



Public food procurement from family farming: A food system and social network perspective

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ABSTRACT

There is promising evidence that public food procurement from family farming (PFPF) can serve as a powerful policy instrument in transitions towards more sustainable food systems. Despite the evidence around PFPF, there is lack of systemic and actor-oriented approaches analysing the relational and interactional dynamics among the multiple and diverse sets of actors in PFPF programs. In this paper, we address this gap by presenting an integrative framework that brings together food systems research, innovation studies and social network analysis, to assess the role of actor networks in PFPF. To illustrate the usefulness of the framework, we present the case of public procurement from family farming in Uruguay. We show how the framework has potential to: highlight the composition and diversity of networks of actors in PFPF; unravel individual and network barriers faced by actors in food systems; and, identify how interactions and (intermediary and brokerage) roles of network actors stimulate innovation or block the changes that are needed for PFPF to catalyse the transition towards sustainable food systems.

1. Introduction

Food systems encompass the entire range of actors (and institutions), and the activities involved in the production, aggregation, processing, distribution, consumption, and disposal of food, and the broader economic, societal, and natural environments in which they are embedded (Nguyen 2018). Well-functioning food systems are key to ensuring food and nutrition security and social welfare and are essential to maintaining the health of human-managed ecosystems (Caron et al. 2018). When it comes to the transformation of food systems, governments have an important role to play in establishing and reinforcing political priorities. Towards this end, there have been growing calls to redesign public food procurement as a lever to bring sustainable food systems to scale.

Public food procurement (also referred to as institutional food procurement and public food purchasing) is the process by which governments purchase food for their own or public use, including public school

feeding programmes, the provision of food in the cafeterias of public offices, hospitals, prisons and universities (FAO 2018a; De Schutter et al. 2022). In their standard forms, public food procurement programs are designed with the primary goal of procuring food in a manner that is cost-efficient, timely and appropriate to institutional needs (Kelly & Swensson 2017). However, this tends to favour dominant, unsustainable food systems, characterised by conventional industrial farming and value chains controlled by large-scale and powerful agri-food industries and companies (Gaitán-Cremaschi et al., 2019). Yet, when properly designed, they can enhance sustainability across various components of the food system (De Schutter 2015; HLPE 2017; Swensson et al. 2021) by, for example, incentivizing sustainable production patterns through guidelines on what types of food will be purchased (e.g., local, diverse, seasonal), from whom (e.g. local farmers, family farmers), and from which type of production (e.g. organic, agroecological) (Swensson & Tartanac 2020). Public food procurement can determine the way food is

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transported and marketed (e.g. through short marketing channels), and it can also shift food consumption patterns towards sustainable and healthy diets (FAO 2015, 2017, 2018a; FAO et al. 2020; Swensson & Tartanac 2020). Therefore, depending on how procurement choices are made, changes in food systems driven by public food procurement may simultaneously contribute to deliver multiple sustainability goals, i.e. social, economic, environmental, and food and nutrition security goals (Swensson & Tartanac 2020).

In recent years, in many countries in Latin America and the Caribbean, public food procurement has targeted the purchasing of food from family farmers (for example, the school feeding public programmes in Colombia, Guatemala, Honduras, Paraguay, and Peru (FAO 2015, 2017; FAO et al., 2021), as well as the special procurement regime in Uruguay, and the Brazilian flagship National School Feeding Program (PNAE) (FAO 2015, 2017; FAO et al., 2021). This illustrates the growing recognition of family farmers not just as food providers, but as central actors in the transition to sustainable food systems (Santacoloma & Zárate 2021).¹ Evaluations of public food procurement from family farming (hereafter *PFPF*), especially the PNAE in Brazil, highlight both the potential and limitations for the transition to sustainable food systems.

A growing body of research suggest *PFPF* has the capacity to increase family farmer's incomes and the functioning of local markets (FAO 2015, 2017; Schneider et al. 2016). Further, *PFPF* has been shown to increase farm-level agrobiodiversity and sustainability, especially in those farms that still hold practices that are more supportive of sustainable agriculture such as agroecology (Guerra et al. 2017; Wittman & Blesh 2017; Valencia et al. 2019) and; *PFPF* has been shown to increase the consumption of fresh food such as fruits and vegetables, promoting healthy diets, especially for schoolchildren (Sidaner et al. 2013; FAO 2015, 2017; FAO et al. 2020). Nevertheless, research has also shown that implementation of *PFPF* is not straightforward. *PFPF* requires enabling institutional and regulatory environments, coordinated interventions in both supply and demand, and the coordination of multi-stakeholder and multi-sectoral actors (FAO 2017; 2018a; Miranda 2018).

To date, research on *PFPF* has generally focused on the motivations and barriers of family farmers who participate in *PFPF* (de Assis et al. 2017; Wittman & Blesh 2017); the potential of these programs in favouring diversification of production, and associated ecosystem services (Wittman et al. 2016; Borsatto et al. 2019; Valencia et al. 2019); the nutritional and health benefits, mostly concerning school feeding (FAO 2015, 2017; Wittman et al. 2016) and; the regulatory frameworks and policy reforms required for developing and implementing *PFPF* initiatives (Kelly & Swensson 2017; Swensson & Tartanac 2020). However, research taking systemic and actor-oriented approaches that go beyond evaluating *PFPF* at specific components of the food system, i.e. agricultural production or consumption, remains nascent. Such systemic and actor-oriented approaches would position *PFPF* as a policy tool in which heterogeneous sets of actors operating across different activities (e.g. production, distribution and consumption of food), across multiple sectors (e.g. agriculture, health, nutrition and social development), and at different governance levels (e.g. local regional and national) connect to mobilise and exchange knowledge, resources and capabilities to solve barriers and stimulate innovation (Turner et al. 2017).

Innovation scholars have emphasised the role of social networks, i.e. a set of actors and their connections, referred to as 'edges' (Borgatti & Halgin 2011), in mobilising and building systemic innovation capacity (Spielman et al. 2009; Turner et al. 2017). Scholarly work has also attributed particular importance to intermediary actors, individuals or

organisations that catalyse transitions by bringing together dispersed, diverse and previously disconnected actors to facilitate knowledge and innovation co-creation and the scaling of innovations (Hermans et al. 2017; Kivimaa et al. 2019). The lack of well-established multi-stakeholder, multi-sectoral, and multi-level networks, and the lack of actors performing intermediary roles, may lead to innovation failures in the design and implementation of *PFPF*, and the inability of this policy instrument to achieve its potential.

In this paper, we address the lack of systemic and actor-oriented approaches and present an integrative framework that enables analysis of the structure and functioning of *PFPF* from a food system and network perspective. Conceptually, our framework builds on elements of two other frameworks: the food system framework developed by Gaitán-Cremaschi et al. (2019) to characterise the diversity of food systems; and, the framework developed by FAO (Kelly & Swensson 2017) that illuminates three interrelated pillars for setting up an effective *PFPF*.

The operational objectives of our framework are to (i) identify supply and demand-side barriers faced by multiple food system actors participating in *PFPF*; and (ii) map the networks of actors configuring a *PFPF*, with the aim of exploring how the functional patterns resulting from the actors' interactions stimulate or block innovation for the proper functioning of *PFPF*. Methodologically, this framework is informed by social network analysis (SNA), a tool to visualise and explore patterns of social relations (Borgatti et al., 2009), which also has increasing application in the context of supply chains (Borgatti and Li, 2009) and food systems analysis (Rocker et al. 2022).

To illustrate the usefulness of the framework, we present the case of public procurement of vegetables from family farming in Uruguay, where *PFPF* was designed and implemented at the end of 2014 as a strategy to enhance food and nutrition security and strengthening family farming. The findings that emerge from the application of the framework provide lessons for the case in Uruguay, but also for the wider design and implementation of *PFPF* worldwide.

2. Public food procurement from family farming: a framework

2.1. A framework to analyse *PFPF* from a systemic and network perspective

Recognizing that food systems are expansive, for analytic purposes three interrelated food system components can be distinguished: (i) the agricultural production system, (ii) the value chain, including consumption and, (iii) the structures that support daily operation and innovation of agricultural production systems and value chains (for a detailed description of each of the three components see Gaitán-Cremaschi et al. (2019)). Interactions across these components give rise to multiple configurations of food systems, with varying sustainability performance in terms of social, economic, environmental, and food and nutrition security goals (IPES-Food 2016; Gaitán-Cremaschi et al. 2019).

The most dominant forms of food system configurations (hereafter dominant food systems) are characterised by a conventional approach to farming that typically involves the systematic use of chemical inputs, mono-cropping, and low diversity production systems (Therond et al. 2017). Products in these systems usually enter into long value chains in which actors are often fully dependent on, or controlled by, a specific party such as specialised distribution firms, large retailers, or agri-food companies (Morel et al. 2020). While these systems perform well in terms of producing large amounts of standardised foods, they are often associated with a range of negative impacts such as land degradation, biodiversity loss, unequal distribution of financial benefits, the marginalisation of rural communities, and health-related problems due to exposure to pesticides (IPES-Food 2015) (left side Fig. 1).

Multiple configurations of alternative food systems have also emerged, harbouring promising technological and non-technological characteristics that can inspire transformation (Gaitán-Cremaschi et al.

¹ In the Latin America and the Caribbean region, around 80% of farms belong to family farmers, making family farming the main source of agricultural and rural employment and of food for domestic consumption (Sabourin et al. 2014; FAO 2018b).

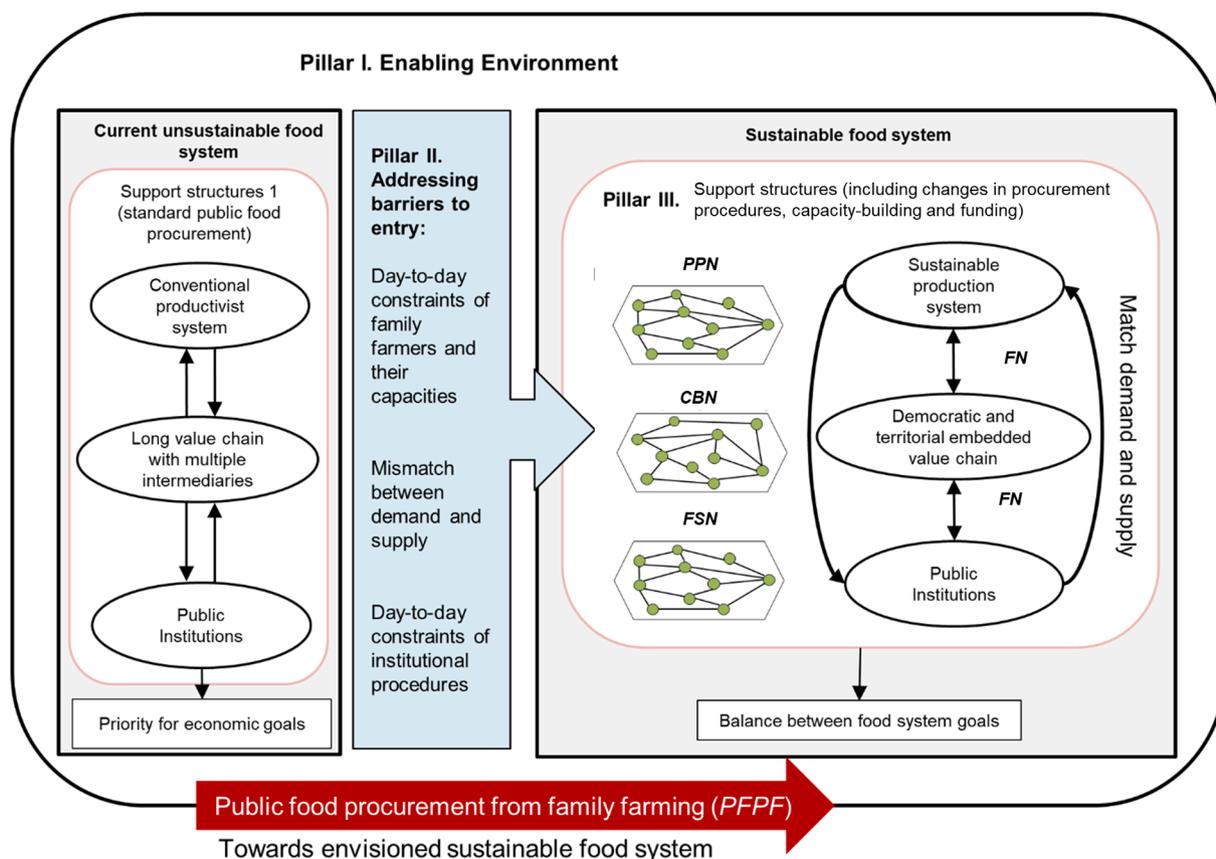


Fig. 1. A framework to analyse the effective implementation of public food procurement from family farming (*PFPF*). On the left side, a dominant food system is depicted based on the productivist paradigm supported by standard public food procurement. On the right side, a sustainable food system supported by redesigned public food procurement that recognises interactions between agricultural production systems, value chains and support structures. Redesigning the standard public food procurement into *PFPF* requires an enabling environment (Pillar I), uncovering day-to-day barriers to move from standard public food procurement to *PFPF* (Pillar II), and support structures with coordinated networks of actors to co-create and scale innovations in the procurement procedures network (*PPN*), the capacity-building network (*CBN*), and the funding support network (*FSN*) (Pillar III). *PFPF* also requires a network of actors that coordinate their actions to deliver food from agricultural production systems to consumers in public organisations, i.e. food flows network (*FN*).

2019, 2020). These include, among others, food systems based on agroecological production or more sustainable agricultural practices enacted by family farmers, and short marketing channels orientated toward local and regional consumption. Despite the efforts to create opportunities for transformation, dominant food systems still receive the bulk of state and industry support via research and development (R&D) activities and programs, extension services and economic and innovation policies, limiting the potential for scaling of alternative systems (Gaitán-Cremaschi et al. 2019).

Public food procurement has traditionally supported the dominant food system by incentivising cost-efficient, transparent and competitive processes (FAO et al., 2021). Further, public food procurement often involves stringent legal, technical, and financial requirements for participation, including, among others, registration as some form of a legal entity, paying taxes and fees, capacity for homogenous and regular deliveries of large size lots, which often include products that are not locally produced, and certificates that guarantee a stipulated quality of the food products, often relating to attributes such as price, size, colour, and firmness (Kelly & Swensson 2017; Miranda 2018; UNIDO, 2020). These requirements also tend to favour dominant food systems, as these host the specialised processing and distribution firms that have the experience, the logistics, and the capital to fulfil the procurement requirements (left side of Fig. 1).

Despite these tendencies, redesigning public food procurement for the explicit inclusion of family farmers (*PFPF*) has gained prominence in recent years as a policy tool to help drive the transition to sustainable food systems (FAO 2017; FAO 2018a; Kelly & Swensson 2017; Miranda

2018; FAO et al., 2021). By reducing the dominance of price as a purchasing criterion and incorporating quality criteria and socio-economic values, public food procurement can be used to support alternative food system configurations and help to achieve broader socio-economic and environmental goals (right side of Fig. 1) (Swensson 2018; FAO et al., 2021).

Following Kelly & Swensson (2017), there are three interrelated pillars for setting up an effective *PFPF* (in our framework a move from left to right in Fig. 1). Pillar I (the upper part of Fig. 1) refers to the external environment of the food system that recognises family farmers as a central actor for rural development and the transition to sustainable food systems, and, therefore, facilitates linkages of family farmers to *PFPF*. The enabling environment provides the background against which *PFPF* is operationalised. The enabling environment includes, among others, policies for rural development; for food security and nutrition; for agroecological and organic production; and for cross-sectoral collaboration, translated into institutional coordination (Kelly & Swensson 2017). Pillar II (in the centre of Fig. 1) refers to day-to-day demand and supply barriers that exist when moving from standard public food procurement to *PFPF*. On the demand side, these barriers include, for example, inflexible tendering and contractual arrangements, and food baskets that do not match local and seasonal production. Examples on the supply side include low and fragmented

production, lack of access to extension services and finance, and a weak marketing capacity of family farmers. Pillar III provides the support structures for innovation that are key to the functioning of *PPPF*²: (i) procurement procedures, (ii) capacity-building, and (iii) funding. Each support structure comprises a network of public and private actors operating in multiple sectors (e.g. agriculture, social development, food and nutrition security, and health) and at different governance levels (e.g. from local to national), contributing to overcoming barriers (cf. Pillar II) to inclusion of family farmers (on the right side of Fig. 1).

The *procurement procedures network (PPN)* involves a set of private and public agents and institutions that coordinate actions to adapt public procedures and practices to the characteristics of family farmers and their production and marketing capacities. Adaptations include changes in contract modalities (e.g. from inflexible competitive public tenders to other more flexible modalities such as direct procurement, and soft tendering³); in tendering requirements and processes (e.g. removing price as the primary criterion to include broader economic, social and environmental criteria); in payment procedures and prices; and in the provision of less costly services for safety and quality control (Kelly & Swensson 2017; Miranda 2018; FAO 2017; FAO 2018a; FAO et al., 2021). The *capacity-building network (CBN)* involves a coordinated and articulated network of state and non-state actors defining and providing a capacity-building strategy targeted at family farmers and tailored to their needs, so that they can comply with institutional requirements in public food procurement (FAO 2017; Kelly & Swensson 2017; FAO 2018a). Capacity-building addresses agricultural production and planning, logistics, marketing, organisational and management skills. The *funding support network (FSN)* refers to the network of actors providing financial flows to ensure that institutional demand is regular and reliable.

Actors involved in the *PPN*, *CBN* and *FSN* networks provide the support structures for actors in agricultural production and value chain that enable them to coordinate their actions and innovate to deliver food to public organisations by, for example, creating and managing food hubs, distributing and transporting food, or by brokering demand and supply through the elaboration of menus that are aligned to local and seasonal production. The articulation between the actors in agricultural production (i.e. family farmers) and the actors in value chains (including consumption by public organisations) are labelled as the food flows network (*FN*). Finally, state and non-state actors can perform roles in one or all the four networks (i.e. *PPN*, *CBN*, *FSN* and *FN*).

2.2. Social networks, innovation and *PPPF*

Social network analysis (*SNA*) is a tool for investigating social structures and their functioning with the use of graph theory (Otte & Rousseau 2002). *SNA* conceptualises a social structure as a network that consists of a set of actors or nodes, along with a set of edges of a specific type that link them (Borgatti & Halgin 2011). Edges refer to social relations such as collaboration, trade, resource, information flows or any other possible connection (Borgatti et al. 2013). *SNA* has been applied to food systems analysis (Rocker et al. 2022), and supply chains (Borgatti and Li, 2009) to, for instance, understand how value is created in supply chains and operations (Han et al. 2020), to understand how local food system networks evolve (Brinkley et al. 2021), to investigate how social networks are important for food system resilience (Bruce et al. 2021), to show the impact that different retailer types have on the development

and maintenance of local food systems (Trivette 2019), and to analyse urban production and food systems (Núñez-Ríos et al. 2020). In this way, *SNA* constitutes a useful tool for the operationalisation of the framework laid out in Subsection 2.1. Specifically, *SNA* can help to map the networks of actors and their relations that constitute each of the support structures of *PPPF*, i.e. the procurement procedures network (*PPN*), the capacity-building network (*CBN*) and the funding support network (*FSN*), as well as the actors that coordinate their actions to deliver food from agricultural production systems to public organisations, i.e. the food flows network (*FN*), and analyse their capacity to innovate and to scale the innovations.

According to Hermans et al. (2017), social networks enhance both the capacity to innovate and the scaling of an innovation in two ways. First, actors in networks provide various complementary resources and knowledge and enable social learning processes, which are essential to design and develop feasible innovations (knowledge and innovation co-creation). Second, social networks enable scaling of innovations. Scaling refers not only to the successful adoption of innovations in 'horizontal networks' of peers (out scaling), but also includes the institutional support for these innovations through 'vertical networks' involving actors at higher governance levels such as agricultural ministries (upscaling) (Douthwaite et al. 2003; Hermans et al. 2013a). Networks enable or constrain actors in their capacity for action. A network's capacity to innovate is determined by the position of the various actors' in the social structure (Burt 1982) and by the sorts of ties the actors can build and take benefit from (Turner et al. 2017; Cofré-Bravo et al. 2019).

To explain a social network's capacity to innovate and its potential for scaling of the innovations, social network scholars have focused on different network features (Rockenbauch et al. 2019). These features include: (i) the network structural properties; (ii) the network composition and diversity; (iii) the position and influence of actors in the networks, including intermediation and brokerage.

Network structural properties infer to the supposition that for innovation to occur, social networks require both an appropriate density and an adequate centralisation level (Spielman et al. 2011; Isaac 2012; Rockenbauch et al. 2019). Density refers to the number of actual relations in the network relative to the number of possible relations, whereas centralisation reflects to which extent all relations in the network run through one or few actors (Freeman 1978; Borgatti et al. 2013). Density is negatively related to network size (Borgatti et al. 2013). High density is commonly related to faster information dissemination and flow in a social system (Aguilar-Gallegos et al. 2017). High-density networks may foster collective action (essential for scaling) and learning, but provide limited entry of new knowledge, resources, and information (essential for knowledge and innovation co-creation), as the actors in the network may tend to have the same type of knowledge and resources (Isaac 2012; Hermans et al. 2017; Rockenbauch et al. 2019). Hence, the network may become myopic. Conversely, low-density networks may enable and stimulate processes of searching (Kratzer & Ammering 2019; Cofré-Bravo et al. 2019) and access to new knowledge, resources, and information. Individual actors in such open networks that are central are less constrained by group norms and therefore more likely to innovate (essential for innovation). However, the few connections in low-density networks may reduce the exchange of knowledge, resources, and information (essential for scaling) (Isaac 2012; Hermans et al. 2017; Rockenbauch et al. 2019).

Network density is related to centralisation, which refers not only to the relative prominence of nodes in networks (i.e. a network can be centralised around particular nodes or set of nodes), but also to the network's overall cohesion (Scott 2013). In highly centralised networks, one or a few central actors may facilitate the diffusion of relevant knowledge and resources within the network. However, at the same time high centralisation may limit access to knowledge sources, and thus prevent social learning, which is essential for innovation (Rockenbauch et al. 2019). Centralised networks are not desirable (Gava et al. 2017) for complex problem solving, knowledge exchange and innovation

² Kelly & Swensson (2017) proposes a fourth building block 'coordination and evaluation', which we treat as being implicitly incorporated in procurement procedures; capacity-building; and funding.

³ Direct procurement involves a non-competitive process whereby the buyer uses a contract to directly procure food from a supplier. Soft tendering applies less restrictive procurement requirements and is restricted to a target group of suppliers (Miranda 2018).

scaling, since these require relationships and access to resources.

Network composition and diversity refers to the number and type of actors (e.g. in terms of sector or scale of operation) that constitute a network. A network's capacity to innovate and its potential for scaling of innovations require broad, multidisciplinary and diverse networks to ensure there are different sources of knowledge and information, skills, and capabilities to identifying and solving complex problems (Borg et al. 2015; Hermans et al. 2017). Low diversity in networks, coupled with homophilous relations (i.e. relations between actors of the same type, for example, between two farmers), may create the trust required for collective action (essential for scaling), but can be a limitation for networks that require diverse information (essential for knowledge and innovation co-creation) (Isaac 2012; Hermans et al. 2017).

Actor network position refers to the claim that innovation requires influential actors with strategic positions in the network, so innovations are developed and spread. These actors are often intermediaries and/or brokers, who act as facilitators of collaborative settings in which social learning takes place (essential for knowledge and innovation co-creation); who connect the different types of actors and facilitate communication in the broader system (essential for outscaling); and who perform an advocacy function (essential for upscaling) (Gava et al., 2017; Hermans et al., 2013a; Hermans et al., 2017). However, although influential actors can use their position in a network to facilitate change, they can also block knowledge and innovation co-creation and scaling due to their central position in the network (Smith et al. 2014).

Finally, different combinations of network density, centralisation and compositions, and influential actors are associated with different trade-offs. It has thus been argued that a dynamic balance needs to be sought over the course of knowledge and innovation co-creation and scaling processes (Cofré-Bravo et al. 2019).

3. Materials and methods

In this and the next sections, we apply the conceptual and methodological framework to the case of *PPFF* in Uruguay. *SNA* is used to map and analyse the structure and functioning of the procurement procedures network (*PPN*), the capacity-building network (*CBN*) and the food flows network (*FN*). The funding support network is not considered as there is no specific funding to *PPFF* in Uruguay. *SNA* is complemented with qualitative information on the existing barriers faced by individuals or groups of actors and with information on the social, technological and institutional innovations that have been implemented to design and improve the functioning of *PPFF* in Uruguay.

3.1. Case: public food procurement from family farming in Uruguay

In Uruguay 47 % of all farms are designated as family farms. These 21,426 farms have an average surface area of 68 ha and are involved in livestock production (54 %), in fruit and vegetable production (23 %), and in milk production (10 %). To be classified as a family farm in Uruguay means that: labour is mainly provided by the family, with hired labour limited to two salaried employees; the family lives on the farm or within a 50 km radius; and the total area for production does not exceed 500 ha (Tommasino et al. 2014; MGAP 2020). Family farms are not by definition more sustainable or apply more sustainable farming practices. However, research suggests that overall, smaller farms are more biodiverse (Ricciardi et al. 2021), while large and industrial farming is often linked to the aggravation of global environmental challenges (Dong 2021).

In Uruguay, different policies address productive, social and organisational aspects of family farming, seeking equitable, economic and sustainable inclusion. For example, Law 19.292 (2014) creates a special regime for family farmers in *PPFF* by establishing that 30 per cent of all public centralised food purchases and 100 per cent of all decentralised public food purchases need to come from family farms (FAO 2015). The Centralised Procurement Unit (UCA) procures food on behalf of central

government agencies through competitive public tendering. Most centralised purchases are for public institutions located in the metropolitan area, including the department of Montevideo and the departments of Canelones and San José. Decentralised purchases are commonly made by departmental governments and institutions that choose and manage their own supplier base (FAO 2018a). Decentralised purchases are carried out through competitive public tendering or direct procurement.⁴ The procedure used depends on the amount (in monetary terms) to be procured.

Under the special regime of Law 19.292 of 2014, family farmers must organise themselves as a society, a cooperative or an association to be able to sell their products to public institutions. The family farmer organisations must be constituted by 5 or more producers, at least 70 % of whom belong to the category family farmers (Miranda 2018). Family farmers who are members of these organisations must be registered in the Registry of Family Farmers managed by the General Directorate of Rural Development (DGDR) of the Ministry of Livestock, Agriculture and Fisheries (MGAP). To participate in public food procurement, the family farmer organisation must be registered in the National Registry of Qualified Organisations (RENAOH), which is also administered by the DGDR. The formalities for participation by family farmer organisations in *PPFF* follow the legal procedures in the public procurement system. However, unlike other food suppliers, products offered by family farmer organisations must come entirely from the activity of their members. A second difference is that prices for food products may be set 40 % higher than the produce reference prices provided by the Farmer Observatory, which is managed by the MGAP and the Agro-Food Park of the metropolitan region (UAM).

To date, there are about 12 family farmer organisations that are registered for participation under Law 19.292 of 2014. All these organisations commercialise fruits and vegetables, with a few commercialising honey, chicken and pork through the decentralised system. The family farmer organisations are mostly located in the south of Uruguay in the department of Canelones and in the north-western department of Salto.

3.2. Data collection

The framework presented in Section 2 was used to analyse the structure and functioning of *PPFF* networks in Uruguay. Emphasis is given to Pillar II and Pillar III of the framework (See Subsection 2.1).

First, a comprehensive list of actors involved in *PPFF* was constructed through a literature review (i.e. reports and organisations' websites) and insights from three local experts knowledgeable on family farming and public food procurement in Uruguay. The final list included 29 actors comprising family farmer organisations and farmer unions ($n = 11$), public organisations implementing Law 19.292 of 2014, or procuring food from family farmers ($n = 11$), private advisors and extension services ($n = 3$), value chain actors ($n = 3$), and an international organisation ($n = 1$). Actors were categorised by type (i.e. public, private and public-private), governance level (i.e. regional, national, international) and sector (i.e. agriculture, social development, food and nutrition security, health, defence, economy, marketing, education, and other). Face-to-face semi-structured interviews were conducted with all actors in November and December 2019. Each interview consisted of two parts. In the first part data were gathered for the *SNA* of the support structures in Pillar III (Fig. 1). Actors were asked to describe their roles, if any, in the *procurement procedures network (PPN)*, *capacity-building network (CBN)*, and *food flows network (FN)*, and provide information on the role

⁴ Public tendering refers to administrative procedures by which the public institutions invite interested suppliers to formulate proposals that meet the tender specifications. From these, the most advantageous is selected. Direct procurement allows public institutions to enter into contracts with suppliers without the need to make a public call for tender.

and nature of the relations (i.e. the edges) of each of other actors that had previously been identified. Edges in the *PPN* and *CBN* pertained to relations of collaboration, and resource, knowledge and information exchange. Edges in the *FN* refer to relations of production, trade and consumption. During the interviews actors were free to identify other actors that were not previously listed. While those actors were not interviewed, they were included in the *SNA* analysis.

The second part of the interview explored the individual and collective barriers in the three networks (Pillar II of the framework) and the implementation of innovations (as a single actor or with other actors) that had been developed to overcome these barriers (Pillar III of the framework). In the interviews open-ended questions were used to generate deeper insights into each actor's perceptions.

3.3. Data analysis

3.3.1. Social network analysis (SNA)

The interviews were recorded, transcribed, coded, and analysed. Social network data was systematised by creating a name-based adjacency matrix with names of all actors, IDs, actor attributes, roles, and relationships. Relationships between the actors were described and coded as absence of relation or presence of unidirectional or bidirectional relations (Aguilar-Gallegos et al. 2017). These data were used to visualize the *PPN*, *CBN* and *FN* networks, and compute *SNA* metrics. From here we could analyse the capacity of the three networks to innovate and to scale innovations. Mapping and analysis was done using UCINET Social Network Analysis software (Borgatti et al. 2002) and NetDraw Network Visualization (Borgatti 2011).

For each of the three networks, the feature *network structural properties*, was assessed using the metrics density and network centralisation. A density of zero indicates that actors are completely disconnected while a density of one indicates a fully-connected network. A centralisation of one means that all actors are linked only to one central actor, whereas a centralisation of zero indicates that all actors have the same number of relations (Freeman 1978; Borgatti et al. 2013). *Composition and diversity* was analysed by the size of the network (i.e. number of actors); the variety of actors that compose the network (i.e. number of actor

categories, sectors and governance levels); and the degree to which the multiple actors interact. The latter was measured using the E-I index (Krackhardt & Stern 1988), which for the case at stake measures the number of relations between actors of the same actor category, sector, and governance level, compared to the number of relations with other actor categories, sectors or governance levels (i.e. E-I index actor category, E-I index sector and E-I index governance level, respectively). The E-I index values range from -1 to +1. Smaller values indicate homophily, i.e. a dominance of relationships among actors of the same category, sector or governance level, and larger values indicate heterophily, i.e., a dominance of relationships between actors of different categories, sector or governance levels. Lastly, to assess the feature *actor network position*, two *SNA* metrics were used; degree centrality and Gould & Fernandez' (1989) brokerage metric. Degree centrality measures the sum of the number of inbound (indegree) and outbound (outdegree) relations an actor has with adjacent actors. Higher degree centrality scores (i.e. higher number of relations) are indicative of influential actors in the network. Gould & Fernandez' (1989) brokerage metric was used to investigate the intermediary or brokerage roles that actors play in each of the *PPPF* networks. This metric computes the number of times an actor connects two otherwise unconnected actors and plays a structuring role (i.e. a coordinator role; a consultant role; a representative role; a gatekeeper role; and a liaison role (Chaudhary & Warner 2016) (Fig. 2).

3.3.2. Analysis of barriers and innovations in PPF

The transcriptions of the interviews were analysed using qualitative content analysis. This is a method used to systematically summarize qualitative data by assigning text to categories that are defined in a coding frame (Schreier 2012). Barriers and innovations were deductively classified in predefined themes (codes), following the conceptual framework introduced in Subsection 2.1. The main themes for the procurement procedures network (*PPN*) included barriers and innovations in contract modalities and tendering processes; prices; payment modalities; food baskets; and internal procedures for food procurement in public institutions. The main themes for the capacity-building network (*CBN*) included barriers and innovations associated with articulation

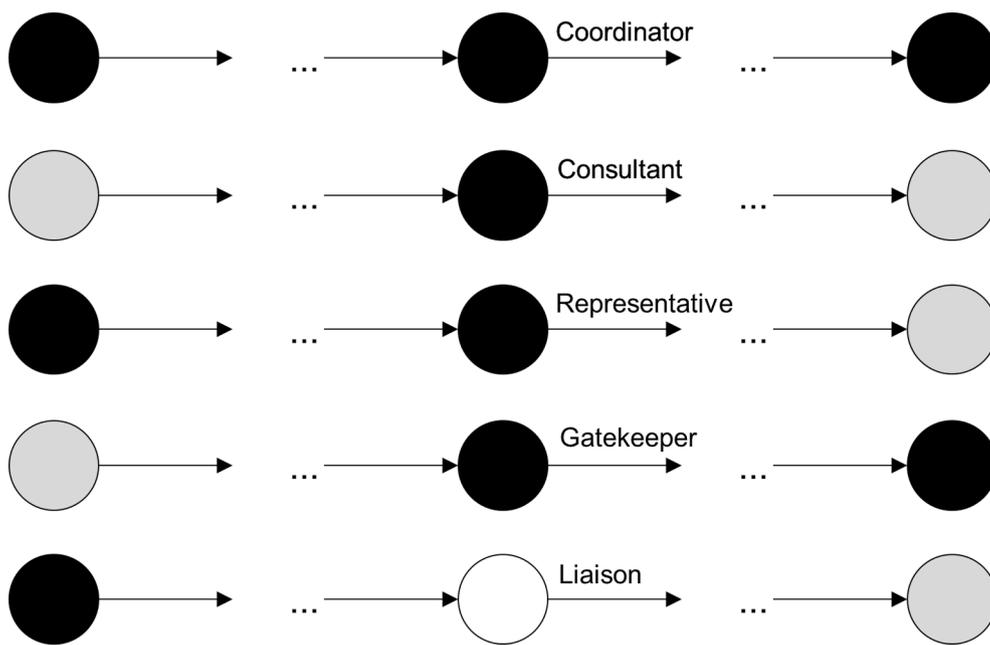


Fig. 2. Gould & Fernandez' brokerage roles (figure taken from Everett & Borgatti 2012). The actor (circle) in the middle of each row plays an intermediary or brokerage role. A black circle represents an actor of category, sector or governance level A; a grey circle represents an actor of category, sector or governance level B and a white circle represents an actor category, sector or governance level C. A coordinator role occurs when the broker connects actors of the same category, sector or governance level and the broker also belongs to that actor category, sector or governance level; a consultant role occurs when the broker connects two unconnected actors that belong to one actor category, sector or governance level while the broker belongs to a different one; a representative role occurs when the broker and one unconnected actor belong to one actor category, sector or governance level while the other unconnected actor belongs to a different one; a gatekeeper role occurs when the broker and one of the two unconnected actors belong to one actor category, sector or governance level while the other unconnected actor belongs to a different one; a liaison role occurs when the broker and the two unconnected actors all belong to

different actor categories, sector or governance levels (Chaudhary & Warner 2016).

and partnerships of state and non-state actors; and targeting and tailoring capacity-building activities to family farmers and institutional needs. Main themes for the food flows network (FN) included barriers and innovations related to horizontal and vertical arrangements between family farmer organisations and actors in the value chain (i.e. transport, distribution and consumption of food).

4. Findings

4.1. Pillar III - PFPF networks—procurement procedures network (PPN), capacity-building network (CBN) and food flows network (FN)

We present the three networks in PFPF, i.e. PPN, CBN and FN, and describe their features regarding network structural properties; composition and diversity; and actor position. These features determine the capacity of the networks to innovate (knowledge and innovation creation to solve the supply and demand-side barriers; subsection 4.2), and to scale the innovations (out and upscaling; subsection 4.3). Section 5 elaborates on policy and theoretical implications. The three networks and their features are visualised in Fig. 3. The full names of the network actors are presented in the Supplementary material.

4.1.1. Network structural properties: density and network centralisation

Densities are not high in any of the three networks. However, the density is higher for the CBN in comparison with the PPN and the FN. Connections in the CBN represent 16 % of all possible connections, whereas in the PPN and the FN these only reach 8 % and 2 %, respectively (Table 1).

Centralisation scores are similar across the three networks: 18 % in the PPN, 16 % in the CBN and 20 % in the FN (Table 1), indicating that only one-fifth of the relations are dominated by few actors. Although based on a low number of observations, these results suggest that the higher the network's density, the lower its centralisation.

4.1.2. Composition and diversity, and actor position (degree centrality, intermediation and brokerage roles)

The PPN is made up of 35 actors, mainly public actors that especially operate at the national level, some of them with offices at the regional level. These actors participate in various sectors, such as agriculture and rural development, food and nutrition security, and social development (Table 2 and Fig. 3a). In this network, each actor category tends to connect with actors of the same category (E-I index actor category score of -0.3), especially at the national level (i.e. public actors with public actors). Further, there are multiple connections between actors across sectors (E-I index sector score of 0.6), mostly in the department of Salto. The connections between actors in this network occur mostly at the same governance level (E-I index governance score of -0.4) (Table 2).

As indicated by their degree centrality score, the most influential actors comprise the General Directorate of Rural Development (DGDR) and the Ministry of Social Development (MIDES, and its territorial office in Salto), who implement policies and programs aimed at supporting family farming and the vulnerable rural population respectively. These actors are also responsible for implementing Law 19.292 (2014). Other influential actors include the National Food Institute (INDA); Transforma Uruguay (TUuguay), which aims to support economic and social development; the Centralized Procurement Unit (UCA), which manages centralised food procurement; and the Purchasing and Contracting State Agency (ACCE). This agency provides advice to public organisations in public purchases and plays an active role in implementing actions to improve the management and transparency of public procurement. Intermediation and brokerage in the PPN is performed by these influential actors except for DGDR and UCA (Fig. 3d). The main intermediation and brokerage roles are described in Subsection 4.3.

The CBN is composed of 27 actors with similar numbers of public and private actors. Most of these actors belong to the agricultural sector, and most operate at the regional level (Table 2 and Fig. 3b). Contrary to the

PPN, actor categories, especially in the regions, connect mostly with actors of a different category (E-I index actor category score of 0.4 , e.g. private actors with public actors), especially through the Regional Development Boards (MDRs). The MDRs are spaces of dialogue and concertation of policies between the public organisations (especially the General Directorate of Rural Development (DGDR) and its Territorial Rural Development Teams (ETDRs-DGDR)) and the family farmer organisations. In this network, there are few linkages between actors belonging to different sectors (E-I index sector score of -0.5), and there is a slight tendency of actors to form more linkages with actors that operate at the same governance level (E-I index governance level score of -0.2) (Table 2).

As indicated by the degree centrality scores, the three actor categories, i.e. public, private and public-private actors, have equal levels of importance. The most influential actors are the DGDR and the ETDRs-DGDR in the departments of Salto and Canelones, which provide organisational and technical advice to family farmer organisations. They also participate in the MDRs; the family farmer organisations in Salto, i.e. Fomento Rural Colonia 18 Julio (SFR18J), Fomento Rural Colonia Ossimani y Llerena (SFRCOyL), Fomento Rural Colonia Gestido (SFRCG) and Fomento Rural Salto (SFRS); and the MDRs. These most influential actors also perform intermediation and brokerage in these networks, except for the family farmer organisations (Fig. 3e). The main intermediation and brokerage roles are described in Subsection 4.3.

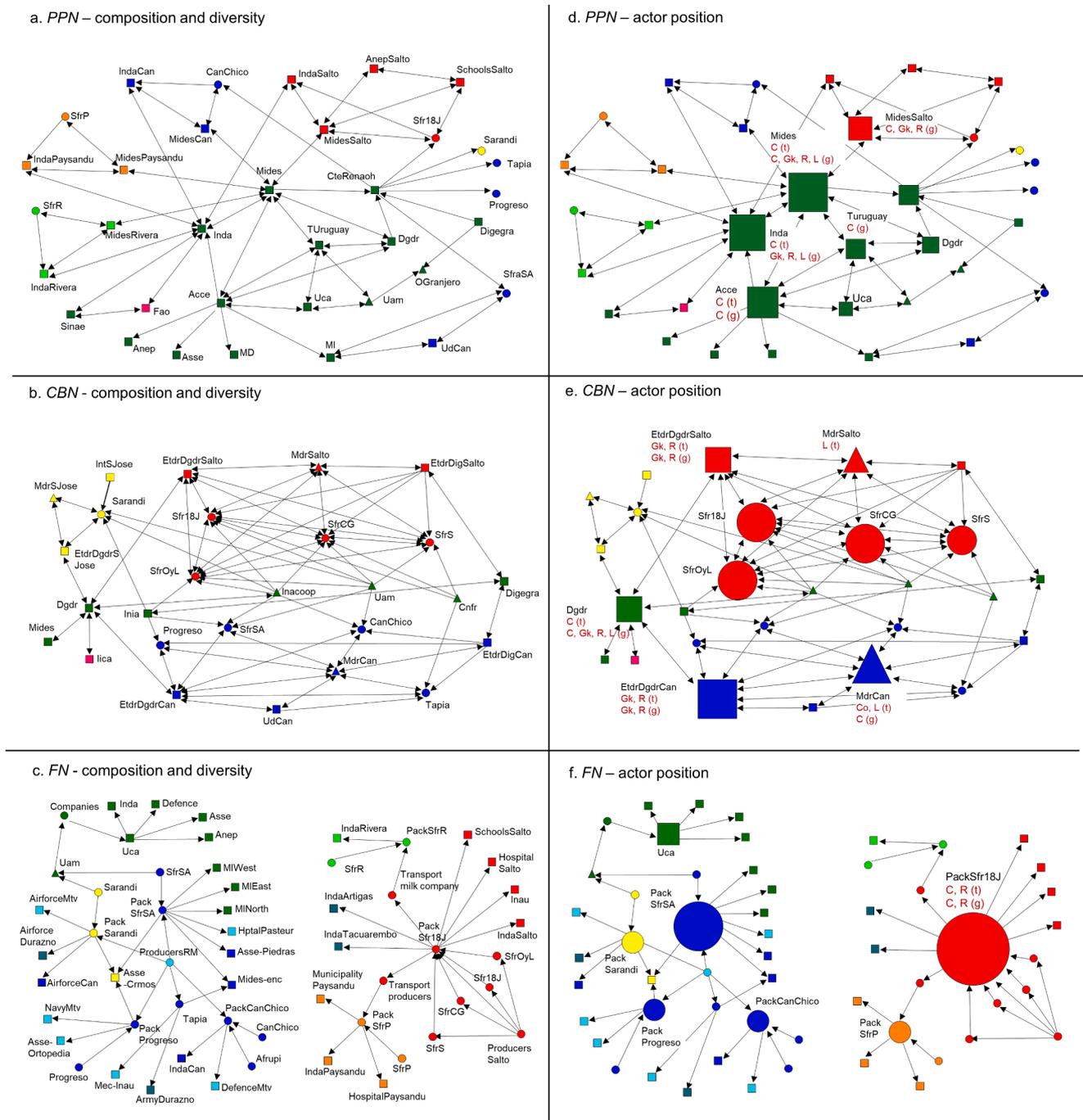
The FN is the largest network in terms of the number of actors, composed of 56 actors. Of these, 31 actors are public organisations that purchase food products from large distribution firms through the centralised purchasing system or from family farmers in the decentralised system (e.g. Ministry of Internal Affairs (MI), INDA, Ministry of Defence; hospitals of the National Administration of Health Services (ASSE) and the Administration of Public Education (ANEP)). The remaining 24 actors are private actors, especially family farmer organisations and their group collection centres (labelled as Pack in Fig. 3c) (Table 2 and Fig. 3c). In this network, each actor category tends to connect more with actors of a different category (E-I index actor category of 0.1) and a different sector (E-I index sector of 0.3) but operates at the same governance level (E-I index governance level of -0.2) (Table 2).

Our analysis points to large differences between the regions. In the north-western departments of Salto, Paysandú, Rivera, Artigas and Tacuarembó there is a regional network in which private actors (mostly the family farmer organisations) connect with each other to supply food to public institutions (e.g. the schools, hospitals and the canteens of INDA in the department of Salto). In the southern departments, family farmer organisations such as Productores Unidos de San Antonio (SFRSA), Fomento Rural Tapia (Tapia), Fomento Rural Progreso (Progreso) and Fomento Rural Canelón Chico (CanChico), often do not connect with each other, but have bilateral connections with regional (e.g. hospitals of ASSE) or national buyers (e.g. Ministry of Internal Affairs). The most influential actors are the family farmer organisations SFR18J in the department of Salto, the organisation SFRSA in the department of Canelones, and the Centralised Procurement Unit (UCA) at the national level. In this network, SFR18J plays the main intermediation and brokerage roles, (Fig. 3f). These roles are described in Subsection 4.3.

4.2. Barriers hampering implementation of PFPF – (Pillar II)

Interviewees reported a range of barriers that are currently inhibiting the optimal implementation of PFPF in Uruguay. Main barriers in the PPN include:

- a. *Contract modalities and tendering process*: the inflexible centralised procurement system and the stringent tender requirements are not adapted to the productive, economic, and logistical capabilities of family farmer organisations. These requirements include among others: large volumes and high frequencies of delivery, payment for



Legend

<p><i>Governance level</i></p> <ul style="list-style-type: none"> ■ Salto ■ Nacional ■ Internacional ■ San Jose ■ Canelones ■ Paysandú ■ Rivera ■ Montevideo ■ Other 	<p><i>Actor type</i></p> <ul style="list-style-type: none"> Public Private Public - private → Direction of relation 	<p><i>Shape size – influence</i></p> <p>Average degree centrality. The higher the average degree centrality the bigger the shape size, and therefore the influence of the actor.</p>	<p><i>Brokerage roles</i></p> <ul style="list-style-type: none"> C - coordinator Co - consultant Gk - gatekeeper R - representative L - liaison t - intermediary between/within actor categories g - intermediary between/within governance levels
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Fig. 3. Composition and diversity, and actor position (i.e. degree centrality and intermediary and brokerage roles) of the procurement procedures network (PPN; a and d, respectively), capacity-building network (CBN; b and e, respectively) and food flows network (FN; c and f, respectively) in public food procurement from family farming (PFPF) in Uruguay.

Table 1

Network structural properties of the procurement procedures network (PPN), capacity-building network (CBN) and food flows network (FN) in PFPF.

	PPN	CBN	FN
Density	8 %	16 %	2 %
Network centralisation	18 %	16 %	20 %

Table 2

Network composition and diversity of the procurement procedures network (PPN), capacity-building network (CBN) and food flows network (FN) in public food procurement from family farming (PFPF).

	PPN	CBN	FN
# actors	35	27	56
Other	0	0	4
# actors × actor category			
Public	25	12	31
Private	8	9	24
Public – private	2	6	1
# actors × sector			
Agriculture	13	23	14
Food and nutrition	5	0	7
Social Development	5	1	1
Education	3	0	2
Economy	2	0	1
Marketing	2	1	9
Health	1	0	7
Defence	1	0	7
Other	3	2	8
# actors × governance level			
Canelones	7	8	12
Salto	5	7	12
National	15	7	10
San Jose	1	4	3
International	1	1	0
Paysandú	3	0	5
Rivera	3	0	2
Metropolitan region	0	0	7
# relations	94	112	62
E-I index ^a			
E-I index actor category	−0.3	0.4	0.1
E-I index sector	0.6	−0.5	0.3
E-I index governance level	−0.4	−0.2	−0.2

^a Values range from −1 (all relations are between actors of the same category, same governance level or same sector) to +1 (all relations are between actors of different categories, different sectors or different governance levels).

compliance with safety standards, and tender specifications that include all products in a single lot, which often includes imported products such as bananas.

- b. *Prices*: the high costs of the management, logistics, and infrastructure for the collection and distribution of food in some cases cannot be recovered by family farmer organisations even with prices 40 % higher than the reference produce price.
- c. *Payments modalities*: delayed payments impose a high financial burden on the family farmer organisations. In most cases, a 45–90 day waiting period is enforced before payment.
- d. *Food baskets*: the design of institutional menus does not consider local agricultural products and their seasonality.
- e. *Internal procedures for procurement of food in public institutions*: there is a lack of knowledge and commitment of procurement officers in public institutions to comply with the family farmer quota under the special regime. Some interviewees mentioned that this could be due to close ties between the officers and traditional suppliers or because changes in procurement procedures imply more work.

Main barriers in the CBN include:

- f. For *articulation and partnerships of state and non-state actors*: capacity-building activities lack coordination between and within

public institutions in (e.g. articulation between the General Directorate of Rural Development (DGDR) and the General Directorate for Farms (DIGEGRA)). Although interviewees mentioned there is an interest in articulation, each institution needs to fulfil different institutional objectives.

- g. For *targeting and tailoring capacity-building activities to family farmers' and institutional needs*: capacity-building activities and programs only have a short duration, are commonly not connected over time, and in many cases are not tailored to the needs of family farmers. For example, interviewees mentioned a general lack of capabilities in logistics, management, and marketing among family farmers, essential to comply with institutional needs, and to a lack of knowledge on how to gain access to public tenders.

Main barriers for the FN include:

- h. For *horizontal arrangements between family farmer organisations*: Law 19.292 of 2014 lacks mechanisms to enhance alliances between family farmer organisations that are complementary in terms of the produce they offer, allowing them competitive advantage in public tenders. Specifically, alliances between family farmer organisations from the north-western departments of Uruguay and family farmer organisations in Canelones were mentioned, as their climatological differences would allow for a broader diversity of produce.
- i. For *vertical arrangements between value chain actors*: interviewees mentioned the logistics and distribution problems to bring produce from family farmer organisations to the consumers (public institutions).

4.3. Innovations to overcome barriers hampering implementation of public food procurement from family farming (PFPF) – Pillar III

This subsection describes the main innovations that have been developed and implemented to solve the supply and demand side barriers, and thus, improve the functioning of PFPF in Uruguay. Following Hermans et al. (2017), innovations refer to new technologies, knowledge, processes, new modes of thinking or the reordering of institutions and of organisations that have been implemented to serve a specific purpose. Description of the innovations focuses on the three areas of interest emerging from the SNA; the national level, the north-western departments of Uruguay, i.e. Salto, Paysandú and Rivera, and the southern department of Canelones. The actors involved in developing the innovations described in this Subsection are depicted in the graphs of the PPN, CBN and FN (Fig. 4) along with their intermediary and brokerage roles. A summary of the innovations is presented in Table 3, along with the supply and demand-side barriers they aimed to overcome (see Subsection 4.2).

4.3.1. Procurement procedures network (PPN)

Three cases of innovations for overcoming barriers in the procurement procedures network (PPN) were mentioned most frequently. In these cases, the most influential actors (high degree centrality scores in the SNA analysis) performed the most essential intermediation and brokerage roles. The first innovation is the inter-institutional committee constituted in 2018 by the General Directorate of Rural Development (DGDR), the Purchasing and Contracting State Agency (ACCE), and the Ministry of Social Development (MIDES), and coordinated by Transforma Uruguay (number 1 in Fig. 4a). In the Network, these four actors bridge the multiple public actors at the national scale, who have complementary interests in PFPF (*coordinator role* – the broker connects public actors at the national level, see Fig. 2). The committee was created to develop proposals for adapting procurement procedures in the centralised system so that family farmers could effectively take advantage of the special regime of Law 19.292. Actors in the committee enact the network functions of knowledge and innovation co-creation and upscaling. At the moment of this study, actions based on a list of

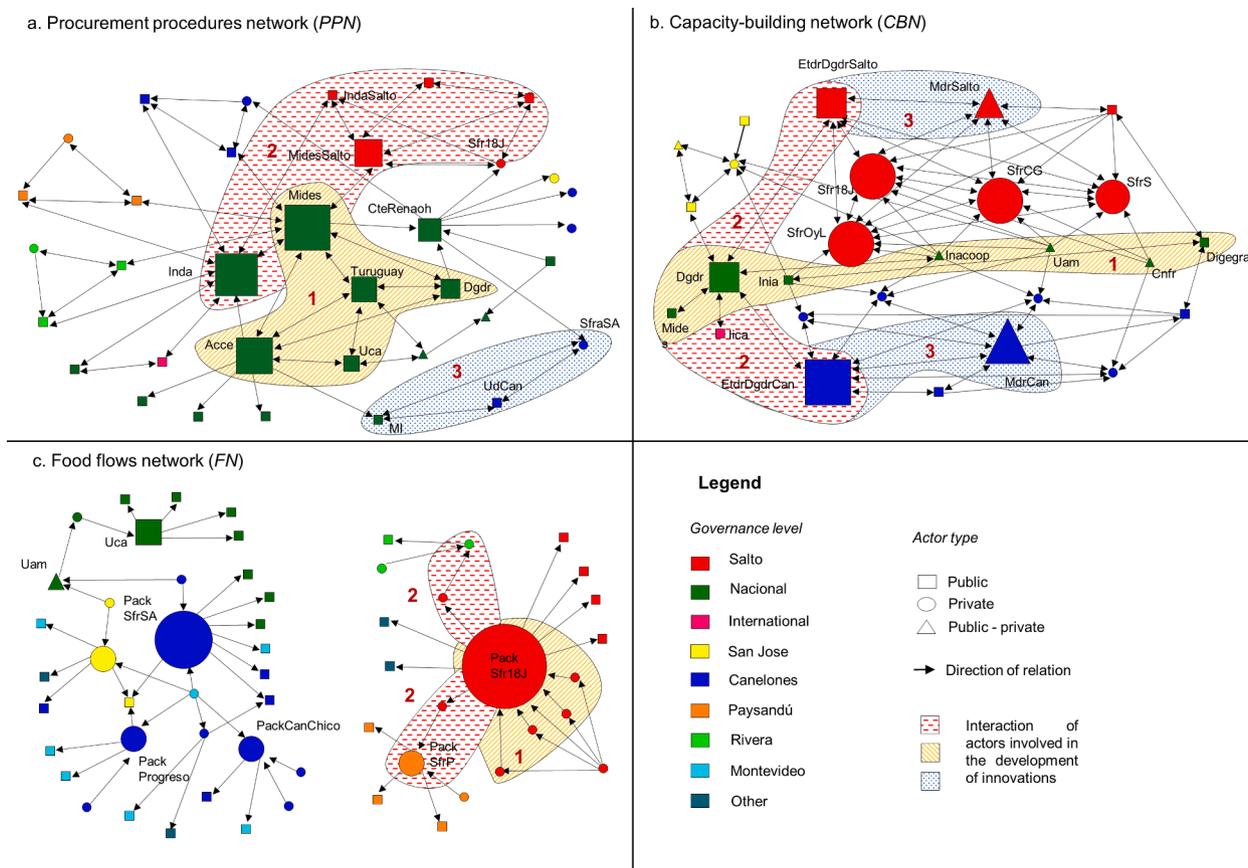


Fig. 4. Group of actors interacting to develop main innovations to overcome supply and demand-side barriers in the procurement procedures network (PPN), capacity-building network (CBN), and the food flows network (FN). The numbers in the figure represent the innovations that are described in Table 3.

proposals, such as preferential delivery for family farmer organisations, lotting, and changes to standard quality controls (see full description of proposals in Table 3) were being analysed by the Centralised Procurement Unit (UCA). Some interviewees commented that UCA seemed reluctant to adopt some of the proposals as it was concerned about reducing the contracting system’s efficiency.

The second innovation refers to the changes in the procurement system at the national and regional level of the MIDES and the National Food Institute (INDA) and the conversion of the Program of Support for Public and Private Institutions into the Feeding Rights program (number 2 in Fig. 4a). These changes were possible with the integration of INDA into the MIDES in 2016. Through the national office and their territorial offices in Salto, MIDES and INDA implemented the Law 19.292 (*representative role* – the broker connects actors operating at the national level with actors operating in regions, see Fig. 2), coordinated actions in the region (*coordinator role* – the broker connects the actors operating at the regional level), and collected information on needs and bottlenecks to design changes in the procurement system to the various problems that arose in the implementation of Law 19.292 (*gatekeeper role* – the broker mediates the relationships between actors operating at the regional level and actors at the national level, see Fig. 2). Changes in the procurement system included new contract modalities; a revolving fund; adjusted tender requirements; and price bonifications for organic or agroecological products (see full description of changes in Table 3). Lessons from the implementation of PPF in Salto were used by MIDES and INDA to institutionalise procurement procedures (upscaling of the innovations) and to outscale the innovation by implementing a pilot in the department of Canelones (*liaison role* – the broker and the other actors all belong to different governance levels, see Fig. 2). For example, the Feeding Rights program has the goal of replacing dry foods delivered by INDA - MIDES with fruits and vegetables to more than 600 centres in the

country in support of the right to adequate food sourced from family farmers. The program was tried out in 2017 with the procurement of food from four family farmer organisations in the department of Salto. Two more organisations, one in the department of Rivera and one in the department of Paysandú, i.e. SFRR and SFRP, joined the pilot later.

The third frequently mentioned innovation concerned internal changes in the procurement system of the Ministry of Internal Affairs (MI). This facilitated one of the first experiences of public food procurement from family farmers in the department of Canelones (number 3 in Fig. 4a). The innovation consisted of direct procurement of food products framed in a tripartite agreement between the MI (the procurement institution), the family farmer organisation SFRSA (the supplier organisation), and the agency of rural development of the municipality of Canelones, acting as a third party between the MI and SFRSA.⁵ The agreement led the MI to adjust the procurement procedures in a process of knowledge and innovation co-creation and procure most of its vegetable demand from the family farmer organisation SFRSA. Since the three actors are directed linked in the network, no brokerage role was identified, which may hamper the network function of scaling the more so because these actors do not hold central positions in the PPN network.

4.3.2. Capacity-building network (CBN)

Three cases of innovations were mentioned most frequently to overcome barriers in the CBN. In all of them, the most influential actors in the network, i.e. DGDR and its regional teams the ETDRs-DGDR, and the MDRs, played essential brokerage roles, especially at the governance

⁵ Beyond SFRSA, there are other four farmer organizations supplying chicken, pork and products derived from milling.

Table 3

Main innovations developed to solve supply and demand-side barriers in the procurement procedures network (PPN), capacity-building network (CBN) and the food flows network (FN). Supply and demand side barriers a – i are described in Subsection 4.2. Numbers in the first column are referenced in Fig. 4, using the shading colour as indicated.

Shading in Fig. 4	Technological and organisational innovations	Objective	Supply and demand side barriers											
			PPN					CBN		FN				
			a	b	c	d	e	f	g	h	i			
Procurement procedures network (PPN)														
1	The interinstitutional committee coordinated by Transforma Uruguay.	Proposals to adapt procurement procedures in the centralised system for participation of family farmer organisations. Proposals included (i) preferential delivery by family farmers to one of the six food procurement zones of the metropolitan region, distinguished by the Centralised Procurement Unit; (ii) tender lotting by specific food categories, e.g. exotic fruits, or local vegetables, instead of a single lot; and (iii) allowing quality control by the Agro-Food Park of the metropolitan region (UAM) to be carried out in the production areas instead of at the wholesale market to reduce logistic costs to farmer organisations.	x			x								
2	Changes in the procurement system of the National Food Institute (INDA) – Ministry of Social Development (MIDES) and conversion of the Program of Support for Public and Private Institutions into the Feeding Rights program.	Changes in the procurement system resulted in the following innovations: (i) contract modalities that evolved from a public tender to a direct procurement; (ii) a revolving fund to pay farmers 3 - 7 days after the invoice, in contrast to the 45-90 day delay in conventional procurement procedures; (iii) changes in the specification of procured items from kilos per product to the composition of three weekly baskets, one with a variable component for which the farmer organisations can propose products adapted to the seasonality of local production; and (iv) an extra price bonus of 10% for all products from certified organic farms, farms in transition to organic or farms producing in an agroecological manner.	x	x	x	x								
3	Internal changes in the procurement system of the Ministry of Internal Affairs (MI) – tripartite agreement.	Procurement of vegetables from the family farmer organisation SFRSA: (i) from centralised to decentralised purchases; (ii) tripartite agreement; (iii) flexibility in implementing the monetary threshold established for direct purchasing to enable contract establishment; (iv) committee for evaluation and monitoring in a monthly basis.	x	x	x		x							
Capacity building network (CBN)														
1	Public calls of MGAP and articulation with other public institutions.	Strengthening of the capacities of family farmer organisations through programs and projects. Projects were launched individually or as part of agreements between the MGAP and other public institutions (e.g. National Institute of Agricultural Research (INIA), MIDES and the National Institute of Cooperatives (INACOOP)).							x	x				
2	Articulation of public institutions (at the national and international level) and articulation with private and public technical advisors.	Strengthening of the capacities of family farmers through improvements in the System of Technical Assistance and Rural Extension for family farming (ATER).							x	x				
3	Rural Development Tables (MDRs).	Creating spaces for public-private dialogue between public institutions and family farmer organisations – decentralisation of rural development, and bringing together family farmer organisations.							x	x				
Food flows network (FN)														
1	Horizontal coordination between family farmer organisations in the north-western departments of Uruguay and group collection centre.	Horizontal linkages between family farmer organisations and collective marketing to supply food to public institutions in the north-western departments of Uruguay allowed (i) the organisations to more successfully compete in other public tenders due to greater volumes and better logistic capabilities; and (ii) allowed MIDES – INDA to connect family farmer organisations constituted by socio-economically vulnerable members with other organisations with a more advanced level of development.											x	
2	Transport arrangements (vertical linkages) between farmer organisations in the north-western departments of Uruguay and value chain actors.	Solutions to logistic problems and reduction of transport costs to supply food products in the north-western departments of Uruguay.												x

levels in which they operate.

The first innovation concerned the public calls for projects launched individually by public institutions or as part of agreements between the MGAP, especially the DGDR, and other public institutions such as MIDES, the National Institute of Agricultural Research (INIA) and the National Institute of Cooperatives (INACOOP) (number 1 in Fig. 4b). While most of these projects were not directly linked to PFPF, the interviewees commented that they had helped family farmers to develop technical, organisational, and management capacities.⁶ For this innovation, DGDR coordinated the public calls together with multiple public

institutions operating at the national level (*coordination role*). It also represented these national institutions at the regional level (*representative role*) through the Territorial Rural Development Teams, i.e. ETDRs-DGDR, and controlled incoming information from the regional to the national level (*gatekeeper role*). The intermediation and brokerage roles performed by these influential actors (high degree centrality scores as informed in the SNA), i.e. DGDR and ETDRs-DGDR, fostered diffusion of resources, skills, and information, which were essential for knowledge and innovation co-creation, and the central position of these actors in the network favoured the scaling of the innovations.

The second innovation concerned the articulation between the Inter-American Institute for Cooperation on Agriculture (IICA) operating at the international level, with the advisors belonging to the ETDRs-DGDR in a process of knowledge and innovation co-creation. DGDR connected actors in triads (*liaison role*) where capacity-building strategies

⁶ Only one project specifically dedicated to PFPF was launched in 2016 by DGDR to strengthen the organisational and commercial capabilities of family farmer organisations planning to supply public institutions.

developed in the agreement IICA - DGDR were outscaled by the ETDRs-DGDR through the System of Technical Assistance and Rural Extension for family farming (ATER) (number 2 in Fig. 4b). In this innovation, the ETDRs-DGDR were essential in implementing the capacity-building programs developed by DGDR and IICA (*representative role*). The ETDRs-DGDR are also the network structures/actors through which the needs of family farmer organisations are fed back to the national level (*gatekeeper role*). This is essential for upscaling.

The third innovation concerned the institutionalisation of the MDRs (number 3 in Fig. 4b). In the department of Salto, the MDRs acted as liaison (*liaison role*) intermediating between the family farmer organisations and the representatives of the MGAP (especially DGDR and DIGEGRA) and other public institutions. Contrary to the case of Salto where family farmer organisations are fully connected (the density of connections in this region is high), in the department of Canelones the MDR also served as a space where family farmers connect to each other (*consultant role* – the broker intermediates family farmer organisations, see Fig. 2). In both regions, the MDRs connect diverse public and private actors with different sources of knowledge and information, skills, and capabilities, which are essential to identifying and solving complex problems. The MDRs are also spaces that facilitate learning and the diffusion and scaling of the innovations.

4.3.3. Food flows network (FN)

Two cases of innovations were mentioned most frequently to overcome barriers in the FN. The first innovation involved the horizontal integration of four family farmer organisations (i.e. linkages between the family farmer organisations in the FN network) in a group collection centre coordinated by SFR18J (*coordination role*) (number 1 in Fig. 4c). To supply food to public institutions, family farmer organisations need to be registered in the RENAHO as stated in Law 19.292 of 2014. However, in the pilot for the procurement of food by MIDES and INDA in the north-western department of Salto, only one of the four family farmer organisations participating, i.e. SFR18J, was formally registered. To overcome this regulatory barrier, an individual farmer-member of each of the non-registered organisations was allowed to register as a member of SFR18J. In the group collection centre, SFR18J were receiving the products from the three organisations, products that were afterwards distributed to public institutions (e.g. schools, hospitals and canteens of INDA in the department of Salto) or transported to the family farmer organisations' collection centres in the departments of Paysandú and Rivera (*representative role*). The regional network structure with multiple horizontal linkages between the family farmer organisations allowed these organisations to increase the volume of products and, more successfully compete in public tenders. For MIDES – INDA this was also a successful innovation that allowed to connect the family farmer organisations in Paysandú and Rivera (outsourcing of the innovations) that involved socio-economically vulnerable members, with the organisations in Salto that had a more advanced level of development.

The second case of innovation involved establishing vertical linkages between the group collection centre in Salto (managed by SFR18J) and two companies to solve logistic and distribution problems (number 2 in Fig. 4c). Transportation of products from the group collection centre to the department of Rivera was done through a big milk company, with which a fixed price per kilo of product was agreed. The transportation of products to the department of Paysandú was outsourced to vegetable retailers with already existing commercialization channels (see the connections in Fig. 3 between the group collection centre managed by the SFR18J and the family farmer organisations in the departments of Paysandú and Rivera).

5. Theoretical, methodological and policy implications

The lessons of this study provide theoretical, methodological, and policy insights for improving *PFPP*, not only in Uruguay but also in other countries in Latin America and the Caribbean. While a growing number

of studies have addressed *PFPP* as a lever for the transition to sustainable food systems, we identified limited attention in the international literature for the relational and interactional dynamics among the multiple and diverse sets of food system actors participating in *PFPP*. More attention is pressing as our study confirms that the capacity for effective implementation of *PFPP* is very much defined by network relations (and intermediation), rather than by the individual roles and actions of actors and organisations, echoing [FAO \(2015, 2017\)](#) and [FAO et al. \(2021\)](#).

We have put forward an integrative framework to help structure thinking about how to assess *PFPP* from a food system and network perspective as a basis for informed decision making. The framework operationalises *PFPP* as a policy tool in which food system actors involved in agricultural production, value chains and support structures connect to mobilise and exchange knowledge, resources and capabilities, with the aim of overcoming barriers and stimulating innovation and scaling. As illustrated with the case of Uruguay, implementation of the framework: (i) allows analysis by visualizing the composition and diversity of the three networks of food system actors in *PFPP*, i.e. the *PPN*, *CBN* and *FN*; (ii) enhances understanding of the influence, roles of actors, and the implications of intermediation in the innovation processes; (iii) unravels individual and collective barriers faced by actors that constrain implementation of *PFPP*; and, (iv) identifies network structures and actors that foster or hinder innovation. The resulting understanding of the constituent networks in *PFPP* enables identifying entry points for interventions so as to stimulate innovation and increase the potential of *PFPP* to support the transition to sustainable food systems. Such analysis is fundamental, as the degree of multi-stakeholder dialogue and coordination in *PFPP* initiatives has been identified as a bottleneck for their successful implementation ([Miranda, 2018](#)).

5.1. Lessons and entry points for intervention in *PFPP* networks

Implementation of our framework to Uruguay's case highlighted the presence of two main regional *PFPP* networks: the pilot initiative of INDA - MIDES in the north-western departments of Uruguay, and the pilot initiative of the family farmer organisation SFRSA in the southern department of Canelones. These regional networks differed in the composition and diversity and actors' position in the respective *PPN*, *CBN* and *FN*.

5.1.1. Procurement procedures network (PPN)

The *PPN* may be considered a low-density network that stimulates processes of searching and access to new knowledge, resources, and information that are essential for changes in procurement procedures, both at the regional and national level. This network structure is also favourable (confirming findings by [Kratzer & Ammering 2019](#); [Simon et al. 2021](#)), since there are no actors who centralise resources and decisions. However, as discussed in Subsection 2.2, given the low number of connections, the exchange of knowledge, resources and information may also be reduced.

Regional *PPN* similarities and differences in terms of the density of connections, composition, diversity, and actor's position (i.e. influence, intermediation and brokerage), revealed two important findings. First, our results showed that there is not a single *PPN* structure that works well across regions. Rather, network structures were based on the region's characteristics and the capabilities of its public institutions and family farmer organisations. This implies that *PFPP* design and implementation need to be kept flexible enough to allow for adjustments and evolution ([Kelly & Swensson 2017](#)). In both regional *PPN* networks, interactions between actors allowed simplifying requirements and adapting tender specifications (e.g. contract size, food basket requirements and payment time-frames). These requirements have been identified in our study and in the literature as some of the most common barriers to *PFPP* as that they create significant transaction costs for participation of family farmers in public food markets ([Mercado et al. 2016](#); [FAO 2017](#); [Miranda 2018](#)). Nevertheless, a bigger and more

connected innovation network with actors from multiple sectors may imply a stronger position as was shown with the *PPN* in the north-western initiative having a stronger position compared to the initiative in the south. This confirms [Sartas et al.'s \(2018\)](#) claims that the bigger and more connected the network, the better the outreach of the innovations and the speed of innovation diffusion.

Second, network differences between the two initiatives suggested that scaling (outscaling and upscaling of innovations) requires the existence of well-positioned influential actors from within the incumbent system. In *SNA* terminology, this implies actors with high degree centrality scores. This was the case of the Ministry of Social Development (MIDES) and the National Food Institute (INDA) and their regional offices in the pilot initiative in the north-west of Uruguay, where these actors intermediated in the creation of new alliances, supported knowledge innovation and co-creation to overcome barriers, and increased the legitimacy of *PPFF*. Moreover, they acted as an information interface between the needs of procuring organisations (e.g. schools, the hospital in Salto and the canteens of INDA) and the family farmer organisations, which was essential for adjusting procurement requirements. Additionally, these actors performed a political function within the network by lobbying and translating the results of the pilot into institutionalised procedural reforms. While the *PPN* structure of the pilot in the south, dominated by only three actors, was effective for solving day-to-day procurement barriers, the lack of intermediation and brokerage roles may hinder the scaling of the innovations. Moreover, since these actors are fully connected in a closed network structure, there may be little entry of new knowledge, resources and information, which are essential for knowledge and innovation co-creation. This points to the need for investments in the creation of an innovation community in *PPFF* networks with special attention to intermediation and brokerage in networks as shown earlier by [Kilelu et al. \(2017a\)](#) and [Ramirez et al. \(2018\)](#) for the case of agri-food clusters.

5.1.2. Capacity-building network (CBN)

Like the *PPN*, the *CBN* may be considered a low-density and low centralised network that may be conducive for innovation. However, at the regional level, our analysis showed three points that deserve special attention. First, the relevance and network position of multi-stakeholder platforms, such as the MDRs (i.e. high degree centrality score). The MDRs intermediated between public and private (i.e. family farmer organisations) actors and connected previously unconnected family farmer organisations in the department of Canelones. While the MDRs were not directly linked to *PPFF* initiatives, strengthening the intermediary roles of the MDRs may capitalise on the network structure of rural decentralisation to articulate farmers' needs in *PPFF*, provide a space where conflicts may be solved, and create the conditions for the spreading of good practices between family farmers and public organisations. This is important as the literature on agricultural innovation systems emphasizes the importance of multi-stakeholder innovation platforms for enhancing the capacity to innovate in stakeholder networks ([Kilelu et al. 2013](#); [Hermans et al. 2017](#)).

Second, public actors from the agriculture sector dominated the *CBN*, which reflected the predominance of homophilous sectoral relations. This network structure has led to public projects on capacity-building mostly focused on improving family farmers' technical-productive capacities or organisational skills. Therefore, public cross-sectoral coordination to tailor capacity-building activities, such as strengthening logistical, managerial and marketing skills, would be still required. This reinforces findings of multiple *PPFF* initiatives around the world in which lack of these skills has been identified as a main area of weakness ([FAO 2017](#)). Public and cross-sectoral coordination will also ensure there is overlap between farmers receiving capacity-building and those supplying food to public institutions ([Cirillo et al. 2017](#)). For example, [Kelly & Swensson \(2017\)](#) found in a cross-case analysis of *PPFF* that even where proper extension services exist, effective implementation of *PPFF* needs an evaluation of the "starting-points" of family farmers so capacity

building activities can be tailored to address skills gaps. For this purpose, the brokerage and intermediation roles such as those performed by the ETDRs-DGDR are essential to translate farmer capacity building needs to higher governance levels, especially in network structures such as the *CBN* where relations are mostly between actors operating at the same level.

Third, the north-western initiative's *CBN* structure with a bigger and denser network than the south's initiative showed that another way of sharing knowledge and capabilities and outscaling best practices in innovation networks is via alliances between family farmers organisations. Consideration of this result in the design and implementation of *PPFF* may enable family farmer organisations to address collectively the high transaction costs involved in participating in *PPFF* models ([Kelly & Swensson 2017](#)).

5.1.3. Food flows network (FN)

Our analysis of the *FN* showed three points that deserve special attention. First, compared to the *PPN* and *CBN* the *FN* has a higher centralisation, especially because of the central position of the family farmer organisation SFR18J. While higher centralisation may facilitate the diffusion of relevant knowledge and resources ([Rockenbauch et al. 2019](#)) among the family farmer organisations, the central position of SFR18J may also pose a risk to the future of this regional network in case this actor is removed. Nevertheless, contrary to the initiative in southern Uruguay, the horizontal engagement of family farmer organisations, their vertical linkages with actors in transport and distribution, and the active involvement of procuring institutions resulted in a vibrant innovation setting that was conducive to an *FN* with a regional scope. This shows that different networks may need different combinations of horizontal and vertical coordination and brokerage, echoing [Poulton et al. \(2010\)](#) and [Kilelu et al. \(2017b\)](#).

Second, differences in network structures between the initiatives in the north-western and southern departments of Uruguay suggest that decentralised purchases in *PPFF* can occur at different levels. This is relevant as decentralised purchases mean more flexibility for customizing procurement systems to suit the needs of public institutions and family farmer organisations ([Kelly & Swensson 2017](#); [Swensson 2018](#)). These are common benefits of decentralised networks ([Gava et al. 2017](#)) and *PPFF* models ([Swensson & Klug 2017](#)).

Third, beyond the learnings derived from the two regional initiatives for decentralised *PPFF*, our results also showed that the 30 per cent quota of centralised food purchases for family farmers had not been reached yet, as illustrated in the *FN*, where no linkages existed between family farmer organisations and the Centralised Procurement Unit (UCA). In the *PPN* the most influential public actors (high degree centrality scores) that operate at the national level, were willing or had the mandate to implement Law 19.292. Yet, in the *FN*, UCA was perceived by the interinstitutional committee coordinated by Transforma Uruguay as blocking system innovation. The prominent place of UCA within the network was hampering the removal of barriers to innovation and scaling of *PPFF* in Uruguay. As such, all the centralised purchases were found to be still subject to the stringent formal and technical requirements that create significant barriers to family farmer organisations to participate and which continue favouring dominant specialized distribution firms.

5.2. Merits and limitations of *SNA* for analysing the structure and functioning of *PPFF* and further research

Linking the use of *SNA* with the emerging literature on food systems, networks, and supply chains ([Borgatti and Li, 2009](#); [Brinkley et al., 2021](#); [Bruce et al., 2021](#); [Rocker et al., 2022](#)) we showed that analyses at the level of nodes and at the level of the whole network are both needed to understand a *PPFF*. *SNA* metrics at the level of the whole network were meaningful to not only understand the network configuration, but also to map out the big picture. Node level *SNA* metrics were useful for

showing the nodes' prominence and importance within the network. They also enabled analysis of the intermediation and brokerage roles that fostered and facilitated the innovation processes. Based on these multiple *SNA* metrics it was possible to compare three different networks and dig down in their structures and innovation contributions. Thus, both analytical levels complemented each other. Our framework has limitations, especially concerning the *SNA*. While *SNA* provided a powerful visual and analytical method to explore the *PFPF* networks, identify supply and demand side barriers and innovation processes, the method falls short of understanding human agency dynamics in social networks (Marshall & Staeheli 2015). A further extension of the framework could combine *SNA* with more reflexive approaches such as those offered by Actor Network Theory (Law & Hassard 1999; Latour 2005) to inform future hypothesis-based research on the processes by which the *PFPF* networks form, sustain, innovate, and change over time (Marshall & Staeheli 2015; Müller & Schurr 2016). Such analysis may also provide more nuanced perspectives on agency, the power dynamics in the transformation of food systems, and on intermediation and brokerage as forms of network-based political capital (Rossi et al. 2019; Turner et al. 2020).

6. Concluding remarks

This research confirmed that there is no 'ideal' network structure for innovation in *PFPF*. Trade-offs in terms of network structure, density, centralisation, diversity and composition will always need to be managed. In turn, innovation in *PFPF* will depend on the maturity of the networks and their actors, i.e., family farmer organisations, supporting institutions, and procuring organisations, etc. The analytical results showed that during the innovation processes the actors' interactions and roles may lead to different configurations depending on their necessities and phases, which is in line with ideas on dynamic network configurations for innovation and scaling (Hermans et al. 2013b; Cofré-Bravo et al. 2019). Our findings showed that different network configurations with different actors are needed across processes of knowledge and innovation co-creation, outscaling and upscaling. This has implications for the literature on public procurement, where actor interactions and roles have been understudied and where applications of multi-scale food system approaches have been limited.

For the case study in Uruguay, *PFPF* was found to be an innovation policy tool with the potential to enact more sustainable local food systems, which was especially noticeable in the initiative in the north-western departments. It encouraged sustainable agricultural practices by providing an extra price bonus of 10 % for all products from certified organic farms, farms in transition to organic or farms producing in an agroecological manner; it promoted local-to-local linkages between family farmer organisations; it created opportunities for collective marketing; it fostered vertical linkages in the value chain and the creation of short marketing channels; it enhanced a better coordination between the suppliers and buyers, with food baskets adapted to the seasonal and local production, which are more likely to satisfy local food preferences; and it fostered a stronger regional governance system. All of this with direct social and economic benefits for family farmers and with potential spill over effects on the local community, nutrition and the environment, which need to be further studied.

Although this analysis was developed prior to the Covid-19 outbreak, the pandemic has revealed that dominant food systems are highly vulnerable to disruptions leading to, e.g., limited access to agricultural inputs, closure of distribution channels, food price spikes, and food shortages (Clapp & Moseley 2020; Nemes et al. 2021; Tittonell et al. 2021). Following a plea by FAO et al. (2021) *PFPF* may be considered an important opportunity to build more sustainable and resilient food systems that help communities better prepare for and cope with such external shocks.

CRedit authorship contribution statement

Daniel Gaitán-Cremaschi: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Laurens Klerkx:** Conceptualization, Writing – review & editing, Supervision. **Norman Aguilar-Gallegos:** Methodology, Formal analysis, Writing – review & editing. **Jessica Duncan:** Conceptualization, Writing – review & editing. **Alejandro Pizzolón:** Methodology, Writing – review & editing. **Santiago Dogliotti:** Methodology, Writing – review & editing. **Walter A.H. Rossing:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodpol.2022.102325>.

References

- Aguilar-Gallegos, N., Martínez-González, E.G., Aguilar-Ávila, J., 2017. Análisis de redes sociales: Conceptos clave y cálculo de indicadores. UACH - CIESTAAM, Chapingo, México.
- Assis, S.C.R.d., Priore, S.E., Franceschini, S.d.C.C., 2017. Impacto do Programa de Aquisição de Alimentos na Segurança Alimentar e Nutricional dos agricultores. *Ciência Saúde Coletiva* 22 (2), 617–626.
- Borgatti, S.P., Everett, M.G., Freeman, L.C., 2002. UCINET for Windows, Version 6.59: Software for Social Network Analysis. Analytic Technologies.
- Borgatti, S.P., Halgin, D.S., 2011. On network theory. *Org. Sci.* 22 (5), 1168–1181.
- Borg, R., Toikka, A., Primmer, E., 2015. Social capital and governance: a social network analysis of forest biodiversity collaboration in Central Finland. *Forest Policy Econ.* 50, 90–97.
- Borgatti, S.P., Everett, M.G., Johnson, J.C., 2013. *Analyzing Social Networks*. SAGE Publications Limited, London, p. 296.
- Borgatti, S.P., 2011. NetDraw: Graph visualization software. Harvard: Analytic Technologies. 2002. Structural Holes: the social structure of competition.
- Borgatti, S.P., Li, X., 2009. On social network analysis in a supply chain context. *J. Supply Chain Manage.* 45 (2), 5–22.
- Borgatti, S.P., Mehra, A., Brass, D.J., Labianca, G., 2009. Network analysis in the social sciences. *Science* 323 (5916), 892–895.
- Borsatto, R.S., Altieri, M.A., Duval, H.C., Perez-Cassarino, J., 2019. Public procurement as strategy to foster organic transition: insights from the Brazilian experience. *Renewable Agric. Food Syst.* 1–9.
- Brinkley, C., Manser, G.M., Pesci, S., 2021. Growing pains in local food systems: a longitudinal social network analysis on local food marketing in Baltimore County, Maryland and Chester County, Pennsylvania. *Agric. Human Values* 38 (4), 911–927.
- Bruce, A., Jackson, C., Lamprinopoulou, C., 2021. Social networks and farming resilience. *Outlook Agric.* 50 (2), 196–205.
- Burt, R.S., 1982. *Toward a Structural Theory of Action*, Vol. 10. Academic Press, New York.
- Caron, P., Ferrero y de Loma-Osorio, G., Nabarro, D., Hainzelin, E., Guillou, M., Andersen, I., Arnold, T., Astralaga, M., Beukeboom, M., Bickersteth, S., Bwalya, M., Caballero, P., Campbell, B.M., Divine, N., Fan, S., Frick, M., Friis, A., Gallagher, M., Halkin, J.-P., Hanson, C., Lasbennes, F., Ribera, T., Rockstrom, J., Schuepbach, M., Steer, A., Tutwiler, A., Verburg, G., 2018. Food systems for sustainable development: proposals for a profound four-part transformation. *Agron. Sustainable Dev.* 38 (4).
- Chaudhary, A.K., Warner, L.A., 2016. Introduction to social network research: brokerage typology. IFAS Extension. University of Florida. Available from: <https://edis.ifas.ufl.edu/pdffiles/WC/WC19700.pdf>.
- Cirillo, C., Györi, M., Soares, F.V., 2017. Targeting social protection and agricultural interventions: the potential for synergies. *Global Food Security* 12, 67–72.

- Clapp, J., Moseley, W.G., 2020. This food crisis is different: COVID-19 and the fragility of the neoliberal food security order. *J. Peasant Studies* 47 (7), 1393–1417.
- Cofré-Bravo, G., Klerkx, L., Engler, A., 2019. Combinations of bonding, bridging, and linking social capital for farm innovation: how farmers configure different support networks. *J. Rural Studies* 69, 53–64.
- de Schutter, O., Quinot, G., Swensson, L.F.J., 2022. Public food procurement as a development tool: the role of the regulatory framework. In: FAO, Alliance of Bioversity International and CIAT and Editora da UFRGS. (2021). *Public food procurement for sustainable food systems and healthy diets – Volume 1*. Rome.
- de Schutter, O., 2015. Institutional food purchasing as a tool for food system reform. In: Global Alliance for the Future of Food. *Advancing health and well-being in food systems: strategic opportunities for funders*, Canada.
- Dong, L., 2021. Toward resilient agriculture value chains: challenges and opportunities. *Prod. Operations Manage.* 30 (3), 666–675.
- Douthwaite, B., Kuby, T., van de Fliert, E., Schulz, S., 2003. Impact pathway evaluation: an approach for achieving and attributing impact in complex systems. *Agric. Syst.* 78 (2), 243–265.
- Everett, M.G., Borgatti, S.P., 2012. Categorical attribute based centrality: E-I and G-F centrality. *Social Networks* 34 (4), 562–569.
- FAO, 2015. *Las compras públicas a la agricultura familiar y la seguridad alimentaria y nutricional en América Latina y el Caribe: Lecciones aprendidas y experiencias*. FAO, Chile.
- FAO, Alliance of Bioversity International and CIAT and Editora da UFRGS, 2021. *Public food procurement for sustainable food systems and healthy diets – Volume 1*. Rome.
- FAO, 2017. *Public Purchases of Food from Family Farming, and Food and Nutrition Security in Latin America and the Caribbean Lessons Learned and Experiences*. FAO.
- FAO, 2018a. *Strengthening sector policies for better food security and nutrition results. Public food procurement. Policy guidance note 11*. FAO.
- FAO, 2018b. *Panorama de la pobreza rural en América Latina y el Caribe. Soluciones del Siglo XXI para acabar con la pobreza en el campo*. Santiago. 116 pp.
- FAO, IFAD, UNICEF, WFP, WHO, 2020. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. Rome, FAO.
- Freeman, L.C., 1978. Centrality in social networks conceptual clarification. *Social Networks* 1 (3), 215–239.
- Gaitán-Cremaschi, D., Klerkx, L., Duncan, J., Trienekens, J.H., Huenchuleo, C., Dogliotti, S., Contesse, M., Rossing, W.A., 2019. Characterizing diversity of food systems in view of sustainability transitions. A review. *Agronomy Sustainable Dev.* 39 (1), 1.
- Gaitán-Cremaschi, D., Klerkx, L., Duncan, J., Trienekens, J.H., Huenchuleo, C., Dogliotti, S., Contesse, M.E., Benitez-Altuna, F.J., Rossing, W.A.H., 2020. Sustainability transition pathways through ecological intensification: an assessment of vegetable food systems in Chile. *Int. J. Agric. Sustainability* 18 (2), 131–150.
- Gava, O., Favilli, E., Bartolini, F., Brunori, G., 2017. Knowledge networks and their role in shaping the relations within the Agricultural Knowledge and Innovation System in the agroenergy sector. the case of biogas in Tuscany (Italy). *J. Rural Studies* 56, 100–113.
- Gould, R.V., Fernandez, R.M., 1989. Structures of mediation: A formal approach to brokerage in transaction networks. *Sociol. Methodol.* 89–126.
- Guerra, J., Blesh, J., Schmitt Filho, A. L., Wittman, H., 2017. Pathways to agroecological management through mediated markets in Santa Catarina, Brazil. *Elementa: Science of the Anthropocene*, 5.
- Han, Y., Caldwell, N.D., Ghadge, A., 2020. Social network analysis in operations and supply chain management: a review and revised research agenda. *Int. J. Oper. Prod. Manage.* 40 (7/8), 1153–1176.
- Hermans, F., Sartas, M., Van Schagen, B., van Asten, P., Schut, M., 2017. Social network analysis of multi-stakeholder platforms in agricultural research for development: Opportunities and constraints for innovation and scaling. *PLoS One* 12 (2), e0169634.
- Hermans, F., Stuijver, M., Beers, P.J., Kok, K., 2013a. The distribution of roles and functions for upscaling and outscaling innovations in agricultural innovation systems. *Agric. Syst.* 115, 117–128.
- Hermans, F., van Apeldoorn, D., Stuijver, M., Kok, K., 2013b. Niches and networks: explaining network evolution through niche formation processes. *Res. Policy* 42 (3), 613–623.
- HLPE, 2017. *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*, Rome, 152 pp.
- IPES-Food, 2015. *The New Science of Sustainable Food Systems: Overcoming Barriers to Food Systems Reform*. International Panel of Experts on Sustainable Food Systems. Available from: <http://www.ipes-food.org/images/Reports/IPES_report01_1505_web_br_pages.pdf>.
- IPES-Food, 2016. *From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems*. International Panel of Experts on Sustainable Food Systems. Available from: <http://www.ipes-food.org/img/upload/files/UniformityToDiversity_FULL.pdf>.
- Isaac, M.E., 2012. *Agricultural information exchange and organizational ties: The effect of network topology on managing agrobiodiversity*. *Agric. Syst.* 109, 9–15.
- Kelly, S., Swensson, L.F.J., 2017. Leveraging institutional food procurement for linking small farmers to markets: Findings from WFP's Purchase for Progress initiative and Brazil's food procurement programmes. FAO Agricultural Development Economics Technical Study 1. Rome, FAO. 101 pp.
- Kilelu, C.W., Klerkx, L., Leeuwis, C., 2013. Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme. *Agric. Syst.* 118, 65–77.
- Kilelu, C.W., Klerkx, L., Leeuwis, C., 2017a. Supporting smallholder commercialisation by enhancing integrated coordination in agrifood value chains: experiences with dairy hubs in Kenya. *Exp. Agric.* 53, 269–287.
- Kilelu, C., Klerkx, L., Omoro, A., Baltenweck, I., Leeuwis, C., Githinji, J., 2017b. Value chain upgrading and the inclusion of smallholders in markets: reflections on contributions of multi-stakeholder processes in dairy development in Tanzania. *Eur. J. Dev. Res.* 29, 1102–1121.
- Kivimaa, P., Boon, W., Hyysalo, S., Klerkx, L., 2019. Towards a typology of intermediaries in sustainability transitions: a systematic review and a research agenda. *Res. Policy* 48 (4), 1062–1075.
- Krackhardt, D., Stern, R.N., 1988. Informal networks and organizational crises: an experimental simulation. *Social Psychol. Q.* 51 (2), 123–140.
- Kratzer, A., Ammering, U., 2019. Rural innovations in biosphere reserves – a social network approach. *J. Rural Studies* 71, 144–155.
- Latour, B., 2005. *Reassembling the Social. Reassembling the Social: An Introduction to Actor-Network Theory*. University Press, Oxford.
- Law, J., Hassard, J. (Eds.), 1999. *Actor Network Theory and After*. Blackwell Publishers/The Sociological Review, Malden, MA.
- Marshall, D.J., Staeheli, L., 2015. Mapping civil society with social network analysis: methodological possibilities and limitations. *Geoforum* 61, 56–66.
- Mercado, G., Hjortso, C.N., Kledal, P.R., 2016. Public procurement for school breakfasts in the Bolivian Altiplano: Governance structures enabling smallholder inclusion. *J. Rural Studies* 44, 63–76.
- MGAP, 2020. *Estado de situación de la producción familiar agropecuaria y los agricultores familiares en base al Censo General Agropecuario y Registro de Productores Familiares Agropecuarios*. Montevideo, Uruguay.
- Miranda, A., 2018. *Public food procurement from smallholder farmers: Literature review and best practices*. Working Paper, No. 176, International Policy Centre for Inclusive Growth (IPC-IG).
- Morel, K., Revoyron, E., San Cristobal, M., Baret, P.V., 2020. Innovating within or outside dominant food systems? Different challenges for contrasting crop diversification strategies in Europe. *PLoS one* 15 (3), e0229910.
- Müller, M., Schurr, C., 2016. 1-Assemblage thinking and actor-network theory: conjunctions, disjunctions, cross-fertilisations. *Trans. Inst. Br. Geographers* 41 (3), 217–229.
- Nemes, G., Chiffolleau, Y., Zollet, S., Collison, M., Benedek, Z., Colantuono, F., Dulstrud, A., Fiore, M., Holtkamp, C., Kim, T.-Y., Korzun, M., Mesa-Manzano, R., Reckinger, R., Ruiz-Martínez, I., Smith, K., Tamura, N., Viteri, M.L., Orbán, É., 2021. The impact of COVID-19 on alternative and local food systems and the potential for the sustainability transition: Insights from 13 countries. *Sustainable Prod. Consumption* 28, 591–599.
- Nguyen, H., 2018. *Sustainable food systems concept and framework*. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Núñez-Ríos, J.E., Aguilar-Gallegos, N., Sánchez-García, J.Y., Cardoso-Castro, P.P., 2020. Systemic design for food self-sufficiency in urban areas. *Sustainability* 12 (18), 7558.
- Otte, E., Rousseau, R., 2002. Social network analysis: a powerful strategy, also for the information sciences. *J. Inf. Sci.* 28 (6), 441–453.
- Poulton, C., Dorward, A., Kydd, J., 2010. The future of small farms: new directions for services, institutions, and intermediation. *World Dev.* 38 (10), 1413–1428.
- Ramirez, M., Clarke, I., Klerkx, L., 2018. Analysing intermediary organisations and their influence on upgrading in emerging agricultural clusters. *Environ. Planning A: Econ. Space* 50 (6), 1314–1335.
- Ricciardi, V., Mehrabi, Z., Wittman, H., James, D., Ramankutty, N., 2021. Higher yields and more biodiversity on smaller farms. *Nat. Sustainability* 4 (7), 651–657.
- Rockenbach, T., Sakdapolrak, P., Sterly, H., 2019. Do translocal networks matter for agricultural innovation? A case study on advice sharing in small-scale farming communities in Northeast Thailand. *Agric. Hum. Values* 36 (4), 685–702.
- Rocker, S., Kropczynski, J., Hinrichs, C., 2022. Using social network analysis to understand and enhance local and regional food systems. In: *Food Systems Modelling*. Academic Press, pp. 231–256.
- Rossi, A., Bui, S., Marsden, T., 2019. Redefining power relations in agrifood systems. *J. Rural Studies* 68, 147–158.
- Sabourin, E., Samper, M., Sotomayor, O. (Eds.), 2014. *Políticas públicas y agriculturas familiares en América Latina y el Caribe Balance, desafíos y perspectivas*. Economic Commission for Latin America and the Caribbean, Santiago.
- Santacoloma, P., Zárate, E., 2021. How can policy environments enhance small-scale farmers' participation in institutional food procurement for school feeding? emerging institutional innovations and challenges in Latin America. In: FAO, Alliance of Bioversity International and CIAT and Editora da UFRGS. (2021). *Public food procurement for sustainable food systems and healthy diets – Volume 2*. Rome.
- Sartas, M., Schut, M., Hermans, F., Asten, P.V., Leeuwis, C., 2018. Effects of multi-stakeholder platforms on multi-stakeholder innovation networks: implications for research for development interventions targeting innovations at scale. *PLoS One* 13 (6), e0197993.
- Schneider, S., Thies, V.F., Grisa, C., Belik, W., 2016. Potential of public purchases as markets for family farming: an analysis of Brazilian school feeding program between 2011 and 2014. In: *Advances in Food Security and Sustainability 1*. pp. 69–95.
- Schreier, M., 2012. *Qualitative Content Analysis in Practice*. Sage Publications.
- Scott, J., 2013. *Social Network Analysis*, third ed. Sage Publications Ltd, London.
- Sidaner, E., Balaban, D., Burlandy, L., 2013. The Brazilian school feeding programme: an example of an integrated programme in support of food and nutrition security. *Public Health Nutr.* 16 (6), 989–994.
- Simon, W.J., Krupnik, T.J., Aguilar-Gallegos, N., Halbherr, L., Groot, J.C.J., 2021. Putting social networks to practical use: Improving last-mile dissemination systems for climate and market information services in developing countries. *Clim. Serv.* 23, 100248.

- Smith, A., Fressoli, M., Thomas, H., 2014. Grassroots innovation movements: challenges and contributions. *J. Cleaner Prod.* 63, 114–124.
- Spielman, D.J., Ekboir, J., Davis, K., 2009. The art and science of innovation systems inquiry: applications to Sub-Saharan African agriculture. *Technol. Soc.* 31 (4), 399–405.
- Spielman, D.J., Davis, K., Negash, M., Ayele, G., 2011. Rural innovation systems and networks: findings from a study of Ethiopian smallholders. *Agric. Hum. Values* 28 (2), 195–212.
- Swensson, L.F.J., Klug, I., 2017. Implementation of decentralised food procurement programmes and the impact of the policy, institutional and legal enabling environment: The case of PRONAE and PAA Africa in Mozambique (No. 161). Working Paper.
- Swensson, L.F., Hunter, D., Schneider, S., Tartanac, F., 2021. Public food procurement as a game changer for food system transformation. *Lancet Planetary Health* 5 (8), e495–e496.
- Swensson, L.F.J., Tartanac, F., 2020. Public food procurement for sustainable diets and food systems: the role of the regulatory framework. *Global Food Security* 25, 100366.
- Swensson, L.F.J., 2018. Aligning policy and legal frameworks for supporting smallholder farming through public food procurement: the case of home-grown school feeding programmes. Working Paper, No. 177, International Policy Centre for Inclusive Growth (IPC-IG), Brasilia.
- Therond, O., Duru, M., Roger-Estrade, J., Richard, G., 2017. A new analytical framework of farming system and agriculture model diversities. A review. *Agronomy Sustainable Dev.* 37 (3), 1–24.
- Tittonell, P., Fernandez, M., El Mujtar, V.E., Preiss, P.V., Sarapura, S., Laborda, L., Mendonça, M.A., Alvarez, V.E., Fernandes, G.B., Petersen, P., Cardoso, I.M., 2021. Emerging responses to the COVID-19 crisis from family farming and the agroecology movement in Latin America—a rediscovery of food, farmers and collective action. *Agric. Syst.* 190, 103098.
- Tommasino, H., Cortelezzi, A., Mondelli, M., Bervejillo, J., Carrazzone, S., 2014. Tipología de productores agropecuarios: caracterización a partir del Censo Agropecuario 2011. In: *Anuario 2014*. OPYPA. Uruguay. pp. 491–508.
- Trivette, S.A., 2019. The importance of food retailers: applying network analysis techniques to the study of local food systems. *Agric. Hum. Values* 36 (1), 77–90.
- Turner, J.A., Klerkx, L., White, T., Nelson, T., Everett-Hincks, J., Mackay, A., Botha, N., 2017. Unpacking systemic innovation capacity as strategic ambidexterity: how projects dynamically configure capabilities for agricultural innovation. *Land Use Policy* 68, 503–523.
- Turner, J.A., Horita, A., Fielke, S., Klerkx, L., Blackett, P., Bewsell, D., Small, B., Boyce, W.M., 2020. Revealing power dynamics and staging conflicts in agricultural system transitions: case studies of innovation platforms in New Zealand. *J. Rural Studies* 76, 152–162.
- United Nations Industrial Development Organization (UNIDO), 2020. Short food supply chains for promoting local food on local markets. Inclusive and sustainable industrial development. Available from: <<https://suster.org/wp-content/uploads/2020/06/SHORT-FOOD-SUPPLY-CHAINS.pdf>>.
- Valencia, V., Wittman, H., Blesh, J., 2019. Structuring markets for resilient farming systems. *Agron. Sustainable Dev.* 39 (2), 25.
- Wittman, H., Blesh, J., 2017. Food sovereignty and Fome Zero: connecting public food procurement programmes to sustainable rural development in Brazil. *J. Agrarian Change* 17, 81–105.
- Wittman, H., Chappell, M.J., Abson, D., Bezner Kerr, R., Blesh, J., Hanspach, J., Perfecto, I., Fischer, J., 2016. A social–ecological perspective on harmonising food security and biodiversity conservation. *Reg. Environ. Change* 17, 1291.