, such as elements of acceleration and institutionalization occurring without a niche-emergence phase. This implies that SPFP efforts should anticipate non-linear dynamics in transitions and be prepared to address challenges that may arise at different stages.

Concluding remarks and further research

This research provides insights for both theoretical understanding and practical guidance in advancing SPFP and, broader food system transitions. Firstly, it underscores the necessity of adopting systemic approaches to effectively address barriers within SPFP, challenging the conventional focus on individual actors and barriers. The study advocates for viewing intermediation as a collective and relational effort. The role of intermediaries, particularly pivotal ones, is highlighted in guiding collective intermediation and shaping diverse transition pathways. The research also highlights that comprehending the advantages and limitations of these pathways allows practitioners to make informed choices when designing and implementing SPFP initiatives. Furthermore, the study emphasizes the need for mechanisms facilitating negotiation and conflict resolution among these intermediaries. Additionally, it stresses the dynamic nature of collective intermediation, advocating for flexibility and adaptability in transition strategies for SPFP and food system transformations. Understanding this dynamic aspect requires practitioners to be adaptable in their approaches, ready to

adjust strategies and collaborations as transition-related barriers evolve due to the non-linear nature of transition dynamics. Lastly, the research also contributes to awareness of ecology intermediation gaps across transition phases and emphasizes the need to support different intermediary types across transitions.

In the context of future research, multiple avenues emerge. Firstly, a need exists to delve deeper into the power dynamics within intermediary networks. Despite a brief mention in this study, this aspect warrants a more comprehensive investigation. It entails exploring how power dynamics influence the outcomes of SPFP. Of particular interest is the examination of conflicts within intermediary types (e.g., niches) and between distinct categories of intermediaries (e.g., niche and regime interactions) as there are varying and divergent interests across different transition phases (Kivimaa et al. 2019a), a dimension not explored here. Exploring power dynamics in SPFP can potentially mirror struggles observed in broader food system transitions. Beyond technical challenges, innovations in food systems expose complex power imbalances that reinforce lock-ins, favouring established food production and consumption patterns and hindering the emergence of more sustainable alternatives. Achieving meaningful transformative change in food systems requires actively addressing these imbalances that influence efforts to bring about change (Conti et al. 2021; Hambloch et al. 2023).

Secondly, expanding the study's geographical scope to include a broader range of regions and countries at distinct stages of food system transitions and SPFP implementation would facilitate a more comprehensive and systematic analysis of barriers and their interactions. It can also provide insights into the similarities, differences, and patterns in the composition and roles of ecologies of intermediaries across various transition phases. A focus should be given to Low- and Middle-Income Countries (LMICs), given their common underrepresentation in transition research (Melchior and Newig 2021). This expanded scope has the potential to identify key barriers that serve as leverage points for successful SPFP implementation. Such insights, in turn, provide guidance for policymakers and practitioners in formulating context-specific and targeted strategies. Additionally, this approach would enable the identification of commonalities and patterns in the emerging barriers and essential roles encountered across phases in food system transitions and SPFP.

Another promising avenue for future research entails a focused investigation into the dynamics of breakdown and the potential destabilization of food system regimes which SPFP aim to change. These breakdown dynamics are often triggered by socio-technical landscape pressures, which encompass shifts in dietary habits, evolving lifestyles, social mobilizations, or commitments to policies such as the Milan Urban Policy Pact, as exemplified in our present study. However, despite its key relevance to food system transitions, this dimension tends to be commonly overlooked within the realm of food system transition studies (El Bilali 2019).

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Declarations

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